Scientifically established strategy of nature protection is one of the most important directions of modern science. Phong Nha – Ke Bang, largest national park of Vietnam plays world-important role in conservation of unique nature and global genetic diversity. Investigation of forests allied to western border of the national park funded by Kreditnstalt fur Wiederaufbau – German Development Bank was realized during summer 2011. Current monograph presents main results of these studies including description of vegetation and data on inventory of local floras in area proposed for extension of the protected territory. Obtained data presented in this monograph indicate straight advisability of expansion of national park on territories with intact primary forests having full spectrum of habitats and living forms of indigenous nature of Indochinese Peninsula. This area also will play role of significant biodiversity flow corridor between protected areas of Vietnam and Laos. If protected areas of both countries were to be connected by explored and studied area, the combined reserve would be the largest surviving karst primary forest in south-east Asia.

Leonid Averyanov

Leonid V. Averyanov, prof. and senior researcher at the Komarov Botanical Institute of the Russian Academy of Sciences, main field of scientific activity - plant taxonomy, plant geography and nature protection.

978-3-659-21784-5

Phong Nha - Ke Bang Flora and Vegetation

Averyanov, Hiep, Loc

Leonid Averyanov
N.T. Hiep
P.K. Loc

Flora and vegetation of areas allied to Phong Nha – Ke Bang

Phong Nha - Ke Bang National Park, Northern Vietnam

LAP LAMBERT Academic Publishing

Leonid Averyanov
N.T. Hiep
P.K. Loc

Flora and vegetation of areas allied to Phong Nha – Ke Bang

Leonid Averyanov
N.T. Hiep
P.K. Loc

Flora and vegetation of areas allied to Phong Nha – Ke Bang

Phong Nha - Ke Bang National Park, Northern Vietnam

LAP LAMBERT Academic Publishing

Impressum / Imprint
Bibliografische Information der Deutschen Nationalbibliothek: Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über http://dnb.d-nb.de abrufbar.

Bibliographic information published by the Deutsche Nationalbibliothek: The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

Coverbild / Cover image: www.ingimage.com

Verlag / Publisher:
LAP LAMBERT Academic Publishing
ist ein Imprint der / is a trademark of
AV Akademikerverlag GmbH & Co. KG
Heinrich-Böcking-Str. 6-8, 66121 Saarbrücken, Deutschland / Germany
Email: info@lap-publishing.com

Herstellung: siehe letzte Seite /
Printed at: see last page
ISBN: 978-3-659-21784-5

Averyanov L.V., N.T. Hiep, P.K. Loc, N.S. Khang, P.V. The, N.V. Tap, N.Q. Vinh, L.T. Kien, N.Q. Hieu. – Flora and vegetation of areas allied to Phong Nha – Ke Bang National Park (Northern Vietnam) — Saarbrucken: Lambert Academic Publishing, 2012 — 224 p.

ISBN: 978-3-659-21784-5

Scientifically established strategy of nature protection is one of the most important directions of modern science. Phong Nha – Ke Bang, largest national park of central Vietnam plays world-important role in conservation of unique nature of central part of eastern Indochina and global genetic diversity. Field scientific exploration and investigation of primary forests allied to western border of the national park funded by Kreditnstalt für Wiederaufbau – German Development Bank, in frame of Vietnam – Germany Development Cooperation was realized during summer 2011. Current monograph presents main results of these studies including detailed description of all kinds of primary vegetation and inventory of local floras observed on areas proposed for extension of the protected territory. All field observations and habitat descriptions were based on extensive herbarium collections included more than 4500 voucher specimens housed presently in main Herbaria in Vietnam and abroad. Data obtained during realization of investigation project presented in this monograph indicate straight advisability of expansion of national park territory with accession of studied forests as typical element of still intact primary aboriginal flora with full spectrum of habitats and living forms of indigenous nature of Indochinese Peninsula. This area also will play role of biodiversity flow corridor between protected areas of Vietnam and Laos. If protected areas of both countries were to be connected by explored and studied area, the combined reserve would be the largest surviving karst primary forest in south-east Asia.

CONTENT

FOREWORDS

Monograph presents main results of field investigation program aimed inventory of plant diversity and vegetation in areas allied to Phong Nha- Ke Bang National Park in limits of Thuong Hoa and Hoa Son municipalities of Minh Hoa district, Quang Binh province (northern Vietnam). Main field works were fulfilled during July-August, 2011 and included studies of the flora and vegetation in 3 regions, both in limestone rocky areas and in mountains composed with shale mother rocks. During investigations were collected more than 800 plant species, completed preliminary inventory of local flora and described all kinds of primary vegetation typical for studied area. All presented data are based on collected voucher herbarium specimens. Among collected plants about 482 numbers present "key species group", such as orchids (151 numbers), conifers (10), ferns (97), members of such families as - Begoniaceae (13), Dipterocarpaceae (14), Lauraceae (20), Magnoliaceae (27), as well as plants used in traditional oriental medicine (150 numbers). Monograph includes - brief illustrated description of vegetation character and structure in most typical kinds of habitats. It also presents schematic vegetation map of studied area with indication of localities most desirable for special protection. Such localities identified as "plant diversity hotspots" are particularly rich in species of primary aboriginal flora and represent intact vegetation patterns. Also monograph includes annotated and illustrated list of collected and observed species with special attention to "key species groups" (most important plants for science and economy). Special significance in monograph content has annotated illustrated list of highly threatened species desirable for top-priority protection, with special focus to globally endangered and critically endangered (according to IUCN criteria) species, as well as endemic and sub-endemic species. Obtained data give straight evidence of clear reason for extension of national park territory into studied areas, which still represent very rich refugee of primary forest stands forming important corridor between woody areas protected in Vietnam and Laos.

Botanists from different agencies of Vietnam and Russia took part in field explorations and laboratory researches data of which are presented in current monograph. Investigation team included following persons – Prof. Leonid V. Averyanov (KBI), Dr. Nguyen Tien Hiep (CPC), Prof. Phan Ke Loc (CPC), MSc. Nguyen Sinh Khang (IEBR, CPC), MSc. Pham Van The (IEBR),

Dr. Nguyen Van Tap (CPC), Mr. Nguyen Tien Vinh (IEBR, CPC), Mr. Nguyen Quang Vinh (PNKBNP), Mr. Le Thuan Kien (PNKBNP) and MSc. Nguyen Quang Hieu (CPC). Acronyms mentioned in brackets are explained below (chapter “Acronyms and abbreviations used”).

ACKNOWLEDGEMENTS

Field and laboratory work presented in this monograph were mainly supported by Provincial Project Management Unit of the Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang National Park Regional Project with funding from the Vietnam-Germany Development Cooperation funded by Kreditanstalt für Wiederaufbau – German Development Bank.

Following agencies and institutions provided significant help in organization of fieldwork and in cameral processing of collected scientific materials, as well as in final manuscript compilation:

- **Center for Plant Conservation (CPC),** Vietnam Union of Science and Technology Associations (VUSTA)
- **Institute of Ecology and Biological resources**, VAST, Vietnam.
- **Komarov Botanical Institute** Russian Academy of Sciences, Russia.
- **Phong Nha- Ke Bang National Park.**

Following scientific experts participated in identification of taxonomically problematic plant species:

- **Dr. David Middleton**, Royal Botanic Garden Edinburgh, UK.
- **Dr. Hendrik Hessel van der Werff,** Missouri Botanical Garden, USA
- **Dr. Mark Newman**, Royal Botanic Garden Edinburgh, UK.
- **Dr. Noriyuki Tanaka**, Department of Education, School of Liberal Arts, Teikyo University, Tokyo, Japan.
- **Prof. Deng Y.F.,** South Chinese Botanical Garden, China.
- **Prof. Hu C.M.**, South Chinese Botanical Garden, China.
- **Prof. Sima Y.K.,** Yunnan Academy of Forestry, Kunming, China.
- **Prof. Sun W.B.,** Kunming Botanic Garden, China.
- **Prof. Xie N.H.,** South Chinese Botanical Garden, China.
- **Prof. Zhang D.X.,** South Chinese Botanical Garden, China.

We express our great gratitude to all mentioned personalities, agencies and institutions for their very important help in work on this monograph.

ACRONYMS AND ABBREVIATIONS USED

Comm. – commune (municipality)
CPC – Center for Plant Conservation VUSTA
CPCV – Herbarium of the Center for Plant Conservation
CR – critically endangered
DBH – diameter of tree trunk at human breast high
DD – data deficient
EA – extended area
EN – endangered
FFI – Fauna and Flora International
FPD – Forest Protection Department
IUCN – International Union for Conservation of Nature
IEBR – Institute of Ecology and Biological Resources VAST
juv – juvenile or immature plant samples
KBI – Komarov Botanical Institute of the Russia Academy of sciences
KfW – Kreditanstalt für Wiederaufbau – German Development Bank
LC – least concern
LE – Herbarium of Komarov Botanical Institute, St. Petersburg, Russia
MO – Herbarium of Missouri Botanical Garden – St. Louis, USA
Mun. – municipality (commune)
NIMM – National Institute of Materia Medica, Ministry of Health
NP – national park
NT – near threatened
PNKBNP – Phong Nha - Ke Bang National Park
PPMU – Provincial Project Management Unit
VAST – Vietnam Academy of Science and Technology
Vill. – village
VU – vulnerable
VUSTA- Vietnam Union of Science and Technology Associations
WWF – World Wildlife Foundation

1. BACKGROUND AND GENERAL REMARKS

1.1. Short overview of project results

Identification and description of typical characteristic vegetation and local floras on the territory of Minh Hoa district (Quang Binh province) as scientific basis for potential extension of Phong Nha - Ke Bang National Park was main objective mission of current project. Project field work were administratively located on territories of Thuong Hoa and Hoa Son municipalities of Minh Hoa district, which still retain extensive stands of primary pristine forests typical for limestone environments of central part of eastern Indochina.

Field-work for observation and collecting of original basic scientific data for description of vegetation and plant diversity were organized during 35 days in period from 20 July to 23 August 2011. In course of these works were made extensive observation in 4 field camps (main camp and field camps № 1-3), were fulfilled standard descriptions of vegetation in 20 representative model plots, were collected 1101 collecting numbers with about 4500 voucher herbarium specimens, which represent about 127 families, 386 genera and more than 800 species of higher vascular plants.

As a main result of completed field-works were identified and shortly described 15 kinds of vegetation observed in studied area. Main attention was attended to primary plant communities that have leading significance for nature protection in expected extension area of PNKBNP. Were recognized main groups of key species most important as subject for priority protection and landforms characterized of highest plant diversity in studied area (Annex 3). Among them were discovered and described 1 new genus and 9 species new for science. All observations and descriptions are documented by voucher herbarium specimens housed at CPC Herbarium and in other responsible Herbaria.

Completed investigation scientifically confirms straight expedience of inclusion of studied areas as integral part of PNKBNP for further protection.

Formal data about schedule of field-works and research efforts are schematically presented in following tables.

Schedule of field work
Dates, activity and research efforts (20 July to 23 August 2011)

2011 DATES	ACTIVITY LOCATION	ACTIONS AND EFFORTS	DESCRIPTIONS AND COLLECTING
July 20-21	Trip Hanoi – Dong Hoi, Bo Trach district, Son Trach municipality	Field work preparation, logistic and permissions	-
22 July	Minh Hoa district, Thuong Hoa municipality, Ban On village	Field work preparation, logistic and permissions	-
23 July-12 August (group a)	Minh Hoa district, Thuong Hoa municipality, Ban On village (Pa Nun Valley and Con Moong mountain), main camp	Observation and collecting of medicinal plants, preliminary identification and photography of specimens collected in camps № 1 and № 2	*CPC 5001-5264* (264 collecting numbers) plot 17 description
23-30 July (group b)	Minh Hoa district, Thuong Hoa municipality, field camp № 1 fixing, Mo O O O village area (Da Lat 1 and Kalap mts)	Observations, plant collecting, vegetation and landforms descriptions around field camp № 1, field books and specimen label writing, photography, plant identification	*CPC 3645-3929* (285 collecting numbers) plots 1-7 descriptions
31 July - 3 August (group b)	Minh Hoa district, Thuong Hoa municipality, main camp in Ban On village	Data analysis, digital writing of labels and vegetation descriptions, preliminary specimen identifications, photography, processing of collections	-
4-12 August (group b)	Minh Hoa district, Thuong Hoa municipality, field camp № 2 fixing, Mo O O O village area (near border with Hoa Son municipality)	Observations, plant collecting, vegetation and landforms descriptions around field camp № 2, field books and specimen label writing, photography, plant identification	*CPC 3894a-3929a CPC 3930-4183* (290 collecting numbers) plot 8-16 descriptions
13 August	Minh Hoa district, Thuong Hoa municipality (Ban On village), Hoa Son and Dan Hoa municipalities (Cha Lo village)	Travel from Thuong Hoa to Hoa Son and Dan Hoa municipalities	-
14-20 August (group a)	Minh Hoa district, Dan Hoa municipalities, Cha Lo village	Data analysis, digital writing of labels and vegetation descriptions, preliminary specimen identifications, photography, processing of collections	-
14-20 August (group b)	Minh Hoa district, Hoa Son municipality, field camp № 3 fixing, Ka Xai Valley	Observations, plant collecting, vegetation and landforms descriptions around field camp № 3, field books and specimen label writing, photography, plant identification	*CPC 4186-4447* (262 collecting numbers) plot 18-20 descriptions
21-22 August	Minh Hoa district, Dan Hoa municipalities, Cha Lo village, Dong Hoi	Travel from Cha Lo village to Dong Hoi	-
22 August	Dong Hoi	Dong Hoi, preliminary report to PNKBNP	-
23 August	Dong Hoi, Hanoi	Travel from Dong Hoi to Hanoi	-

Totally: 20 model plots and 1101 collecting numbers

Field exploration research efforts in studies of vegetation (Quang Binh province, Minh Hoa district)

ACTIVITY LOCATION	STUDIED PLOTS	STUDIED VEGETATION TYPES
Main camp Thuong Hoa municipality, Son Trach and Ban On villages	Plot № 17	Closed primary evergreen seasonal tropical lowland broad-leaved forests on wet flat seasonally flooded river/stream valleys and on low flat river/stream terraces on crystalline eroded limestone and shaly limestone
Camp № 1 Thuong Hoa municipality, Mo O O O village	Plots №№ 1-7	Closed primary evergreen seasonal tropical lowland broad-leaved forests on wet flat seasonally flooded stream valleys and on low flat river/stream terraces on crystalline eroded limestone and shaly limestone Closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone Closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on rocky mountain tops on crystalline highly eroded limestone (wind-formed and/or other specific modification) Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous forests (with *Dacrydium elatum* and *Dacrycarpus imbricatus*) on steep rocky slopes and on mountain tops on crystalline highly eroded limestone
Camp № 2 Thuong Hoa municipality, Mo O O O village	Plots №№ 8-16	Closed primary evergreen seasonal tropical lowland broad-leaved forests on mountain slopes on crystalline highly eroded limestone Closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on rocky mountain tops on crystalline highly eroded limestone (wind-formed and/or other specific modification)
Camp № 3 Hoa Son municipality, Ka Xai valley	Plots №№ 18-20	Closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone Closed primary evergreen seasonal tropical lowland broad-leaved forests on leveled slopes and low ridges composed by stratified shale (modified by recent fractional logging)

1.2. Phong Nha - Ke Bang National Park and the Phong Nha - Ke Bang National Park Regional Project

Phong Nha - Ke Bang National Park was recognized by UNESCO on 2003 as World Heritage Site for its geological values as defined in its criteria. The project area consists of the core zone of the PNKBNP with an area of 116,824 ha including potentially extended area of 31,070 ha. It belongs to two municipalities - Thuong Hoa and Hoa Son of Minh Hoa district, Quang Binh province. The Nature Conservation & Sustainable Natural Resource Management in PNKBNP Region, supported by Kreditanstalt für Wiederaufbau – German Development Bank, aims to improve the management of PNKBNP and reduce the pressure on its natural resources. To implementation aims mentioned over, one Consulting contract (no. 02/6-011/HDTV-PNKB) on consulting services on the supply of biodiversity assessment expert services on

flora and vegetation for the Nature Conservation and Sustainable Natural Resource Management in PNKBNP Region Project BMZ ID 2004 65 989 had been signed between the Provincial Project Management Unit of the Nature Conservation and Sustainable Natural Resource Management in PNKBNP Regional Project and Center for Plant Conservation, Vietnam Union of Science and Technology Associations. The survey on flora and vegetation will have the following functions:

- to inform the management plan and management implementation,
- to form the basis of long term biodiversity monitoring, and/or to assess the impact of improved management,
- to provide a basis to apply for World Heritage status on biodiversity grounds for the extension of PNKBNP area.

1.3. Phong Nha - Ke Bang National Park and allied areas physical structure and climate

Rolling rocky remnant limestone hills and low mountains are dominating landforms in landscapes of PNKBNP area. Impressive karstic area here historically derived from ancient sedimentary highly metamorphosed limestone formation of Paleozoic age accumulated on beds of ancient seas about 400 million years ago. In this sense, this is the oldest karstic area in Asia. It has been subject to massive tectonic changes, and comprises a series of rock types that were interbedded in complex ways. Like much territories of central Vietnam, it has been subject to extensive tectonic changes. As a result, the limestones of PNKBNP are often inter-bedded with a number of other rocks, sometime shaly and silicate sandstone. It was at least 5 stages of Earth's crust development and movement in this area - Late Ordovician - Early Silurian Stage (about 450 Ma); Middle-late Devonian Stage (about 340 Ma); Carboniferous-Permian (about 300 Ma); Mesozoic Orogenic and Cenozoic stage (http://en.wikipedia...). These several main development stages with 5 tectonic megacycles corresponding with the 5 geological evolution stages of the world are listed shortly below:

1 - Late Ordovician –Early Silurian stage (463.9 –430 Ma)

The earth's crust was broken down and then subsided, forming the terrigenous sediments of the Long Dai formation, which are distributed in a linear form extending in a

NW-SE direction, yielding fossils of *Graptolithina* of O3- S1 age (*Deirastrites convolutus, Monograptus halli* etc.).

2 - Middle –Late Devonian stage (386-362.5 Ma)

The earth's crust subsided for the second time, and the sea expanded. The sediments that evolved were composited of sandstone, siltstone and claystone intercalated with limestone, yielding characteristic fossil assemblages corresponding with the transgressive direction as follows: *Calceola sandalina, Desquamatia kurbesekiana, Stringocephalus burtini, Emanuella takwanesis, E. volhynica, Desquamatia ventrycosa, Scoliopora denticulata, Stachyodes costulata, S. lagowiensis* (shallow sea) and *Connodonta* (open sea).

3 - Carboniferous –Permian stage (362.5 –245 Ma)

This was the stage when the Carboniferous –Permian limestone massifs were formed. The earth's crust in the Phong Nha – Ke Bang National Park area was broken down for the third time, creating shallow, isometric basins (Marginal sea of continent), and yielding fossils aged from the Lower Carboniferous (*Crinoidea, Foraminifera* and *Tetracoralla*) to the Middle Carboniferous (*Foraminifera*) and finally the Permian (*Foraminifera* and *Tetracoralla*).

4 - Mesozoic orogenic stage (Triassic, Jurassic, Cretaceous)

The Phong Nha – Ke Bang National Park limestone massif was lifted up above the sea level and karst weathering and denudation processes occurred.

5 - Cenozoic stage

This was the stage when the mountains and old karstic cave systems of Phong Nha – Ke Bang National Park were formed with ages respective to the following surface levels:

- 1600- 1400 m level: corresponding with the first generation of caves dating from the Oligocene (36 Ma).

- 1000- 800 m (in the west) 700 –600m (in the east) level: corresponding with the first generation of caves dating from the Miocene (23 Ma to 5 Ma).

- 600 –400 m and 300- 200 m levels: corresponding with Pliocene (5 –1.6 Ma).

- 100 –0 m level (1.6 Ma to present), corresponding with various interglacial cycles in Quaternary: 100-80 m: Gond –Mindel interglacial cycle (more than 800 Ka), 80–60 m: Mindel–Riss interglacial cycle (over 300 Ka), 40–25 m and 25–15 m: Riss –Wurm interglacial cycle (over 70 Ka) and 15–6m: Flandrian transgression (18–4 Ka).

The endogenous and exogenous geological processes, which have occurred from Triassic up to now, have created the diverse topography and geomorphology of the area. They formed following main landforms in this area:

- Non-karst landforms: low, round-top mountains with flattened surfaces and leveled terraces along the valleys of Son and Chay Rivers and at the margins of the central limestone massif. In general, non-karstic formations includes 3 types: the middle and low dome-block mountains developed in intrusive magmatic massifs; the middle denudation-structural mountain belts developed in terrigenous rocks of Cretaceous age; and the low block-

denudational mountain belts developed in other terrigenous rocks (http://en.wikipedia...).

- Transitional landforms, with a complicated alternation between limestone massifs and terrigenous terrain.

- Karst landforms characterized old tropical karst formed mainly in the Cenozoic, constituting 2/3 of the area, forming the largest limestone wilderness in the world (Gourou, 1966; http://www.phongnhatours...). Karstic formations may be divided into two groups of forms. One are karstic forms on the earth surface including mesas, table-like hills or low mountains bordered with very steep slopes or cliffs, narrow canyons and valleys, dolines, border polje etc. A second geomorphology form includes underground karst topography consisting of numerous caves, underground grottoes and complex of underground rivers.

Presently PNKBNP area represent largest karstic limestone area in the world intermixed in some parts with other non-limestone rocks of very different geological origin and history. If the Hin Namno national biodiversity conservation area of Khammouane province of Laos, bordering PNKBNP on the west was to be combined with the national park in a continuous reserve, the combined reserve would be the largest surviving karst primary forest in south-east Asia comprising about 317,754 ha (http://en.wikipedia...).

Phong Nha - Ke Bang National Park also contains two dozens of mountain peaks with over 1000 m in height. Highest of them are - Peak Co Preu with a height of 1213 m a.s.l., Phu Tao (1174 m), Co Unet (1150 m) and Peak Co Rilata (1128 m). Mountains of karstic area of the park rise at typical height of above 800 m constitute a continuous range along Laotian-Vietnamese border. Notable summits here above 1000 m are: Phu Canh (1095 m), Phu Mun (1078 m), Phu Tu En (1078 m), Phu On Chinh (1068 m), Phu Dung (1064 m), Phu Tu Oc (1053 m), Phu Long (1015 m), Phu Oc (1015 m) and Phu Dong (1002 m). Inserting into these summits are many lowest peaks 800–1000 m high, like summits of Phu Sinh (965 m), Phu Co Tri (949 m), Phu On Boi (933 m), Phu Tu (956 m), Phu Toan (905 m), Phu Phong (902 m) and nui Ma Ma (835 m).

Non-karstic area consists a smallest portion of PNKBNP territory, distributing mainly in outer circle of limestone in the north, northeast and southeast of the national park. The height of these summits usually varies from 500-1000 m. Here there are narrow valleys along streams and rivers, such as Am, Cha Lo, Chua Ngut and Rao Thuong river valley in the southernmost edge. In the north-south direction, there exist notable summits: Phu Toc Vu (1000 m),

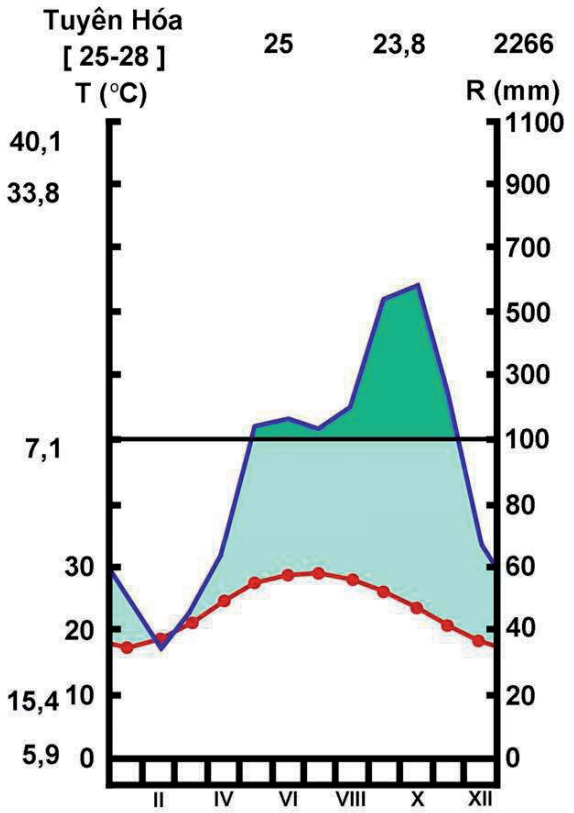
Ma Tac (1068 m), Co Khu (886 m), U Bo (1009 m) and Co Rilata (1128 m). The highest summit in the non limestone area and also the highest summit of PNKBNP is Co Preu (1213 m), a summit in the southernmost edge of the park.

Potentially extended area as planned will be included to the PNKBNP. It spreads at northern boundary of the central part of Truong Son Range where landscape forms are very diverse. In modern plant geography, this area belongs to the southernmost part of the North Indochinese floristic province of Indochinese floristic Region of Indomalesian Subkingdom of Paleotropical Realm and lies on extreme south portion of this province (Averyanov et al., 2003a, b, 2004a). Extended area coincides geologically with the southern boundary of a large system of ancient highly eroded karstic limestone massif - Ke Bang, composed of solid, highly metamorphosed marble-like Paleozoic limestone and are dissected by deep river valleys deeply eroded by karst. Rocky limestone landscapes provide unique habitats for plant communities with numerous local endemics. Its eastern, northern and western parts include a narrow band of silicate lowland hills.

