

**BirdLife International Vietnam Programme
and the
Forest Inventory and Planning Institute
with financial support from the
European Union**

**An Investment Plan for
Kon Ka Kinh Nature Reserve,
Gia Lai Province, Vietnam**

A Contribution to the Management Plan

**Conservation Report
Number 11**

BirdLife International

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by

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Table of Contents

Executive Summary	vii
Executive Summary in Vietnamese	ix
1. Introduction	1
1.1 Background to Vietnam	1
1.2 Conservation in Vietnam	1
1.3 Rationale for the Investment Plan	2
1.4 Field Survey	3
2. Site Features	5
2.1 Biogeography	5
2.2 Topography	5
2.3 Geology	5
2.4 Soils	5
2.5 Meteorology	6
2.6 Hydrology	6
2.7 Flora Overview	7
2.8 Vegetation Types	8
Medium Montane Broadleaf Evergreen Forest	8
Low Montane Broadleaf Evergreen Forest	9
Degraded Evergreen Forest	9
Regenerating Forest	10
Bamboo Forest	10
Scrub with Scattered Trees	10
Grassland and Scrub	10
2.9 Fauna Overview	10
2.10 Mammals	11
Mammal Records	11
Bat Survey	12
2.11 Birds	12
2.12 Herpetiles	13
Altitudinal Distribution of Herpetile Species	13
2.13 Butterflies	14
3. Socio-economic Features	16
3.1 Population and Infrastructure	16
Demographics	16
Transportation	17
Health Care	18
Education	18
3.2 Economic Activities	19
Agriculture	19
Animal Husbandry	20
Social Forestry	20
Natural Resource Use	21
Rural Economy	21
3.3 Cultural Features of the Ba Na Ethnic Minority	22
3.4 Forest Enterprises	22

4. Evaluation	24
4.1 Biological Evaluation	24
Size	24
Habitat	24
Biodiversity	24
Globally Threatened Species	26
New Taxa	26
Endemic and Restricted-range Species	26
4.2 Economic Evaluation	26
Watershed Protection	26
Forestry	27
Medicinal Plants	27
Genetic Resources	27
Potential Tourism Value	27
Scientific Research Value	27
5. Management Recommendations	29
5.1 Proposed Name	29
5.2 Proposed Special-use Forest Category	29
5.3 Proposed Management Responsibility	29
5.4 Proposed Boundary	30
5.5 Proposed Management Zoning	31
Administration and Services Area	31
Strict Protection Area	31
Forest Rehabilitation Area	32
Buffer Zone	33
5.6 Proposed Management Structure	34
Directorate	34
Administration Department	34
Technical and Financial Department	34
Protection Department	35
5.7 Proposed Management Objectives	36
5.8 Proposed Investment Programmes	37
Infrastructure Development Programme	38
Conservation and Protection Programme	40
Scientific Research and Monitoring Programme	41
Awareness and Extension Programme	42
5.9 Proposed Buffer Zone Development Programme	42
Sedentarisation Programme	43
Social Forestry Programme	43
Agriculture Programme	44
Irrigation Programme	44
Animal Husbandry Programme	45
Transportation Programme	45
Education Programme	45
Health Care Programme	46
6. Finance	47
6.1 Investment Capital	47
6.2 Implementation of the Investment Plan for Kon Ka Kinh Nature Reserve	47

6.3 Buffer Zone Development Programme	50
6.4 Summary of Project Benefits	50
References	53
Appendix 1: Flora Recorded at Kon Ka Kinh Nature Reserve	60
Appendix 2: Mammals Recorded at Kon Ka Kinh Nature Reserve	66
Appendix 3: Birds Recorded at Kon Ka Kinh Nature Reserve	68
Appendix 4: Herpetiles Recorded at Kon Ka Kinh Nature Reserve	73
Appendix 5: Butterflies Recorded at Kon Ka Kinh Nature Reserve	75

List of Tables

Table 1: Meteorological Data from Three Weather Stations near Kon Ka Kinh Nature Reserve	6
Table 2: Plants Recorded in the Study Area	7
Table 3: Globally Threatened Plant Species Recorded in the Study Area	7
Table 4: Vegetation Types at Kon Ka Kinh Nature Reserve	8
Table 5: Vertebrate Species Recorded at Kon Ka Kinh Nature Reserve	10
Table 6: Globally Threatened and Endemic Mammals Recorded at Kon Ka Kinh Nature Reserve	11
Table 7: Globally Threatened and Restricted-range Birds Recorded at Kon Ka Kinh Nature Reserve	13
Table 8: Population Distribution and Density in the Buffer Zone Communes	16
Table 9: Ethnic Composition in the Buffer Zone Communes (1997 Data)	17
Table 10: Sedentarisation in the Buffer Zone Communes	17
Table 11: Education Provision and Attendance in the Buffer Zone	19
Table 12: Rice Production in the Buffer Zone Communes	19
Table 13: Production of Cassava and Maize in Five Buffer Zone Communes	20
Table 14: Livestock Ownership in the Buffer Zone	20
Table 15: Economic Status of Buffer Zone Inhabitants in K'Bang District	21
Table 16: Land-use in Seven Forest Enterprises	22
Table 17: Comparison of Recorded Plant Diversity at Kon Ka Kinh Nature Reserve with other Nature Reserves in the Western Highlands (Ranked)	24
Table 18: Comparison of Mammal and Bird Diversity at Kon Ka Kinh with other Montane Nature Reserves	25
Table 19: Bird Endemism Ranking for Five Montane Nature Reserves in Vietnam	25
Table 20: Comparison of Herpetile Diversity at Kon Ka Kinh Nature Reserve with Six Other Areas (Ranked)	25
Table 21: Globally Threatened Species Recorded at Kon Ka Kinh Nature Reserve	26
Table 22: Strict Protection and Forest Rehabilitation Sub-areas	31
Table 23: Management Regime for the Strict Protection Area	32
Table 24: Management Regime for the Forest Rehabilitation Area	33
Table 25: Commune Areas in the Nature Reserve and Buffer Zone	33
Table 26: Plan for Agricultural Expansion in the Buffer Zone	44
Table 27: Plan for Developing the Irrigation System	45
Table 28: Selected Construction Activities in the Buffer Zone Development Programme	46
Table 29: Investment Schedule for the Investment Plan for Kon Ka Kinh Nature Reserve	47
Table 30: Cost Estimates for the Five Year Investment Plan for Kon Ka Kinh Nature Reserve (in VND million)	48
Table 31: Disbursement Schedule for the Investment Plan for Kon Ka Kinh Nature Reserve (in VND million)	49
Table 32: Investment Schedule for the Buffer Zone Development Programme	50
Table 33: Cost Estimates for the Five Year Buffer Zone Development Programme (in VND million)	51

Table 34: Disbursement Schedule for the Buffer Zone Development Programme (in VND million)	52
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List of Maps

Map 1: Location of Kon Ka Kinh Nature Reserve	56
Map 2: Land-use in Kon Ka Kinh Nature Reserve	57
Map 3: Population Density and Ethnic Composition of Communes in the Buffer Zone	58
Map 4: Management Zoning of Kon Ka Kinh Nature Reserve	59

List of Figures

Figure 1: Schematic Diagram of Nature Reserve Staff Hierarchy	35
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Conventions Used

Plant names, sequence and species limits follow Pham Hoang Ho (1991). Mammal names (common and scientific), sequence and species limits follow Corbet and Hill (1992), with scientific names given at first mention and in Appendix 2. Bird names (common and scientific), sequence and species limits follow Inskipp *et al.* (1996), 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). Butterfly names, sequence and species limits follow Corbet *et al.* (1992).

Diacritical marks are omitted from Vietnamese names due to typographical limitations and the restricted understanding of international readers.

A globally threatened species is any species assigned a category of threat in the IUCN Red Lists of Threatened Animals and Plants (IUCN 1996 and 1997); the term excludes species listed as Near Threatened or Data Deficient.

Endemic Bird Area refers to an area supporting at least two restricted-range bird species. A restricted-range bird species is a species with a global breeding range of less than 50,000 km².

Indochina refers to the biogeographic region of Cambodia, Laos and Vietnam.

The study area refers to Ha Dong and Ayun communes, Mang Yang district, and Kon Phe, Kroong and Dak Roong communes, K'Bang district, Gia Lai province.

Abbreviations and Acronyms Used

BAP	-	Biodiversity Action Plan
FAO	-	Food and Agriculture Organisation
FIPI	-	Forest Inventory and Planning Institute, Hanoi
FPD	-	Forest Protection Department
FREC	-	Forest Resources and Environment Centre
GNP	-	gross national product
IEBR	-	Institute of Ecology and Biological Resources
IUCN	-	World Conservation Union
MARD	-	Ministry of Agriculture and Rural Development
MOF	-	Ministry of Forestry (now part of MARD)
MOSTE	-	Ministry of Science, Technology and the Environment
NEA	-	National Environment Agency
NGO	-	non-governmental organisation
NTFP	-	non-timber forest product
UNDP	-	United Nations Development Programme
WWF	-	World Wide Fund for Nature

Executive Summary

This report is an English translation of the investment plan for Kon Ka Kinh Nature Reserve, Gia Lai province, originally written in Vietnamese by the Forest Inventory and Planning Institute (FIPI) in collaboration with BirdLife International. The objective of the original investment plan was to provide the necessary information and justification to secure funding to establish and manage Kon Ka Kinh Nature Reserve. The objective of the English translation is to make the information contained within the investment plan available to an international audience interested in Kon Ka Kinh Nature Reserve, Gia Lai province. Following approval of the investment plan at the provincial and national level, Kon Ka Kinh Nature Reserve was established in November 1999.

As part of the European-Union-funded project entitled *Expanding the Protected Areas Network in Vietnam for the 21st Century*, BirdLife International worked in collaboration with FIPI to formulate an investment plan for Kon Ka Kinh Nature Reserve. This work supported the government of Vietnam's commitment to increase the nation's protected area coverage to 2 million ha by the year 2000. Furthermore, this work was consistent with the Biodiversity Action Plan for Vietnam, in which Kon Ka Kinh Nature Reserve was identified as a "priority for action".

Between February and April 1999, BirdLife International and FIPI conducted a field survey in K'Bang and Mang Yang districts, Gia Lai province. During this survey, data were collected on the physical, biological and socio-economic features of Kon Ka Kinh Nature Reserve. These data were then used to formulate management recommendations for the nature reserve and buffer zone.

Kon Ka Kinh Nature Reserve is located in the Western Highlands of Vietnam. The nature reserve covers 41,710 ha, ranges in elevation from 570 to 1,748 m and supports a range of montane habitat types. Analysis of vegetation data shows that an area of 8,247 ha, equivalent to 20% of the nature reserve has been degraded by past commercial logging activities and continuing illegal timber extraction. A further 12,286 ha, or 29% of the nature reserve, has been cleared by commercial logging or shifting cultivation and now supports a range of secondary vegetation types.

During the field survey, 652 vascular plant species were recorded, including 16 globally threatened species (IUCN 1997) and 10 species endemic to Vietnam. Many of the plant species recorded at Kon Ka Kinh are of high economic value, particularly the timber species *Fokienia hodginsii*. To the south of Mount Kon Ka Kinh, the highest point in the nature reserve, lies a 2,000 ha plateau that supports mixed coniferous and broadleaf forest dominated by *F. hodginsii*. This habitat sub-type is not represented elsewhere in Vietnam's protected areas system, and is one of the key conservation features of Kon Ka Kinh Nature Reserve.

Forty two species of mammal, 160 species of bird, 51 species of herpetile and 209 species of butterfly were recorded during the field survey. These included 12 globally threatened species (IUCN 1996), five restricted-range bird species and three mammal species endemic to Indochina. One of these endemic mammal species, Truong Son Muntjac *Muntiacus truongsonensis*, was only discovered in 1997, and is currently known only from one other protected area in Vietnam.

During the field survey, an undescribed taxon of laughingthrush *Garrulax* was collected. This taxon is closely related to Rufous-throated Laughingthrush *G. rufogularis*, and may constitute a species new to science.

At least eight butterfly taxa recorded at Kon Ka Kinh Nature Reserve may be new for science, and at least seven species may be new records for Vietnam. One mammal species, Moluccan Whiskered Bat *Myotis ater*, is a new record for Vietnam. In addition, several plant species recorded during the field survey may represent new records for Vietnam or new species for science.

A total of 27,210 people live in the seven communes that comprise the buffer zone of Kon Ka Kinh Nature Reserve, at a density of 16.9 people/km². Seventy one percent of the inhabitants of the buffer zone belong to the Ba Na ethnic minority, with most of the remainder belonging to the Kinh (ethnic Vietnamese) ethnic group. Only 51% of the households in the buffer zone are permanently settled, although there are plans to settle more households as part of the government-sponsored 'Fixed Cultivation and Sedentarisation Programme'.

The main economic activities in the buffer zone are agriculture, forestry, animal husbandry and forest product collection. Most Kinh households, who practice wet rice cultivation, produce sufficient rice for the whole year. However, most Ba Na households, who generally practice shifting cultivation, only produce enough rice for four to nine months of the year; during the remainder of the year they depend upon other crops such as cassava and maize, or exploit forest resources. Exploitation of certain forest resources is occurring at unsustainable levels, and potentially the most harmful activities, from a conservation perspective, are hunting and rattan collection. Timber extraction by local people is believed to occur at low levels; a more serious problem is illegal timber extraction by groups of loggers from other parts of Vietnam.

Because of the low population density and large area of unused, fertile land, the buffer zone has been and continues to be a focus for spontaneous migration from other parts of Vietnam, particularly the northern provinces. For instance, in 1997 and 1998, a total of 413 migrants settled in Lo Ku commune, amounting to 17% of the current population of the commune. Spontaneous migration is one of the most serious conservation problems at Kon Ka Kinh Nature Reserve, because, as the population of the buffer zone increases, so does pressure on the forest resources of the nature reserve.

There are seven forest enterprises operating in the area. In total, these forest enterprises manage 134,084 ha of land, including 66,086 ha of natural forest. Although the forest enterprises are permitted to exploit natural forest, the area that they are allowed to exploit is reduced annually, and the focus of their activities is shifting from exploitation to protection. This investment plan proposes that some areas currently under the management of Dak Roong and Krong Pa Forest Enterprises will be transferred to Kon Ka Kinh Nature Reserve.

This report outlines four investment programmes to establish and manage Kon Ka Kinh Reserve for the five year period from 2000 to 2004. The first is an infrastructure development programme to demarcate the nature reserve boundary and construct the necessary infrastructure to protect and manage the nature reserve. The second is a conservation and protection programme of activities to protect natural forest and rehabilitate degraded areas. The third is a scientific research and monitoring programme to provide ecological information to assist in the long-term management of the nature reserve, and to monitor the effectiveness of management actions. The fourth is an awareness and extension programme to involve local communities in conservation and promote the sustainable use of natural resources.

The estimated total cost of the four programmes is VND 21,837 million over the first five years. A buffer zone development programme to promote socio-economic development in the buffer zone and reduce local people's dependence on forest resources should be formulated following the establishment of the nature reserve. This report outlines recommended activities to be included in this programme.

Kon Ka Kinh Nature Reserve is situated 12 km to the west of Kon Cha Rang Nature Reserve, linked by intervening forest areas. The two nature reserves, therefore, form an area large enough to support viable populations of large mammals, such as Tiger *Panthera tigris* that neither area could support in isolation. However, the intervening forest areas are currently under forest enterprise management. BirdLife and FIPI strongly recommend that, in the future, these areas should be incorporated within the boundaries of the two nature reserves to form one contiguous protected area. This recommendation is contained within the Tropical Forestry Action Plan, the Biodiversity Action Plan for Vietnam and the BirdLife/FIPI report entitled *Expanding the Protected Areas Network in Vietnam for the 21st Century*.

Tóm tắt dự án

Báo cáo này là bản dịch tiếng Anh từ bản gốc tiếng Việt với tiêu đề Dự án đầu tư khu bảo tồn thiên nhiên Kon Ka Kinh, tỉnh Gia Lai, do Viện Điều tra Quy hoạch Rừng và tổ chức BirdLife International tiến hành xây dựng. Bản gốc tiếng Việt dự án đầu tư với đầy đủ các thông tin cần thiết và định hướng cho việc thành lập và quản lý bảo vệ khu bảo tồn thiên nhiên Kon Ka Kinh. Mục đích của bản dịch tiếng Anh nhằm tạo điều kiện thu hút các cá nhân, tổ chức trên thế giới có quan tâm đối với khu Bảo tồn Thiên nhiên Kon Ka Kinh, tỉnh Gia Lai.

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Khu Bảo tồn Thiên nhiên Kon Ka Kinh nằm ở Cao Nguyên Plei Ku của Tây Nguyên. Khu bảo tồn trải rộng ở độ cao từ 570 đến 1748m với nhiều hệ sinh thái rừng đặc trưng cho đai cao. Khoảng 8.247 ha diện tích rừng chiếm 20% diện tích khu bảo tồn đã bị tác động do hậu quả của các hoạt động kinh tế trước đây và do sự khai thác bất hợp pháp đang diễn ra. Hơn 12.286 ha rừng, chiếm 29% diện tích khu bảo tồn, đã bị khai thác hoặc do sự du canh du cư do đó xuất hiện kiểu thảm thực vật thứ sinh.

Kết quả khảo sát đã ghi nhận được 652 loài thực vật có mạch, bao gồm 16 loài bị đe dọa toàn cầu (IUCN 1997) và 10 loài đặc hữu cho Việt Nam. Nhiều loài thực vật ghi nhận tại Kon Ka Kinh có giá trị kinh tế cao, đặc biệt là loài Pơ Mu *Fokienia hodginsii*. Phía Nam của đỉnh núi Kon Ka Kinh (1748m), có diện tích 2,000ha rừng trên địa hình bằng phẳng đặc trưng bởi rừng hỗn giao cây lá rộng và rừng cây lá kim, điển hình là loài *F. hodginsii*. Sinh cảnh này không thấy ở bất kỳ nơi nào trong hệ thống các khu rừng đặc dụng Việt Nam, và đây là một trong những đặc trưng bảo tồn của khu bảo tồn thiên nhiên Kon Ka Kinh.

Khu hệ động vật hoang dã đã ghi nhận cho khu bảo tồn bao gồm: 42 loài thú, 160 loài chim, 51 loài ếch nhái, bò sát và 205 loài bướm. Trong số đó có 12 loài hiện đang bị đe dọa toàn cầu (IUCN 1996), năm loài chim có vùng phân bố hẹp và 3 loài thú đặc hữu cho Đông Dương. Một trong các loài thú đặc hữu là loài Mang Trường Sơn *Muntiacus truongsonensis*, lần đầu tiên phát hiện vào năm 1997 và hiện nay chỉ được bảo vệ duy nhất ở một khu bảo tồn khác của Việt Nam.

Có ít nhất 8 loài bướm đã được ghi nhận là loài mới cho khoa học và ít nhất là 7 loài ghi nhận mới cho Việt Nam. Loài Dơi muỗi *Myotis atercung* là loài thú mới ghi nhận cho Việt Nam phát hiện ở khu bảo tồn này. Thêm vào đó, trong đợt khảo sát này nhiều loài thực vật đã được phát hiện mới cho khoa học hoặc cho Việt Nam.

Vùng đệm khu bảo tồn quy hoạch cho 7 xã với tổng dân số 27.210 người, mật độ dân cư 16,9 người/km². Nhóm dân tộc thiểu số Ba Na chiếm 71%, số còn lại là dân tộc Kinh. Mặc dù có nhiều kế hoạch nhằm tái định cư các hộ gia đình ở vùng đệm trong Chương trình định canh định cư của quốc gia nhưng chỉ có 51% số hộ của vùng đệm định cư ổn định.

Các hoạt động kinh tế chính trong vùng đệm là nông nghiệp, lâm nghiệp, chăn nuôi gia súc và khai thác các sản phẩm của rừng. Phần lớn các hộ gia đình người Kinh, những người có kinh nghiệm trồng lúa nước, sản xuất đủ lúa gạo cho tất cả các năm. Mặc dù vậy phần lớn số hộ dân tộc người Ba Na vẫn duy trì hình thức canh tác du canh nên chỉ đủ lương thực từ 4 đến 9 tháng trong năm; thời gian còn lại trong năm phụ thuộc vào hoa màu khác như ngô khoai sắn, hoặc khai thác các nguồn tài nguyên. Sự khai thác quá mức nguồn tài nguyên thiên nhiên đã xảy ra ở mức đáng báo động bao gồm các hoạt động săn bắn, bẫy động vật hoang dã, khai thác song mây. Mức độ khai thác gỗ trộm của người dân cư địa phương thấp ngược lại nghiêm trọng hơn là sự khai thác gỗ trái phép của người dân từ các nơi khác đến.

Do mật độ dân cư thấp và diện tích đất chưa sử dụng còn nhiều, đất đai màu mỡ, vùng đệm đã và đang trở thành mục tiêu cho sự di dân tự do từ các vùng trên cả nước. Thí dụ điển hình vào năm 1997 và 1998, có tổng số 413 người định cư tại xã Lơ Ku, chiếm tới 17% tổng số dân hiện nay của xã. Sự di cư tự do là một trong những vấn đề nghiêm trọng trong công tác bảo tồn của khu vực, bởi vì khi dân số trong vùng đệm tăng cũng đồng nghĩa làm tăng áp lực đối với nguồn tài nguyên rừng của khu bảo tồn.

Hiện tại có 7 lâm trường đóng trên địa bàn các xã vùng đệm. Nhìn chung, các đơn vị này quản lý 134.084ha đất rừng, bao gồm 66.086 ha diện tích rừng tự nhiên. Mặc dù các đơn vị này được phép khai thác rừng tự nhiên, nhưng khối lượng khai thác hàng năm đang giảm dần và đang chuyển sang chuyên quản lý bảo vệ rừng. Dự án đầu tư khu bảo tồn Kon Ka Kinh đã quy hoạch một phần diện tích của các lâm trường Đak Roong và Krong Pa đưa vào vùng lõi của khu bảo tồn.

Bản báo cáo này đưa ra 4 chương trình đầu tư nhằm thiết lập và quản lý khu bảo tồn Kon Ka Kinh trong giai đoạn 5 năm từ năm 2000 đến 2004. Chương trình thứ nhất là chương trình phát triển cơ sở hạ tầng để xây dựng cột mốc ranh giới khu bảo tồn và xây dựng cơ sở hạ tầng cần thiết cho công tác quản lý bảo vệ. Chương trình thứ hai là các hoạt động nhằm phục hồi hệ sinh thái rừng đã bị tác động bằng các biện pháp lâm sinh. Chương trình thứ ba là chương trình nghiên cứu khoa học và theo dõi diễn biến tài nguyên rừng tạo cơ sở để xây dựng kế hoạch quản lý dài hạn cho khu bảo tồn, đồng thời theo dõi kết quả của các hoạt động quản lý. Chương trình thứ tư là chương trình tuyên truyền, giáo dục nâng cao nhận thức của người dân địa phương về vấn đề bảo tồn và sử dụng bền vững nguồn tài nguyên thiên nhiên.

Ước tính chi phí cho 4 chương trình là hơn 21.837 triệu đồng trong 5 năm đầu. Đề xuất chương trình phát triển kinh tế, xã hội vùng đệm sẽ tiến hành song song với các chương trình của khu bảo tồn. Chương trình này nhằm thúc đẩy sự phát triển kinh tế-xã hội trong khu vực đệm và giảm sự phụ thuộc của người dân địa phương vào nguồn tài nguyên rừng.

Dự án đề xuất thành lập khu bảo tồn thiên nhiên Kon Ka Kinh với tổng diện tích đất là 41.710 ha. Khu bảo tồn Kon Ka Kinh cách khu bảo tồn Kon Cha Răng 12km về phía tây, và được nối liền với nhau bằng hành lang rừng. Cả hai khu bảo tồn này nếu được liên kết với nhau bằng hành lang rừng bền vững sẽ rất lý tưởng để bảo vệ các loài thú lớn như Hổ *Panthera tigris*. Tuy vậy, hiện tại hành lang này hiện do hai lâm trường Tràm Lập và Krong Pa quản lý. Tổ chức BirdLife International và FIPI kiến nghị: trong tương lai hai khu bảo tồn này sẽ sát nhập thành một khu bảo tồn lớn. Đây cũng là kiến nghị trong chương trình hành động đa dạng sinh học của Việt Nam và trong báo cáo thành quả của dự án BirdLife/FIPI với tiêu đề Mở rộng hệ thống các khu rừng đặc dụng Việt Nam cho thế kỷ 21.

1. Introduction

This is an English-language version of an investment plan for Kon Ka Kinh Nature Reserve, prepared by the Forest Inventory and Planning Institute (FIPI) and BirdLife International and originally published in Vietnamese. The objective of the Vietnamese report was to provide the justification and details necessary to formally establish Kon Ka Kinh Nature Reserve, Gia Lai province. The objective of the English translation is to serve as a source document for a wider audience.

1.1 Background to Vietnam

Geography. The Socialist Republic of Vietnam is a relatively narrow strip running north-south along the eastern coast of the Indochinese Peninsula. With a 3,000 km coastline, Vietnam extends from 23°37.5' to 8°00.5'N. It is approximately 525 km across at its widest point and 47 km across at its narrowest point. Vietnam's total land area is 331,689 km². Mountain ranges extend along Vietnam's border with the People's Republic of China in the north, and along the borders with the Lao People's Democratic Republic and the Kingdom of Cambodia in the west. The highest point is Mount Fan Si Pan in the far north at 3,143 m, although average mountain altitudes are around 1,000 m. Vietnam is topographically complex, with the exception of the narrow, coastal lowlands of the central region and the southern Mekong Delta region.

Demographics. The population of Vietnam is approximately 77 million people (1998), with a growth rate of 2.3% (at this rate, the population will double in 32 years). The country is composed of 61 provinces with 570 urban centres. Eighty percent of the population live in rural areas. Two cities have over 1 million inhabitants: Ho Chi Minh City (formerly Saigon) and Hanoi, the capital. Literacy rates are high: 93% for males and 83% for females. Life expectancy is 62 years for males and 67 years for females (Pham Ngoc Dang 1998).

Economics. Vietnam is currently undergoing an economic transition towards a more market-oriented economy. Vietnam's annual per capita gross national product (GNP) is about US\$300 (UNDP 1999). GNP has been growing rapidly for the past decade. Vietnam's leading exports in order of contribution to GNP are crude oil, coal, rice, coffee, textiles, marine products, shoes, tea, cashew nuts and rubber. It is the world's third largest rice exporter and the fifth largest coffee exporter.

Environment. Economic growth, infrastructure development, population growth, protracted wars, and the development of agriculture, forestry and fishing have resulted in over-exploitation of Vietnam's natural resources. The environment in Vietnam has largely been compromised: forest cover has undergone a massive decline and is now estimated at less than 20% of the country's total land area (less than 10% primary forest) (Vo Quy 1998). 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.

1.2 Conservation in Vietnam

The government of Vietnam recognised the need for conserving and rehabilitating the natural environment at the end of the 1970s. Its first priority was to provide areas for settling war veterans. The second priority was chemical detoxification and remediation for human resettlement of areas affected by chemical defoliants. The third priority was given to reforestation, establishing protected areas and conversion of forests into cultivated land (MOF 1991a). Only in the 1990s has the conservation emphasis moved towards protecting endangered habitats and species.

Vietnam's forests are divided into three categories (MOF 1991a,b):

- (a) **Production Forests.** These are forested areas which can be allocated to any organisation or individual (with management requirements and harvesting regulations) for domestic commercial timber needs as stipulated in Vietnam's Forestry Law, Articles 28-34;
- (b) **Protection Forests.** These forested areas can be allocated to forestry agencies, people's committees, or to the people directly, for the main purposes of watershed protection, soil-erosion control, and foreshore protection with special provisions as per Articles 35-37; and
- (c) **Special-use Forests (Protected Areas).** These are forested lands allocated for environmental conservation, tourism, educational purposes, national defence and other special uses. These lands can be allocated to organisations and agencies in the state forestry sector which are expected to generate revenues outside of the strict protection areas and follow management procedures as per Articles 39-41. Special-use Forests are further subdivided into:
 - (i) *Cultural and Historical Sites* intended to preserve and maintain areas of national and cultural interest and importance;
 - (ii) *Nature Reserves* intended to preserve all representative vegetation types and conserve biodiversity; and
 - (iii) *National Parks* intended to protect and conserve all major wildlife and habitat types found within Vietnam.

Vietnam currently has proposals for 105 protected areas, comprising 976,000 ha or 3% of the total land area. If these proposals are adopted, there will be 10 national parks, 61 nature reserves, and 34 cultural and historical sites (Dang Huy Huynh 1998). Vietnam is actively gazetting new sites as part of its treaty obligations under the Convention on Biological Diversity. The policy document entitled *Renovation of Strategies for Forestry Development until the Year 2000* contains a commitment to expand Vietnam's system of Special-use Forests to 2 million hectares by the year 2000, thereby doubling the network of protected areas.

The biodiversity of Vietnam is currently poorly surveyed but it is estimated that the country supports approximately 275 mammal species, 826 bird species, 260 reptile species, 82 amphibian species, 500 freshwater fish species, 2,000 marine fish species and 12,000 plant species (Dang Huy Huynh 1998, MacKinnon 1997).