The climatic regime in PNKBNP is monsoon tropical climate with cool winter (but having no any month with mean temperature less than 17°C) and summer-autumn-winter rains (Nguyen Khanh Van et al., 2000; Averyanov et al., 2003a). The weather here hot and humid in summer, and moderate to rather cool in winter. The annual mean temperature is 23 to 25°C, with an absolute maximum of 41°C in the summer and an absolute minimum of 6°C in the winter. The hottest months in this region fall from June to August, with an average temperature of 28°C, and the coldest time from December to February with an average temperature of 18°C. Annual rainfall is 2000 mm to 2500 mm, and 88% of the rainfall is from July to December. With more than 160 rainy days per year, no month is without rain. Mean annual relative humidity is 84% (http://en.wikipedia...). Climate is characterized by 1, rarely 2 dry months with dry period for plant growth regularly less than 15 days. This climatic regime is favorable to the formation and development of closed evergreen seasonal tropical forests in all over the PNKBNP area (Nguyen Khanh Van et al., 2000; Averyanov et al., 2003a, b, 2004a, 2005b).

There are no meteorological stations on the territory of PNKBNP with appropriate duration of documented observations. Therefore, climate data for studied area were devised on data obtained in closest Tuyen Hoa meteorological station. These data are presented below as follow:

Bioclimatic diagram of Tuyen Hoa meteorological station
(data from - Nguyen Khanh Van et al., 2000)



Legend to diagram: Tuyen Hoa - name of meteorological station; [25-28] - number of years of observation (the first number represents observation of temperature, the second – data on precipitation); 25 – elevation a.s.l. (m) of the meteorological station; 23.8 - mean annual temperature (°C); 2266 - mean annual total of precipitation (mm); 15.4 - mean minimum of temperature of coldest month; 5.9 - absolute temperature minimum (°C); 33.8 - mean temperature maximum in warmest month (°C); 40.1 - absolute temperature maximum (°C); 7.1 - mean temperature range (°C); Light blue area - humid period; dark green - per-humid period; red curve – mean monthly temperature; blue curve - mean monthly precipitation; black horizontal line - limit between humid period (lower) and per-humid period (upper).

Data for mean month temperature and precipitation fluctuations for Tuyen Hoa meteorological station
(data from - Nguyen Khanh Van et al., 2000)

Tuyen Hoa meteorological station, 17°50' N, 106°08' E, elev. 25 m a.s.l.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	mean annual
Tempera-ture	17,5	18,8	21,4	24,8	27,7	28,8	29,2	28,1	26,2	23,8	20,9	18,4	23,8
Precipita-tion	50,7	34,9	47,2	66,0	140,7	170,0	136,1	209,5	530,1	582,0	231,4	67,9	2265,5

Legend to table: 1st line - months; 2nd line - temperatures (mean monthly temperatures in °C); 3rd line - precipitation (mean monthly precipitation).

The flora of EA is certainly rich and diverse, but far from documented complete inventory. It is reported that flora of PNKBNP may be estimated as comprising at least 2650 species of higher vascular plants (http://www.phongnhatours...). The richest in number of species families should be Orchidaceae, Fabaceae s.l., Rubiaceae, Euphorbiaceae, Acanthaceae, Moraceae, Lauraceae, Fagaceae, as well as ferns and fern allies.

Primary forests covered all present territory of PNKBNP, as well as allied regions in prehistoric ages during long and stable geological history. These forests belong to formations of closed tropical evergreen seasonal forests and include in EA studied area 4 main climax types - broad-leaved lowland forests (at elevations less than 700 m a.s.l.) on limestone and on silicate mother rocks; and broad-leaved and coniferous submontane forest on remnant limestone mountains observed at elevations higher than 700 m a.s.l. In some specific habitats and on unusual landscape forms, like rocky mountain tops and vertical cliffs, these forests form specific wind-formed modifications with peculiar physiognomy and species composition.

Pristine forests formerly covered all EA, from low stream valleys, foothills and rocky slopes to the highest picks of mountain ridges. Emergent trees in these primary forests reached 35-45(50) m high with continuous upper canopy matrix formed by trees of 25-30 m in height. Numerous epiphytes and large woody lianas are very characteristic for this forest community. However, along many-aged human activity almost all of primary forests of Vietnam, as well as in PNKBNP area has been heavily damaged by logging and forest fires, mainly for primitive agriculture and valuable timber. For example, almost all forests on lowland silicate hills were logged in EA years ago. Logging of last

stands of such woods still observed in the area. Trees with valuable timber, like *Diospyros* spp., *Magnolia* spp., *Manglietia* spp., *Michelia* spp., *Dipterocarpus* spp., *Dysoxylum* spp., *Aquilaria* spp. and species of Lauraceae used for building construction, furniture and trade represent largest interest to local economy. Rocky landscape of karstic limestone mountains partially prevents wide logging of forest due to difficulties of timber transportation. Nevertheless, trees of most expensive timber are fractionally logged even in such areas. Besides fractional logging forests on rocky limestone usually much better protected, still retain almost primary character in numerous localities of studied area.

1.4. Brief history of Phong Nha - Ke Bang National Park relevant to studies of flora and vegetation

The history of PNKBNP started from the Phong Nha nature reserve with an area of 50 km^2 officially declared by the Vietnamese government on 9 August 1986 and was extended to 411.32 km^2 by 1991. On 12 December 2001, the Vietnamese Prime Minister by Decision 189/2001 189/2001/QĐ-TTG turned a nature reserve into a national park. It was declared, that purpose of this protected area should protect forest resources, biodiversity within the boundary of this national park and to preserve scientific values of fauna and flora in central Vietnam, especially rare species native to this region (http://en.wikipedia...). At that time the park covered a total area of 857.54 km^2 which are divided into three zones, a "strictly protected zone" (648.94 km^2), an "ecological recovery zone" (174.49 km^2), and an "administrative service zone" (34.11 km^2).

In 1999, the IUCN conducted special field survey in PNKBNP and at the meeting in July 1999, Evaluation Bureau concluded that Phong Nha nature reserve would meet with criteria I and IV as a world heritage nominee. This bureau stated that the site was part of an extremely complex and ancient karst plateau with high geo- and biodiversity extremely rich in endemic species. However, lack of research means that the true significance of the biodiversity and geology of the area cannot be fully assessed. Eventually, PNKBNP was recognized as a world natural heritage site at the UNESCO's 27^{th} general assembly session being held in Paris June 30–July 5, 2003 as it meets with criteria viii in accordance with UNESCO's appraisal scale as it displays an

impressive amount of evidence of earth's history and is a site of very great importance for increasing human understanding of the geologic, geomorphic and geo-chronological history of the region.

Since the recognition by UNESCO in 2003, the government of Vietnam has continued to compile scientific documentation to seek recognition of the park as a world natural heritage in terms of biodiversity in addition to geographical values. According to WWF report in 2000, PNKBNP is one of 200 biodiversity centers of the world and one of the 60 significant sanctuaries of Vietnam. It has a unique forest types in the world: “green tropical forest. The park also has 15 other types of forests”.

At the final conference of the National Council for Cultural Heritage held in Vietnam in 2007, scientists attending the meeting highly praised the scientific documentation of Phong Nha - Ke Bang National Park. Accordingly, the park is second to no other national parks listed in UNESCO's world heritage sites as far as biodiversity is concerned.

Present field botanical assessment fulfilled outside official area of PNKBNP provides additional documented data for extending area of national park into extremely rich territory allied to its border.

1.5. Previous biodiversity survey work on flora and vegetation in and around Phong Nha – Ke Bang National Park

In modern geography PNKBNP area and allied territories belong to the Truong Son geomorphologic region (named sometime as Annamite eco-region) and in plant geography represent integral part of North Indochinese floristic province of Indochinese floristic Region of Indomalesian Subkingdom of Paleotropical Realm (Averyanov et al., 2003a, b, 2004a).

Partial data on vegetation and plant diversity of PNKBNP were presented in a number of general monographs and special surveys (Le Ba Thao, 1997; Le Xuan Canh et al., 1997; Cao Van Sung, Le Quy An, 1998; Timmins et al., 1999; Dudley, Nguyen Cu, Vuong Tien Manh, 2003; http://en.wikipedia...; http://vietnamtravels...; http://www.phongnhatours...; http://www.unep-wcmc..., etc.).

The diversity of vegetation and habitats causes outstanding plant diversity at PNKBNP. Preliminary surveys of the botanical diversity of

PNKBNP have been less than comprehensive (Le Xuan Canh et al., 1997; Cao Van Sung, Le Quy An, 1998; Timmins et al., 1999; http://www.phongnhatours..., etc.). However, preliminary results indicate here a rich and diverse flora with the preliminary list of vascular plant standing at 193 families, 906 genera and 2651 species noted in following table.

Preliminary list of vascular plants of PNKBNP flora
(http://www.phongnhatours...)

TAXA	FAMILIES	GENERA	SPECIES
1. Psilotophyta	1	1	1
2. Lycopodiophyta	2	4	16
3. Equisetophyta	1	1	2
4. Polypodiophyta	23	73	176
5. Pinophyta	6	10	19
6. Magnoliophyta	160	817	2437
- Magnoliopsida	131	638	1909
- Liliopsida	29	179	528
Total	**193**	**906**	**2651**

Phong Nha – Ke Bang National Park is located in the middle of Vietnam that causes the flora of PNKBNP is representative of the transition zone of two different floras of northern and southern parts of the country. This area is the southernmost locality of some tree species of the northern flora, such as: *Excentrodendron tonkinense, Platanus kerrii, Dipterocarpus retusus* and *Bursera tonkinensis* etc. At the same time, the area is also northernmost of some tree species of the southern regional flora, such as *Dipterocarpus kerrii, D. grandiflorus, Dialium cochinchinensis, Pterocarpus macrocarpus* etc. Remarkable diversity of florogenetic elements in PNKBNP flora is presented in following table.

Spectrum of plant geography element in flora of PNKBNP flora
(http://www.phongnhatours...).

№	FLOROGENETIC ELEMENT	NUMBER OF SPECIES
1	Tonkin endemism	150
2	Central Vietnam endemism	159
3	South endemism	46
4	Vietnam endemism	64
5	Indochina endemism	509
6	Southern China endemism	165
7	Hunan, Taiwan, Philippines element	60
8	Himalaya element	7
9	India element	240
10	Malaysia element	58
11	Indonesia-Malaysia element	39
12	Indonesia-Malaysia-Ocean Australia element	11
13	Tropical Asia element	306
14	Palaeo-tropical element	33
15	New tropical and circum tropical element	33
16	East Asia element	37
17	Asia element	45
18	Northern temperate element	1
19	Wide disposing element	19
20	Exotic and migrant element	29

In particular, an isolated karst area of PNKBNP is important centre of the local calcium dependent endemism. The site supports 419 plant species that are endemic to Vietnam. In particular, a narrowly endemic genus *Oligocera*s Gagnep. (*O. eberhardtii* Gagnep.) is confined to the site. In addition a narrowly located coniferous species to karst area as *Calocedrus rupetris* Aver. et al. Otherwise 28 orchid species endemic to Vietnam have been found here, such as *Bulbophyllum hiepii, Cleisostoma simondii, Cymbidium atropurpureum, Paphiopedilum dianthum, P. malipoense, Biermannia calcarata, Bulbophyllum insulsum, B. macraei, B. tixieri, Chiloschista trudelii, Cleisostoma melanorachis, Epigeneium labuanum, Eria boniana, E. gagnepainii, E. globulifera, E. thao, Liparis averyanoviana, L. petraea, L. pumila, Malleola seidenfadenii, Micropera poilanei, Panisea albiflora, Phalaenopsis gibbosa, Pteroceras simondianum, Thrixspermum fleuryi, Anoectochilus calcareus, Mischobulbum longiscapum* and *Rhomboda petelottii* (http://www.phongnhatours...).

Tentative data of 1995 showed that 96.2% of the PNKBNP territory was forest-covered, 92.2% in primary forest, much of it badly damaged by fire during the American war. Presently forest covers about 110 500 ha, mainly in the north and centre of the area. This dominant cover (±75% of the whole) is a dense wet tropical evergreen lowland forest on rock, followed by much smaller areas of the same on rock above 800 m (±8.5%) and below 800 m on soil (±8.3%). The upland forest grows on rough towers of karst along the narrow limestone range on the Vietnam-Laos frontier. The lowland non-karst forest grows on low hills of sandstone, schist and acidic granite with a relatively moist thick soil with surface streams. There is also a notable dense 50 sq. km forest on limestone of about 2500 *Calocedrus rupestris* and *Calocedrus macrolepis* trees. It is the largest unique forest in Vietnam, and most of the trees are 500–600 years old. Other vegetation types include relatively small areas of grasses and scrub on both limestone and non-limestone soils, permanent wetland forest, rattan and bamboo forests. There are also some agricultural lands on the territory of PNKBNP.

The forest contains giant buttressed trees up to 50 m high with woody climbers, a canopy layer and understorey. The commonest species are *Hopea hainanensis, Sumbaviopsis albicans, Garcinia fagraeoides, Excentrodendron tonkinense, Chukrasia tabularis, Photinia arboreum* and *Diospyros salletii*. On thin well-drained soil seedlings can grow only in crevices and holes of rocky limestone where soil has accumulated, so growth is stunted and regeneration after disturbance is slow. The evergreen forest on limestone has scattered deciduous trees such as *Dipterocarpus kerrii, Anogeissus acuminata, Pometia pinnata* and *Lagerstroemia calyculata*. The dominant tree families are the Lauraceae, Fagacaeae, Theaceae and Rosaceae. There are also scattered gymnosperms, such as *Dacrycarpus imbricatus, Podocarpus neriifolius* and *Nageia fleuryi*. Endemic species of tree here are: *Excentrodendron tonkinense, Cryptocarya lenticellata, Deutzianthus tonkinensis, Eberhardtia tonkinensis, Heritiera macrophylla, Hopea hongayensis, Illicium parviflorum, Litsea baviensis, Madhuca pasquieri, Michelia foveolata, Peltophorum tonkinensis, Semecarpus annamensis* and *Sindora tonkinensis* (http://www.unep-wcmc...).

Most widespread vegetation type in PNKBNP is tropical dense moist evergreen forest on limestone spreading under 800 m above sea level. About 96.2% of the national park territory is covered with such forest, 92.2% of which

is intact primary forest. Is to be said that following proportion of different kinds of plant cover is observed in the area:

- 74.7% of the park is covered with evergreen tropical wet forest on limestone rocks at the elevations of under 800 m;
- 8.5% is evergreen tropical wet forests on limestone rocks at the elevation of above 800 m;
- 8.3% evergreen tropical wet forest on soil mounts at the elevations of under 800 m;
- 1.1% impacted evergreen tropical wet forest on limestone rocks;
- 2.8% impacted evergreen tropical wet forest on soil mounts;
- 1.3% grass, bush on limestone rocks;
- 2% grass, bush on soil mounts;
- permanent wetland forests, rattan and bamboo forests and agricultural plantations: totally less than 1% (http://www.unep-wcmc...).

The site conditions are important habitats for high value and threatened plant species. Natural University, Hanoi National University, in combination with the Research Center of PNKBNP, has discovered 1320 additional species in this park, of which some groups are assessed as specially rare and precious. Among recorded plants, 116 threatened species are listed in the Vietnam Red Data Book of Plant (1997) and the IUCN Red List … (2009). *Calocedrus rupestris* discovered here are listed in Appendix II A (Limit of exploitation and use for commercial purposes) of the Decree of Government No. 32/2006/ND-CP on management of endangered, precious and rare forest plants and animals dated 30 March 2006.

The current vascular plant list for the PNKBNP contains 116 threatened species, of which 62 species are listed in Vietnam Red Data Book and 79 species listed in the IUCN Red List of Threatened Species 2006. Many threatened plant species with very high values occur in the national park, such as *Dipterocarpus kerrii* (CR), *Dipterocarpus turbinatus* (CR), *Dipterocarpus hasseltii* (CR), *Hopea chinensis* (CR), *Hopea hainanensis* (CR), *Hopea mollissima* (CR), *Hopea reticulata* (CR), *Hopea siamensis* (CR), *Vatica diospyroides* (CR), *Dalbergia bariaensis* (EN), *Dalbergia mammosa* (EN), *Erythrophleum fordii* (EN), *Hopea pierrei* (EN) and *Vatica cinerea* (EN) (http://www.phongnhatours...; http://vietnamtravels...).

Principal minus of all surveys mentioned above consists of obvious insufficiency of appropriate documentation of field observations with verified

correctly identified voucher herbarium materials housed in responsible Herbaria. As result, these data cannot be approved and corrected by standard taxonomic studies by specialists, experts and monographers. Most of them include obvious mistakes that can not be verified being not based on voucher specimens supported plant species records. Unfortunately, such studies can not be accepted as truly scientific investigations and give only tentative picture of real plant diversity in studied area.

First preliminary exploration of vegetation and plant diversity properly supported by voucher herbarium and living collections was fulfilled in 2005. This survey was managed by FFI with support of Counterpart International Vietnam, Food for Progress Program. It concerns inventory of Orchid family with detailed description of main species habitats and types of forests found in PNKBNP territory (Averyanov et al., 2005b).

Mentioned preliminary survey was completed during 20 days (15 January - 5 February 2005). Reconnaissance field studies included 4 sites of PNKBNP, both in limestone rocky areas and in mountains composed with silicate rocks. During investigations were collected 558 numbers of herbarium and living specimens collecting numbers, among them about 355 numbers of orchids (all living specimens), which belong to about 208 orchid species and 69 genera. All voucher living specimens of orchids were exclusively housed in the nursery of PNKBNP. Survey report included checklist with full inventory of this collection and indicates groups of orchid more perspective for commercial propagation. Kinds of landscapes, main forest dominants, discovered species of orchids and other ornamental plants perspective for propagation were illustrated with photographs of high resolution. Recommendations included follow items: Collecting of new living orchid specimens; Secure, careful and qualified care of living collection; Observations of development and growth of collected living specimens; Regular inventory of living collection and careful fixation of specimen death; Careful observations of specimen flowering and gathering materials for species determination; Appropriate documentation of collected scientific materials; Appropriate keeping of collected scientific documentation; Primary coniferous limestone forests of PNKBNP represent unique formation of global importance. Their studies and protection is goal of highest priority; Organization of ecotourism system in PNKBNP may give very high economic and commercial effect and provide additional employment for many people.

Large number of extremely rare, highly endangered orchids were discovered in PNKBNP during this study as a first that outlined area of the national park as one of the richest "orchid hotspot" in Indochina. Regrettably, it was alone scientifically correct investigation of plant diversity on PNKBNP territory.

Meanwhile, extensive collecting and studies of plant diversity were made during last years in Quang Binh province outside territory PNKBNP in regions closely allied to borders of the national park. Schematic data of most significant explorations accompanied with voucher herbarium specimens are summarized in following table.

Exploration field searches of plant diversity made by CPC and allies groups in Quang Binh province mainly outside PNKBNP territory

Date	Collecting numbers	Number of voucher specimens	Locality
1997 May	VH 4570-4843	274	Thuong Hoa comm.
1998 April	P 9001-9110	110	Dan Hoa comm.
2004 December	WP 880-1130	251	Thuong Hoa, Hung Trach, Son Trach, Tan Trach comm.
2005 January	HAL 5827-6383	557	Thuong Hoa, Hung Trach, Son Trach and Tan Trach comm.
2008 April	HAL 11613-11843	231	Dan Hoa comm.
2009 February	HAL 12174-12605	432	Dan Hoa comm.
2011 April-May	CPC 2451-2775; 2798-2800	346	Tuyen Hoa, Le Thuy distr.

Mentioned botanical explorations brought surprisingly numerous significant discoveries. Main results of these studies are listed as follow:

- Discovery and description of outstandingly rich, highly endangered, rarest primary coniferous forests unique in the area, with such dominants and co-dominants as *Calocedrus rupestris, Dacrycarpus imbricatus, Dacrydium elatum, Fokienia hodginsii, Pinus dalatensis.* Such critically globally endangered ecosystem were discovered in a number of localities formed both rocky limestone, and also on silicate rocks, like shale, schist and sandstone.

- Definition of southern and northern distribution limits of such important species indicators as *Calocedrus rupestris, Pinus dalatensis, Paphiopedilum appletonianum, P. malipoense* and many others that is very important for understanding of plant geography borders in Indochina.

- Discovery of numerous species new for the Vietnamese flora. Among them are - *Abrodictyum pluma, Bulbophyllum depressum, Chionographis chinensis, Nervilia muratana, Teratophyllum hainanense* etc.

- Discovery and description of a number of plants, new for science. Among them one new genus – *Hiepia* and a large series of new species for science like – *Arenga riparia, Aspidistra coccigera, Begonia crassula, B. gesneriifolia, B. minuscula, B. rigidifolia, Cheirostylis serpens, Hiepia corymbosa, Hoya lockii, Peliosanthes argenteostriata, P. retroflexa, Tupistra theana* and some others.

Data about mentioned discoveries were published in parts in numerous publications (Averyanov, Averyanova, 2003; Averyanov et al., 2000, 2002, 2003a, b, c; 2004a, b; 2005a, b, c, d; 2008, 2010, 2011a, b; Nguyen Tien Hiep et al., 2004; Averyanov, 2008, 2009, 2010, 2011, 2012; Pham Van The, Averyanov, 2011; The Pham Van, Averyanov, 2012; Phan Ke Loc et al. 2005; 2011; Averyanov, Tanaka, 2012).

Noteworthy, that strong restrictions for professional plant studies and herbarium collecting by botanists on the territories of protected areas in Vietnam (including PNKBNP) remove wide scientific activity away from these areas. In such conditions, localities outside protected area often appear botanically explored much better than areas officially protected. For example, most significant discoveries in Quang Binh province were made outside PNKBNP, territory of which remains actually almost unexplored by professional botany. Such practice do not promote rise of our knowledge of plant diversity observed on territories of protected areas and give no possibilities to protect newly discovered species as their type localities (loci classici) lie outside protected areas, often in critically endangered habitats.

2. METHODOLOGY OF STUDIES AND SURVEY LOCATIONS

Area of field investigations allies to territory PNKBNP, and administratively belongs to Thuong Hoa and Hoa Son municipalities (communes) of Minh Hoa district, Quang Binh Province (northern Vietnam). Itineraries and locations of investigations for study of the flora and vegetation in EA of PNKBNP are presented on the map 1.

The general outline of aboriginal flora and schematic description of the main types of primary vegetation, as far as most typical primary plant zonal and azonal communities at the elevations 300-800 m a.s.l. was expected as a main goal of field-work and botanical survey of EA of PNKBNP region: Thuong Hoa and Hoa Son municipalities.

Description of structure and species composition of different primary vegetation types and primary plant communities were made mainly along landscape profiles (transects) from lowest to highest elevation beginning from lowest elevation belt where primary forest (pristine or slightly disturbed) were observed. Various kinds of secondary plant formations that represent different stages of degradation of primary plant communities (various kinds of secondary forests, secondary scrub, secondary grasslands, weed and ruderal plant communities, etc.) were not studied during this field works.

Description of vegetation were based on field observations along landscape transects and on detailed descriptions of structure and species composition in 20 model plots, selected at different elevation in most typical and representative plant communities. Selected plots varies in size from 5 x 20-30 m in description of cliff lithophytic plant communities, 10 x 30-40 m on steep slopes to 20 x 20 m in descriptions of mountain slope forest formations. Size of selected plots depended of possibly large found land square with acceptably uniform, homogenic vegetation cover. Model plots were selected in all types of primary plant communities, that were found along studied landscape profiles or transects.

Most usual size of model plots used for description of species composition and vegetation of forest formation was 20 x 20 m. For each plots were determined geographical position (coordinates), landform, elevation above sea level (used abbreviation - a.s.l.), slope exposition and inclination. In this work were used standard GPS satellite system, altimeter, compass and topographic maps (1:50.000). In each plot were briefly described features of

leaf litter, main soil horizons and parental rocks. Vegetation structure was described for each distinct stratum with determination of projective coverage and species composition for each storey (including herb and moss/lichens stratum). Detailed description of non strata vegetation – epiphytic, lithophytic, climber and vine community, as far as plants of specific life forms like root and canopy parasites, mycotrophic achlorophyllous herbs etc., were provided for each description with determination of dominating species. Special attention in exploration was attended to species of "key group" - orchids (Orchidaceae), gymnosperm species (Podocarpaceae), magnolias (Magnoliaceae), begonias (Begoniaceae), ferns (Pteridophyta) and medicinal plants. Number of tree boles with their diameter for each tree strata are given in forest descriptions for each plot. The diameter of the tree bole was measured at breast height about 1.3 m above the ground (used abbreviation – DBH).

Additional important information on vegetation structure and species composition of primary plant communities in studied area was obtained from observations and plant collections, which were made during numerous extensive feet routes for botanical exploration in studied mountains.

Plants, habitats and landscapes photography was made by *"Canon"* and *"Nikon"* photo-cameras with *"Canon", "Nikon", "Cosina", "Sigma"* and *"Tamron"* lenses of various focus distance. For artificial lighting were used straight various compatible flash systems.

To producing vegetation map were used data: Digital Elevation Model (DEM) name SRTM in 90 m resolution, Landsat 5 image (6 bands) in 30 m resolution captured in 15 Feb. 2009, satellite image is performed ortho-rectification to reduce effects of topography. All spatial data are standardized to WGS84 zone 48 projections.

Methods of forest classification: Almost all research area is spread on limestone mother rock so both unsupervised and supervised will be used in this process.

Unsupervised classification: The algorithms of ISODATA will be used in unsupervised to classify. The image will be classed maximally to 20 clusters. In order label or allocate classes as accurately as possible, a set of information will be employed such as field data, a forest/land cover map, topographic maps and thematic maps as well as local knowledge.

Maximum likelihood classification: the training areas will be digitized based on field data, result of unsupervised classification and these data will be

used to select training areas for the supervised classification process. Maximum likelihood method is used to classify for this area. The classified image is converted to vector data and edit the fusion regions. Close forests are divided into 2 categories: less than 700 m and higher than 700 m based on Digital Elevation Model (DEM).

Standard blank elaborated by Prof Averyanov was used for description and documentation of observations in each studied model plots. Items and paragraphs of blank accepted for vegetation descriptions are presented below as follow:

Vegetation description

Plot № 00; Date:; Made by:; Administrative position:; Coordinates:; Geomorphologic position:; Elevation:; Slope exposition:; Slope inclination:; Exposed rock outcrops:; Parental soil material:; Leaf litter coverage:; Soil:; Zonal (elevational) plant community:; Available photo documentation:

Plant community structure

Plot size:

Emergents:

Plant name:	Number	Height in m.	Diameter (in cm at BH)	Projective coverage in %

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.

Dominants:

Associates:

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.

Dominants:

Associates:

3 stratum (tree storey):

Height in m.	Projective coverage in %.

Dominants:

Associates:

4 stratum (shrubs):

Height in m.	Projective coverage in %.

Dominants:

Associates:

5 stratum (herbs):

Height in m.	Projective coverage in %.

Dominants:

Associates:

6 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.

Dominants:

Associates:

Non strata vegetation:

Epiphytes & semi-epiphytes:
Dominants:
Associates:

Climbers & lianas:
Dominants:
Associates:

Plants of specific living forms (parasitic, mycotrophic etc.):

Each name used in vegetation descriptions are based on collected voucher herbarium specimens, which are housed with appropriate collecting number and name in Herbaria at Center for Plant Conservation (CPC), PNKBNP, Komarov Botanical Institute of the Russian Academy of Sciences (LE) and Missouri Botanical Garden (MO). Index “CPC”, which represents abbreviation of name of Center for Plant Conservation is used for herbarium collecting numbers in this project. Herbarium processing work was implemented by technician – Mr. Nguyen Tien Vinh. During the field survey,

about 33 local people from Thuong Hoa (On and Yen Hop villages), Dan Hoa (Cha Lo village) were involved into field-works.

In plant identification, were used numerous taxonomic literature sources that concerns to South-East Asian floras such as:

"Flore Generale de l'Indochine" (Eds. M.H. Lecomte & H. Humbert, 1907-1951).
"Flore du Cambodge, du Laos et du Viet-Nam" (Eds. A. Aubreville, J.F. Leroy and Ph. Morat, 1960-1997).
“Flora of Java” (Backer, Bakhuizen, 1968).
"An illustrated flora of South Viet-Nam" and "An illustrated flora of Vietnam" (Pham Hoang Ho, 1970-1972, 1991-1993, 1999-2000.).
"Contributions to the orchid flora of Cambodia, Laos and Vietnam" (Seidenfaden, 1975).
"Vascular plant synopsis of Vietnamese flora" (Ed. Averyanov et al., 1990, 1996).
"The orchids of Indochina" (Seidenfaden, 1992).
"Identification guide to Vietnamese orchids (Ochidaceae Juss.) " (Averyanov, 1994).
“Orchids of Southern Ryukyu Islands” (Garay, Sweet, 1974).
“The Genera of Orchidaceae in Hong Kong” (Hu, Shiu-ying, 1977).
“Flora of Taiwan” (Liu Tsang-Shui, Su Horng-Jye, 1978).
“Hong Kong Orchids” (Barretto, Young Saye, 1980).
“Orchids of India” (Bose, Bhattacharjee 1980).
“Flora of Ceylon” (Jayaweera, 1981).
“Orchids of Nilgiris” (Joseph, 1982).
“Orchidiana Philippiniana” (Valmayor, 1984).
“Orchids of Java” (Comber, 1990).
“The Orchids of Peninsular Malaysia and Singapore” (Seidenfaden, Wood, 1992).
“A check-list of the orchids of Borneo” (Wood, Cribb,1994).
“Native orchids of China in color”. (Chen Singchi, Tsi, Zhanhuo, Luo Yibo, 1999).
“Wild orchids of Thailand” (Vaddhanaphuti, 2000).
“Orchids of Sumatra” (Comber, 2001).
“Orchids of Sarawak” (Beaman, et al., 2001).
“Flora Yunnanica”.
“Flora Sichuanica”.
“Icones Cormophytorum Sinicorum” (1987).
Flora Malesiana. Multi-volume edition.
Flora of Thailand. Multi-volume edition.
and others monograph.

Flowers of most important, rare and scientifically significant species were also collected as an alcohol fixed specimens (additionally to herbarium material) for further studies.

Names of some plant species from taxonomically critical groups still need verification by further laboratory studies for verification of their

identifications and description of new species. Described plant communities remain also a bit incomplete due to insufficient time for plant collecting, particularly in habitats on inaccessible cliffs.

3. BRIEF DESCRIPTION OF VEGETATION TYPES OBSERVED IN THE STUDIED AREA

According to most widely cited and accepted UNESCO International Classification and Mapping of Vegetation (International Classification…, 1973; http://unesdoc...) observed kinds of primary climax vegetation (plant communities) may be generally classified as follow:

FORMATION GROUP
1. Closed tropical evergreen seasonal forests

Formations
1.1. Lowland forest
Sub-formation
1.1.1. Broad-leaved forest

1.2. Submontane forest
Sub-formations
1.2.1. Broad-leaved forest
1.2.2. Mixed forest
1.2.3. Needle-leaved (coniferous) forest

At the same time, high regional specificity of aboriginal vegetation observed in studied EA needs further elaboration and detailed specification of specific plant communities found in the area of field investigation. Appropriate explication of vegetation kinds accepted and described in our research is presented below in form of following table.

Studied and observed kinds of plant communities in extended area
(Quang Binh province, Minh Hoa district)

1. ZONAL PRIMARY PLANT COMMUNITIES	data from
1.1 LOWLAND	
1.1.1 Closed primary evergreen seasonal tropical lowland broad-leaved forests on leveled slopes and low ridges composed by stratified shale at elev. (350)500-600 m a.s.l.	observations, descriptions, plots **№ 19, 20**
1.1.2. Closed primary evergreen seasonal tropical lowland broad-leaved forests on wet flat seasonally flooded river/stream valleys and on low flat river/stream terraces on crystalline eroded limestone and shaly limestone at elev. (250)300-400(450) m a.s.l.	observations, descriptions, plots **№ 1, 7, 17**
1.1.3. Closed primary evergreen seasonal tropical lowland broad-	observations,

leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone at elev. 400-700 m a.s.l.	description, plots **№ 4, 5, 8-11, 13-16, 18**
1.1.3a. Wind-formed and/or other specific modifications. Closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on vertical and subvertical cliffs on crystalline highly eroded limestone at elev. 400-700 m a.s.l.	observations
1.1.3b. Wind-formed and/or other specific modifications. Closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on rocky mountain tops on crystalline highly eroded limestone at elev. 400-700 m a.s.l.	observations, descriptions, plots **№ 3, 6, 12**
1.2. SUBMONTANE	
1.2.1. Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous forests (with *Dacrydium elatum* and *Dacrycarpus imbricatus*) on steep rocky slopes and on mountain tops on crystalline highly eroded limestone at elev. 700-800(900) m a.s.l.	observation, description, plots **№ 2**
1.2.1a. Wind-formed and/or other specific modifications Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous short-tall forests on vertical and subvertical cliffs on crystalline highly eroded limestone at elev. 700-800(900) m a.s.l.	observations
1.2.1b. Wind-formed and/or other specific modifications. Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous short-tall forest on rocky mountain tops on crystalline highly eroded limestone at elev. 700-800(900) m a.s.l.	observations
2. AZONAL PRIMARY PLANT COMMUNITIES	
2.1. Riparian riverine shrub and herbaceous communities on swampy and rocky steam/river valleys	observations
2.2. Aquatic riverine aquatic herbs communities on steams and rivers	observations
3. SECONDARY PLANT COMMUNITIES	
3.1. Open medium and highly disturbed primary forests	observations
3.2. Rich secondary forests and woodlands	observations
3.3. Poor secondary forests and woodlands	observations
3.4. Closed and open secondary scrub	observations
3.5. Secondary herbaceous communities and grasslands	observations

Main attention in fulfilled field research was attended to primary plant communities that have leading significance for nature protection in proposed EA of PNKBNP. Below we present simplified description of observed kinds of vegetation (plant communities) based on field observation, representative plot descriptions and collected voucher herbarium specimens as a scientific documentation of completed investigation (Annexes 1-5).

3.1 ZONAL PRIMARY KINDS OF PLANT COMMUNITIES
3.1.1 LOWLAND

3.1.1.1
Closed primary evergreen seasonal tropical lowland broad-leaved forests on leveled slopes and low ridges composed by stratified shale at elev. (350)500-600 m a.s.l.

Description of this kind of forests is based on extensive field observations and description of representative model plots № 19, 20 (field camp № 3), as well as collected voucher herbarium specimens (Annexes 1-5). Such forests may be observed in non limestone areas of EA.

Non limestone areas consist relatively small portion of EA, studied in south-western part of Hoa Son municipality, Minh Hoa district (Map 1, 2) and associated with rolling hills and low ridges, as well as with narrow beds and low terraces of stream and rivers valleys at elevations 450-550 m a.s.l. Dark to light brown stratified and clay shale were commonly observed as parental soil material here. Well developed weathered material covers commonly all forest floor without mother rock outcrops. Leaf litter form usually 100% cover to 5-10 cm in depth. Soils include yellow-brown, yellow to light yellow horizon 5-15 cm thick, based on light brown alluvial clay to 1 m in depth and deeper.

Following structure of the forest was observed in studied area.

1 stratum includes numerous species of trees that reach 25-40(50) m tall to 1 m DBH with projective coverage from 20 to 70%. Most typical species are - *Allospondias lakonensis, Altingia siamensis, Canarium bengalense, Dracontomelum duperreanum, Elaeocarpus grandiflorus*, *Endospermum chinense*, *Engelhardia roxburghiana, Ficus glaberrima,* and species of such genera as *Aglaia, Diospyro*s and *Pterospermum*. Usual associates here are - *Chukrasia tabularis, Dacrycarpus imbricatus, Diplopanax vietnamensis*, *Lithocarpus pseudoreinwardtii, Magnolia dandyi, M. masticata* and species of *Artocarpus, Actinodaphne* and *Michelia.* Some trees, like *Engelhardia roxburghiana* may reach 45-50 m tall appearing as emergents towered above canopy matrix of 1 forest stratum.

2 stratum includes also many species of trees (7)10-20(25) m tall (12)15-40 cm DBH with projective coverage from 60 to 70%. Most typical

species are – *Alangium ridleyi*, *Amesiodendron chinense*, *Cinnamomum ovatum*, *Diospyros latisepala*, *Lithocarpus pseudoreinwardtii*, *Polyalthia jucunda*, *Schima wallichii*, *Xerospermum microcarpum*, as well as species of such genera as *Actinodaphne, Beilschmiedia, Schefflera* and *Syzygium*.

3 (shrub) stratum rich in species and reach 3-7(10) m tall with projective coverage varying from 10 to 80%. Typical species observed here are – *Archidendron clypearia, Diospyros choboensis*, *Ficus langkokensis*, *F. variolosa*, *Flacourtia rukam*, *Gironniera subequalis, Grewia bulot, Magnolia masticata*, *Miliusa sinensis*, *Psychotria sarmentosa, Styrax litseoides*, *Symplocos adenophylla* and species of *Aglaia*, *Elaeocarpus, Garcinia, Magnolia*, *Michelia* and *Tabernaemontana*. Palms (*Livistona* sp.) are common in this stratum. Numerous saplings of large trees of 1 stratum observed here (*Alangium ridleyi*, *Elaeocarpus grandiflorus*, *Magnolia masticata, Pometia pinnata* and species of *Actinodaphne* and *Pterospermum*) exhibits potentially normal regeneration of the forest.

4 (herbaceous) stratum to 3 m tall is well presented with projective coverage commonly about 80%. It includes following common species:

Aglaonema siamensis,
Allophylus cochinchinensis,
Alpinia sp.,
Antidesma costulatum,
A. yunnanensis,
Ardisia gigantifolia,
Ardisia spp. (2 sp.),
Begonia acetosella,
Blastus multiflorus,
Bolbitis sp.,
Calanthe odora,
Carex sp.,
Colysis sp.,
Croton cascarilloides,
Croton sp.,
Cyathea sp.,
Desmos spp. (2 species),
Dichroa febrifuga,
Disporum trabeculatum,
Dracaena angustifolia,
Euodia lepta,
Homalomena occulta,
Ixora sp.,
Lasianthus biflorus,
Lasianthus spp. (2 sp.),
Leea indica,
Lophatherum gracile,
Medinilla assamica,
Microlepia hookeriana,
Ophiorrhiza sp.,
Paraboea sp.,
Phrynium placentarum,
Phylogacanthus turgidus,
Polystichum sp.,
Psychotria rubra,
Psychotria sp.,
Pteris grevilleana,
P. omeiensis,
Schismatoglottis calyptrata,
Selaginella sp.,
Strobilanthes sp.,
Tabernaemontana sp.,
Tacca chantrieri,
Tainia sp.,
Tectaria decurrens,
Tectaria spp. (2 sp.).

Numerous seedlings of trees of higher forest stratum have remarkable proportion in species composition of herbaceous stratum. Most common here were observed seedlings and saplings of such species as:

Actinodaphne sp.,
Alangium ridleyi,
Archidendron clypearia,
Eberhardtia tonkinensis,
Elaeocarpus grandiflorus,
Gironniera subequalis,
Gomphadra mollis,
Lindera sp.,
Lithocarpus sp.,
Litsea cubeba,
Neolitsea sp.,
Pinanga sp.,
Polyalthia sp.,
Pterospermum sp.,
Schefflera sp.,
Sterculia lanceolata,
Sterculia sp.,
Syzygium sp.

Mosses and lichen stratum very poor (less than 1% of projective coverage) and includes few juvenile unidentifiable samples.

Genuine epiphytes are not common and presented by such species as *Asplenium nidus, Oberonia* sp., *Thrixspermum centipeda, Aglaomorpha coronans, Dendrobium* sp. and *Nephrolepis cordifolia.* A number of creeping epiphytic vines allies to this group of species of non-strata vegetation. They are - *Dischidia* sp., *Epipremnum pinnatum, Piper albispicum, Pothos repens* and *Scindapsus poilanei.*

Numerous herbaceous and woody lianas are fairly common in forests of described type, particularly in their disturbed modifications. Most common species here are –

Ancistrocladus tectorius,
Artabotrys hexapelalus,
Bauhinia sp.,
Bowringia callicarpa,
Byttneria tortilis,
Calamus poilanei,
Capparis cantoniensis,
Cocculus sp.,
Combretum sundaicum,
Combretum sp.,
Connarus paniculatus,
Derris sp.,
Dioscorea sp.,
Entada phaseoloides,
Erythropalum scandens,
Fibraurea tinctoria,
Ficus sagittata,
F. subulata,
Galeola nudiflora,
Gnetum montanum,
Gynostemma pentaphyllum,
G. pubescens,
Kadsura grandiflora,
Millettia sp.,
Morinda officinalis,
Mussaenda cambodiana,
Smilax glabra,
Stauntonia cavaleriana,
Tetrastigma sp.,
Thladiantha cordifolia.

Among them are remarkable achlorophyllous orchid - *Galeola nudiflora* and significant medicinal plant - *Morinda officinalis* widely used in traditional oriental medicine.

Noteworthy, observed forests include a numbers of such primitive archaic elements of tertiary floras as *Altingia siamensis, Diplopanax vietnamensis*, numerous magnolias (*Magnolia, Michelia*) and gymnosperms. Some of them, like *Diplopanax vietnamensis*, are genuine “living fossils”,

which is regarded as congeneric with *Mastixicarpum,* representatives of which were an integral component of paratropical broad-leaved evergreen vegetation that covered much of the Northern Hemisphere from the uppermost Cretaceous to the late Miocene, about 65 to 7 million years ago (Averyanov, Nguyen Tien Hiep, 2002).

Available illustrative documentation of physiognomy, structure and species composition of described forest is presented in Annex 4-5, figures: 8, 15, 16, 27-34, 55, 106, 108, 140, 145, 146.

3.1.1.2
Closed primary evergreen seasonal tropical lowland broad-leaved forests on wet flat seasonally flooded river/stream valleys and on low flat river/stream terraces on crystalline eroded limestone and shaly limestone at elev. (250)300-400(450) m a.s.l.

Description of this kind of forests is based on extensive field observations and description of representative model plots № 1, 7, 17 (main camp and field camp № 1), as well as on collected voucher herbarium specimens (Annexes 1-5). Forest of this type spreads in EA along stream and river valleys at elevation 250-450(450) m a.s.l. and occupies seasonally flooded alluvial valley beds and low valley terraces (Map 1, 2). Commonly stream or river valleys in studied area are fairly narrow and often appears as narrow canyons with very steep rocky slopes and bluffs composed with highly eroded solid karstic white to gray limestone. Meanwhile, very often waterproof gray to dark gray, or almost black stratified lime shale, or clayey shale form bottom of valley beds. During rainy season in September – October stream water covers here forest floor in period from 2- to 3 month. Flooded water brings a lot of alluvial clay material awashed from steep valley slopes, which identified specific soil character in such localities.

Leaf litter covers 70-90% of surface during rainless time. At this time its depth varies from 2 to 5 cm. Fallen leaves, however, are easily awashed by heavy rains at the beginning of rainy season into depressions, karstic dolines or riverbeds. It denudates forest floor, when open soil surface may easily reach 100%.

Observed soils consist of brown to light brown horizon of 5-15 cm in depth, deeper light brown to light yellow-brown alluvial clay to 1 m thick based on more or less weathered gravel of limestone, lime shale or clay shale, placed eventually on mother rocks.

Following structure of the forest was specified in studied area.

1 forest stratum includes a number of tree species 20-30(35) m tall to 0.8(1) m DBH with canopy projective coverage 15-50%. Most common species of this stratum observed here are *Allospondias lakonensis*, *Artocarpus borneensis, Canarium nigrum*, *Cryptocarya concinna, Dipterocarpus hasseltii, Elaeocarpus grandiflorus*, *Manglietia chevalieri*, *Magnolia masticata*, *Pometia pinnata, Sloanea sinensis* and species of such genera as – *Actinodaphne, Aglaia*, *Ailanthus*, *Nephelium* and *Syzygium*.

Largest trees found in all studied area were observed in this forest kind. Such trees often appear as giant emergents, which may reach 40-50 m tall and 1.5-2 m DBH forming impressive buttresses 3-4 m long and 2-3 m tall with total side projection of trunk 7-8(10) m wide (fig. 35, 36). *Dracontomelum duperreanum* (fig. 35, 36), *Dysoxylum mollissimum* (fig. 42), *Lagerstroemia ovalifolia* (fig. 39) and some other species, appear as most common emergent in studied area, very often growing also on lower part of rocky limestone mountain slopes. Canopy diameter of such trees can reach 40 m in diameter with canopy projective coverage (density) 30-40 %.

2 forest stratum is formed by trees 10-20(25) m tall, (10)15-40 cm DBH. Observed projective stratum coverage varies from 50 to 90%. Most common species are - *Dipterocarpus retusus*, *Elaeocarpus grandiflorus*, *Hydnocarpus annamensis, Knema pierrei*, *Pometia pinnata, Sarcosperma kachinensis,* as well as representatives of such genera as *Actinodaphne*, *Adenanthera*, *Aglaia*, *Castanopsis*, *Cinnamomum, Michelia* and *Polyalthia*.

3 (shrub) stratum is rather poor. It is formed by scarce trees and shrubs 3-7(10) m tall with projective coverage 25-35%. Usually this stratum is not too rich in species and includes *Arenga westerhautii*, *Caryota sympetala*, *Ficus nervosa*, *Leea indica*, *Saurauia tristyla*, *Streblus macrophyllus, Wrightia macrocarpa*, species of *Antidesma*, *Calamus, Camellia*, *Microdesmis*, *Pinanga*, as well as immature saplings of *Cryptocarya, Knema pierrei*, *Litsea, Syzygium* and a number of tree species of higher strata. *Streblus macrophyllus* is most common species here.

4 (herbaceous) stratum includes herbs and shrubs 0.05-3 m tall forming projective coverage 25-85%. Species composition may be reach, but most herbs, shrubs and seedlings here are presented by small, depressed, very weak samples with miserable portion in stratum cover. Very often they are seedlings or juvenile plantlets originated from seeds of plants from high canyon slopes incapable survive in flooded environment. Among such species were specified –

Aglaia sp.,
Alpinia sp.,
Amischotolype mollissima,
Amomum sp.,
Amorphophallus sp.,
Angiopteris evecta,
Ardisia sp.,
Asarum wulingense,
Asplenium obscurum,
Begonia tetraptera,
Blastus sp.,
Calamus sp.,
Calanthe odora,
Capparis sp.,
Caryota sympetala,
Clausena sp.,
Clinacanthus sp.,
Colysis sp.,
Corymborkis veratrifolia,
Costus tonkinensis,
Croton sp.,
Curculigo latifolia,
Dendrocnide sp.,
Diplazium donianum,
Diplazium sp.,
Elatostema sp.,
Gomphandra sp.,
Hydnocarpus sp.,
Impatiens sp.,
Lasianthus sp.,
Leea indica,
Musa sp.,
Ophiorrhiza sp.,
Phrynium sp.,
Pilea sp.,
Pollia thyrsiflora,
Polystichum sp.,
Pseudodracontium sp.,
Psychotria sp.,
Pteris grevilleana,
Rhynchotechum ellipticum,
Sambucus hookeri,
Sterculia sp.,
Strychnos sp.,
Tectaria decurrens,
Trevesia palmata.

Few flood-tolerant species very often appear here as absolute co- or mono-dominants of plant community representing to 99%-portion in own cover (fig. 9-11, 17). Usual species of this group in EA are - *Aglaonema ovatum*, *A. siamense, Alocasia* sp., *Goodyera fumata*, *Homalonema occulta*, *Hydrocotyle javanica, Schismatoglottis calyptrata*, *Tacca chantrieri*, *Thelypteris* sp., and *Zippelia begoniifolia,* but most common in flooded forests are some species of *Aspidistra, Ophiopogon* and *Peliosanthes*. In rather open wet places may be commonly found dense cover of creeping herbaceous vine - *Gynostemma pubescens.*

Moss and lichens cover is miserable. It presented by few juvenile, unidentified, xylophytes and epiphytes not higher than 1 cm, not exceeding 3-5% of soil surface.

Lithophytic, epiphytic herbs and different vines form non-strata vegetation.

Richness of lithophytes may be high. It straightly depends of amount of rock outcrops not covered flooded water in rainy season. Even temporary shortly flooded rocks remain very poor in lithophytic species.

Epiphytes are not too rich and comprise commonly such species as - *Aglaomorpha coronans, Asplenium nidus, A. pseudo-laserpitifolium, Ceratostylis subulata, Dendrobium terminale*, *D. truncatum, Eria paniculata, Flickingeria angustifolia, Lemmaphyllum microphyllum, Liparis* sp., *Lomariopsis spectabilis, Pyrrosia lanceolata, Schoenorchis gemmata* and *Trichotosia pulvinata*. Creeping epiphytic vines are presented by *Dischidia acuminata*, *Dischidia* sp., *Epipremnum pinnatum, Ficus cordata, F. pumila, F. racemosa, Lomariopsis spectabilis, Piper albispicum, Piper* sp., *Pothos repens*, *Rhaphidophora decursiva*, *Scindapsus poilanei* and *Vandenboschia auriculata.*

Large herbaceous and woody lianas are rather common, particularly in opened disturbed forest modifications or in open places of fallen trees of rocky outcrops. Some vines can reach 30-40 m long and 15-20 cm of stem diameter. Among vine species most common here are - *Anamirta cocculus, Bauhinia ornata, B. oxysepala, Callerya reticulata, Fissistigma* sp., *Hiptage* sp., *Millettia pachyloba, Paederia* sp., *Stephania sinica, Strychnos* sp., *Tetrastigma* sp. and *Trichosanthes* sp.

Temporary flooding is serious factor limiting species diversity of valley forest in studied area, particularly in lowest strata. Other kinds of primary forests in EA exhibit much more high species diversity.

Available illustrative documentation of physiognomy, structure and species composition of described forest is presented in Annex 4-5, figures: 3-5, 9, 10-12, 17, 18, 35, 36-39, 40, 41, 42, 43, 45, 49, 50, 65, 66, 91, 92, 95-97, 109.