1.3 Rationale for the Investment Plan

Current Legislative Status. Several documents govern the establishment, expansion, development, management and regulation of Vietnam's protected areas network, of which the most important with regard to Kon Ka Kinh Nature Reserve are, in chronological order:

- Decision No. 194/CT of the Prime Minister, dated 9 August 1986, proposing the establishment of 73 protected areas, including two national parks, 46 nature reserves, and 25 cultural and historical sites. This decree included the original recommendation for the formation of Kon Ka Kinh Nature Reserve, Gia Lai province;
- Decision No. 1171/QD of the Minister of Forestry, dated 30 December 1986, which outlines the management regulations and objectives of Special-use Forests;

- Decision No. 62 LN/KL of the Prime Minister, dated 3 February 1990, which regulates the principles and procedures for the establishment of Special-use Forests;
- Guidelines of the Ministry of Forestry (MOF) (now under the Ministry of Agriculture and Rural Development (MARD)), dated July 1991, outlining the methods and contents of investment plans for the establishment of Special-use Forests;
- The Forestry Sector Review, and the Tropical Forestry Action Programme and Plan, which were established in December 1991 under UNDP/FAO Project VIE/88/037, in order to institute Vietnam's terms of reference on forest policy and legislation;
- MOF Letter No. 1,586, dated 13 July 1993, which regulates the establishment and requirements of buffer zones for Vietnam's national parks and nature reserves;
- Decision No. 202/TTg of the Prime Minister, dated 2 May 1994, defining the policies and legislation regarding the protection, regeneration and growing of forest;
- MOF Circular No. 09/KH, dated 13 September 1994, governing the investment of capital in the forestry sector;
- Vietnam's signing of the Convention on Biological Diversity in 1993, ratified in 1994, and thereby obliging Vietnam to increase its protected area coverage to 2 million hectares by the year 2000;
- Within the scope of the Convention on Biological Diversity, Vietnam formulated a national Biodiversity Action Plan (BAP) (Government of SRV/GEF 1994), ratified under Decision No. 845/TTg of the Prime Minister, dated 22 December 1995. Kon Ka Kinh Nature Reserve is listed in the BAP as a priority area in Vietnam for expansion in order to protect regional biodiversity; and
- The Vietnam Forestry Development Strategy, approved during the 11th National Assembly in March 1997. The Vietnam Forestry Development Strategy aims to expand the coverage of Special-use Forests by a further 1,444,900 ha by the year 2000.

Biological Justification. Kon Ka Kinh Nature Reserve supports a large area of low montane broadleaf evergreen forest with high levels of endemism, including five restricted-range bird species and three mammal species endemic to Indochina. The biological value of the nature reserve is evaluated in detail in Section 4.1.

Economic Justification. Kon Ka Kinh Nature Reserve protects the watersheds of two major rivers: the Ba River to the south and the Dak Phe River to the north-west. These rivers play very important roles in supplying water for irrigation, domestic use and hydro-electricity generation.

1.4 Field Survey

Aim and Objectives. The aim of the field survey was to collect data on the physical, biological and socio-economic features of Kon Ka Kinh Nature Reserve, in order to formulate management recommendations for the nature reserve and buffer zone.

Specific objectives included to:

- Evaluate the conservation value of Kon Ka Kinh Nature Reserve based on the current physical, biological and socio-economic features;
- Evaluate the status of endemic, restricted-range and globally threatened species in the study area;
- Propose boundaries for Kon Ka Kinh Nature Reserve and buffer zone;
- Assess the level and effects of human use of forest resources at Kon Ka Kinh Nature Reserve;
- Outline a management plan for Kon Ka Kinh Nature Reserve and formulate guidelines for its implementation;
- Recommend a programme of activities to promote, in a sustainable manner, socio-economic development in the buffer zone of Kon Ka Kinh Nature Reserve;
- Generate cost estimates for investment in the nature reserve, as well as an investment schedule; and
- Summarise the benefits to be derived from investment in Kon Ka Kinh Nature Reserve.

Study Area. Kon Ka Kinh Nature Reserve is located in K'Bang and Mang Yang districts, Gia Lai province ([Map 1](#)). The nature reserve contains parts of five communes: Ha Dong, Ayun, Kroong, Kon Pne and Dak Roong. The study area is defined by the boundaries of these five communes, and is bounded by the coordinates 14°03' to 14°36'N and 108°12' to 108°32'E. The study area is approximately 50 km north-east of Plei Ku town and 30 km east of Kon Tum town. The study area lies within the watersheds of the Ba and Dak Pne Rivers, and is centred on Mount Kon Ka Kinh, the highest point in the study area.

Study Period. The field survey was conducted between February and April 1999.

2. Site Features

2.1 Biogeography

Kon Ka Kinh Nature Reserve is situated within the Bolovans-Kon Tum Montane Forests Ecoregion of the Indo-Pacific region, under the classification of Wikramanayake *et al.* (1997). According to the classification of MacKinnon (1997), the nature reserve is located in sub-unit Ma (Central Annam Mountains) of the Indo-Chinese sub-region.

2.2 Topography

Kon Ka Kinh Nature Reserve is situated on the Kon Tum Plateau in the Western (Central) Highlands of Vietnam, and contains Mount Kon Ka Kinh (1,748 m). To the north of the study area is Mount Ngoc Linh, the highest mountain in the Western Highlands. To the south and west, the topography is flatter, and altitudes are below 500 m.

Altitudes within the study area range from 570 m in the Ba River valley, to 1,748 m at the summit of Mount Kon Ka Kinh. There are several mountain peaks above 1,500 m in the study area, including Kon N'Gouk (1,588 m), and unnamed peaks at 1,642 and 1,524 m. These mountains are heavily dissected by valleys, with slope angles of 25 to 30°. To the south of the summit of Mount Kon Ka Kinh is a flat plateau, 2,000 ha in extent, which supports mixed coniferous and broadleaf forest.

2.3 Geology

The geology of the study area is characterised by metamorphic rocks, principally gneiss. To the east and north-east of the study area, the surface is covered by a layer of basalt.

2.4 Soils

According to the classification of Cao Liem and Nguyen Ba Nhuan (1985), the main soil types in the study area are:

- (a) **Feralite Humus Soil in Mountains.** This soil type is distributed above 1,000 m, where climatic conditions are cold and humid. This soil type is loose, light and acidic, and has a coarse humus layer 5 to 8 cm thick. The mechanical composition is heavy loam. This soil type is distributed on basalt with gentle slopes of between 3 and 5°, and on metamorphic rocks with slopes of between 10 and 15°;
- (b) **Red-brown and Brown Feralite Soil on Basalt.** This soil type is loose and highly fertile, and has a humus layer 5 cm thick. The mechanical composition is medium loam;
- (c) **Red-yellow and Grey-yellow Feralite Soil on Granite and Sandstone.** This soil type is distributed at altitudes between 500 and 800 m. Generally, this soil type is loose, thin and acidic, and has a humus layer only 3 cm thick. The mechanical composition is light to medium loam. This soil type has the lowest nutrient content of the soils in the study area; and
- (d) **River and Stream Alluvial Soil.** This soil type is distributed along the Con, Re and Ba Rivers, and other rivers and streams in the study area. This soil type is light and neutral.

2.5 Meteorology

According to the classification of Nguyen Duc Ngu (1985), Kon Ka Kinh Nature Reserve lies in climatic sub-zone II of climatic zone I of the Western Highlands. This climatic sub-zone is characterised by moderate temperatures (average temperature of the coldest month under 16°C) and high rainfall (total annual rainfall over 2,800 mm). There are no weather stations in the study area itself, although Table 1 contains data from three nearby weather stations. These three weather stations are at lower altitudes than the study area and, consequently, record higher temperatures and lower rainfall than those experienced in the study area.

Table 1: Meteorological Data from Three Weather Stations near Kon Ka Kinh Nature Reserve

Meteorological Data	Weather Station		
	Kon Tum	An Khe	Plei Ku
Total annual rainfall (mm)	1,805	1,466	2,272
Maximum mean monthly rainfall (mm) and month	339 (August)	348 (October)	492 (August)
Minimum mean monthly rainfall (mm) and month	2.5 (January)	2.4 (February)	3.0 (January)
Annual no. of rainy days	132	142	154
Annual mean temperature (°C)	23.4	23.6	21.8
Absolute highest air temperature (°C) and month	39 (May)	38 (April)	36 (April)
Absolute lowest air temperature (°C) and month	5.5 (January)	9.0 (January)	5.7 (January)
Annual mean humidity (% RH)	78	82	80

The study area experiences two distinct seasons. During the dry season, which lasts from December to April, it is relatively warm: the average temperature of the hottest month (April) is 25°C. Total rainfall during the dry season only amounts to 25 to 30% of total annual rainfall. During February and March, relative humidity is as low as 70 to 72%, and the main wind direction is from the north-east. The rainy season, which lasts from May to November, is cool relative to other parts of central Vietnam: the average temperature of the hottest month (May) is 25°C. Rainfall is highest during September, October and November, as is relative humidity, which reaches 83 to 92%. During the dry season, the study area experiences the south-western monsoon.

2.6 Hydrology

The study area straddles two main watersheds: streams originating in the east of the study area feed rivers that flow east, into the South China Sea; whilst the west of the study area forms part of the catchment of the Mekong River. Due to the steep mountain topography, rivers and streams originating in the study area are often short, narrow and fast flowing, with many waterfalls.

In the study area, there are two main river systems:

- (a) **Ba River:** The watershed of the Ba River includes parts of Kon Ka Kinh and Kon Cha Rang Nature Reserves, as well as intervening areas. The Ba River flows in a south-easterly direction and joins the Da Rang River, which flows into the South China Sea at Tuy Hoa town. The Ba River has a highly seasonal flow, with the three months October, November and December accounting for 60 to 70% of the total annual flow; and
- (b) **Dak Pne River:** Streams originating on the western side of Mount Kon Ka Kinh feed the Dak Pne River, which flows north and joins the Dak Bla River, which merges with the Krong Po Ko River at Kon Tum town. The Krong Po Ko River, in turn, flows west to Cambodia, where it becomes the Tonle San River, which joins the Mekong River at Stoeng Treng.

Both the above-mentioned river systems play key roles in supplying water for irrigation, domestic use and hydro-electricity generation in downstream areas.

2.7 Flora Overview

The field survey recorded 652 vascular plant species in 450 genera and 130 families (Table 2 and Appendix 1). Of these species, 238 are timber species, 110 have known medicinal uses and 38 have potential economic value as ornamentals. Many of these species have high economic value, such as the timber species *Fokienia hodginsii*, *Decussocarpus fleuryi*, *Azelia xylocarpa*, *Pterocarpus macrocarpus*, *Dalbergia cochinchinensis* and *Chukrasia tabularis*, and the medicinal plant species *Aquilaria crassna*, *Coscinium fenestratum*, *Fibraurea tinctoria*, *Anoectochilus lylei* and *A. roxburghii*.

Table 2: Plants Recorded in the Study Area

Division	Families	Genera	Species
Lycopodiophyta	2	3	4
Equisetophyta	1	1	1
Polypodiophyta	13	28	35
Pinophyta	5	7	8
Magnoliophyta	109	411	604
Total	130	450	652

Seventeen of the 130 plant families recorded in the study area are represented by 10 or more species: Fabaceae (36 species), Orchidaceae (35), Rubiaceae (28), Lauraceae (25), Euphorbiaceae (22), Poaceae (19), Asteraceae (17), Moraceae (16), Fagaceae (14), Meliaceae (13), Apocynaceae (13), Arecaceae (13), Melastomataceae (11), Araceae (11), Cyperaceae (10), Annonaceae (10) and Theaceae (10). The tree flora is dominated by members of the following families: Cupressaceae, Podocarpaceae, Fagaceae, Lauraceae, Hamamelidaceae, Magnoliaceae, Burseraceae, Euphorbiaceae, Betulaceae, Ericaceae, Theaceae, Myrtaceae, Araliaceae and Elaeocarpaceae.

Sixteen species recorded in the study area are listed in the IUCN Red List of Threatened Plants (IUCN 1997) as globally threatened, of which one is listed as Endangered, four are listed as Vulnerable and 11 are listed as Rare (Table 3).

Ten of the plant species recorded in the study area are endemic to Vietnam: *Pinus dalatensis*, *Craibiodendron scleranthum*, *Azelia xylocarpa*, *Calamus poilanei*, *Dalbergia cochinchinensis*, *Dialium cochinchinensis*, *Alchornea annamica*, *Baccaurea silvestris*, *Dendrobium ochraceum* and *Bulbophyllum hiepii*. In addition, several specimens were collected that may represent new records for Vietnam or new species for science. These specimens await final determinations.

Table 3: Globally Threatened Plant Species Recorded in the Study Area

Species	IUCN 1997
<i>Pinus dalatensis</i>	E
<i>Fokienia hodginsii</i>	V
<i>Decussocarpus fleuryi</i>	V
<i>Cephalotaxus mannii</i>	V
<i>Coscinium fenestratum</i>	R
<i>Adinandra microcarpa</i>	R
<i>Casearia annamensis</i>	R
<i>Rhododendron fleuryi</i>	R
<i>Craibiodendron scleranthum</i>	R
<i>Semecarpus caudata</i>	R
<i>Schefflera kontumensis</i>	R
<i>Altingia poilanei</i>	R
<i>Calamus poilanei</i>	V
<i>Arundinaria baviensis</i>	R
<i>Liparis chapaensis</i>	R
<i>Epigeneium chapaense</i>	R

Notes: E = Endangered; V=Vulnerable; R = Rare as per IUCN (1997)

2.8 Vegetation Types

The natural vegetation cover at Kon Ka Kinh Nature Reserve consists of broadleaf evergreen forest, with smaller areas of mixed broadleaf and coniferous forest. A significant proportion of the vegetation cover at Kon Ka Kinh is relatively undisturbed, although a similar proportion has been degraded by human activities (Table 4). Areas

Table 4: Vegetation Types at Kon Ka Kinh Nature Reserve

Vegetation Type	Area (ha)	%
Broadleaf evergreen forest below 900 m	889	2.1
Broadleaf evergreen forest above 900 m	19,703	47.2
Degraded evergreen forest	8,247	19.8
Regenerating forest	3,990	9.6
Bamboo forest	736	1.8
Scrub with Scattered Trees	3,035	7.3
Scrub	3,803	9.1
Grassland	722	1.7
Agricultural land	585	1.4
Total	41,710	100.0

Source: Quy Nhon Sub-FIPI; 1999 data

that have experienced a large amount of disturbance support a range of secondary vegetation types, including regenerating forest, bamboo forest, grassland and scrub (Map 2).

The main vegetation types at Kon Ka Kinh Nature Reserve are classified according to Thai Van Trung (1978). Based upon this classification, the following vegetation types are found at Kon Ka Kinh:

- (a) medium montane broadleaf evergreen forest;
- (b) low montane broadleaf evergreen forest; and
- (c) secondary vegetation.

Vegetation types (a) and (b) broadly equate to tropical montane evergreen forest in the classification developed by MacKinnon and MacKinnon (1986) and refined by MacKinnon (1997). Under the classification developed by Whitmore (1975), these vegetation types broadly equate to tropical lower montane rainforest.

Medium Montane Broadleaf Evergreen Forest

Medium montane broadleaf evergreen forest, which is distributed at elevations above 900 m, is the dominant vegetation type in the nature reserve (Table 4). This forest type is dominated by broadleaf tree species from the following families: Fagaceae, Lauraceae, Magnoliaceae, Hamamelidaceae, Theaceae, Ericaceae, Myrtaceae and Araliaceae.

Medium montane broadleaf evergreen forest is stratified into three layers:

- (a) **Canopy Layer.** The height of the canopy layer varies according to altitude and soil type: typically, the canopy layer is 20 to 25 m in height, although it is as low as 10 to 12 m in some areas. The canopy is closed but uneven. The species composition of this layer is dominated by members of the Fagaceae (*Castanopsis* spp., *Lithocarpus* spp. and *Quercus* spp.), Lauraceae (*Cinnamomum* spp., *Litsea* spp., *Alseodaphne* spp. and *Cryptocarya* spp.) and Magnoliaceae (*Michelia* spp.); three families that are characteristic of montane forest above 1,000 m in Vietnam (Collins *et al.* 1991). Other common canopy species include *Craibiodendron scleranthum*, *Symingtonia populnea*, *S. tonkinensis*, *Altingia poilanei*, *Schima wallichii*, *Adinandra rubropunctata*, *Pyrenaria oblongicarpa*, *Dacryodes dungii*, *Polyalthia*

nemoralis, *Diplopanax stachyanthus*, *Syzygium* spp., *Madhuca* sp., and *Betula alnoides*. Species present in smaller numbers or in a more restricted area include *Podocarpus nerifolius*, *Daphniphyllum* aff. *himalaensis*, *Kopsia* aff. *harmandiana*, *Rhododendron* spp., *Illicium griffithii* and *Elaeocarpus limitanus*.

- (b) **Middle Layer.** This layer is continuous with the canopy layer, and contains immature specimens of canopy layer species, as well as smaller trees restricted to this layer, such as *Baccaurea silvestris*, *Gironniera subaequalis*, *Garcinia* spp., *Diospyros* spp., *Chisocheton cumingianus* subsp. *balansae*, *Aglaiia* spp., *Photinia* aff. *prunifolia*, *Paranephelium spirei* and *Nephelium* aff. *melliferum*, and
- (c) **Ground Layer.** The ground layer contains a mix of tree saplings, palms, shrubs and herbs. Common shrubs include *Lasianthus* spp., *Psychotria rubra*, *Ardisia* spp., *Evodia* spp. and members of the Melastomataceae. Common herbs include *Dianella nemorosa*, *Phrynium dispernum*, *Curculigo* spp. and members of the Zingiberaceae and Acanthaceae. Close to the forest floor, the vegetation is dominated by *Selaginella* spp. and a variety of fern species. The dwarf bamboo, *Arundinaria baviensis*, is distributed at altitudes above 1,400 m, in association with other bamboo species, including *Schizostachyum* sp.

Sub-type: a) Mixed Coniferous and Broadleaf Forest containing *Fokienia hodginsii*

To the south of the summit of Mount Kon Ka Kinh lies an area of around 2,000 ha of mixed coniferous and broadleaf forest. This forest sub-type is dominated by *Fokienia hodginsii*, although other conifer species are present, including *Pinus dalatensis*, *Podocarpus imbricatus* and *Dacrydium elatum*. *F. hodginsii* is distributed at elevations above 1,300 m, whilst *P. imbricatus* and *D. elatum* are restricted to altitudes below 1,400 m. This forest sub-type has been extensively logged for *F. hodginsii*.

Low Montane Broadleaf Evergreen Forest

Low montane broadleaf evergreen forest is distributed below 900 m, and occupies a small area of the nature reserve relative to other vegetation types. This forest type is composed mainly of broadleaf trees interspersed with a few conifers.

Low montane broadleaf evergreen forest is stratified into four layers:

- (a) **Emergent Layer.** Trees in the emergent tree layer reach heights of up to 40 m, and include members of the Dipterocarpaceae, Fabaceae, Moraceae and Meliaceae;
- (b) **Canopy Layer.** The height of the canopy layer is between 20 and 30 m. The species diversity of this layer is very high, and the following species are well represented: *Castanopsis* spp., *Lithocarpus* spp., *Cinnamomum* spp., *Litsea* spp., *Cryptocarya* spp., *Dialium cochinchinensis*, *Aglaiia gigantea*, *Michelia* spp., *Canarium littorale* and *Dacryodes dungii*.
- (c) **Middle Layer.** This layer is 8 to 15 m in height, and comprises a mixture of shade-tolerant trees and immature specimens of species found in the canopy and emergent layers; and
- (d) **Ground Layer.** The ground layer contains a mix of shrubs, herbs and saplings, with the following families being well represented: Acanthaceae, Urticaceae, Araceae, Zingiberaceae and Polypodiaceae.

Degraded Evergreen Forest

This forest type is formed as a result of unsustainable human activities, usually in the form of timber

extraction. The forest canopy is incomplete (canopy cover ranges between 10 and 40%), and there is a lot of light penetration to the lower forest layers, encouraging growth of understorey vegetation. Tree species with high economic value, such as *Fokienia hodginsii* and *Dalbergia cochinchinensis*, are rare, and the tree flora is dominated by fast-growing, pioneer species. This forest type covers nearly 20% of the nature reserve, and is distributed in easily accessible areas, close to habitation, and in areas containing high densities of economically valuable species.

Regenerating Forest

This is a secondary vegetation type, distributed in areas that have previously been cleared. Fast-growing, pioneer species, such as *Mallotus apelta*, *Macaranga* spp. and *Trema orientalis* dominate the tree flora. The structure of this forest type is complex, and there is no clear division into forest layers. Canopy cover is 80 to 90%.

Bamboo Forest

Small areas of bamboo forest are distributed in the north and south-east of the nature reserve. This vegetation type is found on abandoned agricultural land. The dominant bamboo species is *Oxytenanthera albo-cyliata*, which grows in clumps at a spacing of 3 to 5 m. These clumps are interspersed with broadleaf trees, including *Vitex* spp., *Engelhardtia* spp., *Wendlandia glabrata* and *Aporusa dioica*. There is little light penetration to the forest floor, and, consequently, ground cover is very sparse and the density of tree seedlings is low.

Scrub with Scattered Trees

This category includes small, isolated patches of forest, and areas of scrub and grassland containing scattered individual trees. This vegetation type covers 7% of the nature reserve. If left undisturbed, some areas of this vegetation type could regenerate naturally into secondary forest.

Grassland and Scrub

Grassland and scrub are secondary vegetation types that reflect past human disturbance. They are distributed in areas that were subjected to intensive cultivation in the past, particularly at lower elevations, along rivers and close to habitation. Grassland and scrub cover 4,525 ha of Kon Ka Kinh Nature Reserve or 11% of the total area. Common scrub species include *Melastoma* spp., *Rhodomyrtus tomentosa*, *Rubus* spp. and *Dodonea viscosa*. A few small trees from the Rutaceae, Euphorbiaceae and Verbenaceae are also present.

The species composition of grassland varies throughout the nature reserve, although *Phragmites vallatoria* and *Erianthus arundinaceus* are usually present. Grasses are perennials: growing to heights of 2 to 3 m during the rainy season and then dying back during the dry season. During the dry season, grassland is vulnerable to fire, and repeated burning inhibits natural regeneration of forest.

2.9 Fauna Overview

The fauna of Kon Ka Kinh Nature Reserve had not been studied prior to the BirdLife/Forest Inventory and Planning Institute (FIPI) survey in 1999. The field survey recorded a total of 253 vertebrate species, including 42 mammal species, 160 bird species, 29 reptile species and 22 amphibian species (Table 5). A total of 209 species of butterfly were recorded during the field survey.

Table 5: Vertebrate Species Recorded at Kon Ka Kinh Nature Reserve

Class	Orders	Families	Species
Mammals	7	19	42
Birds	12	35	160
Reptiles	2	10	29
Amphibians	1	5	22
Total	22	69	253

2.10 Mammals

A total of 42 mammal species were recorded at Kon Ka Kinh Nature Reserve (Appendix 2), including seven species listed in the IUCN Red List of Threatened Animals (IUCN 1996) as globally threatened, and one species, Buff-cheeked Gibbon *Hylobates gabriellae*, listed as Data Deficient. Three species recorded during the field survey are endemic to Indochina: Buff-cheeked Gibbon, Douc Langur *Pygathrix nemaus* and Truong Son Muntjac *Muntiacus truongsonensis* (Table 6).

Table 6: Globally Threatened and Endemic Mammals Recorded at Kon Ka Kinh Nature Reserve

Species	Scientific Name	IUCN 1996	Endemism
Pig-tailed Macaque	<i>Macaca nemestrina</i>	VU	
Bear Macaque	<i>M. arctoides</i>	VU	
Douc Langur	<i>Pygathrix nemaus</i>	EN	EI
Buff-cheeked Gibbon	<i>Hylobates gabriellae</i>	DD	EI
Asiatic Black Bear	<i>Ursus thibetanus</i>	VU	
Tiger	<i>Panthera tigris</i>	EN	
Truong Son Muntjac	<i>Muntiacus truongsonensis</i>	NE	EI
Southern Serow	<i>Naemorhedus sumatraensis</i>	VU	
Malayan Porcupine	<i>Hystrix brachyura</i>	VU	

Follows Corbet and Hill (1992). Notes: EN = Endangered; VU = Vulnerable; DD = Data Deficient as per IUCN (1996); NE = not evaluated; EI = Endemic to Indochina

Mammal Records

Sunda Pangolin *Manis javanica*. Scales were observed in local villages. This species is widespread in southern Vietnam, and listed by IUCN (1996) as Near Threatened.

Moluccan Whiskered Bat *Myotis ater*. Two individuals were collected at 1,600 m, in medium montane broadleaf evergreen forest, along a narrow ridge top. This represents the first record of this species for Vietnam. The previous known range of Moluccan Whiskered Bat extends from western Sumatra, across Borneo, the Philippines and Sulawesi, to Papua New Guinea (Corbet and Hill 1992).

Pig-tailed Macaque *Macaca nemestrina*. One group was observed in broadleaf evergreen forest above 900 m.

Bear Macaque *M. arctoides*. One captive individual was observed in Tung village, Kroong commune.

Douc Langur *Pygathrix nemaus*. This species was not observed in the wild during the field survey. However, two specimens were observed in a taxidermist's shop in K'Bang town; these specimens belonged to the subspecies Grey-shanked Douc Langur *P. n. cinereus*. The taxidermist reported that they came from Dak Roong Forest Enterprise, between Kon Ka Kinh and Kon Cha Rang Nature Reserves.

Buff-cheeked Gibbon *Hylobates gabriellae*. Gibbons were heard calling on three occasions, all in the same area, but the species was not observed. The species was assumed to be Buff-cheeked Gibbon based on distribution data given by Corbet and Hill (1992). The calling density at Kon Ka Kinh Nature Reserve was relatively low, although this might have resulted from frequent rain in the early mornings during the study period, rather than from any underlying low density of gibbons.

Tiger *Panthera tigris*. A set of fresh tracks, measuring 145 mm at the widest point were seen along a ridge-top path at 14°17'N 108°24'E.

Truong Son Muntjac *Muntiacus truongsonensis*. The skull of a small muntjac was collected from a hunter's house in Dak Phe commune. This skull was identified as Truong Son Muntjac, although this was a preliminary identification and the specimen awaits final determination. Truong Son Muntjac is a recently described species that was first discovered in Hien district, Quang Nam province in 1997 (Pham Mong Giao *et al.* 1998).

Southern Serow *Naemorhedus sumatraensis*. Two hunters' trophies were identified as belonging to this species. During the study period, however, no signs of Southern Serow were seen.

Malayan Porcupine *Hystrix brachyura*. One individual was observed in the early evening, on a path in medium montane broadleaf evergreen forest.

Bat Survey

A total of 14 bat species, representing four families and eight genera, were recorded at Kon Ka Kinh Nature Reserve (Appendix 2), including one new species record for Vietnam: Molocuan Whiskered Bat. This figure represents approximately 20% of the known bat fauna of Vietnam. The diversity of the known bat fauna of Kon Ka Kinh is comparable to that at other montane forest areas in Vietnam: a survey of Ngoc Linh (Quang Nam) proposed nature reserve recorded 21 species (Tordoff *et al.* 2000), and a survey of Hoang Lien Nature Reserve recorded 17 species (Tordoff *et al.* 1999).

When the results of the field survey at Kon Ka Kinh are compared with those of a BirdLife/FIPI survey of similar duration at nearby Kon Cha Rang Nature Reserve (Map 1), significant differences between the two bat faunas are revealed. Overall, Kon Cha Rang has a higher known bat species diversity (20 species compared with 14), which may reflect the difference in elevation between the two sites: Kon Cha Rang supports mainly low montane broadleaf evergreen forest, whereas Kon Ka Kinh supports mainly medium montane broadleaf evergreen forest. Additionally, many survey nights at Kon Ka Kinh were affected by rain, which makes bat nets easier to detect, and may have led to an under-recording of species diversity.

Further surveys are required over a more extensive area and at different times of the year to obtain a more complete knowledge of the bat community at Kon Ka Kinh Nature Reserve. Special emphasis should be given to lower elevation habitats since this is likely to increase the number of known species. Additionally, surveys on fruit bats are required, in order to determine their status and distribution within the nature reserve and to assess threats to their populations.

The combined bat species diversity of Kon Ka Kinh and Kon Cha Rang Nature Reserves is greater than for the whole of Sri Lanka, which is considered to have a very diverse bat fauna (P. J. J. Bates pers. comm. 1998). Furthermore, the fact that approximately 40% of known Vietnamese bat species were recorded from the two nature reserves suggests that the two sites may be of high conservation significance for bats, although too little is known about the biogeography and status of bats in Vietnam to determine the relative importance of these sites in a national context. Of the 28 species recorded at the two nature reserves, only six were recorded at both sites, possibly reflecting the differences in habitat types between the two sites. Therefore, the two bat faunas are complimentary to one another, and it is necessary to conserve both sites in order to conserve the full range of bat diversity in north-eastern Gia Lai province.

2.11 Birds

A total of 160 bird species were recorded at Kon Ka Kinh Nature Reserve, representing 12 orders and 35 families (Appendix 3). This total includes five restricted-range species (Stattersfield *et al.* 1998) and four species listed in Collar *et al.* (1994) as globally threatened (Table 7).