3.1.1.3
Closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone at elev. 400-700 m a.s.l.

This is the kind of forest that covers the largest area of EA. Its description is based on extensive field observations and description of 11 representative model plots: № 4, 5, 8-11, 13-16, 18 (field camps № 1-3), as well as on collected voucher herbarium specimens (Annexes 1-5). Forest of this type is most widespread, diverse and rich-species kind of vegetation in studied area with most complicated vertical structure that characterized by existence of 2-3 tree strata. These forests cover more or less steep, usually rocky slopes of remnant karstic limestone mountains that represent most usual kind of landform in EA (Map 1, 2). In studied area forests of this kind spread at elevations 400-700 m a.s.l. Investigation of them was documented by description of series of model plots along transect starting from mountain foothills at elevation 422 m a.s.l. (plots № 5, 14) to higher part of cliffy slopes in places approaching to mountain and ridges peaks at elevation 680 m a.s.l. (plots № 9, 15). Characteristic specifity of forest habitats on remnant karstic limestone mountains consists of very steep inclination of their slopes and their rocky character with rock outcrops to 90% of surface, and usual slope inclination 35-80°, often in combination with more or less high vertical cliffs above or below of model plots.

Mountain rocks here are composed by solid, crystalline, marble-like, highly eroded white, light to dark gray limestone, often forming mosaic picture with intermixture of all types in alone cliff of mountain top.

Forests on lower part of mountain slopes faced to narrow stream valleys may be shady and very humid with abundance of epiphytic mosses and wet-loving species. At the same time, on steep cliffy slopes of southern exposition environmental conditions may be rather dry with domination of dry-tolerant and even succulent species. Specific conditions are sometime observed on high terraces and in anticline depressions between tops of limestone ridges were soils commonly richer than on slopes due to accumulation here more amounts of leaf and other organic litter. Leaf litter horizon commonly have thickness (3)5-10 cm with coverage 70-100% (except rock outcrops). However, accumulations of leaf litter in small depressions, caverns and karstic pockets my reach thickness

0.5 m and even more. Such pockets form specific substrate conditions necessary for normal existence and regeneration of largest part of woody species in forest on rocky limestone.

Surface humus soil horizon may be almost black to dark brown, but very often it brown, gray-brown or yellow-brown. Often this horizon, particularly on steep slopes only (3)5-15 cm depths (fig. 24, 25) Meantime, on terraces, depressions, on leveled parts of lower slopes, or on mountain foothills it reaches 40-60 cm in depth (fig. 26). Light brown, gray or yellow clay mixed with more or less weathered limestone lies deeper. This horizon varies from 0.5 to 1.5 m thick and is placed directly on mother rocks. Fertility of soils reaches maximum on leveled parts of middle and lowers mountain slopes, where also largest forest trees demonstratively are always observed (fig. 37-58). On highest part of mountain slopes soils thinner and 1 (canopy) forest stratum much shorter.

Following structure of the forest was specified in studied area.

Giant trees-emergents are most impressive elements of described forests. They represent integral regular element of intact primary wood on middle and lower parts of mountain slopes. Such trees reach 40-45(50) m tall with trunks to 2.5 m DBH spreading buttresses to 3-4 m long and to 2-3 m tall. As more common trees-emergents in studied area were observed - *Bischofia javanica* (fig. 44), *Dracontomelum duperreanum* (fig. 35, 36), *Dysoxylum mollissimum* (fig. 42), *Elaeocarpus grandiflorus* (fig. 58), and some others, including few unidentified species of Rubiaceae. Giant canopies of these trees may reach 40 m in diameter. Their density varies from 10 to 30%.

1 (canopy) stratum is formed by trees (15)25-30(40) m tall with (0.2)0.4-1.5(2) m DBH. The height of canopy forest stratum may be very variable. It directly depends of slope elevation, its inclination, soil richness and forest proximity to mountain tops. Projective coverage of this stratum varies from (15)20 to 50(80)%. Forest of this type has richest species composition in first and other tree and shrub strata. Species observed here as dominants and co-dominants of 1 (canopy) stratum are listed below as follow:

Ailanthus integrifolia,
Alangium ridleyi,
Allospondias lakonensis,
Amoora oligosperma,
Artocarpus borneensis,
Artocarpus sp.,
Beilschmiedia pergamentacea,
Bischofia javanica,
Burretiodendron brilletii,
Canarium nigrum,
Chukrasia tabularis,
Cinnamomum ovatum,

Cryptocarya annamensis,
Dipterocarpus hasseltii,
Dipterocarpus retusus,
Dracontomelum duppereanum,
Dysoxylum loureiri,
Elaeocarpus grandiflorus,
Endospermum chinense,
Ficus altissima,
F. glaberrima,
Gironniera subequalis,
Hopea siamensis,
Lithocarpus pseudoreinwardtii,
Lithocarpus sp.,
Manglietia fordiana,
Michelia doltsopa,
M. gioi,
M. macclurei,
Michelia sp.,
Polyalthia jucunda,
Polyalthia sp.,
Pometia pinnata,
Pterospermum truncatolobatum,
Pterospermum sp.,
Sapindus sp.,
Schima wallichii,
Sloanea sigun,
S. sinensis,
Sterculia sp.,
Vatica cinerea,
Zenia insignis.

2 tree forest stratum well presented in low and middle part of mountain slopes were it often reach 20-30(35) tall with trees (10)15-50 cm DBH forming projective cover (40)50-70%. Among most common trees here were observed following species:

Alangium ridleyi,
Castanopsis sp.,
Celtis philippense,
Cinnamomum sp.,
Deutzianthus tonkinensis,
Diospyros sp.,
Dipterocarpus sp.,
Dracontomelum duppereanum,
Engelhardia roxburghiana,
Ficus spp.,
Hopea siamensis,
Hopea sp.,
Hydnocarpus annamensis,
Knema pierrei,
Lagerstroemia sp.,
Machilus sp.,
Michelia doltsopa,
Magnolia spp.,
Nephelium sp.,
Polyalthia jucunda,
Pterospermum sp.,
Sapindus sp.,
Streblus macrophyllus,
Syzygium sp.,
Vatica cinerea.

On more or less flattened slopes on rich soils also 3 forest stratum may be usually observed. Trees of this stratum have commonly height (7)10-20 m with 10-20(40) cm DBH and canopy projective coverage (10)40-60%. Species usually observed here are:

Ardisia sp.,
Diospyros hasseltii,
Diospyros sp.,
Garcinia oblongifolia,
Hydnocarpus annamensis,
Knema pierrei,
Polyalthia jucunda,
Polyalthia sp.,
Sapindus sp.,
Streblus macrophyllus,
Sumbaviopsis albicans,
Syzygium sp.,
Vatica cinerea,
Wrightia macrocarpa.

Most common co-dominants here are - *Streblus macrophyllus* and *Sumbaviopsis albicans.* At the same, time this stratum less pronounced in high part of slopes by trees only 10-15 m tall with projective coverage only 10-30%.

Sometimes, particularly on extra steep slopes, it actually absents, when shrubs and small gnarled trees present second forest stratum.

Shrub stratum of the forest in most cases is well presented and consists of small trees and shrubs (2)3-10 m tall. Projective coverage varies in wide limits being specifies as - (10)40-60(80)%. More than half representatives here are saplings of trees of highest forest strata, such as:

Aglaia lawii,
Aglaia sp.,
Alangium ridleyi,
Albizia sp.,
Amoora oligosperma,
Ardisia sp.,
Citrus macroptera,
Gironniera subequalis,
Grewia bulot,
Hopea sp.,
Knema pierrei,
Lithocarpus sp.,
Litsea spp.,
Magnolia dandyi,
M. liliifera,
M. masticata,
Nephelium sp.,
Ormosia sp.,
Phoebe tavoyana,
Polyalthia intermedia,
P. jucunda,
Polyalthia sp.,
Pometia pinnata,
Sloanea sinensis,
Sterculia sp.,
Streblus macrophyllus,
Sumbaviopsis albicans,
Syzygium sp.,
Vatica cinerea,
Vatica sp.,
Xerospermum microcarpum.

Other genuine shrubby species form specific fraction of this stratum. Next species form this group of species:

Antidesma costulatum,
Antidesma sp.,
Arenga westerhoutii,
Baccaurea sp.,
Breynia sp.,
Calamus sp.,
Callicarpa sp.,
Calophyllum balansae,
Caryota sympetala,
Caryota sp.,
Clausena austroindica,
Dalbergia sp.,
Dendrocnide sp.,
Deutzianthus tonkinensis,
Diospyros rufogemmata,
Diospyros sp.,
Ficus sp.,
Flacourtia rukam,
Illicium cambodianum,
Lasianthus sp.,
Memecylon edule,
Miliusa sinensis,
Phyllanthus insularis,
Pittosporum pauciflorum,
Psychotria sp.,
Radermachera sp.,
Schefflera sp.,
Villebrunea integrifolia,
Wendlandia sp.

Herbaceous stratum includes herbs, sedges, ferns, undershrubs and small shrubs to 3(4) m tall forming projective coverage (10)20-80%. Species composition in this stratum is very rich and diverse. In humid lower parts of slopes wet- and shade-loving species dominate. At the same time in high rocky slopes, dry-lowing and lithophytic species become abundant. Wet-loving

species common on lower parts of slopes faced to shady canyons are listed below as follow:

Achyranthes sp.,
Aglaonema ovatum,
A. siamense,
Aglaonema sp.,
Alocasia longifolia,
A. macrorrhiza,
Alocasia sp.,
Alpinia sp.,
Amischotolype mollissima,
A. hookeri,
Amomum sp.,
Angiopteris cochinchinensis,
Ardisia silvestris,
Begonia acetosella,
Calanthe alismifolia,
C. odora,
Caryota maxima,
C. sympetala,
Corymborkis veratrifolia,
Costus tonkinensis,
Dichroa febrifuga,
Distichochlamys citrea,
Elatostema balansae,
E. scabra,
Elatostema spp.,
Geophila repens,
Goodyera fumata,
Homalonema occulta,
Impatiens sp.,
Laportea thorelli,
Lasianthus biflorus,
Liparis nervosa,
Mapania palustsis,
Miliusa sinensis,
Ophiorrhiza tonkinensis,
Ophiorrhiza sp.,
Pandanus sp.,
Pentaphragma sinense,
Pilea baviensis,
Pilea sp.,
Piper sp.,
Pollia secundiflora,
Rhaphidophora decursiva,
Schismatoglottis calyptrata,
Scindapsus sp.,
Selaginella sp.,
Strobilanthes sp.,
Tacca chantrieri,
Villebrunea integrifolia,
Xanthosoma sp.,
Zeuxine nervosa,
Zingiber zerumbet,
Zippelia begoniifolia.

Species composition in middle and particularly on high parts of mountain slopes is different. Most common species here are:

Allophylus viridis,
Amorphophallus spp.,
Ardisia colorata,
Ardisia spp.,
Arenga westerhoutii,
Aspidistra coccigera,
Aspidistra spp.,
Asplenium cardiophyllum,
A. ensiforme,
A. saxicola,
A. unilaterale,
Asplenium sp.,
Athyrium mackinnonii,
Begonia crassula,
Breynia sp.,
Calamus sp.,
Camellia sp.,
Campylotropis henryi,
Canthium sp.,
Carex indica,
Carex sp.,
Cheirostylis chinensis,
Chirita spp.,
Chloranthus spicatus,
Clinacanthus sp.,
Colysis digitata,
Dianella nemorosa,
Diplazium donianum,
Diplazium sp.,
Disporum trabeculatum,
Hedyotis acutangula,
H. biflora,
Hedyotis spp.,
Hypolytrum nemorum,
Impatiens verrucifer,
Ixora grandifolia,
Lasianthus chinensis,
Lasianthus spp.,
Lepisorus sp.,
Medinilla assamica,
Ophiopogon reptans,
Ophiopogon sp.,
Paraboea sp.,
Peliosanthes argenteostriata,
Peliosanthes sp.,
Pilea peltata,
Pleocnemia leuzeana,
Polystichum deltodon,
Polystichum sp.,
Pseudodracontium spp.,

Psychotria sarmentosa,
Psychotria spp.,
Pteris grevilleana,
Rhynchotechum ellipticum,
Rhynchotechum sp.,
Tectaria decurrens,
Tectaria spp.,
Tropidia angulosa,
T. curculigoides,
Tupistra theana,
Uvaria sp.

Seedlings and saplings of trees of highest forest strata are very common on any part of slopes. Often their portion may reach 20-30% of stratum density. These young plants form important basis of potential forest regeneration. Most commonly observed species from this group are:

Aglaia lawii,
Aglaia sp.,
Alangium ridleyi,
Albizia sp.,
Antidesma yunnanensis,
Antidesma sp.,
Aquilaria crassna,
Celtis sp.,
Cinnamomum sp.,
Claoxylon indicum,
Clausena austroindica,
Croton cascarilloides,
Caryota sp.,
Desmos sp.,
Deutzianthus tonkinensis,
Ficus hispida,
F. langkokensis,
Garcinia oblongifolia,
Gardenia sp.,
Gonocaryum sp.,
Grewia bulot,
Helicia obovatifolia,
Knema pierrei,
Litsea verticillata,
Litsea sp.,
Magnolia liliifera,
Mallotus sp.,
Microdesmis sp.,
Nephelium sp.,
Phyllanthus insularis,
Pinanga sp.,
Polyalthia jucunda,
Pometia pinnata,
Pterospermum sp.,
Sterculia hymenocalyx,
S. lanceolata,
Sterculia sp.,
Streblus macrophyllus,
Strychnos sp.,
Symplocos sumuntia,
Ternstroemia sp.,
Trevesia palmata,
Vatica cinerea,
Vitex sp.,
Wrightia macrocarpa,
Wrightia sp.,
Xerospermum microcarpum.

Sometimes on forest floor in studied area may be found very rare endemics of eastern Indochina like - *Anoectochilus calcareus, Aphyllorchis montana, Mischobulbum longiscapum* and *Rhomboda petelottii.*

Lichen and mosses cover (stratum) commonly less than 3 cm tall. It may reach 50(60)% of projective coverage, but almost in all cases is presented by juvenile and immature, unidentifiable densely adpressed to substratum lithophytes and xylophytes.

Non strata vegetation is rich, particularly on higher parts of slopes. It presented by genuine epiphytes, epiphytic creeping vines, lithophytes and different kinds of herbaceous and woody vines. Among them were observed following species:

Genuine herbaceous epiphytes:

Aglaomorpha coronans,
Asplenium nidus,
Bulbophyllum ambrosia,
B. delitescens,
B. retusiusculum,
B. salmoneum,
Bulbophyllum spp.,
Callostylis rigida,
Cleisostoma birmanicum,
C. racimiferum,
C. striatum,
C. williamsonii,
Coelogyne fimbriata,
Cymbidium dayanum,
Dendrobium aduncum,
D. spatella,
D. terminale,
D. truncatum,
Eria paniculata,
E. thao,
Eria sp.,
Flickingeria angustifolia,
F. fimbriata,
Gastrochilus sp.,
Huperzia carinata,
Kingidium deliciosum,
Liparis viridiflora,
Oberonia sp.,
Parapteroceras elobe,
Pyrrosia lanceolata,
P. lingua,
Thelasis pygmaea,
Thrixspermum centipeda,
Trichotosia pulvinata.

Epiphytic undershrubs and shrubs: *Aeschynanthus* spp., *Schefflera pauciflora*, *Schefflera* sp., *Vaccinium bullatum, V. dunalianum*.

Creeping epiphytic vines:

Arthropteris palisotii,
Colysis digitata,
Davallia repens,
Dischidia acuminata,
D. tonkinensis,
Dischidia sp.,
Epipremnum pinnatum,
Ficus pumila,
F. racemosa,
F. sagittata,
F. subulata,
F. tomentosa,
Hiepia corymbosa,
Hoya carnosa,
Hoya spp.,
Lemmaphyllum microphyllum,
Lomariopsis spectabilis,
Medinilla sp.,
Piper gymnostachyum,
Piper spp.,
Pothos grandis,
P. repens,
Scindapsus poilanei,
Scindapsus spp.,
Vandenboschia auriculata.

Lithophytic herbs and ferns:

Antrophyum callifolium,
Asplenium antrophioides,
A. unilaterale,
Asplenium sp.,
Begonia spp.,
Cleisostoma rostratum,
Diplazium esculentum,
Diplazium sp.,
Heterogonium sagenoides,
Laportea interrupta,
Loxogramme acrostichoides,
Paraboea sp.,
Primulina sp.,
Tectaria decurrens,
Thelypteris sp.

Woody vines (climbers) are usual and diverse in slope forests. Among them were specified next species:

Afgekia filipes,
Alyxia hainanensis,
Anamirta cocculus,
Artabotrys hexapelalus,
Bauhinia ornata,
B. oxysepala,
Bauhinia sp.,
Berchemia loureiriana,
Byttneria tortilis,
Caesalpinia sp.,
Calamus nilletii,
C. poilanei,
Combretum sundaicum,
Combretum sp.,
Connarus sp.,
Derris sp.,
Desmos sp.,
Entada phaseoloides,
Erythropalum scandens,
Fissistigma sp.,
Gnetum montanum,
Gnetum sp.,
Illigera rhodantha,
Illigera sp.,
Jasminum sp.,
Kadsura grandiflora,
Melodinus sp.,
Mussaenda bonii,
Radermachera sp.,
Rhaphidophora decursiva,
Secamone sp.,
Smilax corbularia,
Smilax sp.,
Stixis suaveolens,
Strychnos sp.,
Tetrastigma sp.,
Uncaria sp.,
Uvaria grandiflora,
Ventilago ochrocarpa.

Some of them, like - *Alyxia hainanensis, Jasminum* sp., *Melodinus* sp., *Smilax corbularia*, *Smilax* sp., *Stixis suaveolens* and *Uncaria* sp. are rather short and approximate to living form of climbing shrub. Some another species represent giant lianas to 40-45 m long with stems sometimes to 20 cm in diameter; stem of some species flat undulate to 30 cm wide. Largest vines observed in studied area are - *Anamirta cocculus*, *Afgekia filipes, Byttneria tortilis, Entada phaseoloides, Epipremnum pinnatum, Erythropalum scandens, Fissistigma* sp., *Gnetum montanum* and *Strychnos* sp.

Genuine herbaceous climbers are not common and may be found only in more or less open places, usually on rocky outcrops and on cliffs. Herbaceous vines observed here area - *Aristolochia contorta, Clematis uncinata*, *Stephania sinica*, *Stephania* sp. and *Trichosanthes* spp.

Available illustrative documentation of physiognomy, structure and species composition of described forest is presented in Annex 4-5, figures: 19, 20, 24-26, 44, 46-48, 51-54, 56-64, 67, 68, 70-72, 98, 99, 103-105, 110, 111, 115, 118, 119, 121, 122, 135-138, 141-143, 144, 162.

3.1.1.3a
Wind-formed and/or other specific modifications.
Closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on vertical and sub-vertical cliffs on crystalline highly eroded limestone at elev. 400-700 m a.s.l.

Forests of this type are observed on extra steep rocky slopes and on sub-vertical cliffs commonly with inclination to 80-90°. Their portion in forests studied in EA is very small. Such plant communities cover inaccessible cliffy portions of remnant karstic limestone mountain slopes, often bordered mountain tops or ridges edges (fig. 3-7). Their vertical structure, species composition and natural conditions are very similar to those found in short-tall forests on mountain tops, described in detail in following paragraph. Project coverage of all strata of cliff forests in primary conditions may reach 100%, but commonly much less. Exploration of these forests by description of model plots is difficult due to physical inaccessibility of habitats, particularly in rainy season. Their study is based on field observations and on collected voucher herbarium specimens (Annexes 1-5). Noticeable, that forests on extra steep slopes and on cliffs is alone plant community, which can retain their intact structure and composition of primary aboriginal species under deep anthropogenic degradation of limestone vegetation all over Vietnam. Very often, such forests represent last miserable fragments of primary vegetation covered vast areas in prehistoric ages.

3.1.1.3b
Wind-formed and/or other specific modifications.
Closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on rocky mountain tops on crystalline highly eroded limestone at elev. 400-700 m a.s.l.

Description of this kind of forests is based on extensive field observations and description of representative model plots № 3, 6, 12, as well as on collected voucher herbarium specimens (Annexes 1-5). Forests of mountain summits occupies not more than 2-3% of EA territory being inserted into matrix of primary forest that covers extensive area of mountain slopes. Like large archipelago composed with numerous small islands, they occupy very small-square rocky habitats on tops of mountains and narrow edges of ridges. Beside

miserable portion in total plant cover these forests have high specifity including many endemical species in all strata. Some species found here are strict endemics of very limited distribution. This is particularly true for epiphytic and lithophytic herbs abundant in top mountain forests.

Short-tall broad-leaved forests in EA were studied on mountain peaks with elevation 550-700 m a.s.l. In all cases, studied forest habitats were bordered by more or less high cliffs along their square perimeter. Meantime, mountain summits itself were rocky, but more or less flat with open rock outcrops (60)70-90(95)%. White to light gray solid, crystalline, marble like, highly eroded limestone is main kind of mother rocks in all observed area.

The leaf litter cover is actually absent on rocky forest floor. All fallen leaves here are accumulated in deep limestone pockets, caverns and crevices, where they form layer to 20-30 cm thick. This layer in some cases may reach even 1 m in depth. Fertile dark brown to nearly black humus rich-soils 20-50 cm thick are placed here below leaf litter layer. Such soil and drainage features form specific natural conditions necessary for growth of most woody and herbaceous species, characteristic for mountain top forest.

Vertical structure of short-tall mountain top forests (or woodlands) is much simpler than structure observed in forests on slopes. Usually communities here are composed by only 2 woody strata of trees and shrubs. Herbaceous and mosses/lichen strata commonly also well presented, but their coverage often not too high. In some cases, bamboo thickets also observed in form of short additional well pronounced stratum.

1 (canopy) forest stratum is composed by trees (4)6-10(12) m tall with DBH 10-25 cm. Nevertheless small dimensions, some trees here may be very old, as their growth on rocky limestone is commonly very slow. Projective coverage of this stratum varies from 10 to 40% and some cases may reach 70-80%. Most common species observed here as forest stratum co-dominants are listed below:

Abelia chinensis,
Adinandra sp.,
Antidesma bunius,
Ardisia sp.,
Beilschmiedia pergamentacea,
Calophyllum balansae,
C. dryobalanoides,
Campylotropis henryi,
Caryota maxima,
Cinnamomum sp.,
Diospyros sp.,
Garcinia oblongifolia,
Garcinia sp.,
Homalium phanerophlebium,
Hopea siamensis,
Illicium cambodianum,
Ixora cuneifolia,
Magnolia liliifera,
Memecylon edule,
Miliusa fusca,
Phoebe tavoyana,
Phyllanthus insularis,

Pistacia cucphuongensis, Pittosporum pauciflorum, Podocarpus neriifolius, Psychotria sp., *Radermachera* sp., *Sinosideroxylon wightianum, Styrax litseoides, Tirpitzia sinensis, Xerospermum microcarpum.*

As most common trees in top mountain forest in EA were specified such species as – *Abelia chinensis, Campylotropis henryi, Hopea siamensis* and *Pistacia cucphuongensis*. Specifity of canopy forest is fairly high. Some trees in EA occur only in this kind of habitat. Among them are such rare endemic and sub-endemic species as - *Abelia chinensis, Calophyllum balansae*, *C. dryobalanoides, Campylotropis henryi*, *Illicium cambodianum, Memecylon edule*, *Phyllanthus insularis, Pistacia cucphuongensis, Pittosporum pauciflorum, Sinosideroxylon wightianum* and *Tirpitzia sinensis.*

2 (shrub) stratum 2-4(5) m tall includes not too many species, but its projective coverage may reach 30-40 and even 60%. Saplings of trees of first stratum form essential portion of density. Mainly these young trees of such species as – *Calophyllum balansae*, *Campylotropis henryi, Garcinia oblongifolia*, *Hopea siamensis, Illicium cambodianum, Litsea* sp., *Memecylon edule, Pittosporum pauciflorum, Sinosideroxylon wightianum* and *Tirpitzia sinensis*. Genuine shrubs and undershrub include following species:

Alniphyllum sp., *Alstonia guanxiensis*, *Ardisia tinctoria, Ardisia* sp., *Brachytome wallichii, Brandisia glabrescens, Breynia* sp., *Callicarpa nudiflora*, *Capparis acutifolia, Desmos pedunculosus, Dracaena* sp., *Ficus* sp., *Glochidion pilosum*, *Glycosmis puberula, G. tricanthera, Glyptopelatum sclerocarpum*, *Homalium* sp., *Lasianthus* sp., *Psychotria sarmentosa, Psychotria* sp., *Rapanea neriifolia, Rhapis laosensis, Schefflera* sp., *Wikstroemia meyenianum.*

Very often, particularly in habitats damaged in the past by fire, more or less dense stratum of bamboo thicket 1-2 m tall present. In intact habitats bamboo regularly absent, but in mountain tops were vegetation was disturbed by fire, bamboo (unidentified in sterile state) forms, as a rule, very dense impassible thickets with projective coverage to 90%.