Table 7: Globally Threatened and Restricted-range Birds Recorded at Kon Ka Kinh Nature Reserve

Species	Scientific Name	Restricted-range Species	Collar <i>et al.</i> 1994
Siamese Fireback	<i>Lophura diardi</i>		VU
Yellow-billed Nuthatch	<i>Sitta solangiae</i>	RRS	VU
Black-hooded Laughingthrush	<i>Garrulax milleti</i>	RRS	VU
White-cheeked Laughingthrush	<i>G. vassali</i>	RRS	
Short-tailed Scimitar Babbler	<i>Jabouilleia danjoui</i>	RRS	VU
Grey-faced Tit-babbler	<i>Macronous kelleyi</i>	RRS	NT

Follows Inskipp *et al.* (1996). Notes: VU = Vulnerable; NT = Near Threatened as per Collar *et al.* (1994); RRS = Restricted-range Species

The bird fauna of Kon Ka Kinh Nature Reserve includes many species characteristic of montane forest in Vietnam, including Maroon Oriole *Oriolus traillii*, Yellow-billed Nuthatch, Cutia *Cutia nipalensis*, Red-tailed Minla *Minla ignotincta*, Grey-headed Parrotbill *Paradoxornis gularis* and Green-tailed Sunbird *Aethopyga nipalensis*. The composition of the bird fauna of Mount Kon Ka Kinh is similar to that of Mount Ngoc Linh, 80 km to the north-west: 139 of the 160 species recorded at Kon Ka Kinh (87%) have been recorded at Ngoc Linh (Kon Tum) Nature Reserve or Ngoc Linh (Quang Nam) proposed nature reserve (Le Trong Trai *et al.* 1999, Tordoff *et al.* 2000).

During the field survey, an undescribed taxon of laughingthrush *Garrulax* was collected. This taxon is closely related to Rufous-throated Laughingthrush *G. rufogularis*, and may constitute a species new to science.

2.12 Herpetiles

A total of 51 herpetile species were recorded at Kon Ka Kinh Nature Reserve, comprising 29 species of reptile in 10 families and 22 species of amphibian in 5 families (Appendix 4). Only one species, *Manouria impressa*, is listed in the IUCN Red List of Threatened Animals (IUCN 1996) as globally threatened. Two species of reptile, *Scincella rufocaudata* and *Sphenomorphus buonloicus*, and two species of amphibian, *Rana chapaensis* and *R. verrucospinosa* are endemic to Vietnam, according to Nguyen Van Sang and Ho Thu Cuc (1996). The known global range of *Sphenomorphus buonloicus* is confined to Gia Lai province in the Western Highlands of Vietnam.

Many species recorded at Kon Ka Kinh Nature Reserve are also known from montane habitats at sites in northern Vietnam, including Hoang Lien Nature Reserve, and Tam Dao and Ba Vi National Parks. Several of these species are new records for the Western Highlands, such as *Oligodon eberharti*, *Leptobranchium palpebralespinosa*, *L. pelodytoides* and *Rana chapaensis*.

Altitudinal Distribution of Herpetile Species

Herpetile species composition varies with altitude:

- (a) **Below 1,000 m.** At elevations below 1,000 m, levels of human impact (logging, fuelwood collection and swidden agriculture) are high, resulting in a patchwork of different habitat types, including hill rice fields, bamboo forest, secondary forest, grassland and scrub. There are many large streams, with beds of rock and gravel. Most of the 27 species (53% of the total) recorded below 1,000 m were common species with wide distributions in Vietnam, for example *Physignathus concincinus*, *Mabuya multifasciata*, *Takydromus sexlineatus*, *Elaphe radiata*, *Ahaetulla prasina*, *Bufo melanostictus* and *Rana limnocharis*,

- (b) **1,000 to 1,400 m.** At these elevations, the dominant vegetation type is broadleaf evergreen forest. There are a number of small, rocky streams. At these elevations, 20 species were recorded (39% of the total), of which a large proportion were amphibian species characteristic of montane areas, for example *Rana andersoni*, *R. kuhlii*, *R. ricketti*, *R. verrucospinosa* and *Philautus petersi*; and
- (c) **Above 1,400 m.** Elevations above 1,400 m support mixed coniferous and broadleaf evergreen forest. The only watercourses are small streams, which are often seasonal. Only 13 species were recorded above 1,400 m, most of which were species characteristic of montane areas, for example: *Oligodon eberhardti*, *Pseudoxenodon macrops*, *Leptobrachium hasselti*, *L. palpebralespinosa*, *Rana chapaensis* and *R. kuhlii*.

In general, species diversity decreases with increased altitude, which is a similar phenomenon to that observed at Tam Dao National Park and Hoang Lien Nature Reserve. An interesting feature of the herpetile community at Kon Ka Kinh Nature Reserve is that, whilst species diversity decreases with increasing altitude, abundance of individuals increases. Species that are abundant at high elevations include *Trimeresurus popeorum*, *Rana chapaensis*, *R. sauteri*, *R. verrucospinosa* and *Microhyla butleri*.

2.13 Butterflies

Species Composition. A total of 209 species of butterfly were recorded at Kon Ka Kinh Nature Reserve (Appendix 5). These species are distributed among 10 families, representing all butterfly families found in Vietnam. The most species-diverse family was the Nymphalidae, with 40 species, followed by the Satyridae (32 species), Hesperidae (31), Lycaenidae (29), Pieridae (28), Papilionidae (19); Danaidae (11); Riodinidae (11), Amathusiidae (6) and Libytheidae (2).

Excluding the Lycaenidae and Hesperidae, 48.4% of the species found at Kon Ka Kinh Nature Reserve are distributed throughout the Oriental region, and 9.5% represent the Sino-Himalayan fauna. The proportion of species with ranges from Indochina to India is much greater at Kon Ka Kinh than at nearby Kon Cha Rang Nature Reserve.

New Taxa. At least eight taxa collected during the field survey may be new for science. These taxa are in the following genera: *Delias* (Pieridae), *Lethe* (Satyridae), *Aemona* (Amathusiidae), *Cirrochroa* (Nymphalidae), *Dodona* and *Abisara* (Riodinidae) and *Ravenna* (Lycaenidae); new taxa are also possible in the Hesperidae. The record of *Ravenna nivea* (Lycaenidae) from Kon Ka Kinh is of special interest because this species was long believed to be endemic to Taiwan. In 1993, a new subspecies, *R. n. howarthi*, was described from a high altitude locality in south-eastern China; and the form recorded at Kon Ka Kinh may represent yet another new subspecies. *Delias georgina* subsp. is a new record for Vietnam. This species is remarkable in that it occurs as a number of distinct races on isolated peaks in the Malay Peninsula and other sites in South-East Asia. The subspecies recorded during the field survey could be endemic to the Kon Tum Plateau.

New Distribution Records. In addition to *Ravenna nivea* and *Delias georgina*, at least five other species recorded at Kon Ka Kinh Nature Reserve are new records for Vietnam: *Paduca fasciata*, *Neptis yerburii*, *N. cartica* and *N. radha* in the Nymphalidae; and *Rapala manea* in the Lycaenidae. Several other records significantly extend the known distribution in Vietnam of some taxa, for example *Talbotia naganum* (Pieridae).

Altitudinal Distribution. Of the 209 butterfly species recorded at Kon Ka Kinh, 81 species were recorded at altitudes below 800 m, along the Krong Pa River, of which 43 were restricted to this altitudinal

range; 110 species were recorded at elevations between 800 and 1,300 m, of which 56 were restricted to this altitudinal range; and 88 species were recorded above 1,300 m, in medium montane broadleaf evergreen forest, of which 50 were restricted to this altitudinal range (Appendix 5).

Rare Species. The field survey revealed no butterfly species listed in the IUCN Red List of Threatened Animals (IUCN 1996). However, a number of species that are believed to be rare in the Oriental region were recorded, such as *Laringa horsfieldii*, *Neurosigma siva* and *Dichorragia nesimachus*. The following species were only recorded in Vietnam on one previous occasion, at Ngoc Linh (Kon Tum) Nature Reserve: *Lethe distans*, *Enispe cygnus*, *Aemonia amathusia* subsp., *Neptis zaida*, *Callerebia narasingha* and *Ypthima dohertyi*; these species are all characteristic of montane evergreen forest.

3. Socio-economic Features

The buffer zone of Kon Ka Kinh Nature Reserve includes all or part of Kon Pne, Kroong, Dak Roong and Lo Ku communes, K'Bang district, and Ha Dong, Ayun and Ha Ra communes, Mang Yang district. All seven communes are either partly contained within the nature reserve or contiguous with the boundary. The inhabitants of Ayun and Ha Ra communes have a relatively low impact on the nature reserve, because they are concentrated along National Highway 19, far from the nature reserve. The highest impact comes from the inhabitants closer to the nature reserve, and it is to these communities that the information given in this section principally relates.

3.1 Population and Infrastructure

Demographics

The total population of the buffer zone is 27,210 people, of which 17,395 (63.93% of the total) inhabit Mang Yang district (Table 8). The population of the buffer zone is concentrated in 82 villages and hamlets, and the population density in the buffer zone communes as a whole is 16.9 people/km². The lowest population density is in Kon Pne commune with 6.2 people/km², whilst Ha Ra and Ayun communes have population densities of over 30 people/km² (Map 3). The higher population densities in Ha Ra and Ayun communes can be attributed to their location along National Highway 19. Natural population growth rates in the buffer zone are high, averaging 3.0% per annum in Mang Yang district and 2.8% per annum in K'Bang district. These figures do not include growth due to immigration.

Table 8: Population Distribution and Density in the Buffer Zone Communes

Commune	Area (ha)	Households		Population		Density (people/km ²)	
		1997	1999	1997	1999	1997	1999
Kon Pne	16,800	204	214	995	1,048	5.9	6.2
Dak Roong	36,100	469	553	2,367	2,604	6.5	7.2
Kroong	31,000	643	805	3,454	3,778	11.1	12.2
Lo Ku	14,021	345	459	1,773	2,387	12.6	17.0
Ha Dong	19,900	506	446	2,510	2,581	12.6	12.9
Ayun	20,948	1,324	1,552	7,020	7,929	33.5	37.8
Ha Ra	22,241	1,154	1,324	6,131	6,883	27.6	30.9
Total	161,010	4,645	5,353	24,250	27,210	15.1	16.9

The majority of the inhabitants of the buffer zone belong to one of two ethnic groups: the Ba Na (the largest ethnic minority in Gia Lai province) and the Kinh (ethnic Vietnamese). The Ba Na comprise 71% and the Kinh 27% of the population of the buffer zone. Ha Dong and Kon Pne communes are almost entirely populated by members of the Ba Na ethnic minority (Table 9); these two communes are the most remote communes in K'Bang and Mang Yang districts. Ha Ra and Ayun communes, which are located along National Highway 19, contain high proportions of Kinh people (Map 3). The other ethnic groups in the buffer zone, which include the Dao (Mien), Tay, Hmong, Gia Rai and Day, comprise less than 2% of the total population. Lo Ku commune is home to 11 ethnic groups; most of which, with the exception of the Ba Na, have migrated from northern and central provinces of Vietnam.

Table 9: Ethnic Composition in the Buffer Zone Communes (1997 Data)

Commune	Ethnic Group			Total
	Kinh	Ba Na	Others	
Kon Pne	0	995	0	995
Dak Roong	260	2,107	0	2,367
Kroong	344	3,044	66	3,454
Lo Ku	362	1,300	111	1,773
Ha Dong	0	2,503	7	2,510
Ayun	2,657	4,134	229	7,020
Ha Ra	2,952	3,179	0	6,131
Total	6,575	17,262	413	24,250

With a large area of fertile land and a low population density, K'Bang district is an attractive area for spontaneous migrants from provinces in northern Vietnam. In recent years, immigration rates have been high, and Lo Ku commune has been a particular "hot spot" for spontaneous migrants: in the two years 1997 and 1998, a total of 413 migrants settled in Lo Ku commune, amounting to 17% of the current population of the commune. In the period from 1991 to 1998, 11,348 spontaneous migrants in 2,893 households settled in K'Bang district as a whole.

As part of the government-sponsored 'Fixed Cultivation and Sedentarisation Programme', funded by the Fund for Eliminating Famine and Reducing Poverty, many spontaneous migrants have been settled either permanently (officially recognised and given land tenure for houseplots and home-gardens) or temporarily (officially recognised but not yet received land tenure). However, in all communes apart from Ha Ra, there are spontaneous migrants who are currently unsettled (not yet officially recognised) (Table 10).

Table 10: Sedentarisation in the Buffer Zone Communes

Commune	Total		Permanently Settled		Temporarily Settled		Unsettled	
	H'holds	People	H'holds	People	H'holds	People	H'holds	People
Kon Pne	214	1,048	0	0	0	0	214	1,048
Dak Roong	553	2,604	150	781	194	717	209	1,106
Kroong	805	3,778	108	507	303	1,421	394	1,850
Lo Ku	459	2,387	162	842	125	696	172	849
Ha Dong	512	2,252	21	92	111	489	380	1,671
Ayun	1,523	7,813	1,084	5,245	0	0	439	2,568
Ha Ra	1,069	5,890	1,069	5,890	0	0	0	0
Total	5,135	25,772	2,594	13,357	733	3,323	1,808	9,092

In Lo Ku commune, a total of VND 500 million has been invested to help 70 households become permanently settled. With these funds, two schools, seven wells and two pipelines were constructed, and the road to the commune centre was upgraded. Additionally, funds were used to make interest-free loans to newly settled households. Significantly, most of the households settled in Lo Ku commune were not unsettled or temporarily settled households from the commune, but migrants from elsewhere in Gia Lai province: 42 households came from Ka Nak town and 25 households came from Son Lang commune.

Transportation

Currently, all communes in the buffer zone are accessible by car, with the exception of Kon Pne. However, the road network only links the main centres of population with the district towns: many villages are accessible only on foot. Much of the present road network was built by forest enterprises, who used it to

extract timber from the area. Consequently, road quality depends upon the level of timber extraction in a particular area: where little timber is being extracted, the roads are poorly maintained, particularly the roads to Lo Ku and Kon Pne communes. The only surfaced road is a 17 km stretch of National Highway 19; other roads are unsurfaced and rough. Presently, transportation within the buffer zone is difficult, especially during the rainy season.

Kon Pne commune is the most remote in the buffer zone. The three villages in this commune are surrounded by mountains higher than 1,100 m. This commune can only be reached on foot, involving an eight-hour walk from Ha Dong or Dak Roong commune. The poor transportation to this commune presents a big obstacle to the area's future development. For this reason, road construction was identified as the highest priority for investment by villagers interviewed.

Health Care

Each commune has a health station run by the district department of health. However, medical equipment is in short supply and the health stations are understaffed. A total of 17 health care staff work in the seven buffer zone communes, comprising eight assistant doctors and nine nurses; there are no doctors working in the buffer zone communes. On average, one nurse and one assistant doctor serve 2,700 people, which can be considered inadequate to meet the health-care needs of the communes concerned.

The commonest medical complaints in the buffer zone are malaria, goitre, tuberculosis, diarrhoea and conjunctivitis. Of these complaints, malaria is the most widespread amongst the local population. The peak months for malaria are April, May, September, October and November. Although, the district departments of health conduct an annual malaria eradication campaign, to date they have had little success. Recently, every household has received 2 kg of iodinated salt every year as a measure against goitre. As a result, goitre, which used to be common, has reportedly been nearly eradicated.

The national family planning programme has had little success in this area. This programme has proven very difficult to implement due to a large, inaccessible population and economic incentives to have many children. Furthermore, high mortality rates are a disincentive to control birth rates.

Education

Generally, each commune has a main school located at the commune centre and several subsidiary schools located in the villages. At the village schools, pupils can only study at the first and second grades, although, at the main schools, they can continue their studies to the seventh grade. Four buffer zone communes have kindergartens, with a total of 1,052 pupils, and three communes have secondary schools, with a total of 438 pupils (Table 11).

The attendance rate for the buffer zone as a whole is 70%, although the rate is considerably lower in Kon Pne commune at 50%. The main reasons for low attendance are that:

- There are economic costs associated with sending children to school, especially loss of labour during the harvest and planting seasons;
- It is too far for many children to travel to school, especially during the rainy season when footpaths are in a poor condition;
- The first language of most ethnic minority people is not Vietnamese, whilst lessons are in this language; and
- That there are few incentives for parents to ensure that their children receive an education.

There are serious shortages of classrooms, qualified teachers and equipment such as textbooks. One result of the shortages of qualified teachers and classrooms is that all schools must hold mixed-grade classes, with up to three grades in one class. Education is an issue that needs addressing because, alongside transportation problems, low levels of education are a major obstacle to economic development in the buffer zone.

Table 11: Education Provision and Attendance in the Buffer Zone

Commune	Kindergarten		Primary School		Secondary School		Attendance (%)	Shortage of Teachers
	Pupils	Teachers	Pupils	Teachers	Pupils	Teachers		
Kon Pne	0	0	169	5	0	0	50	1
Dak Roong	0	0	436	11	0	0	65	5
Kroong	112	6	742	22	0	0	65	6
Lo Ku	208	0	653	30	0	0	75	6
Ha Dong	0	0	575	15	55	1	75	5
Ayun	380	15	1,188	32	205	5	80	8
Ha Ra	352	10	1,047	28	223	4	80	12
Total	1,052	31	4,810	143	483	10	70	43

3.2 Economic Activities

Agriculture

Only two buffer zone communes, Ha Ra and Ayun, have large areas of wet rice land: Ha Ra has 320 ha and Ayun 925 ha (Table 12); most of this land is cultivated by Kinh people. In the other communes in the buffer zone, the staple crop is hill rice, which is grown commonly by shifting cultivation. Shifting cultivation is most widely practised in remote villages, particularly in Ha Dong and Kon Pne communes. Annually, in late April or at the beginning of May, hill fields are created by clearing vegetation. Hill rice is cultivated in these fields for three to four years, after which time the soil becomes exhausted and the field is abandoned. Local people reported that they were permitted to clear areas of secondary growth less than five years old for hill fields but preferred to clear areas of primary forest because of the soil was more fertile and there were fewer trees to cut. Only one crop of hill rice is harvested each year.

Presently, shifting cultivation is the principal cause of natural forest clearance in the area. For instance, K'Bang District Forest Protection Department (FPD) reported that, from January to March 1999, 35.1 ha of forest in the district was cleared. The Ba Na people inhabiting the buffer zone depend heavily on agricultural activities, so the most important natural resource for these people is forest land that can be cleared for agriculture.

Table 12: Rice Production in the Buffer Zone Communes

Commune	Wet Rice			Hill Rice		
	Area (ha)	Productivity (tonnes/ha)	Yield (tonnes)	Area (ha)	Productivity (tonnes/ha)	Yield (tonnes)
Kon Pne	5	2.9	14.5	123	0.9	194.9
Dak Roong	51	1.3	67.3	306	0.9	278.3
Kroong	12	2.7	31.9	238	1.3	308.0
Lo Ku	10	2.5	25.0	285	1.0	274.8
Ha Dong	13	1.9	27.4	320	1.0	340.0
Ayun	925	2.0	1,850.0	1,210	2.7	3,218.6
Ha Ra	320	2.0	641.0	396	2.3	909.6
Total	1,336	2.0	2,657.1	2,878	1.9	5,524.2

In recent years, learning from the Kinh people, the Ba Na have begun to cultivate wet rice. Although productivity is still low (around 2.0 tonnes/ha) wet rice cultivation is leading to an increase in overall agricultural production and a diversification of crops. Additionally, wet cultivation can be a more environmentally sustainable activity as it reduces the need to clear forest. All communities in the buffer zone wish to expand their wet rice land but many are restricted by water availability and shortage of flat land.

Other staple crops grown in the buffer zone are cassava, maize, green beans and sweet potato (Table 13). These products are used for both cattle feed and food for people during lean times prior to the rice harvest. Green beans are mainly cultivated in Kroong and Lo Ku communes with a total area of 253 ha and an approximate productivity of 0.26 tonnes/ha. One kilogramme of green beans sells for VND 5,000 to 6,000.

Table 13: Production of Cassava and Maize in Five Buffer Zone Communes

Commune	Cassava			Maize		
	Area (ha)	Productivity (tonnes/ha)	Yield (tonnes)	Area (ha)	Productivity (tonnes/ha)	Yield (tonnes)
Kon Pne	70	9.0	630.0	37	1.7	6.5
Dak Roong	32	5.4	171.2	36	1.8	64.8
Kroong	41	9.0	368.1	113	1.8	201.0
Lo Ku	56	8.9	501.0	63	1.4	87.3
Ha Dong	10	9.0	90.0	6	1.7	10.8

The major industrial crops in the buffer zone are coffee, pepper and sugar cane. In recent years, the price of coffee has been high and stable, encouraging the cultivation of the crop in K'Bang district. Since coffee only grows well on red ferric acrisol soils, coffee is mainly grown in Dak Roong and Kroong communes where these soils are distributed. The total area of coffee plantations in these two communes is 226 ha. Most coffee plantations belong to Kinh migrants from northern Vietnam, forest enterprise workers, and landowners from Ka Nak, Plei Ku and Quy Nhon towns. The development of coffee plantations has led to increased pressure on the forest in K'Bang and Mang Yang districts as local people clear forest and sell the land to migrants or landowners.

Animal Husbandry

Animal husbandry is an important source of income for the inhabitants of the buffer zone (Table 14). The four most commonly bred domestic animals are cows, buffalo, pigs and chickens. There are high levels of disease amongst animals. For instance, during the field survey, a large number of chickens in Kon Pne commune were killed by disease. In remote areas, such as Kon Pne and Ha Dong communes, there is little potential for commercial livestock raising because of difficulties in transporting livestock to market. Hence, most livestock is raised for domestic consumption.

Table 14: Livestock Ownership in the Buffer Zone

Commune	Buffalo and Cattle	Pigs
Kon Pne	184	284
Dak Roong	985	913
Kroong	311	584
Lo Ku	489	434
Ha Dong	1,135	1,107
Ayun	2,009	2,737
Ha Ra	2,056	2,585
Total	17,169	8,644

Social Forestry

Many households in the buffer zone sign forest protection contracts to protect areas of natural forest. In

1998, these households received VND 35,000 to 45,000 per hectare per year, paid either in cash or in rice. Forest protection contracts are issued by the forest enterprises in the area, and are a very important source of income for villagers in remote areas. However, the inhabitants of Ha Dong and Kon Phe communes have yet to be allocated forest land for protection, despite the eagerness of villagers in these communes to be allocated forest land for this purpose.

Natural Resource Use

Timber Extraction. Although they are permitted to do so, Ba Na people rarely use timber for house construction. Rather, houses are usually made of bamboo with a palm roof. Most illegal timber extraction taking place within Kon Ka Kinh Nature Reserve is being carried out by groups of Kinh people from northern Vietnam who travel to Gia Lai province for this purpose. For instance, a group of men from Thanh Hoa province were encountered removing sawn lengths of *Fokenia hodginsii* from the forest on 13 April 1999. Such timber extraction is not associated with shifting cultivation.

Non-timber Forest Products. The most economically important non-timber forest products (NTFPs) collected by the inhabitants of the buffer zone are honey, rattans, *Litsea* bark and *Amomum* fruit. These products are usually sold to Kinh traders who come visit the villages periodically. Honey is sold to traders for VND 20,000 to 25,000 per litre, and *Litsea* bark for VND 4,000 to 7,000 per kg. The exact price depends upon the difficulty in transporting the NTFP from the village to market. It was reported that certain NTFPs, particularly rattans, were becoming increasingly rare in the forest. This indicates that NTFP collection is taking place at unsustainable levels, which may be threatening to drive populations of some species to extinction. Enhancement planting of rattans is one way in which this problem might be alleviated.

Hunting. When interviewed, local people usually denied hunting in the forest or claimed that they rarely hunted because of low densities of animals. However, local people were frequently observed shooting and trapping animals during the field survey. As well as being a source of food and income, hunting is an important part of Ba Na culture; Ba Na men pay VND 3,000 for cartridges to shoot small birds, even when it is uneconomic to do so. Forest rodents are frequently caught for food by trapping them or digging out their burrows. Deer, wild pigs, civets and monkeys are the most valuable and frequently hunted large and medium-sized mammals. Most hunted animals are consumed within the village, although some species are sold to wildlife restaurants in local towns. The most valuable animal is the tortoise, *Cuora trifasciata*, which can sell for over VND 20 million per animal. This species was reported to be very rare now and may become locally extinct in the near future.

Rural Economy

Household income has four main sources, agriculture, forestry, animal husbandry and forest product collection, with agriculture being the most important. Most Kinh households, who practice wet rice cultivation, produce sufficient rice for all year. However, most Ba Na households, who generally practice shifting cultivation, only produce enough rice to feed themselves for four to nine months of the year, depending on how much land they cultivate; during the remainder of the year they consume maize, cassava and sweet potato.

Table 15: Economic Status of Buffer Zone Inhabitants in K' Bang District

Commune	Poor		Hungry		Total	
	H'holds	Popn.	H'holds	Popn.	H'holds	Popn.
Kon Phe	25	109	184	905	209	1,014
Dak Roong	140	680	328	1,621	468	2,301
Kroong	39	142	553	3,213	592	3,355
Lo Ku	163	732	203	1,326	366	2,058
Total	367	1,663	1,268	7,065	1,635	8,728

Table 15 shows the economic status of households in the four buffer zone communes in K'Bang district based on the criteria of K'Bang District People's Committee. Under these criteria, poor households are defined as those with sufficient rice for at least nine months and an average income of greater than VND 55,000 per month, and hungry households are defined as those with sufficient rice for eight months or less and an average income of less than VND 45,000 per month. The communes with the highest proportions of hungry households are Kon Pne and Kroong, with 90 and 93% respectively. Each year the district must provide rice to Kon Pne commune.

A government-funded famine alleviation programme operates in the buffer zone communes. The aim of this programme is to help households to improve their economic status by lending them money without interest. However, it was reported that this programme has not met with much success because the recipients of interest-free loans have not known how to invest the capital, except in livestock. The high mortality rates of livestock makes such investment risky and, consequently, the famine alleviation programme has had a negative effect on some households.

3.3 Cultural Features of the Ba Na Ethnic Minority

In Vietnam, the Ba Na ethnic minority are concentrated in Kon Tum, Binh Dinh, Phu Yen and Gia Lai provinces. The Ba Na live in stilt houses made of bamboo and palm thatch. In each village, there is a large communal house called a *nha rong*, which is the centre of all cultural activities in the village. In traditional villages, the Ba Na live in extended family groups, with two or three households descended from the same ancestors living together under the same roof. Each household has their own land, crops and kitchen; therefore, it is easy to recognise the number of households in a house by counting the number of kitchens. When individual households have sufficient money and labour, they leave the extended family group and establish houses of their own.

3.4 Forest Enterprises

Seven forest enterprises are located in the buffer zone of Kon Ka Kinh Nature Reserve: four in K'Bang district and three in Mang Yang district (Table 16). Presently, the forest resources in the study area are managed and protected by both the forest enterprises and the district FPDs: the forest enterprises are responsible for forest areas under their management, and the FPDs are responsible for all other forest in the two districts.

Table 16: Land-use in Seven Forest Enterprises

Forest Enterprise	Land-use (ha)								Total
	1	2	3	4	5	6	7	8	
Dak Roong	6,762	6,436	4,307	620	3,875	131	834	265	23,230
Krong Pa	3,367	2,713	2,320	1,455	7,048	108	1,843	296	19,150
Tram Lap	6,637	7,008	2,101	1,246	643	25	508	241	18,409
Lo Ku	568	2,001	2,515	1,375	9,332	110	1,161	228	17,290
Ha Ra	4,189	1,989	4,592	317	5,680	745	2,131	243	19,886
Mang Yang I	4,380	601	608	3,070	5,920	0	0	0	14,579
Mang Yang II	16	2,599	377	6,168	10,169	1,518	212	481	21,540
Total	25,919	23,347	16,820	14,251	42,667	2,637	6,689	1,754	134,084

Notes: 1 = rich forest; 2 = medium forest; 3 = poor forest; 4 = regenerating forest; 5 = bare land (including scrub with scattered trees, scrub and grassland); 6 = plantation forest; 7 = agricultural land; 8 = residential land, land with special uses, lakes and rivers

Previously, the forest in the study area was heavily logged. In recent years however, following the government's initiative to halt logging by the year 2000, all forest enterprises have had to reduce the

amount of timber they extract annually. In 1999, Dak Roong Forest Enterprise was permitted to exploit 11,498 ha of forest; Krong Pa Forest Enterprise 8,280 ha; Tram Lap Forest Enterprise 7,269 ha; and Ha Ra Forest Enterprise 3,824 ha. In 1999, these areas had been reduced to 3,000, 3,475, 3,000 and 1,500 ha respectively. Therefore, the main duty of forest enterprises with regard to natural forest is shifting from exploitation to protection.

The reduction in the area of forest that the forest enterprises are permitted to exploit is causing them great difficulties. All forest enterprise directors complained that the reduction in revenue was making it difficult for them to protect the areas of forest not being exploited. They also identified lack of power to enforce regulations as a further obstacle to performing their forest protection duties.

4. Evaluation

4.1 Biological Evaluation

Size

Kon Ka Kinh Nature Reserve covers 41,710 ha in the Bolovans-Kon Tum Montane Forests Ecoregion. In terms of size, Kon Ka Kinh Nature Reserve is comparable to other protected areas in the Western Highlands: Yok Don National Park (58,000 ha), Ngoc Linh (Kon Tum) Nature Reserve (41,420 ha), Mom Ray Nature Reserve (48,600 ha), Chu Yang Sin Nature Reserve (32,328 ha), Nam Ca Nature Reserve (24,500 ha) and Bi Doup-Nui Ba Nature Reserve (73,912 ha).

By itself, Kon Ka Kinh Nature Reserve is not large enough to support viable populations of large mammals, such as Tiger. However, 10 km to the east of Kon Ka Kinh Nature Reserve, lies Kon Cha Rang Nature Reserve (16,000 ha) (Map 1). These two nature reserves are linked by an intervening area of forest, which is currently under the management of Dak Roong and Tram Lap Forest Enterprises. In the future, the boundaries of the two nature reserves should be revised to make them contiguous. This recommendation is included in the Biodiversity Action Plan (Government of SRV/GEF 1994), the Tropical Forestry Action Plan (MOF 1991a) and the BirdLife/FIPI report entitled *Expanding the Protected Areas Network in Vietnam for the 21st Century* (Wege *et al.* 1999).

In the aforementioned report, Wege *et al.* (1999) identified ecoregions that were under-represented within the protected areas system of Vietnam. They determined that the Bolovans-Kon Tum Montane Forests Ecoregion was one such ecoregion, and calculated that an additional 107,150 ha of Special-use Forest should be decreed within this ecoregion in order for it to be equitably represented within the protected areas system. Furthermore, the authors identified Gia Lai as a priority province for expanding the protected areas system, as less than 10% of the natural forest in the province is currently decreed as Special-use Forest. Therefore, Wege *et al.* (1999) recommended that Kon Ka Kinh Nature Reserve should be extended eastwards to connect with Kon Cha Rang Nature Reserve.

Habitat

Kon Ka Kinh Nature Reserve includes 19,703 ha (47% of the total area) of forest classified as rich or medium, which can be considered to represent relatively undisturbed primary forest. The nature reserve supports montane habitats across an altitude range from 700 to 1,700 m, comprising low montane and medium montane broadleaf evergreen forest. Of particular importance are 2,000 ha of mixed coniferous and broadleaf forest containing *Fokienia hodginsii*. Within the protected areas system of Vietnam, this habitat sub-type is known only from Kon Ka Kinh Nature Reserve.

Biodiversity

To date, a total of 652 plant species have been recorded at Kon Ka Kinh Nature Reserve, which is comparable, in terms of plant species diversity, to other sites in the Western Highlands (Table 17).

Table 17: Comparison of Recorded Plant Diversity at Kon Ka Kinh Nature Reserve with other Nature Reserves in the Western Highlands (Ranked)

Nature Reserve	Area (ha)	Families	Genera	Species
1. Chu Yang Sin	32,328	142	475	876
2. Ngoc Linh (Kon Tum)	41,420	156	537	874
3. Kon Ka Kinh	41,710	131	452	652
4. Bi Doup-Nui Ba	73,912	126	288	425

The flora and fauna of Kon Ka Kinh Nature Reserve both have large Sino-Himalayan components. The nature reserve has great floral and faunal similarities with the high mountains of north-western Vietnam but also with the high peaks further south in the Western Highlands, on the Da Lat Plateau. Mammal and bird species diversity at Kon Ka Kinh is comparable to that at other montane nature reserves in Vietnam (Table 18).

Table 18: Comparison of Mammal and Bird Diversity at Kon Ka Kinh with other Montane Nature Reserves

Nature Reserve	Mammal Species	Bird Species
Kon Ka Kinh	42	160
Ngoc Linh (Kon Tum)	52	190
Mom Ray	76	208
Chu Yang Sin	49	203
Bi Doup-Nui Ba	93	154
Hoang Lien	66	208

The level of endemism in the bird fauna of Kon Ka Kinh can be scored for comparison with that of other montane nature reserves (Table 19). Ranking the scores for eight montane sites in Vietnam indicates that Kon Ka Kinh Nature Reserve has relatively high levels of bird endemism compared with the other sites, and that Kon Ka Kinh is a “hot spot” for avian diversity in the Western Highlands of Vietnam.

Table 19: Bird Endemism Ranking for Five Montane Nature Reserves in Vietnam

Sites	Genera	Species	RRS	Red-listed	Score	Rank
Ngoc Linh (Kon Tum)	125	190	7	17	1,125	1
Kon Ka Kinh	120	160	5	17	1,030	2
Chu Yang Sin	120	203	6	7	993	3
Bi Doup-Nui Ba	111	154	7	7	919	4
Hoang Lien	110	208	4	7	908	5

Scoring method gives five points per genus, one point per species, 20 points per restricted-range species (RRS) (Stattersfield *et al.* 1998) and 10 points per red-listed species (listed in either Collar *et al.* (1994) or Anon. (1992))

Herpetile species diversity at Kon Ka Kinh Nature Reserve is comparable to that at other sites in central Vietnam (Table 20). If compared with the herpetile fauna of the Western Highlands as a whole, Kon Ka Kinh supports 67% of the orders, 68% of the families and 36% of the species found in this region. The herpetile survey at Kon Ka Kinh was limited in terms of time and scope. However, if further studies were conducted at different times of year, the total number of herpetile species known from the nature reserve would certainly increase.

In comparison with other protected areas in Vietnam, Kon Ka Kinh has a high diversity of butterfly species. The 209 butterfly species recorded during the field survey compare with the 143 species recorded at Xuan Lien Nature Reserve, 88 species recorded at Ben En National Park and 117 recorded at Pu Huong Nature Reserve during field surveys of comparable duration. It should

Table 20: Comparison of Herpetile Diversity at Kon Ka Kinh Nature Reserve with Six Other Areas (Ranked)

Area	Species
1. Kon Ha Nung	82
2. Western Quang Nam province	66
3. Ngoc Linh (Kon Tum) Nature Reserve and vicinity	63
4. Kon Ka Kinh Nature Reserve	51
5. Bach Ma National Park	47
6. Chu Yang Sin Nature Reserve	44
7. Ea So proposed nature reserve	34

be noted that the present list of 209 species is preliminary and will probably be supplemented in the future, since a number of specimens are not included pending more detailed taxonomic study. The high diversity of butterfly species at Kon Ka Kinh is associated with the high diversity of habitat types, which, in turn, is associated with the complex and variable topography of the area.

Globally Threatened Species

Of the 652 plant species recorded at Kon Ka Kinh Nature Reserve, 16 are listed in the IUCN Red List of Threatened Plants (IUCN 1997) as globally threatened, including one species listed as Endangered: *Pinus dalatensis*. Of the 253 vertebrate species recorded, 12 are globally threatened (IUCN 1996), comprising seven mammal, four bird and one herpetile species (Table 21).

Table 21: Globally Threatened Species Recorded at Kon Ka Kinh Nature Reserve

Group	Total No. of Species	Globally Threatened
Mammals	42	7
Birds	160	4
Herpetiles	51	1
Butterflies	209	0
Plants	652	16
Total	1,114	28

No butterfly species recorded at Kon Ka Kinh Nature Reserve are listed in the IUCN Red List of Threatened Animals (IUCN 1996) as globally threatened. However, a number of species were recorded that are known to be rare in the Oriental Region, for instance, *Laringa horsfieldi*, *Neurosigma siva* and *Dichorragia nesimachus*.

New Taxa

During the course of this survey, a new form of laughingthrush, close to Rufous-chinned Laughingthrush was discovered. In Vietnam, Rufous-chinned Laughingthrush was previously known only from Hoang Lien Nature Reserve in northern Vietnam. The form discovered at Kon Ka Kinh may be a new subspecies and represent a major range extension for this species in Vietnam, or it may be a new species. The final determination is currently taking place.

Of the butterflies recorded at Kon Ka Kinh Nature Reserve, at least eight taxa may be new to science. These new taxa include *Delias georgina* subsp., which could be endemic to the Kon Tum Plateau.

Endemic and Restricted-range Species

Kon Ka Kinh Nature Reserve supports high levels of endemism. Ten plant species endemic to Vietnam are found at the nature reserve, including *Calamus poilanei*, *Dalbergia cochinchinensis* and *Baccaurea silvestris*. Three mammal species endemic to Indochina were recorded at the nature reserve: Buff-cheeked Gibbon, Douc Langur and Truong Son Muntjac. In addition, four herpetile species endemic to Vietnam were recorded, including *Sphenomorphus buonloicus*, which is known globally only from Gia Lai province.

Kon Ka Kinh Nature Reserve supports five restricted-range bird species: Yellow-billed Nuthatch, Black-hooded Laughingthrush, White-cheeked Laughingthrush, Short-tailed Scimitar Babbler and Grey-faced Tit Babbler. Five species recorded at Kon Ka Kinh are endemic to Vietnam and Laos: Red-vented Barbet *Megalaima lagrandieri*, White-cheeked Laughingthrush, Black-hooded Laughingthrush, Short-tailed Scimitar Babbler and Grey-faced Tit-babbler.

4.2 Economic Evaluation

Watershed Protection

Kon Ka Kinh Nature Reserve supports a large area of forest that has an important role in upstream watershed protection for several of the large rivers in Gia Lai and Kon Tum provinces. These rivers include the Ba River, which provides water for irrigation and domestic use for a number of districts in Gia Lai, Phu Yen and Khanh Hoa provinces, and the Dak Phe River, which provides water for irrigation and domestic use for a number of districts in northern Gia Lai province and southern Kon Tum province.

Additionally, the Dak Phe River system forms part of the catchment of the Yaly hydro-electric power station.

Forestry

Kon Ka Kinh Nature Reserve contains 238 commercial timber species, many of which have high value, such as *Fokienia hodginsii*, *Pterocarpus macrocarpus*, *Chukrasia tabularis*, *Michelia* spp., *Azelia xylocarpa*, *Dalbergia cochinchinensis*, *Decussocarpus fleuryi* and *Pinus dalatensis*. The nature reserve can, therefore, act as a source of seed for forestry programmes in the area.

Areas of poor forest, regenerating forest and scrub, in and around the nature reserve are of great importance for the inhabitants of the buffer zone as sources of firewood and other forest products. Issuing local people with protection contracts for these areas will provide them with a vital source of income, and promote the natural regeneration of these areas. Forest land in the buffer zone that is degraded or cleared of forest can be allocated to households for agroforestry activities. When implementing agroforestry programmes, the aforementioned high-value indigenous trees should be preferred, in order to create areas of habitat with a value for conservation. Forestry activities such as these could improve the living standards of local people and may help to prevent migration into the buffer zone in the future.

Medicinal Plants

Kon Ka Kinh Nature Reserve supports at least 110 plant species with known medicinal uses and 38 species with potential economic value as ornamental plants. Use of plants in traditional medicine is widespread amongst local people, many of whom are distrustful of, or have no access to, western medicine. The potential pharmaceutical value of many of these medicinal plant species remains largely untested but it is possible that some medicinal plant species found at Kon Ka Kinh may contain chemical compounds with important pharmaceutical properties.

Genetic Resources

Kon Ka Kinh Nature Reserve protects a reservoir of plant and animal genetic resources with many potential agricultural applications. This potential remains untapped commercially, however.

Potential Tourism Value

Kon Ka Kinh Nature Reserve covers a large area of pristine and beautiful primary forest. Mount Kon Ka Kinh, at 1,748 m, is the highest point in Gia Lai province. The flora and fauna of the nature reserve contain many rare and interesting species, although populations of many species, particularly large mammals, are low. Therefore Kon Ka Kinh Nature Reserve has some natural features of interest to hikers, campers and birdwatchers. Another feature of the area of interest to visitors are the ethnic minority communities. The inhabitants of the buffer zone are mostly Ba Na people, who retain many traditional customs such as traditional dress and housing styles, dance, and the production of *ruou can*, an alcoholic drink that is drunk through straws.

However, the potential tourism value of Kon Ka Kinh Nature Reserve must be considered to be low at the present time. Firstly, transport within the nature reserve and buffer zone is difficult due to the steep terrain and poor quality of the roads; this is particularly true of areas of interest to visitors. Secondly, the current management regulations for Special-use Forests make no provision for tourism at nature reserves, only at national parks.

Scientific Research Value

The biological data presented in this investment plan are the results of a preliminary study; further, more detailed, studies are required in order to provide more complete information on biodiversity and ecology necessary for the management of Kon Ka Kinh Nature Reserve. At Kon Ka Kinh Nature

Section 4 - Evaluation

Reserve, there is potential to study, not only subjects relevant to the conservation of the site, but also subjects of wider interest to the scientific community. For instance, Kon Ka Kinh is a good site for studies on altitudinal zonation of tropical montane forest. Understanding the dynamics of the ecosystem at Kon Ka Kinh will assist in identifying sustainable forest management practices aimed at minimising the loss of Vietnam's biodiversity.

5. Management Recommendations

5.1 Proposed Name

The name of the nature reserve should be Kon Ka Kinh, following Decision No. 194/CT of the Prime Minister, the original government document that decreed the nature reserve (Cao Van Sung 1995). The name is derived from Mount Kon Ka Kinh, which, at 1,748 m, is the highest peak in the study area.

5.2 Proposed Special-use Forest Category

Kon Ka Kinh was included in Decision No. 194/CT of the Prime Minister, dated 9 August 1986 as one of 73 Special-use Forests. In this document, Kon Ka Kinh was decreed as a nature reserve, and this should continue to be the Special-use Forest category of the site. This category reflects the high biodiversity value of the area, and the low potential for the development of tourism. In Vietnam, a nature reserve equates to category IV (habitat/species management area) in the IUCN protected areas classification (IUCN 1994).

5.3 Proposed Management Responsibility

Kon Ka Kinh Nature Reserve should fall under the jurisdiction of Gia Lai Provincial People's Committee. The administration of the nature reserve should be the responsibility of the provincial forest protection department (FPD). The Ministry of Agriculture and Rural Development (MARD) should, on behalf of the government, provide technical and financial support to the nature reserve, and seek assistance from the government, donor organisations and non-governmental organisations (NGOs) for the implementation of this investment plan.

After this investment plan is approved by the government, the provincial FPD should establish a nature reserve management board. The nature reserve management board should comprise three representatives of the provincial FPD, together with the nature reserve director and vice-directors. The nature reserve management board should be responsible for the protection and management of the nature reserve and the implementation of the investment programmes outlined in this investment plan.

It is highly recommended that the nature reserve management board be supported and guided by a management advisory committee composed of officials from relevant provincial and district-level departments, as well as representatives of the buffer zone communities. The management advisory committee can assist the management of the nature reserve by:

- Monitoring the implementation of the investment programmes;
- Coordinating the activities of district and provincial-level departments, governmental institutions and non-governmental organisations working in the buffer zone; and
- Providing a channel through which the views of the local communities and other stakeholders in the nature reserve can be aired.

5.4 Proposed Boundary

The boundary of Kon Ka Kinh Nature Reserve proposed here is based on:

- A biodiversity assessment of the study area;
- An assessment of the current status of the forest resources of the study area;
- The distribution of all habitat types and their associated plant and animal populations, especially populations of species of high conservation importance, such as endemic and globally threatened species;
- Population distribution and land-use in the study area; and
- The potential for boundary increases in the future.

The boundary was discussed at a demarcation workshop, held in Hanoi on 8 May 1999 and attended by representatives of the forest protection and forest development departments of MARD, Gia Lai Provincial FPD, the Forest Inventory and Planning Institute (FIPI), the Institute of Ecology and Biological Resources, Hanoi (IEBR), and the National Environment Agency (NEA) of the Ministry of Science, Technology and the Environment (MOSTE). The participants at this workshop unanimously supported the boundary described below, which was also approved at a meeting held by Gia Lai Provincial People's Committee, in Plei Ku town on 19 August 1999.

The boundary should include the following areas (Map 4):

- Compartments 62, 63, 68, 71 and 74 to 79, and parts of compartments 64, 65, 67, 70 and 73, Kon Phe commune;
- Compartments 18 and 23 (which are currently managed by Dak Roong Forest Enterprise) and compartment 31 (which is currently managed by Krong Pa Forest Enterprise), Dak Roong commune;
- Compartments 81, 85, 88, 91 and 92 (which are currently managed by Krong Pa Forest Enterprise), and compartments 86, 95, 98, 101, 102 and 104 to 110, Krong commune;
- Compartments 432 to 435 and part of compartment 436, Ayun commune; and
- Compartments 405, 411 and 414, Ha Dong commune.

The nature reserve defined here is bounded by the coordinates 14°09' to 14°30'N and 108°16' to 108°28'E.

Defined by the above boundary, Kon Ka Kinh Nature Reserve will:

- Cover 41,710 ha in five communes;
- Comprise Mount Kon Ka Kinh and parts of the watersheds of the Dak Lorr, Krong Pa and Dak Phe Rivers;
- Protect both the east and west faces of Mount Kon Ka Kinh;

- Include all natural habitat types, particularly mixed coniferous and broadleaf evergreen forest containing *Fokienia hodginsii*,
- Support populations of large and medium-sized mammals, such as Tiger, Asiatic Black Bear, Southern Serow, Truong Son Muntjac, Buff-cheeked Gibbon and Douc Langur, as well as restricted-range bird species; and
- Contain no villages or human inhabitants.

As defined here, Kon Ka Kinh Nature Reserve will contain 2,343 ha currently managed by Dak Roong Forest Enterprise, 5,604 ha currently managed by Krong Pa Forest Enterprise and 8,614 ha currently managed by Mang Yang I Forest Enterprise. If, in the future, the boundaries of Kon Ka Kinh and Kon Cha Rang Nature Reserves were revised to make them contiguous, the two nature reserves would include all the land currently managed by Dak Roong and Tram Lap Forest Enterprises.

5.5 Proposed Management Zoning

Table 22: Strict Protection and Forest Rehabilitation Sub-areas

In order to facilitate more effective management and protection, Kon Ka Kinh Nature Reserve should be zoned into three administrative areas, with each area having a different management regime: a Strict Protection Area, a Forest Rehabilitation Area and an Administration and Services Area (Map 4). For the same reason, the Strict Protection and Forest Rehabilitation Areas should, in turn, be zoned into sub-areas (Table 22).

Sub-area	Area (ha)	%
Strict Protection Sub-area I	11,026	26.4
Strict Protection Sub-area II	12,038	28.9
Forest Rehabilitation Sub-area I	3,706	8.9
Forest Rehabilitation Sub-area II	8,708	20.9
Forest Rehabilitation Sub-area III	6,232	14.9
Total	41,710	100.0

Administration and Services Area

The administration and services area should comprise the headquarters of Kon Ka Kinh Nature Reserve in Ayun commune. This area should be situated outside of the Strict Protection and Forest Rehabilitation Areas and cover 2,000 to 3,000 m².

Strict Protection Area

The Strict Protection Area should cover 23,064 ha or 55% of the total area of the nature reserve. The Strict Protection Area should be free from exploitation or human activities that may compromise it in any way, including active forest rehabilitation (Table 23). The aim of this area should be to provide an area of natural habitat capable of supporting viable populations of animal and plant species. The Strict Protection Area should be zoned into two sub-areas:

- Strict Protection Sub-area I.** This sub-area should comprise 11,026 ha in the north-east of the nature reserve, including compartments 18, 23, 31, 68, 71, 74, 81, 85, 86 and 91, and parts of compartments 67, 70 and 73. This sub-area covers Mount Kon Ka Kinh. A total of 7,151 ha or 65% of this sub-area is classified as rich, medium or poor forest; these forest types are located at elevations between 800 and 1,748 m. A further 927 ha is classified as elfin forest, and the remainder of the sub-area comprises grassland and scrub with scattered trees, distributed near villages in Dak Roong commune; and
- Strict Protection Sub-area II.** This sub-area should comprise 12,038 ha in the west of the nature reserve, including compartments 75 to 79, 95, 101, 104, 105, 405, 411 and 414. This

sub-unit contains an area of approximately 2,000 ha of mixed coniferous and broadleaf evergreen forest, which is dominated by the following species of conifer: *Fokienia hodginsii*, *Podocarpus imbricatus*, *Dacrydium elatum* and *Pinus dalatensis*. This sub-area contains 1,455 ha of elfin forest, accounting for 12% of the sub-area.

Table 23: Management Regime for the Strict Protection Area

Activity	Impacts	Management
Logging	Forest fragmentation, habitat loss, loss of animal and plant species	Strictly prohibited
Charcoal production	Forest fragmentation, habitat loss, loss of animal and plant species, air and ground pollution	Strictly prohibited
Fragrant wood/oil distilling	Forest degradation, habitat loss, loss of plant species, disturbance to natural regeneration	Strictly prohibited
Mining	Forest and habitat loss, pollution, loss of animal and plant species	Strictly prohibited
Construction of roads, houses and other infrastructure	Forest and habitat loss, disturbance to wildlife, pollution	Strictly prohibited
Hunting and trapping	Loss of animal species, disturbance to wildlife	Strictly prohibited
Fishing with poison or dynamite	Habitat loss, loss of animal species, pollution	Strictly prohibited
Fishing	Loss of animal species	Strictly prohibited
Ornamental plant collecting	Unknown but could threaten plant populations	Strictly prohibited
Livestock grazing	Disturbance to natural regeneration, habitats and wildlife	Strictly prohibited
Fire	Forest and habitat loss	Strictly prohibited
Firewood collecting	Disturbance to natural regeneration	Limited
Rattan collecting	Habitat loss, disturbance to wildlife	Limited
Medicinal plant collecting	Loss of plant species, potential disturbance to habitat	Limited
Honey collecting	Possible fire hazard	Limited

Follows Decision No. 1171/QĐ of the Minister of Forestry, dated 30 December 1986

Forest Rehabilitation Area

The Forest Rehabilitation Area should cover 18,646 ha or 45% of the total area of the nature reserve. The aim of the Forest Rehabilitation Area should be to restore areas of degraded forest to their natural condition by natural or assisted rehabilitation, in order to increase the total area of habitat available for wildlife populations. The management regime should permit limited human activities that are consistent with this aim (Table 24). The Forest Rehabilitation Area should be zoned into three sub-areas:

- (a) **Forest Rehabilitation Sub-area I.** This sub-area should comprise 3,706 ha in the north-west of the nature reserve, including compartments 62 and 63, and parts of compartments 64 and 65. Scrub and scrub with scattered trees cover 2,276 ha or 61% of the sub-area; a smaller area is covered by bamboo forest;
- (b) **Forest Rehabilitation Sub-area II.** This sub-area should comprise 8,708 ha in the south-east of the nature reserve, including compartments 88, 92, 98, 102 and 106 to 109. Grassland, scrub and scrub with scattered trees cover 2,966 ha or 34% of the sub-area; and
- (c) **Forest Rehabilitation Sub-area III.** This sub-area should comprise 6,232 ha in the south-west of the nature reserve, including compartments 110 and 432 to 435, and part of compartment 436. Previously, forest in this sub-area was exploited by Mang Yang Forest Enterprise, and, consequently, the sub-area is dominated by regenerating forest and poor

forest. The nature reserve management board should sign contracts with individual households for the protection and reforestation of the area. Small areas with no forest should be reforested with native tree species.

Table 24: Management Regime for the Forest Rehabilitation Area

Activities	Impacts	Management
Logging	Forest fragmentation, habitat loss, loss of animal and plant species	Strictly prohibited
Fragrant wood/oil distilling	Forest degradation, habitat loss, loss of plant species, disturbance to natural regeneration	Strictly prohibited
Reforestation with alien species	Habitat loss, loss of plant and animal species	Strictly prohibited
Hunting and trapping	Loss of animal species, disturbance to habitat	Strictly prohibited
Mining	Forest and habitat loss, pollution, loss of animal and plant species	Strictly prohibited
Construction of roads, houses and public facilities	Forest and habitat loss, disturbance to wildlife, pollution	Strictly prohibited
Livestock grazing	Disturbance to natural regeneration, habitats and wildlife	Strictly prohibited
Fire	Forest and habitat loss	Strictly prohibited
Converting forest to cultivation	Forest and habitat destruction, loss of animal and plant species	Strictly prohibited
Honey collecting	Possible fire hazard	Permitted
Exploitation of non-timber forest products	Over-exploitation may lead to loss of plant species and habitat loss	Limited and regulated
Reforestation with local indigenous tree species	Habitat expansion, maintenance of biodiversity	Encouraged
Forest protection contracts	Habitat protection, maintenance of biodiversity	Encouraged

Follows Decision No. 1171/QĐ of the Minister of Forestry, dated 30 December 1986

Buffer Zone

Buffer zones are areas adjacent to protected areas in which land-use is partially restricted, giving an added degree of protection to the protected area, whilst providing benefits to local communities. Buffer zones can have two functions (adapted from MacKinnon *et al.* 1986):

- (a) **Extension Buffering** which extends the area of habitats contained within the protected area and supports larger breeding populations than could survive within the nature reserve area alone. These areas can have limited socio-cultural use; and
- (b) **Socio-Buffering** where wildlife use is of secondary importance and management is primarily aimed at providing products for local use but land-use does not conflict with the nature reserve's objectives.

Table 25: Commune Areas in the Nature Reserve and Buffer Zone

Commune	Area in Nature Reserve (ha)	Area in Buffer Zone (ha)
Kon Phe	12,626	4,174
Dak Roong	3,217	32,883
Kroong	17,253	13,747
Lo Ku	0	14,021
Ha Dong	3,388	16,512
Ayun	5,226	15,722
Ha Ra	0	22,241
Total	41,710	119,300

The principal function of the buffer zone of Kon Ka Kinh Nature Reserve should be socio-buffering. The buffer zone should be contiguous with but outside of Kon Ka Kinh Nature Reserve, and comprise

all or part of seven communes, with a total area of 119,300 ha (Table 25).

The buffer zone development programme should be designed and implemented separately from the investment programmes outlined in this investment plan. The nature reserve management board, together with the relevant provincial and district authorities should have responsibility for writing an investment plan for the buffer zone.

5.6 Proposed Management Structure

Directorate

Personnel. The nature reserve directorate should comprise the following members of staff:

- (a) **Nature Reserve Director.** Responsible for managing all nature reserve staff, and cooperating with government bodies, institutions, consultants and NGOs. Supports, coordinates and presents all activities and programmes that aim to address the objectives of the nature reserve;
- (b) **Vice-Director (Administrative).** Responsible for the overall operational aspects of the nature reserve regarding management and development. Reports to the director on the progress of investment programme activities, as well as the budgetary status; and
- (c) **Vice-Director (Technical).** Responsible for coordinating research to collect scientific data necessary for management of the nature reserve. Must be aware of any occurring impacts on the nature reserve, and responsible for technical support.

Functions The director should be the highest authority in regard to the management of the nature reserve. This individual must possess strong leadership and management skills as well as an appropriate professional and academic background.

The principal task of the director should be to organise, direct and supervise the work of the management board. The director should also be responsible for the elaboration and implementation of the investment programme activities outlined in this investment plan. The director must also ensure that all relevant government policies and regulations are complied with. The director must coordinate with local authorities and communities during all stages of the establishment and management of the nature reserve.

The vice-directors should assist the director and, in the absence of the director, be responsible for all activities in the nature reserve.

Administration Department

Personnel. The administration department should consist of one head of department, one accountant, one administrative clerk, one servant and one driver.

Functions This department should carry out the administrative functions required for the nature reserve to function adequately.

Technical and Financial Department

Personnel. The technical and financial department should consist of one head of department, two technical experts and one cashier/clerk.

Functions This department should assist the directorate in monitoring construction work and the implementation of the investment programme activities outlined in this investment plan. The two technical experts should be responsible for identifying appropriate courses of action for habitat rehabilitation. They should also conduct scientific research in collaboration with national and international organisations. This department should also be in charge of preparing the nature reserve budget, and monthly, quarterly and annual financial reports. The staff of the technical and financial department should be under the direct supervision of the nature reserve directorate.

Figure 1: Schematic Diagram of Nature Reserve Staffing Structure



Protection Department

Personnel. The protection department should comprise 37 members of staff, of which there should be one head of department, one deputy head, five personnel for each of six guard stations and five personnel for one mobile protection team to be stationed at the nature reserve headquarters. The deputy head should also be the head of the mobile protection team.

Functions. The protection department should be responsible for the conservation of habitats and species in the nature reserve, in accordance with the management regulations for Special-use Forests. Under the guidance of the directorate, the head of the protection department should be responsible for coordinating with K’Bang and Mang Yang District FPDs, local forest enterprises, relevant local authorities and the police.

This department’s principal daily tasks should be to patrol the nature reserve, prevent violations of nature reserve regulations and stop all illegal activities, especially hunting and timber extraction. Of equal importance, the department should be responsible for involving local communities in the management and conservation of the nature reserve. This should be achieved through environmental awareness activities; community meetings, through which local people can have input into decisions

regarding management of the nature reserve; and social forestry schemes, whereby forest land in the nature reserve and buffer zone can be allocated to individual households on short-term protection contracts or for long-term forestry purposes.

The senior guards should be responsible for the implementation of the activities outlined above, under the guidance of the head of the protection department and the nature reserve directorate. The senior guards should also be responsible for recording and reporting all violations of nature reserve regulations to their superiors.

Four forest guards and one senior guard should be stationed at each guard station. They should be responsible for:

- Implementing the conservation and protection programme outlined in this investment plan;
- Cooperating with local authorities to allocate forest land to households for protection and regeneration;
- Enforcing the regulations of the nature reserve;
- Raising awareness amongst local people about forest-fire prevention, the importance of conservation, and the regulations of the nature reserve;
- Organising and conducting patrols of the nature reserve, and inspections of forest land allocated to local people;
- Maintaining regular contact with other guard stations and with the head of the protection department; and
- Recording violations of nature reserve regulations and other field observations.