3 herbaceous stratum is presented by exclusively lithophytic herbs 5-100 cm tall. They survive here only in limestone pockets and rock crevices and form projected coverage only 5-10%. Nevertheless, their species composition

enough rich and include a number of local endemics. Among herbs in mountain-top forests were observed next species:

Aeschynanthus sp.,
Anoectochilus calcareus,
Antrophyum callifolium,
Ardisia spp.,
Aspidistra sp.,
Asplenium antrophioides,
Asplenium cardiophyllum,
A. tenuifolium,
A. thunbergii,
Begonia crassula,
Begonia sp.,
Campylotropis henryi,
Carex sp.,
Cheirostylis chinensis,
Colysis dissimilialata,
Cyclopeltis crenata,
Habenaria calcicola,
Hedyotis acutangula,
Impatiens verrucifer,
Nephelaphyllum tenuiflorum,
Ophiopogon reptans,
Ophiopogon sp.,
Ophiorrhiza sanguinea,
Ophiorrhiza sp.,
Piper albispicum,
Pseudodracontium sp.,
Pteris plumbea,
Rhomboda petelottii,
Selaginella sp.,
Tropidia curculigoides,
Tupistra theana.

Rocky habitats on mountain tops are rather dry and some herbaceous species here belong to true stem, or leaf succulents. Plant with juicy succulent leaves – like *Begonia crassula*, or herbs with bottle-like stems – like *Impatiens verrucifer*, gives to rocky outcrops characteristic desert appearance.

Lichen and mosses cover is weak and is presented by juvenile, unidentifiable densely adpressed lithophytes growing mainly on north faced rocks. Their total cover commonly much less than 10%.

Epiphytes in intact primary mountain-top short-tall forests reach their maximal abundance in studied area. Some of them grow here also as lithophytes on north faces cliffs, mainly at the base of old trees trunks. Species composition in this group is very rich and includes next species common in observed area:

Aglaomorpha coronans,
Appendicula hexandra,
Bulbophyllum ambrosia,
B. depressum,
B. hymenanthum,
B. retusiusculum,
B. salmoneum,
Bulbophyllum spp.,
Callostylis rigida,
Ceratostylis subulata,
Cleisostoma paniculatum,
C. striatum,
Coelogyne fimbriata,
Davallia repens,
Dendrobium aduncum,
D. nobile,
D. salaccence,
D. spatella,
D. terminale,
D. truncatum,
Epigeneium labuanum,
Eria paniculata,
E. pannea,
E. spirodela,
E. thao,
Eria sp.,
Flickingeria angustifolia,
F. fimbriata,
Hedyotis acutangula,
Lepisorus sp.,
Liparis pumila,
L. viridiflora,
Neocheiropteris phyllomanes,
Oberonia cavaleriei,
Ornithochilus difformis,
Panisea garrettii,

Parapteroceras elobe, Pholidota articulata, P. levelleana, P. yunnanensis, Phreatia plantaginifolia, Pyrrosia lanceolata, P. lingua, Schoenorchis gemmata, Taeniophyllum glandulosum, Thelasis pygmaea, Trichotosia pulvinata, Vaccinium dunalianum, Vittaria elongata.

Some epiphytic species grow here in great abundance, forming continue unbroken cover of rock outcrops and stems of old gnarled trees. Most usual species in this group are - *Appendicula hexandra, Ceratostylis subulata*, *Dendrobium spatella*, *D. terminale*, *D. truncatum, Eria spirodela*, *E. thao*, *Flickingeria angustifolia*, *F. fimbriata, Panisea garrettii*[1] *, Pholidota levelleana*, *P. yunnanensis*, *Pyrrosia lanceolata, P. lingua*, *Thelasis pygmaea* and *Vaccinium dunalianum*. Small creeping epiphytic vines like *Dischidia acuminata* and *D. tonkinensis* also allied to this group.

Small herbaceous and woody vines are not rare, but their participation in forest cover here is not significant. Among vines and climbers are most common such species as – *Alyxia hainanensis*, *Bauhinia ornata*, *Clematis uncinata*, *Clematis* sp., *Morinda officinalis*, *M. umbellata*, *Pottsia grandiflora, Secamone* sp. and *Ventilago* sp.

Among plants of unusual living forms are not rare parasitic canopy shrubs, mainly species of *Loranthus* sp.

Species composition of short-tall mountain-top forests are very characteristic and rich in aboriginal strictly endemic rare species. Three species found here during field assessment are found and described as new for science. They are – *Begonia crassula* (fig. 112-114), *Bulbophyllum salmoneum* (fig. 118, 119) and *Tupistra theana* (fig. 110, 111) named after team participant – MSc. Pham Van The (fig. 162).

It is noticeable that short-tall mountain-top communities were damaged in the past by anthropogenic or natural forest-fires in largest part of mountain tops and ridges edges observed in EA. Plant communities are presented by different stages of regeneration successions in such localities. They often appear in form of open scrub or woodlands. Regeneration of primary forest with full spectrum of aboriginal species composition after forest fire and soil degradation moves extremely slowly and needs hundreds and hundreds years. It is usual

[1] ***Panisea garrettii*** **(I.D.Lund) Aver., comb. nov.** (*Panisea tricallosa* var. *garrettii* I.D.Lund, 1987, Nordic Journ. Bot. 7: 524).

picture in any rocky limestone areas all over Vietnam (Averyanov et al., 2000). Lithophytic component is most sensitive, regeneration of which sometimes very problematic.

Available illustrative documentation of physiognomy, structure and species composition of described forest is presented in Annexes 4-5, figures: 2, 6, 7, 21, 22, 69, 73-77, 82-87, 89, 90, 100-102, 112-114, 116, 117, 120, 123-125, 127-130, 139.

3.1.2 SUBMONTANE

3.1.2.1
Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous forests (with *Dacrydium elatum* and *Dacrycarpus imbricatus*) on steep rocky slopes and on mountain tops on crystalline highly eroded limestone at elev. 700-800(900) m a.s.l.

It is provisionally accepted that submontane tropical forests spread in eastern Indochina, as well as in EA above nominal elevational belt at about 700-800 m a.s.l. (Averyanov et al., 2003a-c, 2004a). In studied area forest of this type covers summit mountain areas elevated higher than 700 m, hence their area in EA is rather limited and more or less fragmented with total square much less than 20% of the area. Submontane forests have structure similar to lowland forests, but species compositions here are fairly different. Climate conditions of submontane forests are more humid and essentially cooler. Numerous cool-loving and even temperate floristic elements are characteristic feature that brightly outline specifity of these woods.

Mixed and particularly coniferous forests are most characteristic and peculiar kind of vegetation in EA with very rich and peculiar species composition. Noticeable, that primary coniferous forests all over the world and in Indochina represent one of the most endangered vegetation kind, extinction of which has presently catastrophic character (Averyanov et al., 2000, 2005a, c, 2008; Nguyen Tien Hiep et al., 2004; Orlova, Averyanov, 2004). Coniferous forest on rocky limestone with domination of *Dacrydium elatum* and *Dacrycarpus imbricatus* has unique strictly endemic nature. These plant communities on rocky limestone firstly discovered in 1997 by Prof. Averyanov,

Prof. Phan Ke Loc and Dr. Nguyen Tien Hiep (voucher herbarium specimens - *VH 4810* and *VH 4811*) and shortly described later (Averyanov et al., 2005b) are typical for PNKBNP area and probably do not occur anywhere outside Quang Binh province.

Description of this kind of forest is based on field observations and description of representative model plots № 2, as well as on collected voucher herbarium specimens (Annexes 1-5).

Mixed and coniferous submontane forests were observed in EA on high part of steep mountain slopes and on summits of limestone mountains at elevation 750-800 m a.s.l. (plot № 2, field camp 1). Mountain rocks here composed by solid, marble-like gray limestone with outcrops 3-5%. Leaf litter with considerable portion of conifer needle-like leaves has 100% coverage and 5 to 10 cm depth, up to 30-40 cm thick in depressions. Upper soil horizon well structured, dark brown, to 10 cm in depth placed on fine limestone gravel 15-25 cm thick, deeper lies rough gravel bedded directly on solid limestone.

1 (canopy) stratum in mixed and coniferous forests is formed by broad-leaved and coniferous trees 25-30 m tall, 60-80 cm DBH. Main dominants here are – *Dacrydium elatum* (fig. 78-81), *Dacrycarpus imbricatus* and *Hopea siamensis*. Their projective coverage reaches 50%.

2 forest stratum includes trees 10-20 m tall with DBH 10-20 cm. Projective coverage of this stratum varies from 60 to 70%. Following species were observed as most common co-dominants in this stratum - *Archidendron clypearia, Camellia* sp., *Cinnamomum* sp., *Diospyros* sp., *Garcinia* sp., *Hopea siamensis, Magnolia* sp., *Podocarpus neriifolius, Symplocos* sp., as well as representatives of such families as -Euphorbiaceae, Fagaceae, Magnoliaceae, Rubiaceae and Theaceae.

3 (shrub) stratum 4-10 m tall has projective coverage 60-70%. It is rich and includes next commonly observed species:

Calophyllum balansae,	*Ficus variolosa,*	*Lithocarpus* sp.,
Calophyllum sp.,	*Garcinia* sp.,	*Magnolia* spp.,
Camellia lutescens,	*Glycosmis ovoidea,*	*Medinilla* sp.?,
Cinnamomum sp.,	*Illicium cambodianum*,	*Phoebe tavoyana*,
Diospyros sp.,	*Ixora* sp.,	*Podocarpus neriifolius,*
Enkianthus quinquiflorus,	*Lasianthus cyanocarpus,*	*Polyosma* sp.

Saplings of *Dacrycarpus imbricatus* and *Dacrydium elatum* commonly found in this stratum give evidence of natural regeneration of first forest storey.

4 (herbaceous) stratum includes herbs, undershrubs and juvenile plantlets 0.01-4 m tall with total projective coverage estimated as 20-40%. Terrestrial herbs, undershrubs and ferns are main dominants in this stratum. Most common species observed here are:

Acrorumohra diffracta,
Adiantum flabellulatum,
Alpinia sp.,
Alsophila podophylla,
Amorphophallus sp.,
Anemone poilanei,
Ardisia silvestris,
Ardisia sp.,
Aspidistra coccigera,
Asplenium ensiforme,
Asplenium sp.,
Begonia sp.,
Bolbitis appendiculata,
Calanthe alismifolia,
Carex indica,
Collabium chinense,
Cyclosorus truncatus,
Dianella nemorosa,
Disporum trabeculatum,
Dryopteris sparsa,
Hypolytrum nemorum,
Illicium cambodianum,
Lasianthus sp.,
Pandanus spp.,
Pentaphragma sinense,
Phyllagathis spp.,
Plagiogyria adnata,
Polygala sp.,
Polystichum grande,
Polystichum spp.,
Pteris vittata,
Rhomboda petelottii,
Selaginella sp.

Seedlings of woody species of highest strata are also common in this storey, among which were regularly observed - *Archidendron* sp., *Arenga westerhoutii*, *Calamus* sp., *Dacrycarpus imbricatus* and *Korthalsia* sp.

Stratum of mosses and lichens relatively well developed and covers about 5% of forest floor. Some moss species form on particularly steep slopes characteristic *Sphagnum*-like pillows 1-3 cm tall.

Epiphytes and epiphytic creeping vines are very common. Most usual here are:

Appendicula hexandra,
Asplenium nidus,
Belvisia annamensis,
Bulbophyllum ambrosia,
B. depressum,
B. retusiusculum,
Ceratostylis subulata,
Cleisostoma striatum,
Cymbidium dayanum,
Dendrobium spatella,
Eria paniculata,
E. thao,
Eria sp.,
Flickingeria angustifolia,
Pholidota chinensis,
Podochilus khasianum,
Pyrrosia lanceolata,
P. lingua,
Teratophyllum hainanense,
Trichomanes sp.,
Trichotosia pulvinata.

Lianas are rather uncommon. Regularly they are small short vines or juvenile samples of large woody climbers. Among species of this group were specified following species - *Entada phaseoloides, Piper* sp., *Psychotria serpens, Luvunga* sp., *Smilax* sp. and *Tetrastigma* sp.

It should be mentioned that main dominant of studied coniferous forests - *Dacrycarpus imbricatus* and *Dacrydium elatum* are reasonably regarded as vulnerable (A1cd and A2cd respectively) according to IUCN criteria (Nguyen Tien Hiep et al., 2004). Forests dominated with these species are globally endangered kind of primary vegetation desired priority in conservation actions.

Available illustrative documentation of physiognomy, structure and species composition of described forest is presented in Annex 4-5, figures: 23, 78-81, 88, 93, 94, 107, 126, 131-134.

3.1.2.1a
Wind-formed and/or other specific modifications.
Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous short-tall forests on vertical and subvertical cliffs on crystalline highly eroded limestone at elev. 700-800(900) m a.s.l.

Wind-formed and/or other specific modifications on subvertical cliffs were observed on extra steep slopes and cliffs of highest mountains in EA. Their preliminary studies are based on observations, but no any plots were described due to inaccessible character of these landforms. Domination or co-domination of conifer species are main specifity of these plant community. Projective coverage may be relatively low, but species composition is similar with conifer plant communities on rocky mountain tops, which are shortly mentioned below.

3.1.2.1b
Wind-formed and/or other specific modifications.
Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous short-tall forests on rocky mountain tops on crystalline highly eroded limestone at elev. 700-800(900) m a.s.l.

Wind-formed coniferous forest modifications on rocky mountain tops are rare in studied area. They were mentioned on the base of observations only. No model plot descriptions were made due to limited time for visiting of remote areas during rainy season. Coniferous wind form short tall forests cover highest

rocky inaccessible tops of remnant limestone mountains bordered commonly by high vertical cliffs. Such plant communities were shortly described earlier (Averyanov et al., 2005b). As main coniferous dominants observed in the area were *Dacrydium elatum, Dacrycarpus imbricatus* and strictly endemic - *Calocedrus rupestris*. Great abundance of epiphytic and lithophytic aboriginal endemic species, particularly ferns and orchids are very characteristic feature of these plant communities. Coniferous short tall mountain top forests are most rich in species critically globally endangered kind of plant community. Unfortunately, limited time and rainy weather provide no conditions of their detailed study during field work session. Shortly this unique kind of vegetation was described earlier (Averyanov et al., 2005b).

3.2 AZONAL PRIMARY KINDS OF PLANT COMMUNITIES

3.2.1
Riparian riverine shrub and herbaceous communities on swampy and rocky steam/river valleys

This kind of vegetation is poor presented in studied area due to torrential character of water regime in streams and small rivers that straightly follow to amount of rainy precipitation (see climate diagram, page 16). In period from September to December water level dramatically increase. All sparse plants inhabited river beds appear at this time flooded. Regular inundation is very strong limited factor decreasing plant diversity of such habitats.

3.2.2
Aquatic riverine aquatic herbs communities on steams and rivers

Due to torrential character of water regime in streams and small rivers aquatic plants are very rare and includes few poorly developed plantlets not desirable for special study.

3.3 SECONDARY PLANT COMMUNITIES

Intact primary forests in proximity to inhabited regions, agricultural field, roads, farms and any explored areas replaced by more or less disturbed and secondary plant communities that represent different stages of successive degradation of aboriginal forests described above. Mentioned below plant communities are common in studied area. However, they were not subject of detailed study in present survey.

3.3.1
Open medium and highly disturbed primary forests

Very usual modification commonly observed on perimeter of any inhabited territory. Cutting of large trees with high quality timber is main disturbing factor of forest structure during initial stage of forest degradation. Usually this process eliminates first (canopy) forest stratum, but species composition on this stage remain very rich, actually not differing from species spectrum of intact primary forest. This kind of the forest is very common in EA.

3.3.2
Rich secondary forests and woodlands

Also very common modification observed everywhere in EA near inhabited areas. It is characterized by replacing of aboriginal native trees of highest forest strata by fast growing woody species, which often not typical for intact primary wood. Species composition remains rich.

3.3.3
Poor secondary forests and woodlands

Further degradation of aboriginal forest is observed everywhere in EA in conditions of increasing of anthropogenic pressure. The elimination of almost all timber trees by cutting, leads to more or less fast growth of both aboriginal and allochtonous elements. Forest structure and species composition become poorer and more and more different from aboriginal species spectrum. The

increasing of anthropogenic pressure commonly stops forest regeneration and leads to succeeded it degradation into scrub communities.

3.3.4
Closed and open secondary scrubs

Pasturing is usual widespread additional factor of forest degrading into closed and open scrub. Scrub plant communities are very common along roads and in vicinities of villages in studied area. They commonly appear as vast pasturelands with numerous shrubby species. Under permanent pasturing this is climax plant community. Forest usually does not regenerate under these conditions. Species composition may be enough rich, but taxonomic spectrum dramatically differs from species composition of primary forest. Large portion here have introduced, exotic and adventive species alien to aboriginal flora.

3.3.5
Secondary herbaceous communities and grasslands

Secondary herbaceous communities and grasslands are final climax stage of vegetation degradation. Such communities are also common in inhabited areas associated with studied EA. Aboriginal plants have miserable portion in such communities. Exotic aggressive weed species have absolute domination here. All they need no any protection.

Schematic results of distribution of most significant selected kinds of vegetation observed in EA of PNKBNP are presented in map 2 (Annex 5).

4. BRIEF DESCRIPTION OF THE FLORA OBSERVED IN THE STUDIED AREA

4.1. Higher vascular plant diversity in the Phong Nha – Ke Bang National Park and the extended area

In modern geography Phong Nha – Ke Bang National Park area and allied territories belong to the Truong Son Geomorphologic Region (named sometime as Annamite eco-region) and in plant geography represent integral part of North Indochinese floristic province of Indochinese floristic Region of Indomalesian Subkingdom of Paleotropical Realm (Averyanov et al., 2003a, b, 2004a). In this connection, current investigation outlines studied EA as an area with typical limestone aboriginal flora of eastern Indochina. Such primary floras are characterized by very rich species composition with large portion of endemic and sub-endemic species (Averyanov et al., 2003a, b, 2004a, 2005b, d). The diversity of vegetation and habitat types causes outstanding plant diversity at PNKBNP. Preliminary surveys of the botanical diversity of PNKBNP have been less than comprehensive (Le Xuan Canh et al., 1997; Cao Van Sung, Le Quy An, 1998; Timmins et al., 1999; http://www.phongnhatours..., etc.). Nevertheless, preliminary results indicate here at least 193 families, 906 genera and 2651 plant species (http://www.phongnhatours...). Actually, local flora of PNKBNP and allied areas is certainly much richer than comparable protected areas due to still remaining numerous remnants of primary forests. At least orchid flora, according to documentary reported species in PNKBNP twice richer than in such comparable protected areas (Averyanov et al., 2005d; Averyanov, Averyanova, 2006). On the base on indirect data it should comprise about 300-350 species (Averyanov, 1994, 2008, 2010, 2011; Averyanov, Averyanova, 2003, 2006). Regularly, the orchids represent in primary nucleus of aboriginal floras of central Vietnam about 8-10% of all vascular plants. Following this extrapolation total local flora of PNKBNP should include at least 2500-3000 species of ferns, gymnosperms and flowering plants. Meanwhile, acceptable inventory of flora needs systematic professional long-term work in the area connected with extensive field exploration, herbarium collecting and well managing of herbarium collections for professional studies of taxonomists of high qualification. At the same time, even fragmentary reconnaissance field

surveys bring numerous discoveries, which essentially expand our knowledge on the flora. Following table give data about new additions in the family Orchidaceae to the flora of PNKBNP and EA based on materials of present survey.

Table.
New documented additions in the family Orchidaceae to the flora of Phong Nha – Ke Bang National Park and allied territory on the base of present survey

I – presence of species (marked with +) recorded in earlier surveys (Averyanov et al., 2005b); **II** - presence of species (marked with +) recorded in current survey; **III** – status of species according to IUCN criteria (IUCN…, 2009, 2010).

Orchid name	I	II	III
Acampe rigida	+	-	LC
Acriopsis indica	+	-	VU
Aerides crassifolia	+	-	VU
A. odorata	+	-	VU
A. rosea	+	-	VU
Anoectochilus annamensis	-	+	VU
A. calcareus	+	+	VU
A. roxburghii	+	-	VU
Aphyllorchis montana	-	+	EN
Apostasia odorata	+	-	LC
A. wallichii	-	+	NT
Appendicula cornuta	+	-	LC
A. hexandra	+	+	NT
Biermannia calcarata	+	+	NT
Bulbophyllum ambrosia	+	+	LC
B. arcuatilabium	+	-	DD
B. astelidum	+	-	DD
B. clandestinum	+	-	VU
B. delitescens	-	+	LC
B. depressum	-	+	NT
B. hymenanthum	-	+	NT
B. insulsum	+	-	LC
B. longiflorum	+	-	LC
B. macraei	+	-	LC
B. macranthum	+	+	LC
B. retusiusculum	+	+	NT
B. salmoneum	-	+	LC
B. tixieri	+	-	LC
Calanthe alismifolia	+	+	LC
C. lyroglossa	+	-	LC
C. odora	-	+	NT
C. triplicata	+	-	LC
Callostylis rigida	+	+	LC
Ceratostylis subulata	+	+	NT
Cheirostylis chinensis	-	+	LC
C. yunnanensis	+	-	LC
Chiloschista trudelii	+	-	EN
Cleisostoma birmanicum	+	+	NT
C. melanorachis	+	-	LC
C. paniculatum	+	-	LC
C. rostratum	+	-	LC
C. simondii	+	-	VU
C. striatum	+	+	NT
C. williamsonii	+	-	LC
Collabium chinense	+	+	NT
Corymborkis veratrifolia	+	+	NT
Cymbidium aloifolium	+	-	LC
C. atropurpureum	+	-	EN
C. cyperifolium	-	+	DD
C. dayanum	+	-	LC
C. ensifolium	+	-	LC
C. lancifolium	+	-	LC
C. sinense	+	-	LC
Cyrtosia nana	-	+	EN
Dendrobium aduncum	-	+	NT
D. anosmum	+	-	DD

D. cariniferum	+	-	**VU**
D. hercoglossum	+	-	**VU**
D. loddigesii	+	-	**VU**
D. nobile	+	+	**NT**
D. salaccense	+	+	**NT**
D. spatella	+	+	**LC**
D. terminale	+	+	**LC**
D. thyrsiflorum var. munutiflorum	-	+	**NT**
D. thyrsiflorum var. thyrsiflorum	+	+	**NT**
D. truncatum	+	+	**LC**
Epigeneium labuanum	+	-	**LC**
Eria boniana	+	-	**LC**
E. corneri	+	-	**LC**
E. gagnepainii	+	-	**VU**
E. globulifera	+	-	**LC**
E. lasiopetala	+	+	**LC**
E. paniculata	+	+	**LC**
E. pannea	+	+	**LC**
E. pusilla	+	-	**VU**
E. siamensis	+	-	**LC**
E. spirodela	+	+	**NT**
E. thao	+	+	**NT**
E. tomentosa	-	+	**NT**
Erythrodes hirsuta	-	+	**LC**
Flickingeria angustifolia	+	+	**LC**
F. fimbriata	+	+	**LC**
Galeola nudiflora	+	+	**NT**
Gastrochilus acutifolius	+	+	**NT**
G. calceolaris	+	+	**NT**
G. hainanensis	+	-	**VU**
Goodyera foliosa	+	-	**LC**
G. fumata	+	+	**LC**
G. hispida	+	+	**VU**
G. procera	+	-	**LC**
G. viridiflora	+	-	**NT**
Habenaria calcicola	-	+	**VU**
H. ciliolaris	+	-	**LC**
Hetaeria anomala	+	-	**VU**
Hygrochilus parishii	+	-	**VU**
Kingidium deliciosum	+	+	**LC**
Liparis aurita	+	-	**EN**
L. averyanoviana	+	-	**NT**
L. bootanensis	+	-	**LC**
L. dendrochiloides	+	-	**NT**
L. distans	+	+	**LC**
L. elliptica	+	-	**LC**
L. latilabris	+	-	**LC**
L. mannii	+	-	**LC**
L. nervosa	+	-	**LC**
L. nigra	-	+	**NT**
L. petelotii	+	-	**VU**
L. petraea	+	-	**VU**
L. pumila	+	+	**NT**
L. stricklandiana	+	-	**LC**
L. tixieri	+	-	**DD**
L. viridiflora	+	+	**LC**
Ludisia discolor	+	-	**LC**
Malaxis ophridis	+	-	**LC**
Malleola seidenfadenii	+	-	**VU**
Micropera poilanei	+	-	**VU**
Miguelia somai	+	-	**NT**
Mischobulbum cordifolium	+	-	**NT**
M. longiscapum	+	+	**VU**
Nephelaphyllum tenuiflorum	+	+	**NT**
Nervilia aragoana	+	-	**NT**
N. muratana	+	+	**NT**
Neuwiedia balansae	+	-	**VU**
Oberonia cavaleriei	+	+	**VU**
O. kwangsiensis	+	+	**VU**
Odontochilus elwesii	+	+	**VU**
Ornithochilus difformis	+	-	**LC**
Panisea albiflora	+	-	**VU**
P. garrettii	-	+	**VU**
P. tricallosa	+	-	**LC**
Paphiopedilum concolor	+	-	**EN**
P. dianthum	+	-	**EN**
P. malipoense	+	-	**EN**
Parapteroceras elobe	+	+	**VU**
Phaius flavus	+	+	**NT**
P. mishmensis	+	-	**VU**
Phalaenopsis gibbosa	+	-	**CR**
Pholidota articulata	+	-	**LC**
P. chinensis	+	+	**NT**
P. imbricata	+	-	**VU**
P. levelleana	-	+	**NT**
P. rubra	+	-	**LC**

P. yunnanensis	+	-	**LC**
Phreatia plantaginifolia	+	+	**VU**
Podochilus khasianus	+	+	**VU**
Polystachya concreta	+	-	**VU**
Pomatocalpaspicatum	+	-	**VU**
Pteroceras simondianum	+	-	**EN**
Renanthera coccinea	+	-	**LC**
Rhomboda petelottii	+	+	**VU**
R. tokioi	+	-	**DD**
Rhynchostylis giganthea	+	-	**EN**
Robiquetia spathulata	+	-	**VU**
Schoenorchis gemmata	+	+	**NT**
Staurochilus fasciatus	+	-	**VU**
Taeniophyllum glandulosum	+	+	**VU**
Tainia hongkongensis	+	-	**VU**
T. latifolia	+	-	**LC**

T. pauciflora	+	-	**VU**
Thecopus maingayi	+	-	**EN**
Thecostele alata	+	-	**VU**
Thelasis khasiana	+	-	**LC**
T. pygmaea	+	+	**NT**
Thrixspermum calceolus	+	-	**VU**
T. centipeda	+	+	**NT**
T. fleuryi	+	-	**VU**
T. formosanum	+	-	**VU**
T. fragrans	+	-	**VU**
T. pauciflora	+	-	**VU**
Trichotosia pulvinata	+	+	**NT**
Tropidia angulosa	+	+	**LC**
Tropidia curculigoides	+	+	**LC**
Vanda pumila	+	-	**VU**
Vrydagzynea albida	+	-	**LC**
Zeuxine nervosa	+	+	**LC**
Z. parvifolia	+	-	**LC**

As we can see from table, 20 species of orchids were recorded in present survey for PNKBNP area for the first time (their names are marked in table with pink shading). They are:

Anoectochilus annamensis,
Aphyllorchis montana,
Apostasia wallichii,
Bulbophyllum delitescens,
B. depressum,
B. hymenanthum,
B. salmoneum,
Calanthe odora,
Callostylis rigida,
Cheirostylis chinensis,
Cymbidium cyperifolium,
Cyrtosia nana,
Dendrobium aduncum,
D. thyrsiflorum var. munutiflorum,
Eria tomentosa,
Erythrodes hirsuta,
Habenaria calcicola,
Liparis nigra,
Panisea garrettii,
Pholidota levelleana.

Among them 5 species belong to categories vulnerable and endangered. They are - *Anoectochilus annamensis* (VU), *Aphyllorchis montana* (EN), *Cyrtosia nana* (EN), *Habenaria calcicola* (VU) and *Panisea garrettii* (VU).

54 orchid species were recorded both in earlier and in current survey (their names are marked in table with green-blue shading). These species are documentary specified in both PNKBNP and in EA territories. These species are:

Anoectochilus calcareus,
Appendicula hexandra,
Biermannia calcarata,
Bulbophyllum ambrosia,
B. macranthum,
B. retusiusculum,
Calanthe alismifolia,
Ceratostylis subulata,
Cleisostoma birmanicum,
C. striatum,
Collabium chinense,
Corymborkis veratrifolia,
Dendrobium nobile,
D. salaccense,
D. spatella,
D. terminale,
D. thyrsiflorum,
D. truncatum,
Eria lasiopetala,
E. paniculata,
E. pannea,
E. spirodela,
E. thao,
Flickingeria angustifolia,
F. fimbriata,
Galeola nudiflora,
Gastrochilus acutifolius,
G. calceolaris,
Goodyera fumata,
G. hispida,
Kingidium deliciosum,
Liparis distans,
L. pumila,
L. viridiflora,
Mischobulbum longiscapum,
Nephelaphyllum tenuiflorum,
Nervilia muratana,
Oberonia cavaleriei,
O. kwangsiensis,
Odontochilus elwesii,
Parapteroceras elobe,
Phaius flavus,
Pholidota chinensis,
Phreatia plantaginifolia,
Podochilus khasianus,
Rhomboda petelottii,
Schoenorchis gemmata,
Taeniophyllum glandulosum,
Thelasis pygmaea,
Thrixspermum centipeda,
Trichotosia pulvinata,
Tropidia angulosa,
Tropidia curculigoides,
Zeuxine nervosa.

Among them 11 species belong to category - vulnerable. These species widely spreading both in PNKBNP and in EA areas are – *Anoectochilus calcareus, Goodyera hispida, Mischobulbum longiscapum, Oberonia cavaleriei, O. kwangsiensis, Odontochilus elwesii, Parapteroceras elobe, Phreatia plantaginifolia, Podochilus khasianus, Rhomboda petelottii* and *Taeniophyllum glandulosum.*

103 species discovered in PNKBNP in previous documented assessment (Averyanov et al., 2005b) were not found during field work in studied EA (their names are marked in table with yellow shading). Most remarkable species of this group are vulnerable, endangered and critically endangered species. They are listed below:

Acriopsis indica (VU),
Aerides crassifolia (VU),
A. odorata (VU),
A. rosea (VU),
Anoectochilus roxburghii (VU),
Bulbophyllum clandestinum (VU),
Chiloschista trudelii (EN),
Cleisostoma simondii (VU),
Cymbidium atropurpureum (EN),
Dendrobium cariniferum (VU),
D. hercoglossum (VU),
D. loddigesii (VU),
Eria gagnepainii (VU),
E. pusilla (VU),

Gastrochilus hainanensis (VU),
Hetaeria anomala (VU),
Hygrochilus parishii (VU),
Liparis aurita (EN),
L. petelotii (VU),
L. petraea (VU),
Malleola seidenfadenii (VU),
Micropera poilanei (VU),
Neuwiedia balansae (VU),
Panisea albiflora (VU),
Paphiopedilum concolor (EN),
P. dianthum (EN),
P. malipoense (EN),
Phaius mishmensis (VU),
Phalaenopsis gibbosa (CR),
Pholidota imbricata (VU),
Polystachya concreta (VU),
Pomatocalpa spicatum (VU),
Pteroceras simondianum (EN),
Rhynchostylis giganthea (EN),
Robiquetia spathulata (VU),
Staurochilus fasciatus (VU),
Tainia hongkongensis (VU),
T. pauciflora (VU),
Thecopus maingayi (EN),
Thecostele alata (VU),
Thrixspermum calceolus (VU),
T. fleuryi (VU),
T. formosanum (VU),
T. fragrans (VU),
T. pauciflora (VU),
Vanda pumila (VU).

Most of these species are rare endemics and sub-endemics of Indochina. Largest part of them was not found in EA due to limited time of field exploration and rainy weather that give no opportunity study of numerous mountain tops where rare orchids grow. Largest part of mentioned species certainly occurs in EA territory.

Among most significant species discovered in EA during field works were presented following “key groups”, namely plants that have particular value for economy and science. Below we recognize these groups as – groups of taxonomically distinct species that has particular significance in plant geography (including endemic, sub-endemic species and species recently discovered and described in the area as a new for science), nature protection (including NT, VU, EN and CR species according to IUCN criteria and species mentioned in CITES appendices), species mentioned in Vietnam Red Data Book (Part II: Plants- 2007) and in Government Decree No 32/2006/ND-CP on the management of threatened plant and animal species, species - indicators of primary habitat richness and species valuable in economy (timber trees, medicinal, ornamental plants, species with edible fruits and leaves). These species are commonly regarded as priorital group for detailed study in short botanical surveys. Below we present these group based on collected voucher specimens.

Key group 1.
List of species cited in Vietnam Government Decree No 32/2006/ND-CP

Aristolochiaceae
Asarum wulingense C.F.Liang.
Cephalotaxaceae
Cephalotaxus mannii Hook.f.
Ebenaceae
Diospyros mun A.Chev. ex H.Lec.
Orchidaceae
Anoectochilus calcareus Aver.,
Dendrobium nobile Lindl.,
Nervilia muratana S.W. Gale & S.K.Wu.

Key group 2.
List of species included in Vietnam Red Data Book, Part II: Plants (2007)

Balanophoraceae
Balanophora laxiflora Hemsl.
Cephalotaxaceae
Cephalotaxus mannii Hook.f.
Ebenaceae
Diospyros mun A.Chev. ex H.Lec.
Magnoliaceae
Magnolia dandyi Gagnep.
Myrsinaceae
Ardisia gigantifolia Stapf.
Orchidaceae
Anoectochilus calcareus Aver.,
Dendrobium nobile Lindl.,
Eria spirodela Aver.
Trilliaceae
Paris polyphylla Sm.

Key group 3.
List of species - endemics of Indochina Peninsula

Acanthaceae
Phlogacanthus annamensis R.Ben.
Anacardiaceae
Allospondias lakonensis (Pierre) Stapf.
Annonaceae
Mitrephora thorelii Pierre,
Polyalthia intermedia (Pierre) Ban,
P. jucunda (Pierre) Finet & Gagnep.,
Uvaria dac Pierre ex Finet & Gagnep.
Apocynaceae
Dischidia tonkinensis Cost.
Arecaceae
Pinanga annamensis Magalon,
Rhapis laosensis Becc.
Clusiaceae
Calophyllum balansae Pit.
Convallariaceae
Disporum trabeculatum Gagnep.
Costaceae
Costus tonkinensis Gagnep.
Ebenaceae
Diospyros choboensis H.Lec.,
D. lobata Lour.,
D. rufogemmata H.Lec.
Fabaceae
Archidendron tetraphyllum (Gagnep.) I.Niels.,
Bauhinia oxysepala Gagnep.
Gleditsia pachycarpa Balansa ex Gagnep.
Zenia insignis Chun.
Flacourtiaceae
Hydnocarpus annamensis (Gagnep.) Lesc. & Sleum.

Hamamelidaceae
Altingia siamensis Craib.
Illiciaceae
Illicium cambodianum Hance.
Lardizabalaceae
Stauntonia cavaleriana Gagnep.
Lauraceae
Cryptocarya annamensis Allen.
Magnoliaceae
Magnolia dandyi Gagnep.
Marattiaceae
Angiopteris cochinchinensis de Vriese.
Orchidaceae
Dendrobium thyrsiflorum var. *minutiflorum* Aver.,
Liparis nigra Seidenf.,
Panisea garrettii (I.D.Lund) Aver.,
Pholidota chinensis Lindl.
Polygalaceae
Polygala tonkinensis Chodat
Polypodiaceae s.l.
Belvisia annamensis (C.Chr.) Tagawa,
Cyclosorus balansae Ching.
Ranunculaceae
Anemone poilanei Gagnep.
Rhamnaceae
Berchemia loureiriana H.Lec.,
Rhamnella tonkinensis (Pit.) Miyasake
Rubiaceae
Gardenia annamensis Pit.,
Ixora krewanhensis Pierre ex Pit.,
Ophiorrhiza tonkinensis Pit.,
Pavetta annamensis Pit.
Rutaceae
Glycosmis ovoidea Pierre,
G. tricanthera Guill.
Sapindaceae
Xerospermum microcarpum Pierre.
Sterculiaceae
Byttneria tortilis Gagnep.
Styracaceae
Styrax litseoides J.E.Vidal.
Thymelaeaceae
Aquilaria crassna Pierre ex H.Lec.
Tiliaceae
Grewia bulot Gagnep.
Urticaceae
Elatostema balansae Gagnep.,
Pilea baviensis Gagnep.

Key group 4.
List of species - local Vietnamese endemics

Anacardiaceae
Pistacia cucphuongensis Dai & Yakovlev.
Apocynaceae
Hiepia corymbosa Pham V.T. & Aver.,
Hoya lockii The P.V. & Aver.
Begoniaceae
Begonia crassula Aver.
Convallariaceae
Aspidistra coccigera Aver. & Tillich,
Peliosanthes argenteostriata Aver. & N.Tanaka,
Tupistra theana Aver. & N. Tanaka.
Ebenaceae
Diospyros mun A.Chev. ex H.Lec.
Nyssaceae
Diplopanax vietnamensis Aver. & H.T.Nguyen.
Orchidaceae
Anoectochilus annamensis Aver.,
A. calcareus Aver.,
Biermannia calcarata Aver.,
Bulbophyllum salmoneum Aver. & J.J.Verm.,
Cyrtosia nana (Rolfe ex Downie) Garay,
Eria spirodela Aver.,
E. thao Gagnep.,
Habenaria calcicola Aver.,
Liparis pumila Aver.,

Mischobulbum ovifolium (Tsi & S.C.Chen) Aver.,
Nervilia muratana S.W.Gale & S.K.Wu,
Oberonia cavaleriei Finet,
O. kwangsiensis Seidenf.,
Pholidota levelleana Schltr.,
Rhomboda petelottii (Gagnep.) Ormerod.

Key group 5.
List of new and recently described species

Apocynaceae
Hiepia corymbosa Pham V.T. & Aver.,
Hoya lockii The P.V. & Aver.
Begoniaceae
Begonia crassula Aver.
Convallariaceae
Aspidistra coccigera Aver. & Tillich,
Peliosanthes argenteostriata Aver. & N.Tanaka.
Tupistra theana Aver. & N.Tanaka.
Orchidaceae
Bulbophyllum salmoneum Aver. & J.J.Verm.,
Dendrobium thyrsiflorum Rchb.f. var. *minutiflorum* Aver.,
Habenaria calcicola Aver.

Key group 6.
List of species newly recorded for the flora of Vietnam

Flacourtiaceae
Homalium phanerophlebium How & Ko.
Oleaceae
Fraxinus griffithii C.B.Clarke.
Rhamnaceae
Ventilago ochrocarpa Pierre.
Rubiaceae
Lasianthus biflorus (Blume) M.Gangop. & Chakrab.

Key group 7.
List of plant species, which meet IUCN criteria as near threatened species

Actinidiaceae
Actinidia latifolia.
Apocynaceae
Alstonia guanxiensis.
Araliaceae
Heteropanax fragrans.
Aristolochiaceae
Aristolochia contorta.
Asarum wulingense.
Balanophoraceae
Balanophora laxiflora.
Begoniaceae
Begonia crassula.
Campanulaceae
Campanumoea celebica.
Caprifoliaceae
Abelia chinensis.
Clusiaceae
Calophyllum balansae,
Garcinia oblongifolia.
Convallariaceae
Disporopsis longifolia,
Disporum trabeculatum.
Dryopteridaceae
Teratophyllum hainanense.
Ericaceae

Enkianthus quinqueflorus,
Vaccinium bullatum,
V. dunalianum.

Euphorbiaceae

Phyllanthus insularis.

Fabaceae

Campylotropis henryi.

Hamamelidaceae

Altingia siamensis.

Hymenophyllaceae

Vandenboschia auriculata.

Illiciaceae

Illicium cambodianum.

Linaceae

Tirpitzia sinensis.

Lomariopsidaceae

Lomariopsis spectabilis.

Lycopodiaceae

Huperzia carinata,
H. hamiltonii,
H. phlegmaria.

Magnoliaceae

Kmeria septentrionalis.

Malvaceae

Hibiscus grewiifolius.

Nyssaceae

Diplopanax vietnamensis.

Oleaceae

Fraxinus griffithii.

Orchidaceae

Apostasia wallichii,
Appendicula hexandra,
Biermannia calcarata,
Bulbophyllum depressum,
B. hymenanthum,
B. retusiusculum,
Calanthe odora,
Ceratostylis subulata,
Cleisostoma birmanicum,
C. striatum,
Collabium chinense,
Corymborkis veratrifolia,
Dendrobium aduncum,
D. nobile,
D. salaccense,
D. thyrsiflorum,
D. thyrsiflorum var. minutiflorum,
Eria spirodela,
E. thao,
E. tomentosa,
Galeola nudiflora,
Gastrochilus calceolaris,
Liparis nigra,
L. pumila,
Mischobulbum cordifolium,
Nephelaphyllum tenuiflorum,
Nervilia muratana,
Phaius flavus,
Pholidota chinensis,
P. levelleana,
Schoenorchis gemmata,
Thelasis pygmaea,
Thrixspermum centipeda,
Trichotosia pulvinata,

Pittosporaceae

Pittosporum pauciflorum.

Plagiogyriaceae

Plagiogyria adnata.

Podocarpaceae

Dacrycarpus imbricatus,
Dacrydium elatum,
Podocarpus neriifolius.

Primulaceae

Lysimachia insignis.

Ranunculaceae

Anemone poilanei.

Sapindaceae

Nephelium chryseum,
Xerospermum microcarpum.

Sapotaceae

Sinosideroxylon wightianum.

Schisandraceae

Kadsura grandiflora.

Tectariaceae

Arthropteris palisotii,
A. repens.

Thymelaeaceae

Wikstroemia meyenianum.

Tiliaceae

Burretiodendron brilletii.

Trilliaceae

Paris polyphylla.

Key group 8.
List of plant species, which meet IUCN criteria as vulnerable species

Aspleniaceae
Asplenium cardiophyllum,
A. tenuifolium.
Cephalotaxaceae
Cephalotaxus mannii.
Convallariaceae
Tupistra theana.
Orchidaceae
Anoectochilus annamensis,
A. calcareus,
Goodyera hispida,
Mischobulbum ovifolium,
Oberonia cavaleriei,
O. kwangsiensis,
Odontochilus elwesii,
Panisea garrettii,
Parapteroceras elobe,
Phreatia plantaginifolia,
Podochilus khasianum,
Rhomboda petelottii,
Taeniophyllum glandulosum.

Key group 9.
List of plant species, which meet IUCN criteria as endangered species

Apocynaceae
Hiepia corymbosa,
Hoya lockii.
Orchidaceae
Aphyllorchis montana,
Cyrtosia nana.

Key group 10.
Species, which meet IUCN criteria as critically endangered species

Ebenaceae
Diospyros mun.

Key group 11.
List of species - indicators of high primary habitats diversity

Anacardiaceae
Pistacia cucphuongensis.
Annonaceae
Polyalthia jucunda.
Apocynaceae
Alstonia guanxiensis.
Arecaceae
Rhapis laosensis.
Aspleniaceae
Asplenium cardiophyllum,
A. tenuifolium.
Begoniaceae
Begonia crassula.
Caprifoliaceae
Abelia chinensis.
Cephalotaxaceae
Cephalotaxus mannii.
Convallariaceae
Peliosanthes argenteostriata,
Tupistra theana.
Dipterocarpaceae
Dipterocarpus hasseltii,
D. retusus,
Hopea siamensis,
Vatica cinerea.
Ebenaceae
Diospyros mun.
Elaeocarpaceae
Sloanea sigun.
Ericaceae
Enkianthus quinqueflorus,
Vaccinium bullatum,
V. dunalianum.
Euphorbiaceae
Phyllanthus insularis.
Fabaceae

Archidendron tetraphyllum,
Campylotropis henryi,
Gleditsia pachycarpa.

Fagaceae

Lithocarpus pseudoreinwardtii,
Quercus acutissima,
Q. rupestris.

Hamamelidaceae

Altingia siamensis.

Illiciaceae

Illicium cambodianum.

Lardizabalaceae

Stauntonia cavaleriana.

Lauraceae

Cryptocarya annamensis.

Linaceae

Tirpitzia sinensis.

Lythraceae

Lagerstroemia ovalifolia.

Magnoliaceae

Michelia gioi.

Meliaceae

Aglaia lawii,
Dysoxylum loureirii,
D. mollissimum.

Myristicaceae

Knema pierrei.

Myrsinaceae

Ardisia gigantifolia.

Nyssaceae

Diplopanax vietnamensis.

Oleaceae

Fraxinus griffithii.

Orchidaceae

Anoectochilus annamensis,
A. calcareus,
Apostasia wallichii,
Appendicula hexandra,
Bulbophyllum delitescens,
Calanthe alismifolia,
C. odora,
Ceratostylis subulata,
Cleisostoma birmanicum,
C. striatum,
Collabium chinense,
Corymborkis veratrifolia,
Dendrobium nobile,
Eria spirodela,
E. thao,
Flickingeria angustifolia,
F. fimbriata,
Goodyera hispida,
Liparis distans,
Mischobulbum cordifolium,
M. ovifolium,
Nephelaphyllum tenuiflorum,
Oberonia cavaleriei,
O. kwangsiensis,,
Odontochilus elwesii
Phaius flavus,
Pholidota chinensis,
P. levelleana,
Podochilus khasianum,
Rhomboda petelottii,
Thelasis pygmaea,
Trichotosia pulvinata.

Pentaphragmataceae

Pentaphragma sinense.

Pittosporaceae

Pittosporum pauciflorum.

Podocarpaceae

Dacrycarpus imbricatus,
Dacrydium elatum,
Podocarpus neriifolius.

Primulaceae

Lysimachia insignis.

Ranunculaceae

Anemone poilanei.

Rubiaceae

Hedyotis acutangula,
H. biflora.

Sapindaceae

Xerospermum microcarpum.

Sapotaceae

Sinosideroxylon wightianum.

Tiliaceae

Burretiodendron brilletii.

Trilliaceae

Paris polyphylla.

Key group 12.
List of "timber tree species" – tree species, sources of valuable timber of good quality

Alangiaceae

Alangium ridleyi.

Anacardiaceae

Dracontomelum duperreanum.

Annonaceae

Polyalthia jucunda.

Dipterocarpaceae

Dipterocarpus hasseltii,
D. retusus,
Vatica cinerea.

Elaeocarpaceae
Elaeocarpus grandiflorus,
Sloanea sigun.

Fabaceae
Zenia insignis.

Fagaceae
Lithocarpus pseudoreinwardtii.

Hamamelidaceae
Altingia siamensis.

Lauraceae
Beilschmiedia pergamentacea,
Cinnamomum ovatum.

Magnoliaceae
Magnolia dandyi,
M. masticata,
Manglietia chevalieri,
Michelia coriacea,
M. doltsopa,
M. gioi,
M. macclurei.

Meliaceae
Dysoxylum mollissimum.

Moraceae
Artocarpus borneensis,
A. styracifolia.

Nyssaceae
Diplopanax vietnamensis.

Podocarpaceae
Dacrycarpus imbricatus,
Dacrydium elatum.

Tiliaceae
Burretiodendron brilletii.

Key group 13.
List of "medicinal plant species" – plant species used in traditional oriental medicine

Araceae
Homalomena occulta,
Rhaphidophora decursiva (fig. 142, 143).

Aristolochiaceae
Aristolochia contorta,
Asarum wulingense (fig. 108).

Cucurbitaceae
Gynostemma pentaphyllum (fig. 141),
G. pubescens.

Erythropalaceae
Erythropalum scandens.

Illiciaceae
Illicium cambodianum (fig. 88).

Lardizabalaceae
Stauntonia cavaleriana.

Magnoliaceae
Michelia gioi (fig. 64).

Meliaceae
Dysoxylum mollissimum (fig. 42).

Menispermaceae
Stephania sinica.

Myrsinaceae
Ardisia gigantifolia (fig. 108).

Orchidaceae
Anoectochilus annamensis (fig. 106),
A. calcareus,
Dendrobium nobile,
Flickingeria fimbriata (fig. 125*).*

Primulaceae
Lysimachia insignis.

Rubiaceae
Morinda officinalis (fig. 145, 146).

Rutaceae
Clausena austroindica.

Schisandraceae
Kadsura grandiflora.

Taccaceae
Tacca chantrieri.

Thymelaeaceae
Aquilaria crassna.

Trilliaceae
Paris polyphylla.

Key group 14.
List of "ornamental plant species" – plant species widely used in ornamental horticulture

Lycopodiaceae
Huperzia carinata,
H. hamiltonii,
H. phlegmaria.
Marattiaceae
Angiopteris cochinchinensis.
Cephalotaxaceae
Cephalotaxus mannii.
Podocarpaceae
Dacrycarpus imbricatus (fig. 27),
Dacrydium elatum (fig. 78-81),
Podocarpus neriifolius.
Apocynaceae
Dischidia acuminata,
D. tonkinensis,
Hoya carnosa,
H. fungi,
H. lockii.
Arecaceae
Rhapis laosensis.
Balsaminaceae
Impatiens verrucifer (fig. 116, 117).
Begoniaceae
Begonia crassula (fig. 112-114).
Convallariaceae
Peliosanthes argenteostriata (fig. 115).
Ericaceae
Enkianthus quinqueflorus,
Vaccinium bullatum,
V. dunalianum (fig. 139).
Fabaceae
Zenia insignis (fig. 70).
Gesneriaceae
Aeschynanthus mendumiae.
Magnoliaceae
Magnolia liliifera (fig. 68).
Malvaceae
Hibiscus grewiifolius.
Orchidaceae
Anoectochilus annamensis (fig. 106),
A. calcareus,
Bulbophyllum ambrosia,,
B. delitescens (fig. 121, 122)
B. macranthum,
B. retisiusculum (fig. 120),
B. salmoneum (fig. 118, 119),
Calanthe odora (fig. 98, 99),
Cleisostoma birmanicum,
Collabium chinense,
Dendrobium aduncum,
D. nobile,
D. thyrsiflorum,
Eria thao,
Gastrochilus calceolaris,
Goodyera hispida,
Liparis nigra,
Mischobulbum cordifolium,
Odontochilus elwesii,
Phaius flavus,
Pholidota chinensis (fig. 132, 133).
Taccaceae
Tacca chantrieri.

Key group 15.
List of plant species with edible fruits

Actinidiaceae
Actinidia latifolia.
Alangiaceae
Alangium ridleyi, local significance (fig. 57).
Anacardiaceae
Allospondias lakonensis, local significance.
Magnoliaceae

Michelia gioi (seeds used as spice in traditional oriental cuisine).

Key group 16.
List of plant species with edible young leaves and shoots

Cucurbitaceae
Gynostemma pentaphyllum (fig. 141), *Gynostemma pubescens.*

Erythropalaceae
Erythropalum scandens.