5.7 Proposed Management Objectives

The aim of Kon Ka Kinh Nature Reserve should be to preserve the biodiversity value of the nature reserve whilst also delivering benefits to local stakeholders. Site-specific management objectives for Kon Ka Kinh Nature Reserve should be based on the protection features of the area, the scope of management actions contemplated, and the range of compatible utilisation that can be accommodated with limited disturbance to the area.

Specific management objectives for Kon Ka Kinh Nature Reserve should be to:

- Conserve the representative montane forest habitats of the area;
- Protect the area's rich biodiversity;
- Protect the populations of globally threatened, restricted-range and endemic species;
- Conserve the genetic resources of the area;
- Maintain the watershed-protection value of the area, in order to reduce soil erosion, siltation,

drought and flooding, and to maintain a source of water for irrigation and domestic use by communities downstream;

- Promote socio-economic development in the buffer zone;
- Promote sustainable use of natural resources or, where sustainable use is unfeasible, identify suitable alternatives;
- Involve local communities, governmental organisations and NGOs in the management of the nature reserve; and
- Promote and facilitate research, particularly on populations of globally threatened species, forest regeneration and changes in vegetation cover.

5.8 Proposed Investment Programmes

The investment programmes detailed in this section outline the activities necessary to establish and manage Kon Ka Kinh Nature Reserve over a five-year period from 2000 to 2004. These programmes must be consistent with the objectives of the nature reserve, whilst taking account of the needs of local people. The investment plan for Kon Ka Kinh Nature Reserve includes the following four programmes:

- (a) infrastructure development programme;
- (b) conservation and protection programme;
- (c) scientific research and monitoring programme; and
- (d) awareness and extension programme.

The investment programmes should:

- Clearly delineate the nature reserve's administrative areas;
- Ensure public awareness of the regulations of the nature reserve;
- Inventory and evaluate the natural resources of Kon Ka Kinh Nature Reserve (flora, fauna and habitats). This work should focus on globally threatened, restricted-range, endemic, and economically important species, considering both their role in the ecosystem and their role in the local economy;
- Evaluate the potential genetic, economic, geological, hydrological and soil values of the nature reserve;
- Evaluate local people's dependence on forest resources, and the pressure they exert on the forest resources of the nature reserve;
- Form the basis of a five-year management plan for the establishment, management and protection of Kon Ka Kinh Nature Reserve; and
- Facilitate investment in Kon Ka Kinh Nature Reserve.

Infrastructure Development Programme

(a) Boundary Demarcation

Objectives. To announce the establishment of Kon Ka Kinh Nature Reserve. To clearly establish the boundaries of the nature reserve and buffer zone. To provide notice of the regulations of the nature reserve.

Activities. Following approval of investment in and establishment of Kon Ka Kinh Nature Reserve by MARD, Gia Lai Provincial People's Committee will be requested to assign personnel to the nature reserve management board and staff. The management board of Kon Ka Kinh Nature Reserve should then hold a series of demarcation workshops to seek agreement on the boundaries and administrative zoning of the nature reserve from representatives of local communities, relevant district-level departments, and local forest enterprises. During these workshops, the nature reserve management board should announce the establishment of the nature reserve, the objectives of the nature reserve and the contents of the management plan. The nature reserve management board should also carry out the following activities:

- (i) *Setting Boundary Pillars.* Demarcation of the nature reserve boundary requires the setting of boundary pillars. These boundary pillars should be made of concrete and set at a spacing of every 100 to 150 m along the boundary. In areas where the boundary follows a clear landscape feature, such as a stream or ridge, boundary pillars need only be placed at the ends of the boundary and at the entrance of trails leading into the nature reserve. Where possible, local people should be involved in the setting of boundary pillars.

Estimated total number of boundary pillars: 150.

- (ii) *Setting Regulation Boards.* Boards carrying the regulations of the nature reserve should be posted at the nature reserve headquarters and guard stations; in villages and commune centres in the buffer zone; and at the entrance of trails leading into the nature reserve. Barriers should be constructed on any roads entering the nature reserve, if necessary.

Estimated number of regulation boards: 15.

(b) Headquarters Construction

Objectives. The nature reserve headquarters should be large enough to accommodate workshops, seminars, training courses and various departmental functions. The headquarters must include a lobby, offices for the director and vice-directors, and rooms for the protection, technical and financial, and administration departments. There should be accommodations, including guest rooms, staff quarters, kitchens and washrooms.

Activities

- Selection of a suitable location;
- Bulldozing of site;
- Construction of headquarters, yard, fence and entrance; and

- Construction of water supply for headquarters.

Estimated area: 700 m².

Location: compartment 435, Ayun commune, Mang Yang district; 14°11'N 108°17'E.

(c) Guard Station Construction

Objectives. To provide suitable lodgings and workspace for forest guards, whose responsibilities will be to enforce regulations, to manage and protect the forest resources from exploitation, and to conduct regular patrols of the nature reserve area.

Activities. Selection of suitable locations for and construction of six guard stations.

Estimated area: 60 m² for each guard station, including bedrooms, workspace and washrooms, within a plot of 300 m².

Total construction area: 6 x 60 m² = 360 m².

The locations of the six guard stations should be as follows:

- (i) *Dak Roong Guard Station.* Location: Kon Lok I village, Dak Roong commune; 14°26'N 108°24'E.

Duties: to protect and manage Strict Protection Sub-area I, and to cooperate with the inhabitants of Dak Roong commune in implementing the conservation and protection programme.

- (ii) *Kroong Guard Station.* Location: on the road to village no. 3, Kroong commune and Mount Kon Ka Kinh; 14°17'N 108°27'E.

Duties: to protect and manage Strict Protection Sub-area I, and to cooperate with the inhabitants of Kroong commune in conducting forest protection and reforestation activities in Forest Rehabilitation Sub-area II.

- (iii) *Lo Ku Guard Station.* Location: Lo Ku commune; 14°10'N 108°28'E.

Duties: to cooperate with the inhabitants of Lo Ku commune in conducting forest protection and reforestation activities in Forest Rehabilitation Sub-area II.

- (iv) *Ayun Guard Station.* Location: De K Tuc village, Ayun commune; 14°08'N 108°20'E.

Duties: to protect and manage Strict Protection Sub-area III; and to cooperate with the inhabitants of Ayun commune in conducting forest protection activities.

- (v) *Kon Pne Guard Station.* Location: Kon Pne commune centre; 14°22'N 108°21'E.

Duties: to protect and manage Strict Protection Sub-area I; and to cooperate with the inhabitants of Kon Pne commune in conducting forest protection and reforestation activities in Forest Rehabilitation Sub-area I.

- (vi) *Ha Dong Guard Station*. Location: Kon Tang village, Ha Dong commune; 14°16'N 108°17'E.

Duties: to protect and manage Strict Protection Sub-area II; and to cooperate with the inhabitants of Ha Dong commune in conducting forest protection activities.

(d) Road Upgrading.

Objectives. To improve access for protecting and managing the nature reserve. To improve communications between the nature reserve headquarters and the guard stations.

Activity. Upgrading and surfacing of 10 km of road to the nature reserve headquarters.

(e) Electric Power Line Construction.

Objective. To supply electricity for the nature reserve headquarters and the communities in Ayun commune.

Activity. Construction of 10 km of 10 kV electric power line to the nature reserve headquarters. This power line should not be routed through areas of natural forest but, where possible, should follow existing roads.

Conservation and Protection Programme

(a) Protection Coverage

This programme is aimed at resource protection and resource management in the nature reserve, and should be implemented by the protection department.

Objectives. To protect the forest resources of the nature reserve. To enforce the regulations of the nature reserve. To involve local communities in conservation activities. To maintain a record of infringements of the regulations of the nature reserve, and other field observations.

Activities

- Establishment of standard operating procedures for each guard station, outlining in detail the scope, objectives and activities for each forest protection team;
- Preparation of weekly, monthly and annual guard schedules for each forest protection team;
- Enforcement of regulations regarding exploitation of forest resources, with particular regard to hunting, trapping, plant collecting and logging; and
- Regular visits to households taking part in the forest regeneration, forest protection and reforestation activities.

(b) Land Allocation for Protection

Objectives. To protect the forest in the nature reserve. To involve local communities in nature conservation by allocating forest land to households for the purpose of protection.

Activity. A total of 11,799 ha of rich, medium, poor and regenerating forest in the nature

reserve should be allocated on protection contracts to individual households living in the buffer zone. Forest guards from the six guard stations together with village and commune leaders are responsible for conducting this activity.

Households participating in this activity should receive VND 70,000 per hectare for the first year and VND 50,000 per hectare for subsequent years.

(c) Land Allocation for Regeneration

Objectives To increase forest cover and available wildlife habitat. To restore areas of degraded forest and scrub with scattered trees to a natural condition.

Activity. A total of 4,751 ha of poor forest, regenerating forest and scrub with scattered trees should be allocated to individual households for the purposes of natural and assisted regeneration.

Households participating in this activity should receive VND 90,000 per hectare for the first year and VND 80,000 per hectare for subsequent years.

(d) Reforestation with Native Tree Species

Objective. To promote the return of degraded habitats to a natural condition.

Activities

- Establishment of a tree nursery adjacent to the nature reserve headquarters in Ayun commune;
- Cultivation of native tree species; and
- Replanting 643 ha of bare land and scrub, mostly within the Forest Rehabilitation Area, with native tree species.

Preference should be given to indigenous tree species, such as *Litsea verticilata*, *L. monopetala*, *Michelia* spp. and *Podocarpus imbricatus*. Mixed planting is emphasised in order to recreate the natural diversity of the forest ecosystem.

The unit price for reforestation should be VND 3.48 million per hectare.

Scientific Research and Monitoring Programme

Objectives To increase understanding of the ecology of the nature reserve in order to assist in formulating both long and short-term protection and management plans. To increase the knowledge and capacity of technical staff in the fields of forestry, biology and natural resource management.

Activities

- On-going monitoring of forest cover and condition;
- Studies of natural and assisted regeneration within the nature reserve;
- Studies of the distribution, migration and population sizes of mammal species, particularly endemic and globally threatened species;

- Studies of the ecology of and threats to restricted-range bird species;
- Other appropriate scientific research; and
- Training of technical staff in biodiversity survey and monitoring techniques.

The capacity of technical staff should be improved by sending them for study at universities in Vietnam or overseas, or for training with non-governmental organisations, such as BirdLife International or the World Wide Fund for Nature (WWF). The scientific research and monitoring programme should be implemented in cooperation with specialist government institutions, such as FIPI, IEBR, Xuan Mai Forestry College and the Institute of Forestry Science.

Awareness and Extension Programme

Objectives. To involve local communities in conservation and promote the sustainable use of natural resources, with reference to Kon Ka Kinh Nature Reserve. To increase local understanding of the important role played by the nature reserve in water-catchment protection.

Activities

- Community meetings to discuss key issues regarding the management of Kon Ka Kinh Nature Reserve;
- Production and distribution of environmental education materials for use in schools; and
- Organisation of training courses on forest protection and rehabilitation for buffer zone communities.

The awareness and extension programme should be implemented through existing channels, such as commune people's committees and district departments of education.

5.9 Proposed Buffer Zone Development Programme

The objective of the buffer zone development programme should be to improve the socio-economic conditions of the buffer zone inhabitants, with the aim of reducing their dependence on the forest resources of the nature reserve. The buffer zone development programme should not form part of the investment plan for Kon Ka Kinh Nature Reserve but should be formulated and implemented by the nature reserve management board, together with relevant district and provincial departments, following the establishment of the nature reserve. However, it will be necessary to coordinate implementation of the buffer zone development programme and the nature reserve investment programmes.

The buffer zone development programme should have the following components:

- (a) sedentarisation programme;
- (b) social forestry programme;
- (c) agriculture programme;
- (d) irrigation programme;
- (e) animal husbandry programme;

- (f) transportation programme;
- (g) education programme; and
- (h) health care programme.

Sedentarisation Programme

Objectives. To promote fixed cultivation amongst local people who currently practice shifting cultivation and supplement their income through hunting and collection of forest products. To reduce local people's dependence on forest resources.

Activity. To accelerate the national Fixed Cultivation and Sedentarisation Programme by permanently settling the 1,808 buffer zone households who are currently unsettled (Table 10), at a cost of VND 2.7 million per household.

Social Forestry Programme

Objectives. To protect the natural forest in the buffer zone. To increase forest cover contiguous to the nature reserve, thus providing a larger area of wildlife habitat. To provide a source of income for local people.

Activities. The buffer zone contains approximately 41,788 ha of rich and medium forest. Most of this forest is currently under the management of local forest enterprises. Under the social forestry programme, individual households should be encouraged to sign protection contracts for this forest. A further 19,262 ha of poor and regenerating forest should be allocated to individual households for natural or assisted regeneration. Households who sign forest protection contracts should receive VND 70,000 per hectare for the first year and VND 50,000 per hectare for subsequent years. Households who are allocated land for regeneration should receive VND 90,000 per hectare for the first year and VND 80,000 per hectare for subsequent years.

The buffer zone contains large areas of scrub, scrub with scattered trees and bare land, much of which has been formed by shifting cultivation. These areas are unable to regenerate naturally. The social forestry programme will provide funds to reforest 3,311 ha with native tree species. This activity should be implemented as a part of the national 661 Programme, also known as the "Five Million Hectare Programme". It is very important that, for reforestation, preference should be given to indigenous species with a high economic value. For reforestation, VND 3.48 million per hectare should be allocated.

Finally, a total of 1,500 ha of forest will be allocated to individual households for use as forest gardens (Table 26).

To successfully implement the social forestry programme, the following supporting activities should also be conducted:

- Design of a detailed forest regeneration programme;
- Selection of indigenous trees species for reforestation;
- Establishment of nurseries to provide seedlings for assisted regeneration and reforestation; and
- Establishment of guidelines for nursery, planting and post-planting care.

The social forestry programme should be implemented through the local forest enterprises, who have the necessary capacity.

Agriculture Programme

Objectives. To increase agricultural production in the buffer zone. To promote a gradual transition from shifting cultivation to fixed cultivation.

Activities.

- Inventory and planning of land-use and soil types in the buffer zone, with emphasis on industrial crops;
- Expansion of the area of available agricultural land, especially wet rice land, by bringing unused land and fallow hill fields into production;
- Promotion of high-yield rice varieties by distributing 15 tonnes of seed rice;
- Training courses and demonstration plots to promote improved agricultural techniques and technology; and
- Dissemination of experience on sustainable cultivation on steep slopes by planting Vetiver Grass *Vetiveria zizanioides* fences to prevent soil erosion.

All activities in the agriculture programme should be implemented by the district departments of agriculture and rural development, in coordination with the nature reserve management board and relevant local authorities.

Table 26: Plan for Agricultural Expansion in the Buffer Zone

Commune	Wet Rice (ha)	Hill Fields (ha)	Green Beans (ha)	Industrial Crops (ha)	Forest Gardens (ha)	Grazing Land (ha)
Kon Pne	30	40	30	0	100	50
Dak Roong	20	50	50	50	250	100
Kroong	40	50	50	50	250	100
Lo Ku	40	50	20	0	200	100
Ha Dong	15	50	50	0	200	50
Ayun	0	100	0	0	250	100
Ha Ra	0	100	0	0	250	100
Total	145	420	200	100	1,500	600

Table 26 outlines the plan for agricultural expansion in the buffer zone. Under the agriculture programme, a total of 865 ha of unused land and fallow hill fields should be improved and brought into production. The 100 ha of industrial crop land in Dak Roong and Kroong communes will mostly be planted with coffee.

Irrigation Programme

Objective. To irrigate a total of 619 ha of land in the buffer zone, with the aim of increasing agricultural production.

Activities.

- Construction of seven irrigation dams at a cost of VND 200 million each; and
- Upgrade or repair of eight irrigation dams at a cost of VND 50 million each (Table 27).

Table 27: Plan for Developing the Irrigation System

Commune	Number of Irrigation Dams		Area to be Irrigated (ha)
	to be Built	to be Upgraded or Repaired	
Kon Pne	2	0	30
Dak Roong	1	0	7
Kroong	2	1	50
Lo Ku	1	1	47
Ha Dong	1	0	10
Ayun	0	3	225
Ha Ra	0	3	250
Total	7	8	619

Animal Husbandry Programme

Objectives: To realise the high potential for animal husbandry in the buffer zone. To increase ownership of livestock, especially large animals, such as buffalo, cows, goats and pigs. To shift the emphasis from livestock raising for domestic consumption to commercial livestock raising.

Activities

- Zoning of 600 ha as grazing land (Table 26);
- Provision of interest-free loans to 1,393 households to allow them to purchase livestock;
- Dissemination of knowledge on the prevention and treatment of common diseases affecting livestock; and
- Employment of veterinary surgeons responsible for monitoring and controlling outbreaks of disease.

Transportation Programme

Objectives: To improve communications between villages, commune centres and district towns. To facilitate economic development in the buffer zone.

Activities

- Construction of 15 km of road from Dak Roong commune to Kon Pne commune;
- Repair of 29 km of road from Lo Bong junction to Ha Dong commune;
- Repair of 15 km of road from Ka Nak town to Lo Ku commune; and
- Upgrading of 70 km of trails between villages and commune centres.

Education Programme

Objectives: To increase the educational level of local people. To raise understanding and awareness of the importance of Kon Ka Kinh Nature Reserve and threats to its conservation. To increase receptiveness of local people to the national family planning programme.

Activities

- Improved compensation and benefits for teachers to encourage them to work in remote villages;

Section 4 - Evaluation

- Teacher training for ethnic minority people; and
- Construction of 52 classrooms (Table 28).

Health Care Programme

Objectives. To reduce the incidence of serious medical conditions, such as malaria, goitre, diarrhoea and pulmonary tuberculosis. To reduce the natural rate of population growth in the buffer zone.

Activities.

- Construction of four new health station rooms and upgrade of four existing health station rooms;
- Provision of medical equipment for health stations;
- Recruitment of qualified health care staff, with priority being given to local people;
- Annual training courses for health care staff;
- Provision of free mosquito nets and contraceptives to local people;
- Awareness activities on disease prevention and family planning; and
- Implementation of the Rural Fresh Water Programme through construction of 72 wells and 39 pipelines (Table 28).

Table 28: Selected Construction Activities in the Buffer Zone Development Programme

Commune	Classrooms	Health Station Rooms	Wells	Pipelines
Kon Pne	6	4	0	6
Dak Roong	16	0	28	14
Kroong	14	4	22	9
Lo Ku	10	0	16	4
Ha Dong	6	0	6	6
Total	52	8	72	39

6. Finance

6.1 Investment Capital

Investment capital should be apportioned for the management and development of Kon Ka Kinh Nature Reserve with the following provisos:

- Investment capital for programmes outlined in the nature reserve investment plan should be accounted for in a five-year plan, from 2000 to 2004;
- Feasibility studies should be conducted for the construction projects outlined in Section 5.8; and
- Investment capital for construction projects should be based on completing the necessary legal documents.

Cost estimates for the management and development of Kon Ka Kinh Nature Reserve total VND 21,837 million (Table 30). This total includes construction costs of VND 12,497 million, equipment costs of VND 992 million and other costs of VND 8,348 million. The average annual cost is estimated at VND 4,367 million (Table 29). Annual disbursements of the investment capital for Kon Ka Kinh Nature Reserve should begin in fiscal year 2000 and end in fiscal year 2004 (Table 31).

Sources of Investment Capital. The investment capital requirements of the nature reserve should be met from the following sources:

- National government budget: VND 14,712 million;
- Favourable interest loans: VND 3,425 million; and
- International donors: VND 3,700 million.

Funding from international donors should be the main source of funding for the scientific research and monitoring, and awareness and extension programmes.

Table 29: Investment Schedule for the Investment Plan for Kon Ka Kinh Nature Reserve

Programme	2000	2001	2002-2004	Total
Infrastructure development	2,360	7,127	588	10,075
Conservation and protection	1,254	1,170	5,148	7,572
Scientific research and monitoring	200	1,100	2,400	3,700
Awareness and extension	110	140	240	490
Total	3,924	9,537	8,376	21,837

6.2 Implementation of the Investment Plan for Kon Ka Kinh Nature Reserve

The investment plan for Kon Ka Kinh Nature Reserve should be implemented in two phases:

- First Phase: 2000.** Activities during this phase focus on infrastructure development, establishing the nature reserve management board and recruiting nature reserve staff; and
- Second Phase: 2001 to 2004.** Activities initiated during the first phase will continue during

**Table 30: Cost Estimates for the Five Year Investment Plan for Kon Ka Kinh Nature Reserve
(in VND million)**

Item	Quantity	Unit Price	Cost
1. Infrastructure development programme			10,075
Demarcation workshops	2	35	70
Boundary pillars	150	0.5	75
Regulation boards	15	2	30
Surface bulldozing for headquarters	10 shifts	1.2	12
Headquarters building	700 m ²	1.5	1,050
Headquarters fence	400 m	0.5	200
Headquarters entrance	1	50	50
Headquarters yard	200 m ²	0.1	20
Water supply	1	200	200
Road upgrading	10 km	500	5,000
Electric power line	10 km	100	1,000
Television broadcast antenna	1	50	50
Guard stations	360 m ²	1.2	432
Cars	2	300	600
Motorbikes	10	25	250
Vehicle registration and maintenance	5 years	60	300
Petrol and oil	5 years	65.5	328
Generators for guard stations	7	7.5	53
15 W mobile phone	1	10	10
6 W mobile phones	10	5	50
Mobile phone relay station	1	20	20
Binoculars	10	5	50
Compasses	10	0.5	5
Cameras	2	10	20
Office equipment	5 years	40	200
2. Conservation and protection programme			7,572
Land allocation for protection	11,799 ha	0.27	3,186
Land allocation for regeneration	4,751 ha	0.41	1,948
Reforestation with native tree species	643 ha	3.48	2,238
Nurseries	2 ha	100	200
3. Scientific research and monitoring programme			3,700
Monitoring forest cover	3 years	200	600
Studies of regeneration	3 years	200	600
Studies of mammals	3 years	200	600
Studies of restricted-range birds	3 years	200	600
Other case studies	3 years	100	300
Training	5 years	200	1,000
4. Awareness and extension programme			490
Materials	5 years	40	200
Camera	2	15	30
Televisions	2	10	20
Video recorders	2	5	10
Slide projector	1	15	15
Overhead projector	1	15	15
Training courses	10	20	200
Total			21,837

Note: excludes staff wages and buffer zone development programme

**Table 31: Disbursement Schedule for the Investment Plan for Kon Ka Kinh Nature Reserve
(in VND million)**

Item	2000	2001	2002-2004	Total
1. Infrastructure development programme	2,360	7,127	588	10,075
Demarcation workshops	70	0	0	70
Boundary pillars	75	0	0	75
Regulation boards	30	0	0	30
Surface bulldozing for headquarters	12	0	0	12
Headquarters building	700	350	0	1,050
Headquarters fence	200	0	0	200
Headquarters entrance	0	50	0	50
Headquarters yard	0	20	0	20
Water supply	200	0	0	200
Road upgrading	0	5,000	0	5,000
Electric power line	0	1,000	0	1,000
Television broadcast antenna	0	0	50	50
Guard stations	288	144	0	432
Car	300	300	0	600
Motorbikes	200	50	0	250
Vehicle registration and maintenance	20	20	260	300
Petrol and oil	50	100	178	328
Generators for guard stations	30	23	0	53
15 W mobile phone	10	0	0	10
6 W mobile phone	50	0	0	50
Mobile phone relay station	20	0	0	20
Binoculars	30	20	0	50
Compasses	5	0	0	5
Cameras	20	0	0	20
Office equipment	50	50	100	200
2. Conservation and protection programme	1,254	1,170	5,148	7,572
Land allocation for protection	826	590	1,770	3,186
Land allocation for regeneration	428	380	1,140	1,948
Reforestation with native tree species	0	0	2,238	2,238
Nurseries	0	200	0	200
3. Scientific research and monitoring programme	200	1,100	2,400	3,700
Monitoring forest cover	0	200	400	600
Studies of regeneration	0	200	400	600
Studies of mammals	0	200	400	600
Studies of restricted-range birds	0	200	400	600
Other case studies	0	100	200	300
Training	200	200	600	1000
4. Awareness and extension programme	110	140	240	490
Materials	40	40	120	200
Camera	30	0	0	30
Televisions	0	20	0	20
Video recorders	0	10	0	10
Slide projector	0	15	0	15
Overhead projector	0	15	0	15
Training courses	40	40	120	200
Total	3,924	9,537	8,376	21,837

the second phase. Also, the conservation and protection, scientific research and monitoring and awareness and extension programmes will be initiated. During the second phase, an investment plan for the five years from 2005 to 2009 will be developed. This plan will emphasise the conservation and protection, scientific research and monitoring, and awareness and extension programmes

6.3 Buffer Zone Development Programme

The buffer zone development programme activities outlined in Tables 32, 33 and 34 are only general recommendations. A detailed buffer zone investment plan should be formulated by the nature reserve management board, with input from relevant district-level departments, following the establishment of the nature reserve. Formulating a buffer zone investment plan will require the collection of more detailed socio-economic data than that presented in this report. Consequently, both the budget and the activities contained in the investment plan may differ from those recommended here. When complete, the investment plan should be submitted to the Ministry of Agriculture and Rural Development (MARD) for approval.

Table 32: Investment Schedule for the Buffer Zone Development Programme

Programme	2000	2001	2002	2003-2004	Total
1. Sedentarisation	2,441	2,441	0	0	4,882
2. Community Forestry	6,154	6,147	6,155	12,289	30,745
3. Agriculture	778	596	363	173	1,910
4. Irrigation	850	550	400	0	1,800
5. Animal Husbandry	807	805	600	586	2,798
6. Transportation	13,605	7,686	1,599	40	22,930
7. Education	280	360	400	0	1,040
8. Health care	535	535	540	0	1,610
Total	25,450	19,120	10,057	13,088	67,715

6.4 Summary of Project Benefits

Establishing Kon Ka Kinh Nature Reserve will have the following benefits:

- Increased protection of the biodiversity of the Western Highlands of Vietnam;
- Protection of mixed coniferous and broadleaf evergreen forest containing *Fokienia hodginsii*, *Dacrydium elatum*, *Podocarpus imbricatus* and *Pinus dalatensis*, which is the natural forest type of the southern Kon Tum Plateau but is now only found on Mount Kon Ka Kinh;
- Increased protection of the genetic resources of northern Gia Lai province, particularly globally threatened and economically valuable species;
- Protection of the watersheds of two major river systems: the Ba and Dak Phe Rivers, thereby safeguarding the water supply for irrigation, domestic use and hydro-electricity generation in Gia Lai, Kon Tum and Phu Yen provinces; and
- Increased living standards of members of the Ba Na ethnic minority living in the buffer zone of Kon Ka Kinh Nature Reserve.