Highest species diversity in EA is observed in primary mixed and coniferous forests. However, similar richness in aboriginal species is also observed in slope and lowland valley primary forest. High level of endemism is typical for any kind of primary forests in studied area and they equally desire protection in EA. Most significant discoveries of new strictly endemic plants of highest endemism level (*Bulbophyllum salmoneum, Hiepia corymbosa, Hoya lockii, Peliosanthes argenteostriata, Tupistra theana* etc.) were made during our survey in primary forests of any type (Pham Van The, Averyanov, 2011; The Pham Van, Averyanov. 2012; Averyanov, Tanaka, 2012; Averyanov, 2012).

It should be mentioned, that less than 1% of EA was studied in our survey. Thought studied localities fairly well represent general character of the flora, large majority of territory of wide karstic area in limits of EA remains absolutely unexplored and inaccessible. It will be reasonable expect much more discoveries in this region in future being into consideration strictly mosaic character of local limestone Indochinese endemism which is confirmed by a number exciting discoveries of last years (Averyanov, Phan Ke Loc, Nguyen Tien Hiep, 2001; Farjon et al., 2002; Averyanov et al., 2002, 2004b, 2005c, 2008, 2010, 2011a, b; Averyanov, 2009).

4.2. Threats to and management concerns of higher vascular plant diversity in the Phong Nha – Ke Bang National Park and the extended area

There are 2 large villages of Arem and Ma Coong ethnic groups in the core zone of the PNKBNP and a number of villages around and in EA. Within the buffer zone, there is a population more than 50000 people that is fast increasing. People are mainly Kinh and minority groups of Chut and Van Kieu,

many of them intensively traditionally exploit forest products as part of their livelihoods (http://www.unep-wcmc...). Excessive exploitation of rare timber such as *Mun* wood (*Diospyros* spp.) and *Hue* wood (*Dalbergia rimosa*), trees for building constructions, oils from trees such as *Cinnamomum balansae*, *rattan* (*Calamus* spp.) has cause an exhaustion of many these plants in many areas of the park. Branch of Ho Chi Minh Highway (Road 20) crossing the edge zone and the connection road linking these two roads crossing the core zone also contribute danger to indigenous forests in EA of PNKBNP, especially along roads and around inhabited areas. Due to poor management by the local government, many areas of forest in the buffer zone were cleared in the past heavily and often completely. Wildfire in the dry season is also a regular threat to the forest in EA of PNKBNP and (http://en.wikipedia...).

Cutting and extra exploitation is main factors that damaged aboriginal primary forests and all connected wild life forms. All other numerous negative factors directly or indirectly connected and issued from primary forest degrading. Protection of nature exclusively and cordially depends of primary forests protection. It may be mentioned, that plant world protection is conceptually different from protection of higher animals. Main efforts should be focused here to protection of habitats and primary woods as a whole ecosystem. Notable, that dominants of primary forest in studied area often reach 2000 and more years old. Such species may be not vulnerable or endangered according to formal categories IUCN, but their stands unique treasure that support all ecosystem and great number of dependent species. After logging, their regeneration is very problematic, at least in period comparable with age of our civilization. Unfortunately, cutting of the forest on periphery of studied EA still observed everywhere in vicinities of inhabited area. Effective manage of forest conservation is basic recommendation for nature protection which provide all conditions for conservation of plant specie diversity. The gathering of selected wild species demanded on market represent special factor of their population decreasing. With few exceptions, this process has not catastrophic character. In primary intact forest conditions, populations of such species are capable regenerate.

Actual prevention of forest cutting and forest overexploitation for timber will be able provide all necessary conditions for nature protection and conservation all spectrum of plant diversity in studied EA. However, this way look not too much realistic without solving of social problems connected with

rising of human populations in inhabited areas inserted partially into EA territory. Main recommendation to management of potentially protected area is diminish human influence to minimum, particularly in places of highest indigenous endemic species diversity, like primary coniferous limestone forests on rocky mountain tops.

5. LIST OF AUTHORS, PARTICIPANTS AND CONTRIBUTORS

Phong Nha – Ke Bang National Park Administry and Management supervisors

Mr. Nguyen Trung Thuc

Director of The Provincial Project Management Unit of the Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang National Park Region project.

Mr. Le Duc Duong

Head of Planning-Personnel Management and PPMU office Manager Nature Conservation and Sustainable Natural Resource Management in the Phong Nha – Ke Bang Region - Quang Binh project.

Authors and field exploration team

(in order to their personal contribution into present monograph)

Prof. Leonid V. Averyanov

Senior researcher of Higher Plant Herbarium of Komarov Botanical Institute, Russian Academy of Sciences, Russia. Plant taxonomist. av-leonid@mail.ru; av_leonid@yahoo.com

Dr. Nguyen Tien Hiep

Director of non governmental organization - the Center for Plant Conservation (CPC) of Vietnam Union of Science and Technology Associations. Plant Taxonomist, project leader. ntienhiep@hn.vnn.vn; hiep.nguyen@cpcvn.org

Prof. Phan Ke Loc

Staff member of the Center for Plant Conservation (CPC) of Vietnam Union of Science and Technology Associations. Plant taxonomist. pkeloc@yahoo.com

MSc. Nguyen Sinh Khang

Staff member (researcher) of Department of Plant Resources, Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology and the Center for Plant Conservation (CPC) of Vietnam Union of

Science and Technology Associations. Plant taxonomist, expert in vegetation. nskhang@gmail.com

MSc. Pham Van The

Staff member (researcher) of Department of Plant Resources, Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology. Plant taxonomist, expert in vegetation. phamvthe@gmail.com; phamvthe@hotmail.com

Dr. Nguyen Van Tap

Staff member of the Center for Plant Conservation (CPC) of Vietnam Union of Science and Technology Associations. Medicinal plant expert.

Mr. Nguyen Tien Vinh

Technician of the Department of Plant Resources, Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology and the Center for Plant Conservation (CPC) of Vietnam Union of Science and Technology Associations. Technician, herbarium processing assistant.

Mr. Nguyen Quang Vinh

Vice head of the Conservation Department of Phong Nha – Ke Bang National Park.

Mr. Le Thuan Kien

Staff member of the Conservation Department of Phong Nha – Ke Bang National Park.

MSc. Nguyen Quang Hieu

Vice Director of the Center for Plant Conservation of Vietnam Union of Science and Technology Associations. Project leader assistant. hieu.nguyen@cpcvn.org; nquanghieu@hotmail.com

Local participants

Thuong Hoa municipality:
Mr. Do Van Son,
Mr. Cao Xuan Hung,
Mr. Cao Xuan Loc,
Mr. Dinh Xuan Nam,
Mr. Tran Duc Sy,
Mr. Tran Van Tu,
Mr. Dinh Xuan Bang.

Dan Hoa municipality:
Mr. Ho Ka,
Mr. Cao The Cong,
Mr. Cao The Dung,
Mr. Cao Quoc Van,
Mr. Ho Bang,
Mr. Ho Huong.

6. LITERATURE CITED

Averyanov L. 1994. Identification guide to Vietnamese orchids (Orchidaceae Juss.). S.-Petersburg. World and Family. 432 p. (in Russian).

Averyanov L. 2008. The orchids of Vietnam. Illustrated survey. Part 1. Subfamilies Apostasioideae, Cypripedioideae and Spiranthoideae. Turczaninowia, Vol. 11, N 1. P. 5-168.

Averyanov L. 2009. *Hayata glandulifera* (Orchidaceae) New Genus and Species From Northern Vietnam. Taiwania. Vol. 54. No. 4. P. 311-316.

Averyanov L. 2010. The orchids of Vietnam. Illustrated survey. Part 2 subfamily Orchidoideae. Turczaninowia, 13, 2. P. 5–98.

Averyanov L. 2011. The orchids of Vietnam. Illustrated survey. Part 3. Subfamily Epidendroideae (primitive tribes – Neottieae, Vanilleae, Gastrodieae, Nervilieae). Turczaninowia, 14, 2. P. 15–100.

Averyanov L. 2012. New orchid taxa and records in the Flora of Vietnam. Taiwania, 57, 0: 000-000 (in print).

Averyanov L., A. Averyanova. 2003. Updated checklist of the orchids of Vietnam. Vietnam National University Publishing House, Hanoi. 102 pp. (English & Vietnamese).

Averyanov L., A. Averyanova. 2006. Orchidaceae. In Manual of Identification Flowering Plants of Cuc Phuong National Park. N 2. Agric. Publ. House. Ho Chi Minh. 264 p. (English & Vietnamese).

Averyanov L., Cribb P., Phan Ke Loc, Nguyen Tien Hiep. 2003b. Slipper Orchids of Vietnam. With an Introduction to the Flora of Vietnam. Royal Botanic Gardens, Kew. Compass Press Limited. 308 p.

Averyanov L., Cribb P., Phan Ke Loc, Nguyen Tien Hiep. 2004a. Lan Hai Viet Nam (Slipper Orchids of Vietnam). 308 pp. Giao thong Van tai Publishing house. Ho Chi Minh City (Vietnamese ed., 2003).

Averyanov L., Nguyen Tien Hiep, D.K.Harder, Phan Ke Loc. 2002. The history of discovery and natural habitats of *Xanthocyparis vietnamensis* (Cupressaceae). Turczaninowia. T. 5. N 4. P. 31-39.

Averyanov L., Nguyen Tien Hiep, Pham Van The, Phan Ke Loc. 2004b. *Calocedrus rupestris* sp. nov. (Cupressaceae), new relict coniferous species from limestone areas of northern Vietnam. Basic Research in Life Sciences with emphasis on upland agriculture and forestry. Proceedings of the 2004 National Conference on Life Sciences. Thai Nguyen University, September 23, 2004. Science and Technics Publishing House, Hanoi. P. 40-44. (in Vietnamese, summary in English).

Averyanov L., Nguyen Tien Hiep, Phan Ke Loc, Averyanova Anna L. 2000. Preliminary orchid checklist of Cao Bang Province (Vietnam). Lindleyana. Vol. 15. No 3. P. 130-164.

Averyanov L., Nguyen Tien Hiep, Phan Ke Loc, Pham Van The. 2005c. Distribution, ecology and habitats of *Calocedrus rupestris* (Cupressaceae) in Vietnam. Turczaninowia 8 (4): 19-35.

Averyanov L., Nguyen Tien Hiep, Phan Ke Loc, Pham Van The. 2008. The Genus *Calocedrus* (Cupressaceae) in the flora of Vietnam. Taiwania. Vol. 53. No 1 P. 11-22.

Averyanov L., Nguyen Tien Hiep, Phan Ke Loc, Do Tien Doan, Regalado J. 2005d. Primary vegetation communities in Pu Luong nature reserve. In Furey, N., Infield, M. (eds.). 2005. Pu Luong Nature Reserve. Biodiversity surveys of a key site for conservation in the Pu Luong – Cuc Phuong Limestone Range. Pu Luong – Cuc Phuong Limestone Landscape Project. Vietnam Forest Protection Department and Fauna & Flora International Vietnam Conservation Support Programme. Hanoi. 94 p. maps. ill. P. 24-42.

Averyanov L., Nguyen Tien Hiep. 2002. *Diplopanax vietnamensis*, a New Species of Nyssaceae from Vietnam - One More Living Representative of the Tertiary Flora of Eurasia. Novon. Vol. 12. N 4. P. 433-436.

Averyanov L., Noriyuki Tanaka. 2012. New Species of *Peliosanthes* and *Tupistra* (Asparagaceae) from eastern Indochina. Taiwania, 57, 0: 000-000 (in print).

Averyanov L., Olaf Gruss, Canh Chu Xuan, Loc Phan Ke, Dang Bui, Hiep Nguyen Tien. 2010. *Paphiopedilum canhii*. A New Species from Northern Vietnam. Orchids. Lindleyana. Mag. Amer. Orch. Soc. Vol. 79. No 5. P. 288-290.

Averyanov L., Pham Van The, Loc Phan Ke, Hiep Nguyen Tien, Canh Chu Xuan, Vinh Nguyen Tien, Hieu Nguyen Quang. 2011b. Field survey of *Paphiopedilum canhii*, from discovery to extinction. Lindleyana. Mag. Amer. Orch. Soc. Vol. 80. No 00. P. 000-000 (in print).

Averyanov L., Phan Ke Loc, Nguyen Tien Hiep, Anna L. Averyanova, Pham Van The, Nguyen Tien Vinh. 2005b. Preliminary survey of orchids (Orchidaceae) in Phong Nha – Ke Bang National Park. FAUNA & FLORA INTERNATIONAL and COUNTERPART INTERNATIONAL. Hanoi. 67 p. 140 ill. (not published report).

Averyanov L., Phan Ke Loc, Nguyen Tien Hiep, D.K.Harder. 2003a. Phytogeographic review of Vietnam and adjacent areas of Eastern Indochina. Komarovia. Vol. 3. pp. 1-83.

Averyanov L., Phan Ke Loc, Nguyen Tien Hiep, Do Tien Doan. 2003c. Highland vegetation and flora of Van Ban District, Lao Cai Province in Northern Viet Nam. Turczaniniwia. T. 6. N 4. P. 47-86.

Averyanov L., Phan Ke Loc, Nguyen Tien Hiep, Pham Van The. 2005a. Distribution, ecology and natural conditions of *Calocedrus rupestris* (Cupressaceae) in Vietnam. P. 285-290. *In* Proceedings of the 1st National Workshop on Ecology and Biological Resources. Hanoi, 17 May 2005. Nha Xuat Ban Nong Nghiep. Ha Noi. P. 927 (in Vietnamese and English).

Averyanov L., Phan Ke Loc, Nguyen Tien Hiep. 2001. The distribution of *Paphiopedilum vietnamense* and its current status in the wild. Orchid Digest. Vol. 65. N. 4. P. 158-162.

Averyanov L., Phan Ke Loc, Pham Van The, Nguyen Tien Hiep. 2011a. *Lockia sonii* – new genus, or firstly discovered natural bigeneric hybrid of Luisia and Vanda? Lindleyana. Mag. Amer. Orch. Soc. Vol. 80. No 00. P. 000-000 (in print).

Cao Van Sung, Le Quy An (eds.). 1998. Environment and Bioresources of Vietnam. Gioi Publishers, Hanoi.

Dudley N., Nguyen Cu, Vuong Tien Manh. 2003. A Monitoring and Evaluation System for Forests Landscape Restoration in the Central Truong Son Landscape. A report for the Central Truong Son Initiative. WWF Indochina, Hanoi, Vietnam

Farjon A., Nguyen Tien Hiep, Harder D.K., Phan Ke Loc, Averyanov L. 2002. A New Genus and Species in Cupressaceae (Coniferales) from Northern Vietnam. *Xanthocyparis vietnamensis*. Novon. Vol. 12. No 2. P. 179-189.

Gourou P. 1966. The tropical world: its social and economic conditions and its future status (geographies for advanced study). Longman. UK. 208 p.

http://en.wikipedia.org/wiki/Phong_Nha-Ke_Bang_National_Park

http://unesdoc.unesco.org/images/0000/000050/005032MB.pdf

http://vietnamtravels.vn/tours/newsdetail/3844/Flora-in-Phong-Nha-%E2%80%93-Ke-Bang-National-Park.htm

http://www.phongnhatours.com/phong-nha-ke-bang-information/flora/

http://www.unep-wcmc.org/medialibrary/2011/06/14/7333dfe5/Phong%20Nha%20Ke%20Bang.pdf

International Classification and Mapping of Vegetation. 1973. Published by the United Nations Educational, Scientific and Cultural Organization. UNESCO. Paris. 93 p.

IUCN "Red List Categories and Criteria". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland. [First published in the Encyclopedia of Earth October 6, 2009; Last revised Date October 6, 2009; Retrieved March 19, 2011. http:// www.eoearth.org/ article/ IUCN_Red_List_Categories_and_Criteria.

IUCN Standards and Petitions Subcommittee. 2010. Guidelines for Using the IUCN Red List Categories and Criteria. Version 8.1. Prepared by the Standards and Petitions Subcommittee in March 2010. http:// intranet.iucn.org/ webfiles / doc/ SSC/ RedList/RedListGuidelines.pdf.

Le Ba Thao. 1997. Vietnam, the country and its geographical regions. The Gioi Publishers, Hanoi.

Le Xuan Canh, Truong Van La, Dang thi Dap, ho Thu Cuc, Ngo Anh Dao, Nguyen Ngoc Chinh, Vu Van Dung, Pham Nhat, Nguyen Thai Tu, Nguyen Quoc Thang, Tran Minh Hien. 1997. A report of field surveys on Biodiversity in Phong Nha Ke Bang forest (Quang Binh Province, central Vietnam). IEBR / FIPI / Forestry College / University of Vinh / WWF Indochina Programme. Unpublished.

Ministry of Science and Technology, Vietnamese Academy of Science and Technology. 2007. Vietnam Red Data Book (Part 2. Plants). 512 p. Publishing House Natural Science and Technology. Ha Noi.

Nguyen Khanh Van, Nguyen Thi Hien, Phan Ke Loc, Nguyen Tien Hiep. 2000. Bioclimatic diagrams of Vietnam. Hanoi. Vietnam Nat. Univ. 126 pp.

Nguyen Tien Hiep, Phan Ke Loc, Nguyen Duc To Luu, P.I. Thomas, A. Farjon, L. Averyanov, J. Regalado. 2004. Vietnam Conifers: Conservation Status Review 2004. Fauna & Flora International, Vietnam Programme. Hanoi. 128 p.

Orlova L.V., Averyanov L.V. 2004. On the taxonomical position of *Ducampopinus krempfii* (Pinaceae). Turczaninowia Vol. 7. No 2. P. 30-44.

Pham V.T., L.V. Averyanov. 2011. *Hiepia corymbosa* – new genus of Apocynaceae (Asclepiadoideae) from Vietnam. Turczaninowia, 14, 3. P. 5-10.

Phan Ke Loc, S.K. Wu, Nguyen Tien Hiep, Pham Van The, Nguyen Sinh Khang. 2005. The diversity of the flora of Vietnam 23. *Teratophyllum hainanense* (Lomariopsidaceae), a new species occurrence for the flora. J. Genetics & Applications 4: 16-19 (in Vietnamese).

Phan Ke Loc, Nguyen Tien Hiep, Leonid Averyanov, Nguyen Sinh Khang, Pham Van The. 2011. Conifers in central part of Truong Son Vietnam - species diversity, distribution and conservation status. Ecological Economy Journal. № 40: 9-17 (in Vietnamese).

Socialist Republic of Vietnam Government Decree No 32/2006/ND-CP on the management of threatened plant and animal species. 2006. 17 pages. Issued at 30 March 2006.

The Pham Van, L.V. Averyanov. 2012. New species - *Hoya lockii* (Apocynaceae, Asclepiadoideae) from Vietnam. Taiwania, 57, 1: 49-54.

Timmins, R. J., Do Tuoc, Trinh Viet Cong, D. K. Hendrichson. 1999. Preliminary Assessment of the Conservation Importance and Conservation Priorities of the Phong Nha-Ke Bang Proposed National Park, Quang Binh Province, Vietnam. Fauna and Flora International - Indochina Programme, Hanoi.

Vietnam Red Data Book. Part 2. Plants. 2007. 512 p. Ministry of Science and Technology, Vietnamese Academy of Science and Technoloy. Publishing House Natural Science and Technology. Ha Noi.

Annex 1.
DOCUMENTED SPECIES

Checklist of plant species
documented by voucher herbarium specimens collected
in expanded areas of Phong Nha – Ke Bang region
(July - August, 2011)

For each species, required data are provided as follow: family name; full scientific name and author; number of voucher herbarium specimens; type of habitats; presence of photo documentation; belongings to CITES appendices; IUCN status when applicable.

TABLE LEGEND:

Figures in table column named as "Habitat" means following kinds of habitats, where species was observed and documented:

1. Closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone at elev. 400-700 m a.s.l.
2. Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous forests (with *Dacrydium elatum* and *Dacrycarpus imbricatus*) on steep rocky slopes and on mountain tops on crystalline highly eroded limestone at elev. 700-800(900) m a.s.l.
3. Closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on rocky mountain tops on crystalline highly eroded limestone at elev. 400-700 m a.s.l. Wind-formed and/or other specific modification.
4. Closed primary evergreen seasonal tropical lowland broad-leaved forests on wet flat seasonally flooded river/stream valleys and on low flat river/stream terraces on crystalline eroded limestone and shaly limestone at elev. 300-400 m a.s.l.
5. Closed and opened primary evergreen seasonal tropical lowland broad-leaved forests on wet river/stream valleys of shale mother rocks at elev. 350-600 m.

Collecting numbers of species, for which photos were made during survey, are marked by underlined bold font in table column named as "Voucher specimens"

IUCN categories tentatively applied (in limits of Indochina Peninsular) to collected and documented species are marked in table column named as "Notes" following to terms and definitions of IUCN (IUCN Standards and Petitions…, 2010; IUCN "Red List Categories and Criteria"…, 2011) as follow: DD (data deficient); **LC** (least concern); **NT** (near threatened); **VU** (vulnerable); **EN** (endangered); **CR** (critically endangered).

Plant names of species belonging to CITES Appendix 2 are marked in table column named as "Species epithet" with asterisk (*).

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
1	2	3	4	5	6	7
FERNS AND FERN ALLIES						
Aspleniaceae						
	Asplenium	*cardiophyllum*	(Hance) Baker	CPC 3820; CPC 3873; CPC 4418	1, 3	VU
	Asplenium	*cheilosorum*	Kunze ex Mett.	CPC 4106	1	LC
	Asplenium	*ensiforme*	Wall. ex Hook. & Grev.	CPC 3745	2	LC
	Asplenium	*protractum*	Tardieu & C.Chr.	CPC 3976	1	LC
	Asplenium	*tenuifolium*	D.Don	CPC 3789	3	VU
	Asplenium	*thunbergii*	Kunze	CPC 3855	3	LC
	Asplenium	*unilaterale*	Lam.	CPC 3836; CPC 4000	1	LC
Cyatheaceae						
	Alsophila	*costularis*	Baker	CPC 4394	5	LC
	Alsophila	*podophylla*	Hook.	CPC 4293; CPC 4381	5	LC
Davalliaceae						
	Davallia	*repens*	(L.f.) Kuhn	CPC 4102	1	LC
Dennstaedtiaceae						
	Acrorumohra	*diffracta*	(Baker) H.Itô	CPC 3750	2	LC
	Microlepia	*hookeriana*	(Wall. ex Hook.) C.Presl	CPC 4363, CPC 4378	5	LC
Dryopteridaceae						
	Bolbitis	*appendiculata*	(Willd.) K.Iwats.	CPC 3746; CPC 4298	2, 5	LC
	Bolbitis	*cadieri*	(H.Christ) Ching	CPC 4365	5	LC
	Ctenitis	*membranifolia*	Ching & C.H.Wang	CPC 3908	4	LC
	Dryopteris	*sparsa*	(Buch.-Ham. ex D.Don) Kuntze	CPC 3752	2	LC
	Polystichum	*deltodon*	(Baker) Diels	CPC 3810	1	LC
	Polystichum	*grande*	Ching	CPC 3729; CPC 3743	2	LC
	Teratophyllum	*hainanense*	S.Y.Dong & X.C. Zhang	CPC 3712	2	NT
Hymenophyllac.						
	Trichomanes	sp.		CPC 3717	2	-
	Vandenboschia	*auriculata*	(Blume) Copel.	CPC 3903 b, CPC 4229, CPC 4295, CPC 4023, CPC 4124	1, 3, 4, 5	NT
Lomariopsida-ceae						
	Cyclopeltis	*crenata*	(Fée) C.Chr.	CPC 3874	1	LC
	Lomariopsis	*lineata*	(C.Presl) Holttum	CPC 3666	1	LC
	Lomariopsis	*spectabilis*	(Kunze) Mett.	CPC 4121	1	NT
	Nephrolepis	*cordifolia*	(L.) C.Presl	CPC 4046	1	LC
Lycopodiaceae						
	Huperzia	*carinata*	Trevis	CPC 3645	1	NT
	Huperzia	*hamiltonii*	(Spring) Trevis	CPC 4041	1	NT
	Huperzia	*phlegmaria*	(L.) Rottl.	**CPC 4336**	5	NT
Marattiaceae						
	Angiopteris	*cochinchinensis*	de Vriese	CPC 3677	1	LC
Plagiogyriaceae						
	Plagiogyria	*adnata*	(Blume) Bedd.	CPC 3730	2	NT
Polypodiaceae						
	Aglaomorpha	*coronans*	(Wall. ex Mett.) Copel.	CPC 4294	5	LC
	Belvisia	*annamensis*	(C.Chr.) Tagawa	CPC 3705	2	LC
	Belvisia	*spicata*	(L.f.) Mirb. ex Copel.	**CPC 3978**	1	LC
	Colysis	*digitata*	(Baker) Ching	CPC 4021; CPC 4048	1	LC
	Colysis	*dissimilialata*	(Bonap.) Ching	CPC 3893; CPC 4050	1	LC