**Table 33: Cost Estimates for the Five Year Buffer Zone Development Programme
(in VND million)**

Item	Quantity	Unit Price	Cost
1. Sedentarisation			4,882
Sedentarisation	1,808 h'holds	2.7	4,882
2. Social Forestry			30,745
Land allocation for protection	41,788 ha	0.27	11,283
Land allocation for regeneration	19,262 ha	0.41	7,897
Reforestation with native tree species	3,311 ha	3.48	11,521
Forest gardens	1,500 ha	0.02	30
Training courses	14	1	14
3. Agriculture			1,910
Land improvement	865	1.5	1,297
High-yield seed rice	15 tonnes	5	75
Training courses	35	1	35
Demonstration plots	85	1	85
Other activities	1,393 h'holds	0.3	418
4. Irrigation			1,800
Irrigation dam construction	7	200	1,400
Irrigation dam upgrade and repair	8	50	400
5. Animal Husbandry			2,798
Grazing land	600 ha	0.02	12
Interest-free loans	1,393 h'holds	2	2,786
6. Transportation			22,930
Road construction	15 km	1,015	15,225
Road repairs	44 km	168.75	7,425
Upgrading roads to villages	70 km	4	280
7. Education			1,040
Classrooms	52	20	1,040
8. Health care			1,610
Health station room upgrading	4	7.5	30
Health station room construction	4	20	80
Wells	72	10	720
Pipelines	39	20	780
Total			67,715

**Table 34: Disbursement Schedule for the Buffer Zone Development Programme
(in VND million)**

Item	2000	2001	2002	2003-2004	Total
1. Sedentarisation	2,441	2,441	0	0	4,882
Sedentarisation	2,441	2,441	0	0	4,882
2. Social forestry	6,154	6,147	6,155	12,289	30,745
Land allocation for protection	2,257	2,257	2,257	4,512	11,283
Land allocation for regeneration	1,579	1,579	1,579	3,160	7,897
Reforestation with native tree species	2,304	2,304	2,304	4,609	11,521
Forest gardens	7	7	8	8	30
Training courses	7	0	7	0	14
3. Agriculture	778	596	363	173	1,910
Land improvement	600	450	247	0	1,297
High-yield seed rice	50	25	0	0	75
Training courses	14	7	7	7	35
Demonstration plots	30	30	25	0	85
Other activities	84	84	84	166	418
4. Irrigation	850	550	400	0	1,800
Irrigation dam construction	600	400	400	0	1,400
Irrigation dam upgrade and repair	250	150	0	0	400
5. Animal Husbandry	807	805	600	586	2,798
Grazing land	7	5	0	0	12
Interest-free loans	800	800	600	586	2,786
6. Transportation	13,605	7,686	1,599	40	22,930
Road construction	10,150	5,075	0	0	15,225
Road repair	3,375	2,531	1,519	0	7,425
Upgrading roads to villages	80	80	80	40	280
7. Education	280	360	400	0	1,040
Classrooms	280	360	400	0	1,040
8. Health care	535	535	540	0	1,610
Health station room upgrading	15	15	0	0	30
Health station room construction	20	20	40	0	80
Wells	240	240	240	0	720
Pipelines	260	260	260	0	780
Total	25,450	19,120	10,057	13,088	67,715

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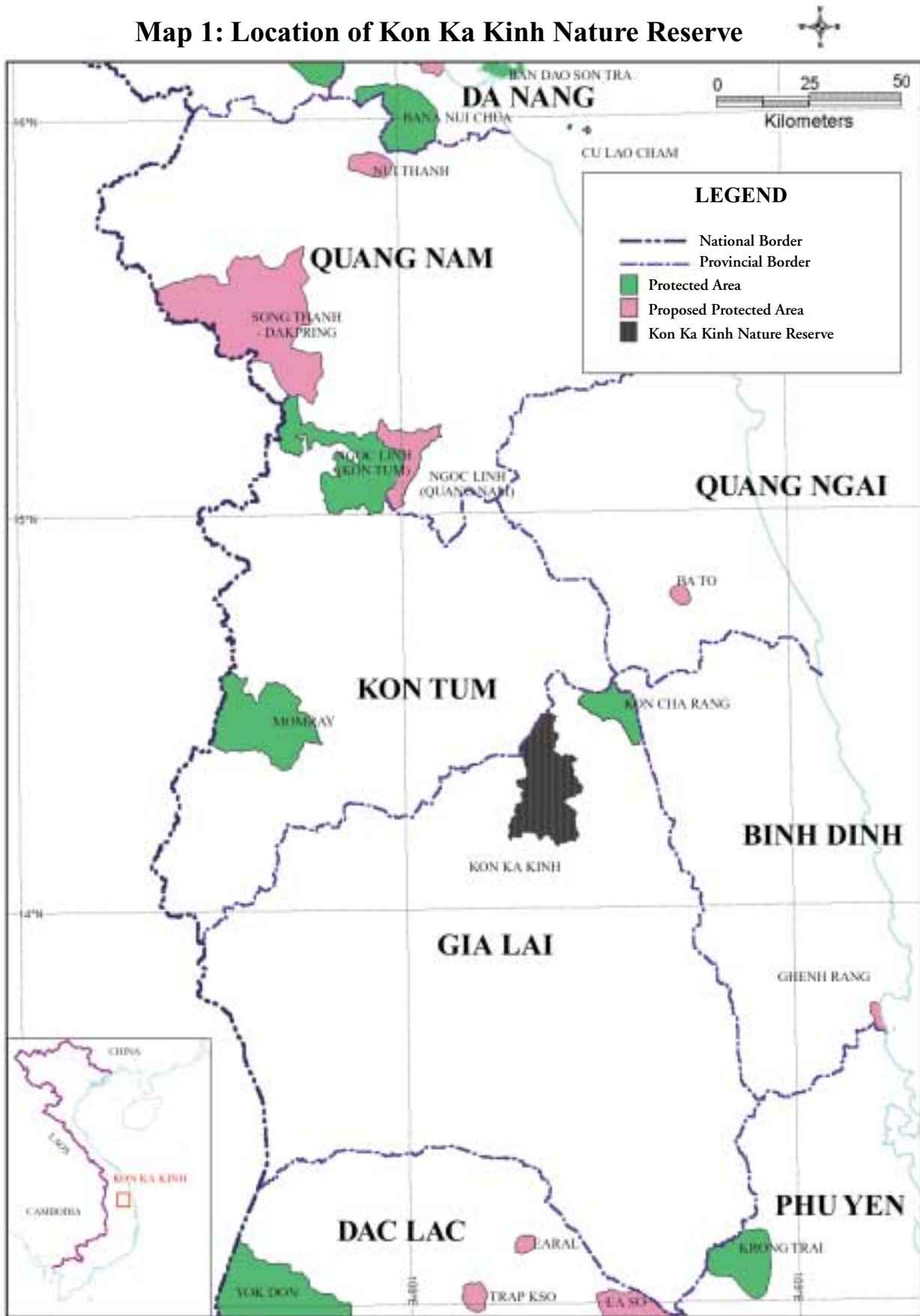
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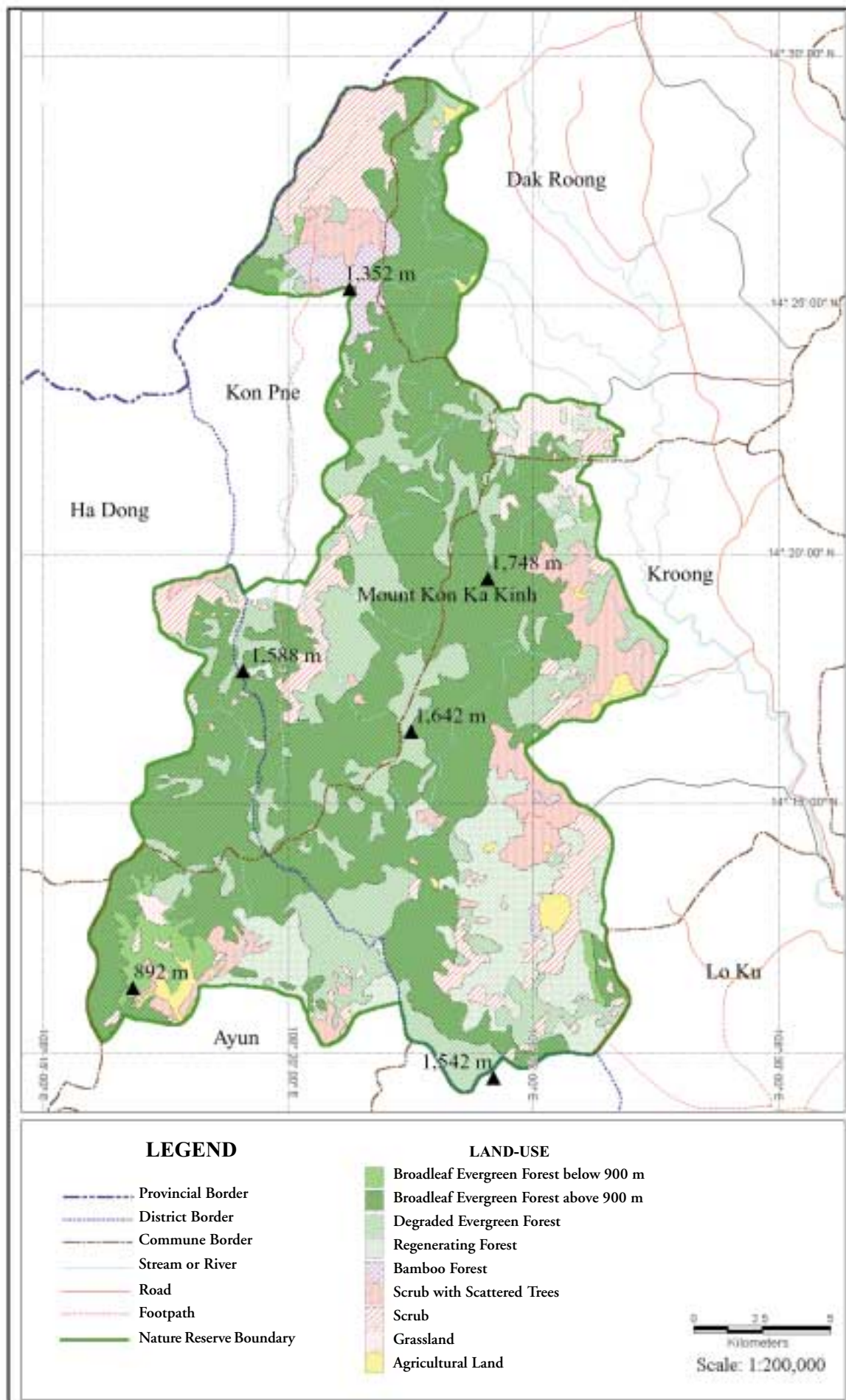
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Map 1: Location of Kon Ka Kinh Nature Reserve

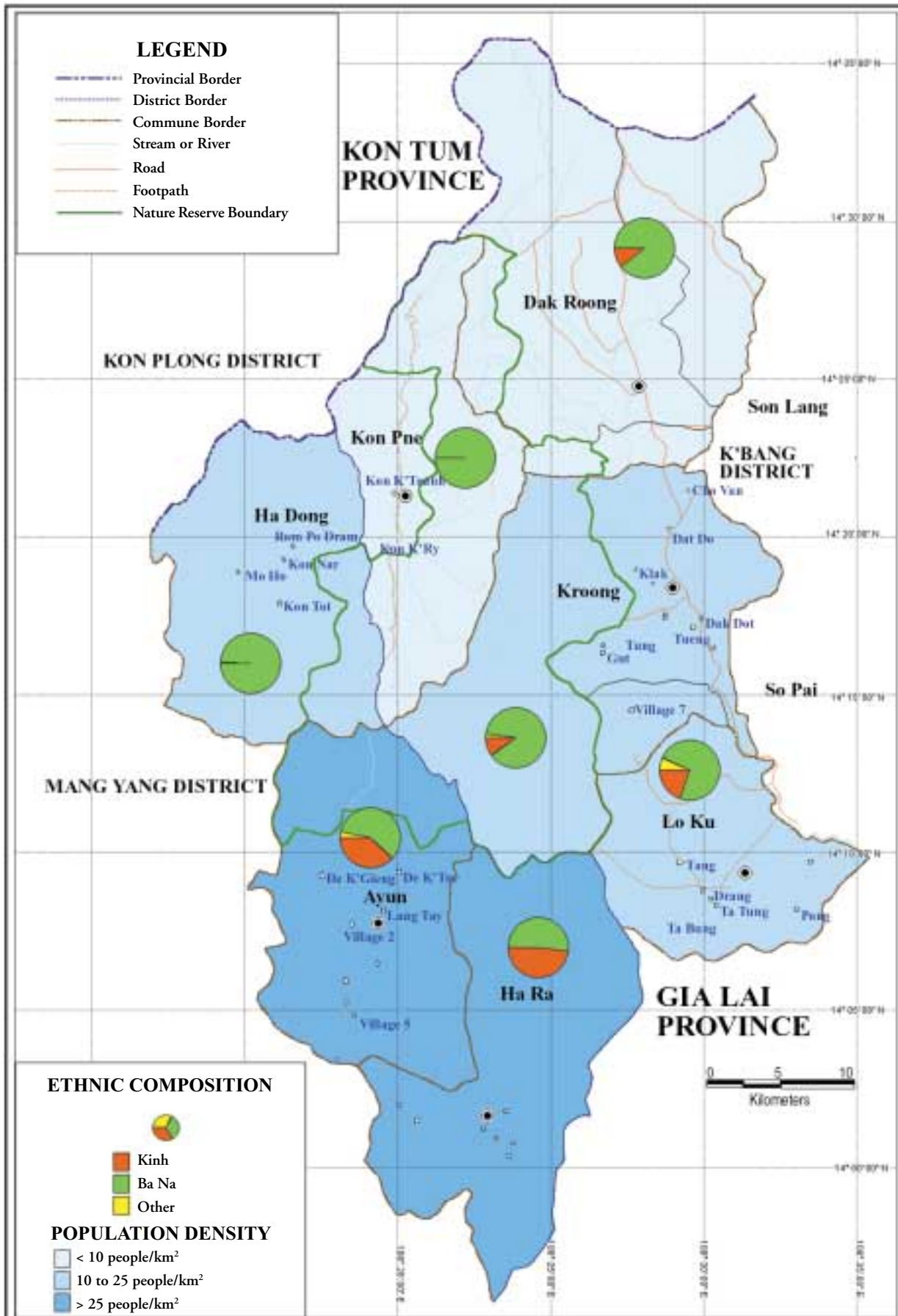


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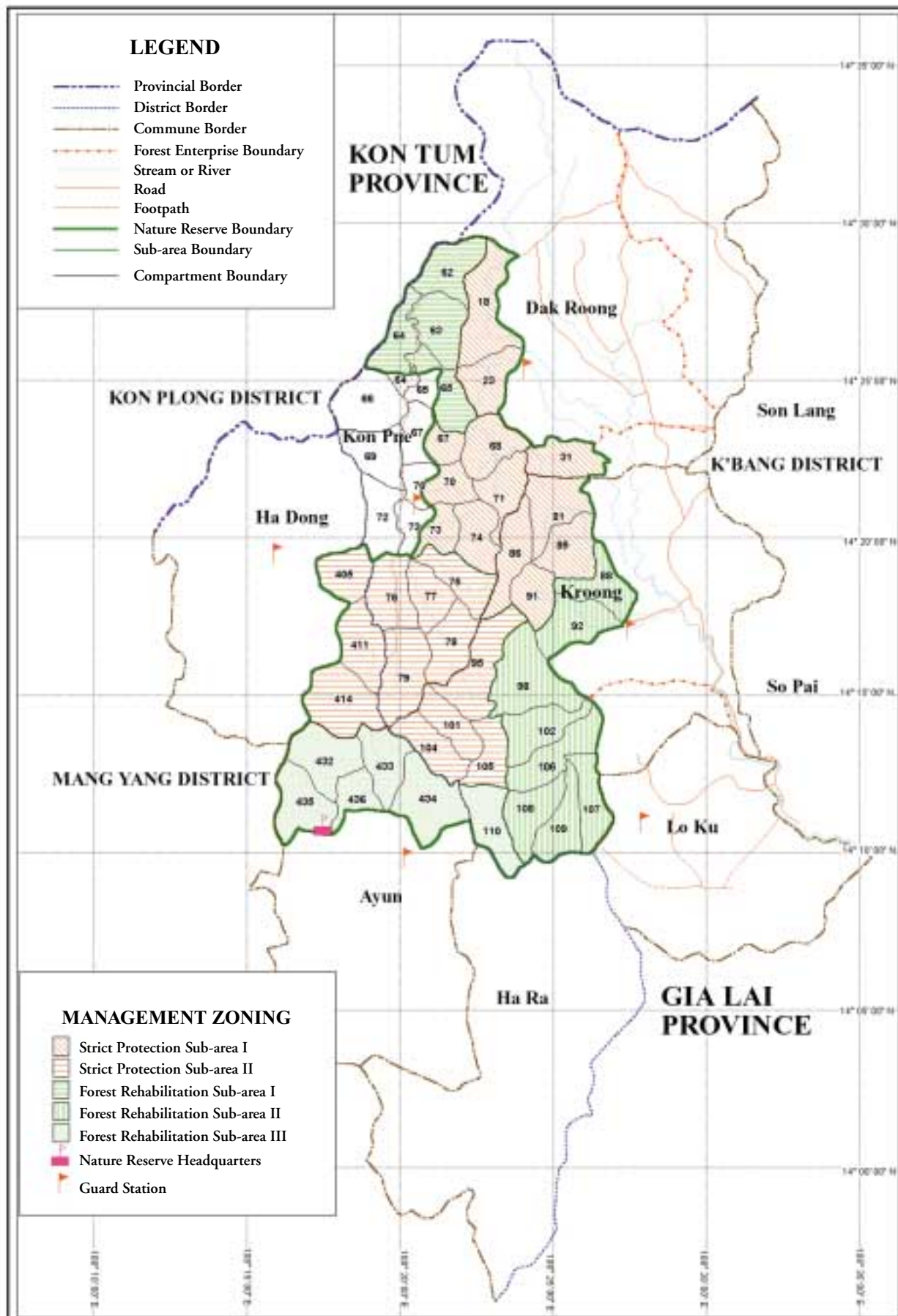
Map 2: Land-use in Kon Ka Kinh Nature Reserve



Map 3: Population Density and Ethnic Composition of Communes in the Buffer Zone



Map 4: Management Zoning of Kon Ka Kinh Nature Reserve



Appendix 1: Flora Recorded at Kon Ka Kinh Nature Reserve

Class, Family, Genus and Species	Notes	Class, Family, Genus and Species	Notes	Class, Family, Genus and Species	Notes
Lycopodiophyta		Thelypteridaceae		<i>P. nemoralis</i>	W
Lycopodiaceae		<i>Cyclosorus philippinarum</i>		<i>Xylopi pierrei</i>	M
<i>Huperzia obovalifolia</i>	O	<i>Coryphoptertis falciloba</i>		<i>Fissistigma oldhami</i>	
<i>Lycopodiella cernua</i>	O	Aspleniaceae		<i>Orophea multiflora</i>	
Selaginellaceae		<i>Asplenium nidus</i>	O	<i>Alphonsea tonkinensis</i>	
<i>Selaginella doederleinii</i>		<i>A. prolongatum</i>		<i>Goniiothalamus</i>	
<i>S. rolandi-principis</i>		<i>A. normale</i>		<i>gabriacianus</i>	
Equisetophyta		<i>Diplazium crinipes</i>		Myristicaceae	
Equisetaceae		Dryopteridaceae		<i>Knema conferta</i>	W,M
<i>Equisetum ramosissimum</i>	M	<i>Tectaria brachiata</i>		<i>K. erratica</i>	W
subsp. <i>debile</i>		<i>T. decurrens</i>		<i>Horsfieldia amygdalina</i>	W
Polypodiophyta		<i>Dryopteris fuscipes</i>		Piperaceae	
Angiopteridaceae		Blechnaceae		<i>Piper boehmeriaefolium</i>	
<i>Angiopteris annamensis</i>	O	<i>Blechnum orientale</i>		var. <i>tonkinensis</i>	
Schizeaceae		<i>Woodwardia japonica</i>	M	<i>P. harmandii</i>	
<i>Lygodium conforme</i>		Pinophyta		<i>P. lolot</i>	M
<i>L. microphyllum</i>		Gnetaceae		Aristolochiaceae	
Adiantaceae		<i>Gnetum montanum</i>		<i>Aristolochia</i> aff. <i>saccata</i>	
<i>Adiantum flabellulatum</i>	O	Pinaceae		<i>Asarum</i> aff. <i>petelotii</i>	
<i>A. philippense</i>	O	<i>Pinus dalatensis</i>	W,M, EV,E	Illiciaceae	
<i>Antrophyum annamensis</i>		Cupressaceae		<i>Illicium griffithii</i>	
<i>A. callifolium</i>		<i>Fokienia hodginsii</i>	W,M,V	Ranunculaceae	
<i>Pteris grevilleana</i>		Podocarpaceae		<i>Clematis armandii</i>	
<i>P. ensiformis</i>		<i>Podocarpus imbricatus</i>	W,O	Menispermaceae	
Gleicheniaceae		<i>P. neriifolius</i>	W,O	<i>Fibraurea tinctoria</i>	M
<i>Dicranopteris linearis</i>		<i>Decussocarpus fleuryi</i>	W,O,V	<i>Coscinium fenestratum</i>	M,R
Polypodiaceae		<i>Dacrydium elatum</i>	W,O	<i>Limacia scandens</i>	
<i>Drynaria rigidula</i>		Cephalotaxaceae		<i>Stephania pierrei</i>	
<i>Aglaomorpha coronans</i>		<i>Cephalotaxus mannii</i>	W,V	<i>Diploclisia glaucescens</i>	
<i>Platyterium coronarium</i>		Magnoliophyta		Lauraceae	
<i>Pyrosia lingua</i> var. <i>heteracta</i>		Magnoliopsida		<i>Cinnamomum</i>	W,M
<i>Phymatosorus scolopendria</i>		Magnoliaceae		<i>parthenoxylon</i>	
<i>Microsorium brachylepis</i>		<i>Manglietia chevalierii</i>	W	<i>C. polyadelphum</i>	W
<i>Colysis wrightii</i>		<i>Magnolia</i> sp.	W	<i>C. ovatum</i>	W
Grammitidaceae		<i>Pachylarnax precalva</i>	W	<i>C. bejolghota</i>	W,M
<i>Prosaptia urceolare</i>		<i>Michelia braianensis</i>	W	<i>C. mairei</i>	W
<i>Scleroglossum pusillum</i>		<i>M. foveolata</i>	W	<i>C. iners</i>	W,M
Cyatheaceae		<i>M. aff. hypolampra</i>	W	<i>C. sp.</i>	W
<i>Cyathea latebrosa</i>		<i>M. mediocris</i>	W	<i>Actinodaphne sesquipetalis</i>	W
Thyrsopteridaceae		<i>Paramichelia baillonii</i>	W	<i>Litsea cambodiana</i>	W
<i>Cybotium barometz</i>	M	Annonaceae		<i>L. cubeba</i>	M
Dennstaedtiaceae		<i>Uvaria microcarpa</i>		<i>L. glutinosa</i>	W,M
<i>Microlepia trapeziformis</i>		<i>Artabotrys hexapetalus</i>		<i>L. monopetala</i>	W
<i>Pteridium aquilinum</i>		<i>Desmos cochinchinensis</i>	O	<i>L. verticillata</i>	W
<i>Lindsaea lobata</i>		<i>Polyalthia jenkinsii</i>	W	<i>Neolitsea elaeocarpa</i>	W
				<i>N. zeylanica</i>	W

Class, Family, Genus and Species	Notes
<i>Lindera spicata</i>	M
<i>Cryptocarya concinna</i>	W
<i>C. metcalfiana</i>	W
<i>Beilschmiedia obovatifolia</i>	W
<i>B. percoriacea</i>	W
<i>Phoebe lanceolata</i>	W
<i>P. tavoyana</i>	W
<i>Machilus odoratissimus</i>	W
<i>Alseodaphne andersonii</i>	W
<i>A. aff. rhododendropsis</i>	W
Hernandiaceae	
<i>Illigera parviflora</i>	M
Dilleniaceae	
<i>Dillenia indica</i>	W
<i>D. scabrella</i>	W
<i>D. turbinata</i>	W
<i>Tetracera scandens</i>	M
Actinidiaceae	
<i>Actinidia aff. latifolia</i>	
Theaceae	
<i>Anneslea fragrans</i>	W
<i>Ternstroemia japonica</i>	W
<i>Adinandra microcarpa</i>	W,R
<i>A. rubropunctata</i>	W
<i>Eurya japonica</i>	
<i>E. tonkinensis</i>	
<i>Pyrenaria oblongicarpa</i>	W
<i>Camellia caudata</i>	
<i>Gordonia tonkinensis</i>	W
<i>Schima wallichii</i> subsp. <i>noronhae</i>	W
Dipterocarpaceae	
<i>Dipterocarpus</i> aff. <i>alatus</i>	W
<i>Shorea roxburghii</i>	W
<i>Parashorea stellata</i>	W
Ancistrocladaceae	
<i>Ancistrocladus tectorius</i>	
Pentaphragmaceae	
<i>Pentaphragmum euryoides</i>	W
Guttiferae	
<i>Garcinia merguensis</i>	W
<i>G. multiflora</i>	W,M
<i>G. oblongifolia</i>	W
<i>Calophyllum dryobalanoides</i>	W
<i>C. sp.</i>	W

Class, Family, Genus and Species	Notes
<i>Cratoxylum formosum</i> var. <i>prunifolium</i>	W
Elaeocarpaceae	
<i>Elaeocarpus griffithii</i>	W
<i>E. limitanus</i>	W
<i>E. nitentifolius</i>	W
<i>E. kontumensis</i>	W
<i>E. stipularis</i>	W
<i>E. tectorius</i>	W
<i>Sloanea sinensis</i>	W
Tiliaceae	
<i>Grewia asitica</i>	
<i>G. bulot</i>	
<i>Triumfetta bartramia</i>	
Sterculiaceae	
<i>Commersonia bartramia</i>	
<i>Helicteres angustifolia</i>	
<i>H. hirsuta</i>	
<i>Pterospermum pierrei</i>	W
<i>Sterculia lanceolata</i>	W
Bombacaceae	
<i>Bombax ceiba</i>	W,M
Malvaceae	
<i>Sida rhombifolia</i>	
<i>Urena lobata</i>	M
Flacourtiaceae	
<i>Scolopia chinensis</i>	
<i>Hydnocarpus annamensis</i>	W
<i>H. kurzii</i>	W
<i>Casearia annamensis</i>	W,R
Passifloraceae	
<i>Adenia heterophylla</i> subsp. <i>heterophylla</i>	
Cucurbitaceae	
<i>Solena heterophylla</i>	M
<i>Gymnopetalum cochinchinensis</i>	M
<i>Hodgsonia macrocarpa</i>	
<i>Gynostemma pentaphyllum</i>	
Begoniaceae	
<i>Begonia aptera</i>	
<i>B. sp.</i>	
Capparaceae	
<i>Capparis viminea</i>	
<i>Crateva religiosa</i>	W

Class, Family, Genus and Species	Notes
Ericaceae	
<i>Rhododendron fleuryi</i>	O,R
<i>R. Iyi</i>	O
<i>R. aff. arboreum</i> subsp. <i>delavayi</i>	O
<i>Vaccinium chunii</i>	
<i>Enkianthus quinqueflorus</i>	
<i>Craibiodendron scleranthum</i>	W,EV,R
<i>Lyonia ovalifolia</i>	W
<i>Gaultheria leucocarpa</i>	
Sapotaceae	
<i>Madhuca</i> sp.	W
<i>Donella lanceolata</i>	W
<i>Sinosideroxylon</i> sp.	W
Ebenaceae	
<i>Diospyros apiculata</i>	W
<i>D. pilosula</i>	W
Styracaceae	
<i>Styrax benjoin</i>	W
<i>Rehderodendron macrocarpon</i>	W
Symplocaceae	
<i>Symplocos annamensis</i>	
<i>S. anomala</i>	W
<i>S. cochinchinensis</i> subsp. <i>laurina</i>	W,M
<i>S. glomerata</i> subsp. <i>congesta</i>	W
<i>S. racemosa</i>	M
Myrsinaceae	
<i>Maesa montana</i>	
<i>Embelia ribes</i>	M
<i>Ardisia aciphylla</i>	
<i>A. corymbifera</i>	
<i>A. crenata</i>	M
<i>A. primulifolia</i>	
<i>A. villosa</i>	
<i>A. gracilipes</i>	
<i>A. aff. brevicaulis</i>	
Primulaceae	
<i>Androsace</i> aff. <i>umbellata</i>	
Amaranthaceae	
<i>Amaranthus spinosus</i>	M
<i>Achyranthes aspera</i>	M
Caryophyllaceae	
<i>Drymaria diandra</i>	
Polygonaceae	
<i>Polygonum senticosum</i>	

Class, Family, Genus and Species	Notes
<i>P. chinensis</i>	M
<i>P. hydropiper</i>	M
Pittosporaceae	
<i>Pittosporum pauciflorum</i>	
Rosaceae	
<i>Photinia</i> aff. <i>prunifolia</i>	
<i>Eriobotrya bengalensis</i>	W
<i>Rhaphiolepis indica</i>	W
<i>R. salicifolia</i>	W
<i>Rubus niveus</i>	
<i>R. alceaefolius</i>	M
<i>R. asper</i>	
<i>R. cochinchinensis</i> var. <i>glabrescens</i>	
<i>Prunus arborea</i> var. <i>montana</i>	W
Fabaceae	
Mimosoideae	
<i>Adenanthera pavonina</i> var. <i>microsperma</i>	W
<i>Entada glandulosa</i>	
<i>Mimosa pudica</i>	M
<i>M. diplotricha</i>	
<i>Acacia pennata</i>	
<i>Albizia lebbeckoides</i>	W
<i>A. corniculata</i>	
<i>A. chinensis</i>	W
<i>A. lucidior</i>	W
<i>Archidendron pellitum</i>	W
<i>A. clypearia</i>	W
<i>A. turgidum</i>	W
Caesalpinioideae	
<i>Peltophorum dasyrrachis</i>	W
<i>Caesalpinia mimosoides</i>	
<i>Dialium cochinchinensis</i>	W, EV
<i>Cassia siamea</i>	W
<i>C. alata</i>	M
<i>Bauhinia cardinale</i>	
<i>B. saigonensis</i>	
<i>Azelia xylocarpa</i>	W, EV
Papilionoideae	
<i>Ormosia balansae</i>	W
<i>O. fordiana</i>	W
<i>O. pinnata</i>	W
<i>Dalbergia cochinchinensis</i>	W, EV
<i>D. nigrescens</i>	W
<i>Pterocarpus macrocarpus</i>	W
<i>Millettia pachyloba</i>	
<i>M. sp.</i>	

Class, Family, Genus and Species	Notes
<i>Derris polyphylla</i>	
<i>Desmodium triquetrum</i>	M
<i>D. heterophyllum</i>	
<i>Christia vespertilionis</i>	
<i>Pueraria montana</i>	
<i>Dunbaria podocarpa</i>	
<i>Crotalaria bialata</i>	
<i>C. chinensis</i>	
Proteaceae	
<i>Helicia cochinchinensis</i>	W
Lecythidaceae	
<i>Careya sphaerica</i>	W
Sonneratiaceae	
<i>Duabanga grandiflora</i>	W
Lythraceae	
<i>Lagerstroemia calyculata</i>	W
Thymelaeaceae	
<i>Aquilaria crasna</i>	M
Myrtaceae	
<i>Decaspermum montanum</i>	W
<i>Rhodomyrtus tomentosa</i>	M
<i>Syzygium cumini</i>	W
<i>S. chanlos</i>	W
<i>S. glomerulatum</i>	W
<i>S. wightianum</i>	W
<i>S. zeylanicum</i>	W
Melastomataceae	
<i>Melastoma septemnerivium</i>	
<i>M. eberhardtii</i>	
<i>M. normale</i>	
<i>M. osbeckoides</i>	
<i>Osbeckia stellata</i> var. <i>crinita</i>	
<i>Allomorphia sulcata</i>	
<i>Blastus borneensis</i> var. <i>eberhardtii</i>	
<i>Phyllagathis ovalifolia</i>	
<i>Sonerila lecomtei</i>	
<i>Medinilla honbaense</i>	
<i>Memecylon angustifolium</i>	
Combretaceae	
<i>Terminalia bellirica</i>	W
Rhizophoraceae	
<i>Carallia brachiata</i>	W
Alangiaceae	
<i>Alangium chinense</i>	W, M
<i>A. kurzii</i>	W
Cornaceae	
<i>Aucuba japonica</i>	W

Class, Family, Genus and Species	Notes
<i>Mastixia arborea</i>	W
Loranthaceae	
<i>Macrosolen bibracteolatus</i>	
<i>Elytranthe alpida</i>	
<i>Helixanthera parasitica</i>	
<i>Dendrophloe varians</i>	
<i>Taxillus parasitica</i>	
Balanophoraceae	
<i>Rhopalocnemis phalloides</i>	
Aquifoliaceae	
<i>Ilex cochinchinensis</i>	W
<i>I. rotunda</i>	W
Icacinaceae	
<i>Gomphandra mollis</i>	W
<i>Platea latifolia</i>	W
Euphorbiaceae	
<i>Phyllanthus reticulatus</i>	M
<i>Glochidion eriocarpum</i>	M
<i>Breynia fruticosa</i>	
<i>Aporusa dioica</i>	W
<i>Baccaurea oxycarpa</i>	W
<i>B. silvestris</i>	W, EV
<i>Antidesma velutinum</i>	
<i>A. bunius</i>	W
<i>Bischofia javanica</i>	W
<i>Bridelia monoica</i>	W
<i>Croton poilanei</i>	
<i>Mallotus philippensis</i>	W
<i>M. apelta</i>	W
<i>Alchornea annamica</i>	EV
<i>A. rugosa</i>	W
<i>Macaranga denticulata</i>	W
<i>M. kurzii</i>	W
<i>Homonoia riparia</i>	
<i>Endospermum chinense</i>	W
<i>Sapium baccatum</i>	W
<i>S. discolor</i>	W
<i>S. rotundifolium</i>	W
Oxalidaceae	
<i>Oxalis corymbosa</i>	M
Balsaminaceae	
<i>Impatiens spireana</i>	
Sapindaceae	
<i>Cardiospermum halicacabum</i>	
<i>Sapindus mukorossi</i>	W
<i>Nephelium</i> aff. <i>melliferum</i>	W
<i>Xerospermum noronhianum</i>	W

Class, Family, Genus and Species	Notes
<i>Pometia pinnata</i>	W
<i>Mischocarpus sundaicus</i>	W
<i>Paranephelium spirei</i>	W
<i>Dodonea viscosa</i>	
Staphyleaceae	
<i>Turpinia cochinchinensis</i>	W
<i>T. montana</i>	W
Aceraceae	
<i>Acer campbellii</i>	W,O
<i>A. laurinum</i>	W
<i>A. erythranthum</i>	W
Sabiaceae	
<i>Meliosma lepidota</i> subsp. <i>longipes</i>	W
<i>M. pinnata</i> subsp. <i>angustifolia</i>	W
Burseraceae	
<i>Dacryodes dungii</i>	W
<i>Canarium littorale</i> var. <i>rufum</i>	W,M
<i>C. subulatum</i>	W
<i>Bursera serrata</i>	W
Anacardiaceae	
<i>Mangifera foetida</i>	W
<i>Bouea oppositifolia</i>	W
<i>Choerospondias axillaris</i>	W,M
<i>Dracontomelon duperreanum</i>	W
<i>Semecarpus caudata</i>	R
<i>S. graciliflora</i>	W
<i>Rhus javanica</i> var. <i>roxburghii</i>	M
<i>Toxicodendron succedana</i>	W
Simaroubaceae	
<i>Brucea javanica</i>	M
<i>Eurycoma longifolia</i>	M
<i>Ailanthus triphysa</i>	W,M
Meliaceae	
<i>Toona sureni</i>	W
<i>Chukrasia tabularis</i> var. <i>velutina</i>	W
<i>Melia azedarach</i>	W
<i>Dysoxylum binectariferum</i>	W
<i>D. cochinchinensis</i>	W
<i>Chisocheton cumingianus</i> subsp. <i>balansae</i>	W
<i>Aphanamixis polystachya</i>	W
<i>Aglaiia cambodiana</i>	W

Class, Family, Genus and Species	Notes
<i>A. gigantea</i>	W
<i>A. hoi</i>	W
<i>A. roxburghiana</i>	W
<i>A. rubescens</i>	W
<i>Heynia trijuga</i>	W
Rutaceae	
<i>Zanthoxylum avicenniae</i>	
<i>Z. myriacanthum</i>	
<i>Z. nitidum</i>	
<i>Z. scabrum</i>	
<i>Evodia leptota</i>	M
<i>E. meliaefolia</i>	M
<i>E. simplicifolia</i>	
<i>Acronychia pedunculata</i>	W,M
<i>Clausena excavata</i>	
Rhamnaceae	
<i>Ventilago calyculata</i>	
<i>Ziziphus poilanei</i>	
Leeaceae	
<i>Leea rubra</i>	M
Vitaceae	
<i>Tetrastigma erubescens</i>	
<i>T. laoticum</i>	
<i>Cissus javana</i>	
<i>Cayratia japonica</i>	M
<i>Ampelocissus polythyrsa</i>	
Apiaceae	
<i>Centella asiatica</i>	M
<i>Hydrocotyle</i> aff. <i>tonkinensis</i>	
<i>Eryngium foetidum</i>	M
<i>Oenanthe javanica</i>	
Araliaceae	
<i>Schefflera kontumensis</i>	M,R
<i>S. octophylla</i>	W,M
<i>Trevesia palmata</i>	M
<i>Brassaiopsis variabilis</i>	
<i>Dendropanax petelotii</i>	W
<i>Diplopanax stachyanthus</i>	W
<i>Aralia armata</i>	M
<i>Heteropanax fragrans</i>	W
Hamamelidaceae	
<i>Altingia poilanei</i>	W,M,R
<i>A. siamensis</i>	W,M
<i>Symingtonia populnea</i>	W
<i>S. tonkinensis</i>	W
<i>Rhodoleia championii</i>	W

Class, Family, Genus and Species	Notes
Daphniphyllaceae	
<i>Daphniphyllum</i> aff. <i>himalaense</i>	W
Ulmaceae	
<i>Celtis orientalis</i>	W
<i>Gironniera subaequalis</i>	W
<i>Trema angustifolia</i>	
<i>T. orientalis</i>	W
Moraceae	
<i>Streblus macrophyllus</i>	W
<i>Maclura cochinchinensis</i>	M
<i>Broussonetia papyrifera</i>	M
<i>Artocarpus styracifolius</i>	W
<i>A. sp.</i>	W
<i>Ficus altissima</i>	W
<i>F. benjamina</i>	W,O
<i>F. racemosa</i>	W
<i>F. subpyrififormis</i>	
<i>F. hirta</i> var. <i>roxburghii</i>	
<i>F. fulva</i> var. <i>minor</i>	
<i>F. langkokensis</i>	W
<i>F. villosa</i>	
<i>F. auriculata</i>	W,M
<i>F. hispida</i> var. <i>hispida</i>	
<i>F. septica</i> var. <i>fistulosa</i>	W
Urticaceae	
<i>Poikilospermum suaveolens</i>	M
<i>Elatostema dissectum</i>	
<i>E. diversifolium</i>	
<i>Pellionia griffithiana</i>	
<i>Boehmeria tonkinensis</i>	
<i>Pouzolzia sanguinea</i>	
<i>Debregeasia velutina</i>	
Juglandaceae	
<i>Engelhardtia serrata</i> var. <i>cambodica</i>	W
<i>E. wallichiana</i>	W
Fagaceae	
<i>Castanopsis argyrophylla</i>	W
<i>C. arietina</i>	W
<i>C. echinophora</i>	W
<i>C. indica</i>	W
<i>Lithocarpus aggregatus</i>	W
<i>L. corneus</i>	W
<i>L. fissa</i>	W
<i>L. magneinii</i>	W
<i>L. stenopus</i>	W
<i>L. tubulosus</i>	W

Class, Family, Genus and Species	Notes
<i>Quercus bambusaefolia</i>	W
<i>Q. baniensis</i>	W
<i>Q. macrocalyx</i>	W
<i>Q. poilanei</i>	W
Betulaceae	
<i>Carpinus poilanei</i>	W
<i>Betula alnoides</i>	W
Loganiaceae	
<i>Gelsemium elegans</i>	
<i>Strychnos axillaris</i>	
<i>Fagraea auriculata</i>	
Apocynaceae	
<i>Bousigonia angustifolia</i>	
<i>B. mekongense</i>	
<i>Melodinus annamensis</i>	
<i>Alstonia scholaris</i>	W,M
<i>Holarrhena pubescens</i>	W
<i>Rauvolfia cambodiana</i>	M
<i>Alyxia hainanensis</i>	
<i>A. pseudosinensis</i>	
<i>Kopsia</i> aff. <i>harmandiana</i>	W
<i>Pottsia laxiflora</i>	
<i>Strophanthus caudatus</i>	M
<i>Wrightia pubescens</i> subsp. <i>lanati</i>	W
<i>Ecdysanthera rosea</i>	
Asclepiadaceae	
<i>Streptocaulon griffithii</i>	M
<i>Hoya macrophylla</i>	
<i>H. minima</i>	
<i>Dischidia acuminata</i>	M
<i>D. hirsuta</i>	
Solanaceae	
<i>Solanum americanum</i>	
<i>S. erianthum</i>	M
<i>S. torvum</i>	W
<i>Physalis angulata</i>	
Convolvulaceae	
<i>Jacquemontia paniculata</i>	
<i>Merremia hederacea</i>	
<i>Xenostegia tridentata</i>	
<i>Ipomoea involucrata</i>	
<i>Lepistemon bnectariferum</i>	
<i>Argyreia capitata</i>	M
Boraginaceae	
<i>Heliotropium indicum</i>	M
Verbenaceae	
<i>Callicarpa arborea</i>	

Class, Family, Genus and Species	Notes
<i>C. longifolia</i>	
<i>Premna scandens</i>	
<i>Vitex pinnata</i>	W
<i>V. sumatrana</i> var. <i>urceolata</i>	W
<i>V. trifolia</i>	W
<i>Gmelina philippensis</i>	M
<i>Clerodendrum cyrtophyllum</i>	M
<i>C. kaempferi</i>	
Lamiaceae	
<i>Elsholtzia blanda</i>	
<i>Anisomeles indica</i>	M
Scrophulariaceae	
<i>Lindernia ciliata</i>	M
<i>L. crustacea</i>	M
<i>Torenia concolor</i>	
Gesneriaceae	
<i>Aeschynanthus garretii</i>	
<i>Slackia tonkinensis</i>	
<i>Paraboea philippensis</i>	
Acanthaceae	
<i>Thunbergia laurifolia</i>	
<i>Strobilanthes</i> cf. <i>boerhavioides</i>	
<i>S. echinata</i>	
<i>S. pennstemonoides</i>	
<i>S. petelotii</i>	
<i>Andrographis laxiflora</i>	
<i>Justicia balansae</i>	
<i>J. glomerulata</i>	
<i>J. quadrifaria</i>	
Bignoniaceae	
<i>Oroxylum indicum</i>	M
<i>Stereospermum neuranthum</i>	W
<i>Markhamia stipulata</i> var. <i>kerrii</i>	
Campanulaceae	
<i>Pratia nummularia</i>	M
Rubiaceae	
<i>Hedyotis capitellata</i> var. <i>mollis</i>	M
<i>H. vestita</i>	
<i>H. hirsutula</i>	
<i>Wendlandia glabrata</i>	
<i>W.</i> aff. <i>salicifolia</i>	
<i>Uncaria homomalla</i>	
<i>U. macrophylla</i>	
<i>U. scandens</i>	
<i>Neonauclea sessilifolia</i>	W

Class, Family, Genus and Species	Notes
<i>Metadina trichotoma</i>	W,M
<i>Mussaenda cambodiana</i>	
<i>M. erosa</i>	M
<i>Aidia oxyodonta</i>	W
<i>Randia spinosa</i>	M
<i>Gardenia philastreii</i>	
<i>Canthium dicoccum</i> var. <i>rostratum</i>	W
<i>Ixora henryi</i>	
<i>Pavetta indica</i>	M
<i>Psychotria sarmentosa</i>	
<i>P. serpens</i>	
<i>P. mekongensis</i>	
<i>P. rubra</i>	M
<i>Lasianthus annamicus</i>	
<i>L. cyanocarpus</i> var. <i>asperulatus</i>	
<i>L. foetidissimus</i>	
<i>Paederia foetida</i>	
<i>Morinda umbellata</i>	
<i>Borreria articularis</i>	M
Caprifoliaceae	
<i>Viburnum punctatum</i>	W
<i>Lonicera macrantha</i>	
Asteraceae	
<i>Vernonia cinerea</i>	M
<i>V. arborea</i> var. <i>javanica</i>	W
<i>Elephantopus mollis</i>	
<i>Ageratum conyzoides</i>	M
<i>Eupatorium odoratum</i>	M
<i>E. fortunei</i>	M
<i>Conyza canadense</i>	
<i>Microglossa pyrifolia</i>	M
<i>Blumea balsamifera</i>	M
<i>B. fistulosa</i>	
<i>B. laciniata</i>	
<i>Siegesbeckia orientalis</i>	M
<i>Eclipta prostrata</i>	M
<i>Bidens pilosa</i>	M
<i>Emilia sonchifolia</i>	M
<i>Crassocephalum crepidioides</i>	M
<i>Gnaphalium luteo-album</i>	
Liliopsida	
Pandanaceae	
<i>Pandanus tectorius</i>	
<i>P. humilis</i>	
Araceae	
<i>Pothos angustifolius</i>	

Class, Family, Genus and Species	Notes
<i>P. repens</i>	
<i>P. yunnanensis</i>	
<i>Epipremnum giganteum</i>	O
<i>Homalomena occulta</i>	M
<i>H. pierreana</i>	
<i>Colocasia esculenta</i>	
<i>Alocasia macrorrhiza</i>	M
<i>Amorphophalus interruptus</i>	
<i>Typhonium flagelliforme</i>	
<i>Arisoema harmandii</i>	
Commelinaceae	
<i>Commelina communis</i>	M
<i>Cyanotis burmanniana</i>	
Arecaceae	
<i>Rhapis laosensis</i>	
<i>Licuala paludosa</i>	
<i>Caryota urens</i>	
<i>Arenga pinnata</i>	
<i>Areca triandra</i>	O,M
<i>Pinanga paradoxa</i>	
<i>Calamus tetradactylus</i>	
<i>C. bousigonii</i>	
<i>C. poilanei</i>	EV,V
<i>C. rudentum</i>	
<i>C. tonkinensis</i>	
<i>Daemonorops pierreanus</i>	
<i>Plectocomia elongata</i>	
Musaceae	
<i>Musa acuminata</i>	
Zingiberaceae	
<i>Costus speciosus</i>	M
<i>C. tonkinensis</i>	
<i>Amomum villosum</i>	M
<i>Catimbium bracteatum</i>	M
<i>Zingiber zerumbet</i>	
<i>Globba pendula</i>	
Marantaceae	
<i>Phrynium dispersum</i>	M
<i>Donax cannaeformis</i>	
Liliaceae	
<i>Dianella nemorosa</i>	
Smilacaceae	
<i>Heterosmilax paniculata</i>	
<i>Smilax annamensis</i>	
<i>S. megacarpa</i>	
<i>S. perfoliata</i>	
Amaryllidaceae	
<i>Curculigo annamitica</i>	

Class, Family, Genus and Species	Notes
<i>C. latifolia</i>	
Cyperaceae	
<i>Fimbristylis pauciflora</i>	
<i>Rhynchospora corymbosa</i>	
<i>Cyperus rotundus</i>	M
<i>C. diffusus</i>	
<i>C. halpan</i>	
<i>Kyllinga sesquiflora</i>	
<i>Mapania kurzii</i>	
<i>Scleria terrestris</i>	
<i>Carex cryptostachys</i>	
<i>C. anomocarya</i>	
Poaceae	
<i>Arundinaria baviensis</i>	R
<i>Bambusa spilosa</i>	
<i>Dendrocalamus patellaris</i>	
<i>Dinochloa</i> sp.	
<i>Melocalamus compactiflorus</i>	
<i>Schizostachyum</i> sp.	
<i>Oxytenanthera albociliata</i>	
<i>Phragmites vallatoria</i>	
<i>Thysanolaena maxima</i>	
<i>Eleusine indica</i>	
<i>Cynodon dactylon</i> var. <i>dactylon</i>	
<i>Pennisetum polystachyon</i>	
<i>Imperata cylindrica</i>	
<i>Miscanthus floridulus</i>	
<i>Saccharum spontaneum</i>	
<i>Erianthus arundinaceus</i>	
<i>Microstegium vagans</i>	
<i>Chrysopogon aciculatus</i>	
<i>Themeda caudata</i>	
Agavaceae	
<i>Dracaena loureiri</i>	M
Dioscoreaceae	
<i>Dioscorea cirrhosa</i>	
<i>D. glabra</i>	M
Orchidaceae	
<i>Anoectochilus lylei</i>	M
<i>A. roxburghii</i>	M
<i>Thecostele alata</i>	O
<i>Arundina graminifolia</i>	O
<i>Phaius tankervilleae</i>	O
<i>Liparis chapaensis</i>	R
<i>Dendrobium lindleyi</i>	O
<i>D. chrysotoxum</i>	O
<i>D. thyrsiflorum</i>	O

Class, Family, Genus and Species	Notes
<i>D. cretaceum</i>	O
<i>D. ochraceum</i>	O,EV
<i>D. ellipsophyllum</i>	O
<i>D. pseudotenellum</i>	
<i>D. aloifolium</i>	
<i>Flickingeria angustifolia</i>	
<i>Eria amica</i>	
<i>Trichotosia microphylla</i>	
<i>T. pulvinata</i>	
<i>Gastrochilus patinatus</i>	O
<i>Holcoglossum subulifolium</i>	O
<i>Cleisostoma fuerstenbergianum</i>	
<i>Schoenorchis rosea</i>	
<i>Bulbophyllum retusiusculum</i>	O
<i>B. abbrevilabium</i>	
<i>B. hiepii</i>	EV
<i>Epigeneium chapaense</i>	R
<i>Coelogyne ridleyi</i>	
<i>Pholidota chinensis</i>	O
<i>P. rubra</i>	O
<i>Eulophia graminea</i>	O
<i>Cymbidium dayanum</i>	O
<i>C. ensifolium</i>	O
<i>Aerides falcata</i>	O
<i>Vanda pumila</i>	O
<i>Renanthera imschootiana</i>	O

Follows Pham Hoang Ho (1991)

Notes: EV = Endemic to Vietnam; W = Wood; M = Medicinal; O = Ornamental
E = Endangered; V=Vulnerable; R = Rare
as per IUCN (1997)

Appendix 2: Mammals Recorded at Kon Ka Kinh Nature Reserve

No.	Common Name	Order, Family, Genus and Species	IUCN 1996	Data Source
	Pangolins:	Pholidota:		
	Pangolins	Manidae		
1	Sunda Pangolin	<i>Manis javanica</i>	NT	I,S
	Treeshrews:	Scandentia:		
	Treeshrews	Tupaïidae		
2	Northern Treeshrew	<i>Tupaia belangeri</i>		O
	Bats:	Chiroptera:		
	Old World Fruit Bats	Pteropodidae		
3	Short-nosed Fruit Bat	<i>Cynopterus sphinx</i>		S
4	Ratanaworabhan's Fruit Bat	<i>Megaerops niphanae</i>		S
	Horseshoe Bats	Rhinolophidae		
5	Pearson's Horseshoe Bat	<i>Rhinolophus pearsonii</i>		S
6	Least Horseshoe Bat	<i>R. pusillus</i>		S
7	Intermediate Horseshoe Bat	<i>R. affinis</i>		S
8	Horseshoe bat species 1	<i>R. sp. 1</i>		S
9	Horseshoe bat species 2	<i>R. sp. 2</i>		S
10	Horseshoe bat species 3	<i>R. sp. 3</i>		S
	Old-World Leaf-nosed Bats	Hipposideridae		
11	Intermediate Leaf-nosed Bat	<i>Hipposideros larvatus</i>		S
	Evening Bats	Vespertilionidae		
12	Moluccan Whiskered Bat	<i>Myotis ater</i>		S
13	Pipistrelle species	<i>Pipistrellus sp.</i>		S
14	Round-eared Tube-nosed Bat	<i>Murina cyclotis</i>		S
15	Tube-nosed bat species	<i>M. sp.</i>		S
16	Hardwicke's Forest Bat	<i>Kerivoula hardwickii</i>		S
	Primates:	Primates:		
	Old-World Monkeys	Cercopithecidae		
17	Pig-tailed Macaque	<i>Macaca nemestrina</i>	VU	O
18	Bear Macaque	<i>M. arctoides</i>	VU	S
19	Grey-shanked Douc Langur	<i>Pygathrix nemaus cinereus</i>	EN	I,S
	Gibbons	Hylobatidae		
20	Buff-cheeked Gibbon	<i>Hylobates gabriellae</i>	DD	H
	Carnivores:	Carnivora:		
	Bears	Ursidae		
21	Asiatic Black Bear	<i>Ursus thibetanus</i>	VU	I
	Weasels, etc.	Mustelidae		
22	Yellow-throated Marten	<i>Martes flavigula</i>		O,S
23	Hog-badger	<i>Arctonyx collaris</i>		H
	Civets	Viverridae		
24	Large Indian Civet	<i>Viverra zibetha</i>		S,I
25	Small Indian Civet	<i>Viverricula indica</i>		O
26	Common Palm Civet	<i>Paradoxurus hermaphroditus</i>		S
27	Masked Palm Civet	<i>Paguma larvata</i>		O
28	Small-toothed Palm Civet	<i>Arctogalidia trivirgata</i>		O
	Mongoose	Herpestidae		
29	Small Asian Mongoose	<i>Herpestes javanicus</i>		O

No.	Common Name	Order, Family, Genus and Species	IUCN 1996	Data Source
	Cats	Felidae		
30	Tiger	<i>Panthera tigris</i>	EN	T
	Even-toed Ungulates:	Artiodactyla:		
	Pigs	Suidae		
31	Pig species	<i>Sus</i> sp.		S, T
	Deer	Cervidae		
32	Barking Deer	<i>Muntiacus muntjak</i>		H, S, T
33	Truong Son Muntjac	<i>M. truongsoneensis</i>		S
	Cattle, Antelopes, etc.	Bovidae		
34	Southern Serow	<i>Naemohedus sumatraensis</i>	VU	S
	Rodents:	Rodentia:		
	Non-flying Squirrels	Sciuridae		
35	Black Giant Squirrel	<i>Ratufa bicolor</i>		O
36	Pallas's Squirrel	<i>Callosciurus erythraeus</i>		O
37	Cambodian Striped Tree-squirrel	<i>Tamiops rodolphii</i>		O
38	Red-cheeked Squirrel	<i>Dremomys rufigenis</i>		O
39	Indochinese Ground Squirrel	<i>Menetes berdmorei</i>		O
	Bamboo Rats	Rhizomyidae		
40	Hoary Bamboo Rat	<i>Rhizomys pruinosus</i>		T
	Old-World Porcupines	Hystricidae		
41	Malayan Porcupine	<i>Hystrix brachyura</i>	VU	O
42	Asiatic Brush-tailed Porcupine	<i>Atherurus macrourus</i>		S

Follows Corbet and Hill (1992)

Status: EN = Endangered; VU = Vulnerable; NT = Near Threatened; DD = Data Deficient as per IUCN (1996)

Data Source: S = Specimen; O = Observed; I = Interview; H = Heard; T = Tracks or Traces

Appendix 3: Birds Recorded at Kon Ka Kinh Nature Reserve

No.	Common Name	Order, Family, Genus and Species	Collar <i>et al.</i> 1994	Notes
		Galliformes:		
		Phasianidae		
1	Rufous-throated Partridge	<i>Arborophila rufogularis</i>		
2	Bar-backed Partridge	<i>A. brunneopectus</i>		
3	Red Junglefowl	<i>Gallus gallus</i>		
4	Silver Pheasant	<i>Lophura nycthemera</i>		
5	Siamese Fireback	<i>L. diardi</i>	VU	
		Piciformes:		
		Picidae		
6	Speckled Piculet	<i>Picumnus innominatus</i>		
7	White-browed Piculet	<i>Sasia ochracea</i>		
8	Stripe-breasted Woodpecker	<i>Dendrocopus atratus</i>		
9	Rufous Woodpecker	<i>Celeus brachyurus</i>		
10	Lesser Yellownape	<i>Picus chlorolophus</i>		
11	Greater Yellownape	<i>P. flavinucha</i>		
12	Bay Woodpecker	<i>Blythipicus pyrrhotis</i>		
		Megalaimidae		
13	Red-vented Barbet	<i>Megalaima lagrandieri</i>		EVL
14	Green-eared Barbet	<i>M. faiostricta</i>		
15	Golden-throated Barbet	<i>M. franklinii</i>		
		Bucerotiformes:		
		Bucerotidae		
16	Great Hornbill	<i>Buceros bicornis</i>		
17	Brown Hornbill	<i>Anorrhinus tickelli</i>	NT	
		Trogoniformes:		
		Trogonidae		
18	Red-headed Trogon	<i>Harpactes erythrocephalus</i>		
		Coraciiformes:		
		Coraciidae		
19	Dollarbird	<i>Eurystomus orientalis</i>		
		Halcyonidae		
20	Banded Kingfisher	<i>Lacedo pulchella</i>		
21	Stork-billed Kingfisher	<i>Halcyon capensis</i>		
22	White-throated Kingfisher	<i>H. smyrnensis</i>		
		Cerylidae		
23	Pied Kingfisher	<i>Ceryle rudis</i>		
		Meropidae		
24	Blue-bearded Bee-eater	<i>Nyctyornis athertoni</i>		
		Cuculiformes:		
		Cuculidae		
25	Large Hawk Cuckoo	<i>Hierococcyx sparverioides</i>		
26	Indian Cuckoo	<i>Cuculus micropterus</i>		
27	Eurasian Cuckoo	<i>C. canorus</i>		
28	Banded Bay Cuckoo	<i>Cacomantis sonneratii</i>		
29	Asian Emerald Cuckoo	<i>Chrysococcyx maculatus</i>		
30	Drongo Cuckoo	<i>Surniculus lugubris</i>		

No.	Common Name	Order, Family, Genus and Species	Collar <i>et al.</i> 1994	Notes
31	Asian Koel	<i>Eudynamys scolopacea</i>		
32	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>		
		Centropodidae		
33	Greater Coucal	<i>Centropus sinensis</i>		
34	Lesser Coucal	<i>C. bengalensis</i>		
		Psittaciformes:		
		Psittacidae		
35	Red-breasted Parakeet	<i>Psittacula alexandri</i>		
		Apodiformes:		
		Apodidae		
36	Asian Palm Swift	<i>Cypsiurus balasiensis</i>		
37	House Swift	<i>Apus affinis</i>		
		Strigiformes:		
		Strigidae		
38	Mountain Scops Owl	<i>Otus spilocephalus</i>		
39	Brown Wood Owl	<i>Strix leptogrammica</i>		
40	Collared Owlet	<i>Glaucidium brodiei</i>		
41	Asian Barred Owlet	<i>G. cuculoides</i>		
		Caprimulgidae		
42	Grey Nightjar	<i>Caprimulgus indicus</i>		
		Columbiformes:		
		Columbidae		
43	Spotted Dove	<i>Streptopelia chinensis</i>		
44	Barred Cuckoo Dove	<i>Macropygia unchall</i>		
45	Emerald Dove	<i>Chalcophaps indica</i>		
46	Thick-billed Green Pigeon	<i>Treron curvirostra</i>		
47	Mountain Imperial Pigeon	<i>Ducula badia</i>		
		Ciconiiformes:		
		Accipitridae		
48	Black-shouldered Kite	<i>Elanus caeruleus</i>		
49	Crested Serpent Eagle	<i>Spilornis cheela</i>		
50	Crested Goshawk	<i>Accipiter trivirgatus</i>		
51	Black Eagle	<i>Ictinaetus malayensis</i>		
52	Mountain Hawk Eagle	<i>Spizaetus nipalensis</i>		
		Ardeidae		
53	Little Heron	<i>Butorides striatus</i>		
		Passeriformes:		
		Pittidae		
54	Rusty-naped Pitta	<i>Pitta oatesi</i>		
		Eurylaimidae		
55	Silver-breasted Broadbill	<i>Serilophus lunatus</i>		
56	Long-tailed Broadbill	<i>Psarisomus dalhousiae</i>		
		Irenidae		
57	Asian Fairy Bluebird	<i>Irena puella</i>		
58	Blue-winged Leafbird	<i>Chloropsis cochinchinensis</i>		
59	Orange-bellied Leafbird	<i>C. hardwickii</i>		
		Laniidae		
60	Long-tailed Shrike	<i>Lanius schach</i>		

No.	Common Name	Order, Family, Genus and Species	Collar <i>et al.</i> 1994	Notes
		Corvidae		
61	White-winged Magpie	<i>Urocissa whiteheadi</i>	NT	
62	Indochinese Green Magpie	<i>Cissa hypoleuca</i>	NT	
63	Ratchet-tailed Treepie	<i>Temnurus temnurus</i>		
64	Maroon Oriole	<i>Oriolus traillii</i>		
65	Large Cuckooshrike	<i>Coracina macei</i>		
66	Black-winged Cuckooshrike	<i>C. melaschistos</i>		
67	Grey-chinned Minivet	<i>Pericrocotus solaris</i>		
68	Long-tailed Minivet	<i>P. ethologus</i>		
69	Scarlet Minivet	<i>P. flammeus</i>		
70	Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>		
71	White-throated Fantail	<i>Rhipidura albicollis</i>		
72	Black Drongo	<i>Dicrurus macrocercus</i>		
73	Ashy Drongo	<i>D. leucophaeus</i>		
74	Crow-billed Drongo	<i>D. annectans</i>		
75	Bronzed Drongo	<i>D. aeneus</i>		
76	Lesser Racket-tailed Drongo	<i>D. remifer</i>		
77	Spangled Drongo	<i>D. hottentottus</i>		
78	Greater Racket-tailed Drongo	<i>D. paradiseus</i>		
79	Black-naped Monarch	<i>Hypothymis azurea</i>		
		Muscicapidae		
80	Blue Whistling Thrush	<i>Myophonus caeruleus</i>		
81	Orange-headed Thrush	<i>Zoothera citrina</i>		
82	Scaly Thrush	<i>Z. dauma</i>		
83	Lesser Shortwing	<i>Brachypteryx leucophrys</i>		
84	Ferruginous Flycatcher	<i>Muscicapa ferruginea</i>		
85	Mugimaki Flycatcher	<i>Ficedula mugimaki</i>		
86	Rufous-browed Flycatcher	<i>F. solitaris</i>		
87	Snowy-browed Flycatcher	<i>F. hyperythra</i>		
88	Little Pied Flycatcher	<i>F. westermanni</i>		
89	Verditer Flycatcher	<i>Eumyias thalassina</i>		
90	Large Niltava	<i>Niltava grandis</i>		
91	Small Niltava	<i>N. macgrigoriae</i>		
92	Pygmy Blue Flycatcher	<i>Muscicapella hodgsoni</i>		
93	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>		
94	Oriental Magpie Robin	<i>Copsychus saularis</i>		
95	White-rumped Shama	<i>C. malabaricus</i>		
96	White-tailed Robin	<i>Myiomela leucura</i>		
97	White-crowned Forktail	<i>Enicurus leschenaulti</i>		
		Sturnidae		
98	Chestnut-tailed Starling	<i>Sturnus malabaricus</i>		
99	Black-collared Starling	<i>S. nigricollis</i>		
100	Vinous-breasted Starling	<i>S. burmannicus</i>		
		Sittidae		
101	Yellow-billed Nuthatch	<i>Sitta solangiae</i>	VU	RRS
		Paridae		
102	Yellow-cheeked Tit	<i>Parus spilonotus</i>		
103	Sultan Tit	<i>Melanochlora sultanea</i>		

No.	Common Name	Order, Family, Genus and Species	Collar <i>et al.</i> 1994	Notes
		Aegithalidae		
104	Black-throated Tit	<i>Aegithalos concinnus</i>		
		Hirundinidae		
105	Barn Swallow	<i>Hirundo rustica</i>		
106	Asian House Martin	<i>Delichon dasypus</i>		
		Pycnonotidae		
107	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>		
108	Red-whiskered Bulbul	<i>P. jocosus</i>		
109	Puff-throated Bulbul	<i>Alophoixus pallidus</i>		
110	Grey-eyed Bulbul	<i>Iole propinqua</i>		
111	Mountain Bulbul	<i>Hypsipetes mccllellandii</i>		
		Cisticolidae		
112	Hill Prinia	<i>Prinia atrogularis</i>		
		Zosteropidae		
113	Oriental White-eye	<i>Zosterops palpebrosus</i>		
		Sylviidae		
114	Grey-bellied Tesia	<i>Tesia cyaniventer</i>		
115	Mountain Tailorbird	<i>Orthotomus cuculatus</i>		
116	Common Tailorbird	<i>O. sutorius</i>		
117	Dark-necked Tailorbird	<i>O. atrogularis</i>		
118	White-tailed Leaf Warbler	<i>Phylloscopus davisoni</i>		
119	Golden-spectacled Warbler	<i>Seicercus burkii</i>		
120	White-spectacled Warbler	<i>S. affinis</i>		
121	Grey-cheeked Warbler	<i>S. polioygenys</i>		
122	Chestnut-crowned Warbler	<i>S. castaniceps</i>		
123	Rufous-faced Warbler	<i>Abroscopus albogularis</i>		
124	Yellow-bellied Warbler	<i>A. superciliaris</i>		
125	White-crested Laughingthrush	<i>Garrulax leucolophus</i>		
126	Black-hooded Laughingthrush	<i>G. milleti</i>	VU	RRS,EVL
127	Black-throated Laughingthrush	<i>G. chinensis</i>		
128	White-cheeked Laughingthrush	<i>G. vassali</i>		RRS,EVL
129	Red-tailed Laughingthrush	<i>G. milnei</i>	NT	
130	Laughingthrush species	<i>G. sp.</i>		
131	Buff-breasted Babbler	<i>Pellorneum tickelli</i>		
132	Scaly-crowned Babbler	<i>Malacopteron cinereum</i>		
133	Large Scimitar Babbler	<i>Pomatorhinus hypoleucos</i>		
134	White-browed Scimitar Babler	<i>P. schisticeps</i>		
135	Coral-billed Scimitar Babbler	<i>P. ferruginosus</i>		
136	Short-tailed Scimitar Babbler	<i>Jabouilleia danjoui</i>	VU	RRS,EVL
137	Streaked Wren Babbler	<i>Napothera brevicaudata</i>		
138	Eyebrowed Wren Babbler	<i>N. epilepidota</i>		
139	Pygmy Wren Babbler	<i>Pnoepyga pusilla</i>		
140	Rufous-fronted Babbler	<i>Stachyris rufifrons</i>		
141	Golden Babbler	<i>S. chrysaea</i>		
142	Striped Tit Babbler	<i>Macronous gularis</i>		
143	Grey-faced Tit Babbler	<i>M. kelleyi</i>	NT	RRS,EVL
144	Silver-eared Mesia	<i>Leiothrix argentauris</i>		
145	Cutia	<i>Cutia nipalensis</i>		

Appendices

No.	Common Name	Order, Family, Genus and Species	Collar <i>et al.</i> 1994	Notes
146	White-browed Shrike Babbler	<i>Pteruthius flaviscapis</i>		
147	Chestnut-fronted Shrike Babbler	<i>P. aenobarbus</i>		
148	Blue-winged Minla	<i>Minla cyanouroptera</i>		
149	Red-tailed Minla	<i>M. ignotincta</i>		
150	Rufous-winged Fulvetta	<i>Alcippe castaneiceps</i>		
151	Mountain Fulvetta	<i>A. peracensis</i>		
152	White-bellied Yuhina	<i>Yuhina zantholeuca</i>		
153	Grey-headed Parrotbill	<i>Paradoxornis gularis</i>		
154	Black-throated Parrotbill	<i>P. nipalensis</i>		
		Nectariniidae		
155	Fire-breasted Flowerpecker	<i>Dicaeum ignipectus</i>		
156	Purple-naped Sunbird	<i>Hypogramma hypogrammicum</i>		
157	Mrs Gould's Sunbird	<i>Aethopyga gouldiae</i>		
158	Green-tailed Sunbird	<i>A. nipalensis</i>		
159	Streaked Spiderhunter	<i>Arachnothera magna</i>		
		Passeridae		
160	White-rumped Munia	<i>Lonchura striata</i>		

Follows Inskipp *et al.* (1996)

Status: VU = Vulnerable; NT = Near Threatened as per Collar *et al.* (1994)

Notes: RRS = Restricted-range Species as per Stattersfield *et al.* (1998); EVL = Endemic to Vietnam and Laos

Appendix 4: Herpetiles Recorded at Kon Ka Kinh Nature Reserve

No.	Class, Order, Family, Genus and Species	Data Source	IUCN 1996	Notes
	Reptilia			
	Squamata:			
	Gekkonidae			
1	<i>Gekko gecko</i>	O		
	Agamidae			
2	<i>Acanthosaura lepidogaster</i>	S		
3	<i>Calotes emma</i>	S		
4	<i>C. mystaceus</i>	O		
5	<i>Draco</i> sp.	O		
6	<i>Physignathus cocincinus</i>	O		
	Scincidae			
7	<i>Mabuya chapaensis</i>	S		
8	<i>M. multifasciata</i>	O		
9	<i>Scincella rufocaudata</i>	O		EV
10	<i>Sphenomorphus buonloicus</i>	O		EV
	Lacertidae			
11	<i>Takydromus sexlineatus</i>	O		
	Varanidae			
12	<i>Varanus nebulosus</i>	O		
13	<i>V. salvator</i>	O		
	Boidae			
14	<i>Python molurus</i>	O	NT	
	Colubridae			
15	<i>Amphiesma stolata</i>	O		
16	<i>Calamaria septentrionalis</i>	S		
17	<i>Cyclophiops major</i>	S		
18	<i>Elaphe radiata</i>	O		
19	<i>Oligodon eberhardti</i>	S		
20	<i>Pseudoxenodon macrops</i>	S		
21	<i>Ptyas korros</i>	O		
22	<i>Rhabdophis subminiatus</i>	O		
23	<i>Xenochrophis piscator</i>	O		
24	<i>Ahaetulla prasina</i>	O		
	Elapidae			
25	<i>Bungarus candidus</i>	O		
26	<i>B. fasciatus</i>	O		
27	<i>Naja naja</i>	O		
	Viperridae			
28	<i>Trimeresurus popeorum</i>	S		
	Testudinata:			
	Testudinidae			
29	<i>Manouria impressa</i>	S	VU	
	Amphibia			
	Anura:			
	Pelobatidae			
1	<i>Leptobranchium hasselti</i>	S		

Appendices

No.	Class, Order, Family, Genus and Species	Data Source	IUCN 1996	Notes
2	<i>L. palpebralespinosa</i>	S		
3	<i>L. pelodytoides</i>	S		
4	<i>Megophrys longipes</i>	O		
	Bufonidae			
5	<i>Bufo galeatus</i>	S		
6	<i>B. melanostictus</i>	O		
	Ranidae			
7	<i>Phrynoglossus laevis</i>	O		
8	<i>Rana andersoni</i>	S		
9	<i>R. chapaensis</i>	S		EV
10	<i>R. guentheri</i>	O		
11	<i>R. kuhlii</i>	S		
12	<i>R. limnocharis</i>	S		
13	<i>R. nigrovittata</i>	S		
14	<i>R. ricketti (Amolops ricketti)</i>	S		
15	<i>R. rugulosa</i>	O		
16	<i>R. sauteri</i>	S		
17	<i>R. verrucospinosa</i>	S		EV
	Rhacophoridae			
18	<i>Philautus petersi</i>	S		
19	<i>P. sp.</i>	S		
20	<i>Rhacophorus leucomystax</i>	S		
	Microhylidae			
21	<i>Microhyla butleri</i>	S		
22	<i>M. heymonsi</i>	S		

Follows Nguyen Van Sang and Ho Thu Cuc (1996)

Data Source: S = Specimen; O = Observed

Status: VU = Vulnerable; NT = Near Threatened as per IUCN (1996)

Notes: EV = Endemic to Vietnam

Appendix 5: Butterflies Recorded at Kon Ka Kinh Nature Reserve

No.	Family, Genus and Species	Global Range	Species Occurrence		
			Site 1	Site 2	Site 3
	Papilionidae				
1	<i>Troides aeacus</i> Feld.	2		r	
2	<i>Parides aidoneus</i> Doubl.	2	r		r
3	<i>P. dasarada</i> Moore	2		r	r
4	<i>Papilio demoleus</i> L.	4	r		
5	<i>P. helenus</i> L.	4		c	r
6	<i>P. nephelus</i> Boisd.	3		r	
7	<i>P. memnon</i> L.	3	c		
8	<i>P. polytes</i> L.	3	u		
9	<i>P. protenor</i> Cram.	2			r
10	<i>P. alcmenor</i> Westw.	2		r	r
11	<i>Graphium aristeus</i> Stoll	4	u		
12	<i>G. agamemnon</i> L.	4	u	u	
13	<i>G. doson</i> C. & R. Feld.	3	c	u	
14	<i>G. eurypylus</i> L.	3	c		
15	<i>G. macareus</i> Godart.	3	u	r	r
16	<i>G. sarpedon</i> L.	4	c	c	
17	<i>G. chironides</i> Honrath	3	r		
18	<i>Lamproptera curius</i> F.	3	u		
19	<i>L. meges</i> Zinken	3	u		
	Pieridae				
20	<i>Delias belladonna</i> F.	3			r
21	<i>D. agostina</i> Hew.	2			r
22	<i>D. pasithoe</i> L.	2	r		
23	<i>D. georgina</i> ssp. or <i>Delias</i> sp. nov.	1		u	
24	<i>Leptosia nina</i> F.	3	u		
25	<i>Pieris canidia</i> Sparrman	3		r	
26	<i>Talbotia naganum</i> Moore	2			u
27	<i>Prioneris thestylis</i> Doubl.	2	c		
28	<i>P. philonome</i> Boisd.	3	u		
29	<i>Appias albina</i> Boisd.	3	r	r	
30	<i>A. nero</i> F.	3	r	r	r
31	<i>A. indra</i> Moore	2	c	c	u
32	<i>A. pandione</i> Geyer	3		u	u
33	<i>A. lyncida</i> Cram.	3	u	u	
34	<i>A. lalage</i> Doubl.	2			u
35	<i>A. olferna</i> Swinh.	3	r		
36	<i>Pareronia anais</i> Lesson	2	u		
37	<i>Ixias pyrene</i> L.	3	r		
38	<i>Hebomoia glaucippe</i> L.	3	u	u	
39	<i>Dercas verhuelli</i> v. d. Hoeven	2		u	
40	<i>Catopsilia pomona</i> F.	5	c	c	c
41	<i>C. scylla</i> L.	4	r		
42	<i>C. pyranthe</i> L.	4	c		
43	<i>Eurema hecabe</i> L.	4	u	r	
44	<i>E. blanda</i> Boisd.	3		u	

No.	Family, Genus and Species	Global Range	Species Occurrence		
			Site 1	Site 2	Site 3
45	<i>E. andersoni</i> Moore	3		u	u
46	<i>E. ada</i> Distant & Pryer	3		r	
47	<i>E. brigitta</i> Stoll.	4	c	u	
	Danaidae				
48	<i>Danaus genutia</i> Cram.	4	u	u	
49	<i>Parantica aglea</i> Stoll	2	c	u	u
50	<i>P. melaneus</i> Cram.	3			u
51	<i>P. sita</i> Koll.	3		r	r
52	<i>Ideopsis vulgaris</i> Butl.	3	r	r	
53	<i>Euploea core</i> Cram.	3	c	c	
54	<i>E. mulciber</i> Cram.	3	c	c	c
55	<i>E. tulliolus</i> F.	4	c		
56	<i>E. algea</i> Godart	3	r		
57	<i>E. doubledayi</i> C. & R. Feld.	3		r	
58	<i>E. radamanthus</i> F.	3	r		
	Satyridae				
59	<i>Melanitis leda</i> L.	5			r
60	<i>M. zitenius</i> Herbst.	3			r
61	<i>Elymnias patna</i> West.	3		r	r
62	<i>Lethe confusa</i> Auriv.	3	u	c	c
63	<i>L. insana</i> Koll.	3			r
64	<i>L. verma</i> Koll.	3		u	u
65	<i>L. distans</i> Butl.	2			r
66	<i>L. vindhya</i> C. & R. Feld.	2			u
67	<i>L. kansa</i> Moore	2			r
68	<i>L. rohria</i> F.	3		r	r
69	<i>L. sinorix</i> Hew.	3		r	
70	<i>L. latiaris</i> Hew.	2			u
71	<i>L. sp. nov.</i>	1			u
72	<i>Penthema darlisa</i> Moore	2		r	
73	<i>P. binghami</i> W-Mas.	2		r	
74	<i>Mycalesis perseoides</i> Moore	2		r	
75	<i>M. francisca</i> Stoll	3		u	c
76	<i>M. mineus</i> L.	3	u	u	
77	<i>M. zonata</i> Matsumura	1		r	
78	<i>M. mnasicles</i> Hew.	3		r	
79	<i>M.anaxias</i> Hew.	3			r
80	<i>Erites falcipennis</i> W.-Mas.	2			c
81	<i>Coelites nothis</i> Westw.	2		r	
82	<i>Ragadia critolaus</i> de Nicev. ssp	1		u	c
83	<i>Ypthima baldus</i> F.	3		c	c
84	<i>Y. huebneri</i> Kirby	2	u		
85	<i>Y. tappana</i> Matsumura	1			r
86	<i>Y. savara</i> (?)	3	r	r	
87	<i>Y. dohertyi</i> Moore	3			u
88	<i>Y. methora</i> (?)	?		u	u
89	<i>Y. cerealis</i>	?		c	
90	<i>Callerebia narasingha</i> Moore	2			r

No.	Family, Genus and Species	Global Range	Species Occurrence		
			Site 1	Site 2	Site 3
	Amathusiidae				
91	<i>Aemona amathusia</i> ssp.	1			u
92	<i>A. sp.</i>	1			u
93	<i>Faunis eumeus</i> Drury	2	u	u	
94	<i>Stichopthalma louisa</i> new subspecies	2			r
95	<i>Thaumantis diores</i> Doubl.	1			u
96	<i>Enispe cycnus</i> Westw.	1			r
	Nymphalidae				
97	<i>Cethosia biblis</i> Drury	3		r	
98	<i>Argyreus hyperbius</i> L.	5	r		
99	<i>Phalanta phalantha</i> Drury	5		r	
100	<i>Cupha erymanthis</i> Drury	4	c	c	
101	<i>Vagrans egista</i> Cram.	4		u	r
102	<i>Cirrochroa tyche</i> C. & R. Feld.	3	c		u
103	<i>C. sp.</i> (near <i>orissa</i>)	1			u
104	<i>Paduca fasciata</i> C. & R. Feld.	3	r		
105	<i>Terinos atlita</i> F.	3	c	u	u
106	<i>Kaniska canace</i> L.	3			u
107	<i>Symbrenthia lilae</i> Hew.	3	r		
108	<i>Junonia almana</i> L.	3	c		
109	<i>J. atlites</i> L.	3	c		
110	<i>J. lemonias</i> L.	4	r		
111	<i>Hypolimnas bolina</i> L.	4	c		
112	<i>Kallima inachus</i> Doyere	2			r
113	<i>Ariadne merione</i> Cram.	3	r		
114	<i>Laringa horsfieldi</i> Boisd.	3		u	
115	<i>Cyrestis themire</i> Honrath	3			u
116	<i>C. thyodamas</i> Doyere	3	u		u
117	<i>Chersonesia risa</i> Doubl.	3			r
118	<i>Neptis hylas</i> L.	4	c	c	
119	<i>N. yerburii</i> Butl.	1		r	
120	<i>N. leucoporos</i> Fruhst.	3		r	
121	<i>N. miah</i> Moore	2		r	
122	<i>N. zaida</i> Westw.	2		r	
123	<i>N. sankara</i> Kollar	3			u
124	<i>N. cartica</i> Moore	2			r
125	<i>N. ananta</i> Moore	2		r	
126	<i>N. radha</i> Moore	1		r	
127	<i>Phaedyma columella</i> Cram.	4	r		
128	<i>Athyma selenophora</i> Kollar	3		r	
129	<i>Sumalia daraxa</i> Doubl.	3			u
130	<i>Neurosigma siva siva</i> Westw.	1	u		
131	<i>Lebadea martha</i> F.	3		r	
132	<i>Tanaecia julii</i> Lesson	3		c	r
133	<i>T. lepidea</i> Butl.	3			u
134	<i>Lexias dirtea</i> F.	3		r	
135	<i>Stibochiona nicea</i> G. R. Gray	2		r	
136	<i>Dichorragia nesimachus</i> Doyere	2		r	

No.	Family, Genus and Species	Global Range	Species Occurrence		
			Site 1	Site 2	Site 3
	Libytheidae				
137	<i>Libythea myrrha</i> Godart	3	c	c	u
138	<i>L. geoffroyi</i> Godart	4	u		
	Riodinidae				
139	<i>Zemeros flegyas</i> Cram.	3	c	c	c
140	<i>Dodona ouida</i> Moore	2		u	u
141	<i>D. egeon</i> Doubl.	3			r
142	<i>D. sp. nov.</i>	1			r
143	<i>Abisara fylla</i> Doubl.	2		r	r
144	<i>A. echerius</i> Stoll.	3		u	
145	<i>A. neophron</i> Hew.	2		u	u
146	<i>A. savitri</i>	1		r	
147	<i>A. sp.</i>	1		r	
148	<i>Paralaxita dora</i> Fruhst.	1			c
149	<i>Stiboges nymphidia</i> Butl.	3			r
	Lycaenidae				
150	<i>Miletus mallus</i> Fruhst.			c	
151	<i>M. chinensis</i> C. Feld.			u	
152	<i>Allotinus drumila</i> Moore		c	c	
153	<i>Discolampa ethion</i> Westw.				r
154	<i>Caleta roxus</i> Godart		u		
155	<i>Pithecops corvus</i> Fruhst.		r		
156	<i>Zizina otis</i> F.		c		
157	<i>Megisba malaya</i> Horsf.		c		
158	<i>Acytolepis puspa</i> Horsf.				u
159	<i>Udara dilecta</i> Moore			c	u
160	<i>U. alboerulea</i> Moore			r	r
161	<i>U. placidula</i> H. Druce			u	u
162	<i>Celatoxia marginata</i> de Nicev.			r	
163	<i>Calenya lenya</i> Evans				r
164	<i>Jamides celeno</i> Cram.		c	c	
165	<i>J. pura</i> Moore		c		
166	<i>Nacaduba sp.</i>			c	c
167	<i>Prosotas sp.</i>			c	c
168	<i>Heliophorus ila</i> de Nicev.			u	
169	<i>Surendra quercetorum</i> Moore		r		
170	<i>Arhopala birmana</i> Moore				r
171	<i>A. eumolphus</i> Cram.		u		
172	<i>Yasoda tripunctata</i> Hew.			r	
173	<i>Hypolycaena erylus</i> Godart		u		
174	<i>Ravenna nivea</i> Nire				r
175	<i>Rapala manea</i> Hew.			c	
176	<i>R. pheretima</i> Hew.		r		
177	<i>R. nissa</i> Kollar ?			c	
178	<i>Curetis bulisi</i> Westw.		r	r	
	Hesperiidae				
179	<i>Hasora vitta vitta</i> Butler		c		c
180	<i>H. chromus chromus</i> Cram.		u		u

No.	Family, Genus and Species	Global Range	Species Occurrence		
			Site 1	Site 2	Site 3
181	<i>H. schoenherr gaspa</i> Evans				r
182	<i>H. malayana</i> C. & R. Feld.				r
183	<i>H. taminatus bhavara</i> Fruhst.				u
184	<i>Choaspes plateni stigmata</i> Evans			r	
185	<i>C. hemixanthus furcata</i> Evans				r
186	<i>Celaenorrhinus asmara consertus</i> de Nicev.		r		
187	<i>C. sp. near putra</i>				c
188	<i>Badamia exclamationis</i> F.		u		
189	<i>Darpa pteris dealbata</i> Dist.			r	
190	<i>D. striata mintia</i> Evans			r	
191	<i>Seseria</i> sp.			r	
192	<i>Astictopterus jama olivascens</i> Moore			u	
193	<i>Iambrix salsala salsala</i> Moore		c	c	
194	<i>Arnetta atkinsoni</i> Moore		r	r	
195	<i>Halpe pelethronix pagaia</i> Evans			r	
196	<i>Notocrypta feisthamelii alysos</i> Moore				u
197	Gen. sp. (<i>Thorexa</i> or <i>Pedesta</i> ?)				r
198	<i>Suada swerga suava</i> Evans		r		
199	<i>Polytremis lubricans lubricans</i> Her.-Schaf		c	c	
200	<i>Pyroneura margherita miriam</i> Evans			r	
201	<i>Lotongus calathus balta</i> Evans			r	
202	<i>Hyarotis adrastus praba</i> Moore			r	
203	<i>Potanthus</i> sp.			r	
204	<i>Borbo cinnara</i> Wall.			u	
205	<i>Caltois sirius sirius</i> Evans				r
206	<i>C. tenuis</i> Evans			u	
207	<i>C. cormasa</i> Hew.			r	
208	<i>C. sp.</i>			r	
209	<i>Parnara bada bada</i> Moore			c	

Global Range:

- 1 - Vietnam and Eastern Himalayas;
- 2 - Indochina to India;
- 3 - Oriental region;
- 4 - Indo-Australian tropics; and
- 5 - Palaeotropics.

Study Sites:

Site 1 - Habitats along the Krong Pa River, below 800m;
 Site 2 - Forested habitats between 800 and 1,300 m; and
 Site 3 - Forested habitats between 1,300 and 1,700 m.

Species Occurrence is divided into three categories:

r - rare (single or two specimens encountered);
 u - uncommon (3 to 10 specimens seen); and
 c - common (11 to 20 specimens seen).

The European Community's (EC) co-operation strategy in Vietnam is to help consolidate Vietnam's transition towards a market economy, whilst promoting sustained growth and sustainable development and mitigating the social effects of this transition.

EC development co-operation gives priority to the protection of the environment and natural resources (in particular tropical forest), sustainable development of the rural sector and improvement of food security levels and support to social sectors affected by the transition to a market economy - mainly health and human resources.

EC economic co-operation is devised to improve the economic, legal and social environment for the private sector, including small and medium enterprises, to support on-going economic and administrative reforms and to promote the integration of Vietnam into regional and global economic frameworks.

Over the past five years (1994 to 1998) the European Community has allocated a total of Euro 200 million (US\$ 211 million) in grant assistance to Vietnam.

The Forest Inventory and Planning Institute (FIPI) was established on 29 January 1961 by Government Decision 140/CP. FIPI is under the general jurisdiction of the Ministry of Agriculture and Rural Development (MARD). FIPI has a staff of 760, divided between the headquarters in Hanoi and six sub-institutes throughout Vietnam. At the headquarters in Hanoi, there is a map-printing section and two scientific and technological centres: the Forest Resources and Environment Centre (FREC) and the Centre for Forestry Information Consulting (CFIC).

FIPI's main roles are to: (a) survey and monitor forest resources; (b) prepare forestry development plans at the national, regional and provincial level; (c) prepare feasibility studies and investment plans for national parks, nature reserves and forest enterprises; (d) develop and inspect the implementation of regulations and technical instructions related to forest inventory and management planning; (e) train forestry professionals in forest inventory and surveying techniques; (f) undertake applied research in the fields of forest inventory, management planning and forestry-based rural development; and (g) provide technical and consultative services for forestry development projects with national and international counterparts.

FIPI maintains and distributes up-to-date data on forest resources in Vietnam. FIPI has participated in many government-sponsored programmes on forestry, biodiversity conservation and regional integrated socio-economic development planning. FIPI has implemented many forestry, upland rural development and natural resources conservation projects supported by bilateral, multilateral, and non-governmental agencies.

BirdLife International is a global conservation federation with a worldwide network of Partner organizations, Representatives and committed individuals.

BirdLife International seeks to conserve all bird species on earth and their habitats and, through this, it works for the world's biological diversity. It recognizes that the problems affecting birds, their habitats and our global environment are linked inseparably with social, economic and cultural factors and that these can only be resolved if human societies function in an ecologically sustainable manner and if the needs, welfare and aspirations of people form a part of all conservation action.

Birds provide BirdLife International with a uniquely valuable focus: they are sensitive indicators of biological richness and environmental trends and fulfil many key ecological functions; they contribute greatly to our understanding of natural processes; they are an important economic resource; and they have inspired and delighted people of many cultures for centuries, which makes them excellent ambassadors for the promotion of conservation awareness and international collaboration.

BirdLife International pursues a programme of:

- * **scientific research and analysis** to identify and monitor worldwide the most threatened bird species and the most critical sites for the conservation of bird diversity;
- * **advocacy and policy development** to promote the conservation of birds and biodiversity through sustainability in the use of all natural resources;
- * **field action and country conservation programmes**, ranging from community-based land-use and management projects to species recovery programmes benefiting both wildlife and people;
- * **network and capacity building** to expand and strengthen the global partnership of conservation organizations and to promote worldwide interest in the conservation of birds and the wider environment.



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