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Colysis	*pothifolia*	(D.Don) C.Presl	CPC 3892	1	**LC**
	Lepisorus	*subrostratus*	(C.Chr.) C.Chr. & Tardieu	CPC 4282	3	**LC**
	Loxogramme	*acrostichoides*	(Baker) C.Chr.	CPC 3956	1	**LC**
	Microsorum	*scolopendria*	(Burm.f.) Copel.	CPC 4407	1	**LC**
	Microsorum	*superficiale*	(Blume) Ching	CPC 3986	1	**LC**
	Pyrrosia	*lanceolata*	(L.) Farw.	CPC 3711; CPC 3917	2, 3	**LC**
	Pyrrosia	*lingua*	(Thunb.) Farw.	CPC 4306	5	**LC**
	Pyrrosia	*porosa*	(C.Presl) Hovenk.	CPC 4248	3	**LC**
	Selliguea	*griffithianum*	(Hook.) Fraser-Jenk.	CPC 4073, CPC 4268	1, 3	**LC**
Pteridaceae						
	Antrophyum	*callifolium*	Blume	CPC 3685; CPC 3931; **CPC 4014**; CPC 4055; CPC 4220	1, 4	**NT**
	Mildella	*nitidula*	(Hook.) C.C.Hall. & Lellinger	CPC 4247	3	**LC**
	Pteris	*grevilleana*	Wall. ex C.Agardh	CPC 4337	5	**LC**
	Pteris	*plumbea*	C.Chr.	CPC 4053	1	**LC**
	Pteris	*vittata*	L.	CPC 3741	2	**LC**
	Vittaria	*elongata*	Sw.	CPC 3762	3	**LC**
Selaginellaceae						
	Selaginella	sp. 1		CPC 3877	1	-
	Selaginella	sp. 2		CPC 3878	1	-
	Selaginella	sp. 3		CPC 3880	1	-
Tectariaceae						
	Arthropteris	*palisotii*	(Desv.) Alston	CPC 3977	1	**NT**
	Arthropteris	*repens*	(Brack.) C.Chr.	CPC 4045		**NT**
	Heterogonium	*sagenoides*	(Mett.) Holtt.	CPC 4380; CPC 4030; CPC 4296; CPC 3999	1, 5	**LC**
	Pleocnemia	*leuzeana*	(Gaudich.) C.Presl	CPC 4145, CPC 4292, CPC 4307, CPC 4004	1, 5	**LC**
	Tectaria	*decurrens*	(C.Presl) Copel.	CPC 4002, CPC 4029	1	**LC**
	Tectaria	*stenoptera*	(Baker) Ching	CPC 3837	1	**LC**
	Tectaria	*triglossa*	Tardieu & C.Chr.	CPC 3885; CPC 3886	1	**LC**
Thelypteridaceae						
	Cyclosorus	*balansae*	Ching	CPC 3904	4	**LC**
	Cyclosorus	*cuspidatus*	(Blume) C.Chr. & Tardieu	CPC 3938	4	**LC**
	Cyclosorus	*truncatus*	(Poir.) Tardieu & C.Chr.	CPC 3704	2	**LC**
	Thelypteris	sp.		CPC 4001	1	-
	gen.	sp.		CPC 3937	4	-
Woodsiaceae						
	Athyrium	*mackinnonii*	(C.Hope) C.Chr.	CPC 3906	4	**LC**
	Diplazium	*donianum*	(Mett.) Tardieu	CPC 3839; CPC 3939	1, 4	**LC**
	Diplazium	*mettenianum*	(Miq.) C.Chr.	CPC 3838; CPC 3907; CPC 4122	1, 4	**LC**
GYMNOSPERMAE						
Cephalotaxaceae						
	Cephalotaxus	*mannii*	Hook.f.	CPC 4237, **CPC 4318**	3, 5	**VU**
	Dacrycarpus	*imbricatus*	(Blume) de Laub.	**CPC 3726,** CPC 4190, **CPC 4372**	2, 5	**NT**
	Dacrydium	*elatum*	(Roxb.) Wall. ex Hook.	**CPC 3727**	2	**VU**
	Podocarpus	*neriifolius*	D.Don	CPC 3723, CPC 4068, CPC 4195, CPC 4406	1, 2, 5	**NT**
ANGIOSPERMAE- DICOTYLEDONS						
Acanthaceae						
	Phlogacanthus	*annamensis*	R.Ben.	CPC 4140	1	**LC**

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Psiloestes	*elongata*	R. Ben.	CPC 3682	1	**LC**
	Strobilanthes	sp.		CPC 4389	5	-
	Thunbergia	*geoffrayi*	R. Ben.	CPC 4257	3	**LC**
	Thunbergia	*grandiflora*	(Rottl.) Roxb.	CPC 3911a, CPC 4150	1	**LC**
	gen.	sp. 1		CPC 3683	1	-
	gen.	sp. 2		CPC 4355	5	-
	gen.	sp. 3		CPC 4424	1	-
	gen.	sp. 4		CPC 4441	1	-
Actinidiaceae						
	Actinidia	*latifolia*	(Gardn. & Champ.) Merr.	CPC 4208	5	**NT**
Alangiaceae						
	Alangium	*barbatum*	(R.Br.) Baill.	CPC 4390	5	**LC**
	Alangium	*chinense*	(Lour.) Harms	CPC 3866; CPC 4161	1, 4	**LC**
	Alangium	*kurzii*	King	CPC 4439	1	**LC**
	Alangium	*ridleyi*	King	CPC 3830; CPC 3920a, **CPC 4353**	1, 4, 5	**NT**
Anacardiaceae						
	Allospondias	*lakonensis*	(Pierre) Stapf	CPC 4354	5	**NT**
	Dracontomelum	*duperreanum*	Pierre	CPC photo only	3	**NT**
	Pistacia	*cucphuongensis*	Dai & Yakovlev	CPC 3798	3	**VU**
	gen.	sp.		CPC 4226	3	-
Ancistrocladaceae						
	Ancistrocladus	*tectorius*	(Lour.) Merr.	**CPC 3840**	1	**LC**
Annonaceae						
	Desmos	*pedunculosus*	(A.DC.) Ban	CPC 3773	3	**LC**
	Disepalum	*petelotii*	(Merr.) D.M.Johnson	CPC 4412	3	**LC**
	Miliusa	*elongata*	Craib	CPC 3922	3	**LC**
	Miliusa	*fusca*	Pierre	CPC 3869	1	**LC**
	Miliusa	*sinensis*	Finet & Gagnep.	**CPC 3828,** CPC 3899a, CPC 4243, CPC 4303	1, 3, 5	**LC**
	Mitrephora	*thorelii*	Pierre	CPC 3901a, CPC 3954, **CPC 4109**	1	**DD**
	Polyalthia	*intermedia*?	(Pierre) Ban	**CPC 3809**	1	**DD**
	Polyalthia	*jucunda*	(Pierre) Finet & Gagnep.	**CPC 3671**, **CPC 4038**	1	**LC**
	Polyalthia	sp.		CPC 4044	1	-
	Popowia	*pisocarpa*?	Endl.	CPC 4308	5	**LC**
	Uvaria	*dac*	Pierre ex Finet & Gagnep.	CPC 4036	1	**DD**
	Uvaria	*grandiflora*	Roxb.	**CPC 3823**	1	**DD**
	gen.	sp.		CPC 4144	1	-
Apocynaceae						
	Aganonerion	*polymorphum*	Pierre ex Spire	**CPC 3847**	3	**LC**
	Alstonia	*guanxiensis*	D.Fong & X.X.Chen	**CPC 3779**, **CPC 3860**, CPC 4272	3	**NT**
	Alyxia	*hainanensis*	Merr. & Chun	CPC 3794, CPC 4097, CPC 4254	1, 3	**LC**
	Dischidia	*acuminata*	Cost.	CPC 3842	3	**LC**
	Dischidia	*tonkinensis*	Cost.	CPC 4043	1	**LC**
	Hiepia	*corymbosa*	The P.V. & Aver.	CPC 3894a	1	**EN**
	Hoya	*carnosa*	(L.f.) R.Br.	**CPC 3959**	1	**LC**
	Hoya	*fungii*	Merr.	CPC 4196	5	**LC**
	Hoya	*lockii*	The P.V. & Aver.	**CPC 4345**, CPC 4383	5	**EN**
	Heterostemma	*oblongifolium*	Cost.	CPC 4103	1	**LC**
	Kopsia	*arborea*	Blume	**CPC 3662**	1	**LC**

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Marsdenia	sp.?		CPC 4415	3	-
	Pilostigma	*inflexum*	Cost.	CPC 3895	4	**LC**
	Tabernaemontana	sp.		CPC 4339	5	-
	Wrightia	*macrocarpa*	Pit.	CPC 3917a; CPC 4009	1	**LC**
	Pentasacme	*brachyanthum*	Hand.-Mazz.	CPC 4399	5	**LC**
	Secamone	sp.		CPC 4152	1	-
Araliaceae						
	Heteropanax	*fragrans*	(G.Don) Seem.	CPC 4214	5	**NT**
	Schefflera	*pauciflora*	R.Vig.	CPC 3672, **CPC 3923**	1, 3	**LC**
	Trevesia	*palmata*	Vis.	**CPC 3686**	1	**LC**
Aristolochiaceae						
	Asarum	*wulingense*	C.F.Liang	CPC 4185	5	**NT**
	Aristolochia	*contorta*	Bunge	CPC 4233, CPC 4297	3, 5	**NT**
Balanophoraceae						
	Balanophora	*laxiflora*	Hemsl.	CPC 4326	5	**NT**
Balsaminaceae						
	Impatiens	*verrucifer*	Hook.f.	**CPC 3863**	3	**LC**
	Impatiens	sp. 1		CPC 3949	1	-
	Impatiens	sp. 2		CPC 4049	1	-
	Impatiens	sp. 3		CPC 4267	3	-
Begoniaceae						
	Begonia	*acetosella*	Craib	CPC 3679, CPC 3919a	1, 4	**LC**
	Begonia	*crassula*	Aver.	CPC 4264, **CPC 3775**, **CPC 3858**, CPC 3962	1, 3	**NT**
	Begonia	*palmata*	D.Don	CPC 4206	5	**LC**
	Begonia	sp. 1		CPC 3655	1	-
	Begonia	sp. 2		CPC 3760	3	-
	Begonia	sp. 3		CPC 3889	1	-
	Begonia	sp. 4		CPC 3925	3	-
	Begonia	sp. 5		CPC 3926	3	-
	Begonia	sp. 6		CPC 4238	3	-
	Begonia	sp. 7		CPC 4288	1	-
Bignoniaceae						
	Radermachera	sp.		**CPC 3862**	3	-
	gen.	sp.		CPC 3972	1	-
Campanulaceae						
	Campanumoea	*celebica*	Blume	CPC 4020	1	**NT**
Capparaceae						
	Capparis	*acutifolia*	Sw.	CPC 4052	1	**LC**
	Capparis	*cantoniensis*	Lour.	CPC 4396	5	**LC**
	Stixis	*suaveolens*	Pierre	CPC 4175	4	**LC**
Caprifoliaceae						
	Abelia	*chinensis*	R.Br.	CPC 4075, CPC 4099, CPC 4270, CPC 4271, CPC 3797, **CPC 5194**	1, 3	**NT**
	Viburnum	*punctatum*	Buch.-Ham. ex D.Don	CPC 4343	5	**LC**
Celastraceae						
	Glyptopetalum	*sclerocarpum*	Kurz	CPC 3765	3	**LC**
Chloranthaceae						
	Chloranthus	*japonicus*	Sieb.	CPC 4440	1	**LC**
Clusiaceae						
	Calophyllum	*balansae*	Pit.	CPC 3735, CPC 3785	2, 3	**NT**
	Garcinia	*oblongifolia*	Champ. ex Benth.	CPC 3851, CPC 3796, CPC 4074	1, 3	**NT**
Combretaceae						
	Combretum	*sundaicum*	Miq.	**CPC 4126**	1	**LC**
	Combretum	sp.		CPC 4417	3	-

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
Cucurbitaceae						
	Gynostemma	*pentaphyllum*	(Thunb.) Mak.	**CPC 3653**	1	LC
	Gynostemma	*pubescens*	(Gagnep.) C.Y.Wu & S.K.Chen	CPC 3896, CPC 4018, CPC 4377	1, 4, 5	LC
	Thladiantha	*cordifolia*	(Blume) Cogn.	**CPC 3894**, CPC 4024	1, 4	LC
Daphniphyllaceae						
	Daphniphyllum	*majus*	Muell.Arg.	CPC 4205	5	LC
Datiscaceae						
	Tetrameles	*nudiflora*	R.Br.	CPC 4118	1	LC
Dipterocarpaceae						
	Dipterocarpus	*hasseltii*	Blume	**CPC 3703, CPC 4016**	1	LC
	Dipterocarpus	*retusus*	Blume	**CPC 3883**, CPC 4316, **CPC 4342,** CPC 4401	1, 5	LC
	Hopea	*siamensis*	Heim	CPC 3706, **CPC 3783**, **CPC 3849**, CPC 3816, **CPC 4092**	1, 2, 3	LC
	Vatica	*cinerea*	King	CPC 3960, **CPC 3924a**	1, 4	LC
	gen.	sp.		CPC 3932	4	-
Ebenaceae						
	Diospyros	*areolata*	King & Gamble	**CPC 4283**	1	DD
	Diospyros	*cauliflora*?	Blume	CPC 3664	1	DD
	Diospyros	*choboensis*	H.Lec.	CPC 4219	1	DD
	Diospyros	*hasseltii*?	Zoll.	**CPC 4119**	1	-
	Diospyros	*lancifolia*	Roxb.	**CPC 3924**	3	DD
	Diospyros	*latisepala*	Ridl.	**CPC 4446**	5	DD
	Diospyros	*lobata*	Lour.	**CPC 4059**	1	DD
	Diospyros	*longipedicellata*?	H.Lec.	CPC 3948	1	-
	Diospyros	*mun*	A.Chev. ex H.Lec.	**CPC 3829**	1	CR
	Diospyros	*rufogemmata*	H.Lec.	CPC 3821	1	DD
Elaeocarpaceae						
	Elaeocarpus	*grandiflorus*	Sm.	CPC 3674	1	LC
	Sloanea	*sigun*?	(Blume) K. Schum.	**CPC 3670**	1	-
	gen.	sp. 1		CPC 3955	1	-
	gen.	sp. 2		CPC 3968	1	-
	gen.	sp. 3		CPC 4313	5	-
Ericaceae						
	Enkianthus	*quinqueflorus*	Lour.	CPC 3724	2	NT
	Vaccinium	*bullatum*	(Dop) Sleum.	CPC 3963	1	NT
	Vaccinium	*dunalianum*	Wight	**CPC 3780**, CPC 4252	3	NT
Erythropalaceae						
	Erythropalum	*scandens*	Blume	CPC 3912a	1	LC
Euphorbiaceae						
	Antidesma	*bunius*	Spreng.	CPC 3868	1	LC
	Antidesma	*fordii*	Hemsl.	CPC 3925a	4	LC
	Antidesma	*montanum*	Blume	CPC 3691	1	LC
	Antidesma	*yunnanensis*	Pax & Hoffm.	CPC 4168	4	LC
	Antidesma	sp. 1		CPC 3989	1	-
	Antidesma	sp. 2		CPC 3922a	4	-
	Bischofia	*javanica*	Blume	**CPC 4147**	1	LC
	Breynia	*baudouini*	Beille	CPC 3985, **CPC 4098**	1	LC
	Breynia	sp.		CPC 4166	4	-
	Claoxylon	*indicum*	(Blume) Endl. ex Hassk.	CPC 4137	1	LC
	Croton	*cascarilloides*	Raeusch.	CPC 3897 b		LC
	Endospermum	*chinense*	Benth.	CPC 4153	1	LC
	Glochidion	*pilosum*	(Lour.) Merr.	CPC 3856	3	LC
	Microdesmis	sp. 1?		CPC 3696	1	-

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Microdesmis	sp. 2?		CPC 4351	5	-
	Phyllanthus	*insularis*	Beille	CPC 3776	3	NT
	Sapium	*rotundifolium*	Hemsl.	CPC 3981	1	LC
	Sauropus	sp.?		CPC 4328	5	-
	Sumbaviopsis	*albicans*	(Blume) J.J.Sm.	**CPC 3827**	1	LC
	Trigonostemon	*thyrsoideus*	Stapf	CPC 3694	1	LC
	gen.	sp. 1		CPC 3899	4	-
	gen.	sp. 2		CPC 4148	1	-
	gen.	sp. 3		CPC 4321	5	-
	gen.	sp. 4		CPC 4402	1	-
Fabaceae						
	Afgekia	*filipes*	(Dunn) R.Geesink	CPC 3997	1	LC
	Archidendron	*clypearia*	(Jack) I.Niels.	CPC 3707	2	LC
	Archidendron	*tetraphyllum*	(Gagnep.) I.Niels.	CPC 4398	5	LC
	Bauhinia	*khasiana*	Baker	**CPC 3946**	1	LC
	Bauhinia	*ornata*	Kurz	CPC 3927 a, **CPC 5261**	4	LC
	Bauhinia	*oxysepala*	Gagnep.	CPC 4304	5	LC
	Bowringia	*callicarpa*	Champ.	CPC 4131, CPC 4155	1, 4	LC
	Callerya	*reticulata*	(Benth.) Schot	CPC 3902	4	LC
	Campylotropis	*henryi*	Schindl.	**CPC 3782**, CPC 4095, CPC 4244	1, 3	NT
	Dalbergia	*hancei*	King	CPC 3964	1	DD
	Dalbergia	sp. 1		CPC 3935	4	-
	Dalbergia	sp. 2		CPC 4151	1	-
	Derris	sp.		CPC 4319	5	-
	Entada	*phaseoloides*	(L.) Merr.	CPC 3929, **CPC 4386**, CPC 4331, CPC 4120	1, 5, 3	LC
	Gleditsia	*pachycarpa*	Balansa ex Gagnep.	CPC 4013	1	LC
	Peltophorum	*dasyrrhachis*	(Miq.) Kurz	**CPC 3876**	1	LC
	Zenia	*insignis*	Chun	**CPC 4025**	1	LC
Fagaceae						
	Lithocarpus	*pseudoreinwardtii*	A.Camus	**CPC 4290,** CPC 4323	5	LC
	Lithocarpus	sp. 1		CPC 4212	5	-
	Lithocarpus	sp. 2		CPC 4255	3	-
	Quercus	*acutissima*?	Carr.	CPC 4217	1	-
	Quercus	*rupestris*	Hickel & A. Camus	CPC 4253	3	DD
	Quercus	sp.		CPC 4213	5	-
Flacourtiaceae						
	Flacourtia	*rukam*	Zoll. & Moritzi	CPC 4125	1	LC
	Homalium	*ceylanicum*	(Gardn.) Benth.	CPC 4414	3	DD
	Homalium	*phanerophlebium*?	How & Ko	**CPC 3843**	3	-
	Hydnocarpus	*annamensis*?	(Gagnep.) Phamh.	CPC 3702	1	-
	Hydnocarpus	*kurzii*	(King) Warb.	CPC 3928a	4	DD
	gen.	sp.		CPC 3676	1	-
Gesneriaceae						
	Aeschynanthus	*mendumiae*	D.Middleton	**CPC 4026**	1	LC
	Aeschynanthus	sp. 1		CPC 3811	1	-
	Aeschynanthus	sp. 2		CPC 3818	1	-
	Aeschynanthus	sp. 3		**CPC 3914**	3	-
	Aeschynanthus	sp. 4		CPC 3951	1	-
	Aeschynanthus	sp. 5.		CPC 4051	1	-
	Aeschynanthus	sp. 6		CPC 4221	1	-
	Aeschynanthus	sp. 7		CPC 4423	1	-
	Chirita	sp. 1		CPC 4265	3	-
	Chirita	sp. 2		CPC 4289	1	
	Epithema	*brunonis*	Blume	CPC 4241	3	LC
	Paraboea	sp. 1		CPC 3911	4	-

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Paraboea	sp. 2		CPC 3988	1	-
	Paraboea	sp. 3		CPC 4240	3	-
	Paraboea	sp. 4		CPC 3987b	1	-
	Primulina?	sp. 1		CPC 3812	1	-
	Rhynchotechum	*ellipticum*	(D.Dietr.) A.DC.	CPC 3681, CPC 4301	1, 5	LC
	Stauranthera	*umbrosa*	C.B.Clarke	**CPC 3998**	1	LC
	gen.	sp. 1		CPC 3668	1	-
	gen.	sp. 2		CPC 3961	1	-
	gen.	sp. 3		CPC 3971	1	-
	gen.	sp. 4		CPC 4031	1	-
	gen.	sp. 5		CPC 4419	3	-
Hamamelidaceae						
	Altingia	*siamensis*	Craib	**CPC 4384**	5	NT
Hernandiaceae						
	Illigera	*celebica*	Miq.	CPC 4322	5	LC
	Illigera	*rhodantha*	Hance	CPC 4149	1	LC
Icacinaceae						
	Gomphandra	*mollis*	Merr.	CPC 3913a	1	LC
Illiciaceae						
	Illicium	*cambodianum*	Hance	CPC 3713, CPC 3813, **CPC 4065**	1, 2	NT
Juglandaceae						
	Engelhardia	sp.		CPC photo only	1	-
Lamiaceae						
	Gomphostemma	*grandiflorum*	Doan	CPC 3680	1	LC
	Gomphostemma	sp.?		CPC 3987a	1	-
Lardizobalanaceae						
	Stauntonia	*cavaleriana*	Gagnep.	CPC 3882, CPC 4364	1, 5	LC
Lauraceae						
	Actinodaphne	*pilosa*?	(Lour.) Merr.	CPC 4421	1	-
	Actinodaphne	sp.		**CPC 3900a**	1	-
	Beilschmiedia	*percoriacea*	Allen	CPC 3687, CPC 4278, CPC 4404	1, 3	LC
	Beilschmiedia	*pergamentacea*	Allen	**CPC 3995**, **CPC 4060**	1	LC
	Beilschmiedia	sp.		CPC 4359	5	-
	Cinnamomum	*ovatum*	Allen	**CPC 4172**	4	LC
	Cinnamomum	sp.		CPC 3732	2	-
	Cryptocarya	*annamensis*	Allen	CPC 4015	1	LC
	Cryptocarya	*concinna*	Hance	CPC 3900	4	LC
	Lindera	sp. 1		CPC 4093	1	-
	Lindera	sp. 2		CPC 4416	3	-
	Litsea	sp. 1		**CPC 4154**	4	-
	Litsea	sp. 2		CPC 3801	3	-
	Litsea	sp. 3		CPC 3850	3	-
	Litsea	sp. 4		CPC 3898	4	-
	Litsea	sp. 5		CPC 4352	5	-
	Machilus	sp.		CPC 4211	5	-
	Neolitsea	*merrilleana*	Allen	CPC 4273	3	LC
	Neolitsea	sp.		CPC 4444	5	-
	Phoebe	*tavoyana*	(Meisn.) Hoof.f.	CPC 3731, CPC 3814, CPC 4063, **CPC 4182**	2	LC
	Phoebe	sp.		**CPC 3832**	1	-
	gen.	sp. 1		CPC 3744	2	-
	gen.	sp. 2		CPC 4034	1	-
Leeaceae						

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Leea	*indica*	Merr.	CPC 3689, CPC 4311	1	LC
Linaceae						
	Tirpitzia	*sinensis*	(Hemsl.) Hallier f.	**CPC 3859**, CPC 4094	1, 3	NT
Loganiaceae?						
	gen.	sp.		CPC 3663	1	-
Lythraceae						
	Lagerstroemia	*ovalifolia*	Teijsm. & Binn.	**CPC 4017**	1	LC
Magnoliaceae						
	Kmeria	*septentrionalis*	Dandy	CPC 3719 ,CPC 3865	1,2	NT
	Magnolia	*dandyi*	Gagnep.	**CPC 4193**	5	LC
	Magnolia	*liliifera*	(L.) Baill.	CPC 3700, CPC 3815, CPC 3826, **CPC 3871**, CPC 4054, CPC 4158, CPC 4215, CPC 4317	1, 4, 5	LC
	Magnolia	*masticata*	(Dandy) Figlar	CPC 4169, CPC 4201, CPC 4234, CPC 4403, CPC 4320, CPC 4325 CPC 4346, CPC 4006	4, 5	LC
	Magnolia	sp. 1		CPC 3722	2	-
	Magnolia	sp. 2		CPC 4360	5	-
	Manglietia	*chevalieri*	Dandy	**CPC 3701,** CPC 4344, CPC 4352 (p.p)	1, 5	LC
	Michelia	*coriacea*	Hung T. Chang & B. L. Chen	**CPC 4405**	1	LC
	Michelia	*doltsopa*	Buch.-Ham. ex DC.	CPC 4112	1	LC
	Michelia	*gioi*	(A. Chev.) Sima & Hong Yu	**CPC 3930**	4	LC
	Michelia	*macclurei*	Dandy	CPC 4159	4	LC
Malvaceae						
	Hibiscus	*grewiifolius*	Hassk.	**CPC 3660, CPC 4184**	1	NT
Melastomataceae						
	Blastus	*borneensis*	Cogn.	CPC 3936	4	LC
	Melastoma	*sanguineum*	Sims.	CPC 4256	3	LC
	Memecylon	*edule*	Roxb.	CPC 3848, CPC 4078	1, 3	LC
	Phyllagathis	sp. 1		CPC 3716	2	-
	Phyllagathis	sp. 2		CPC 3902a	1	-
	Phyllagathis	sp. 3		CPC 3890	1	-
Meliaceae						
	Aglaia	*lawii*	(Wight) C.J.Saldanha	CPC 3695, CPC 3944	1, 4	LC
	Amoora	*oligosperma*	(Pierre) Pellegr.	CPC 4160	4	LC
	Dysoxylum	*loureirii*	Pierre	**CPC 4033**	1	LC
	Dysoxylum	*mollissimum*?	Blume	**CPC 4176**	4	-
	Walsura	sp.?		CPC 4010	1	-
	gen.	sp. 1		CPC 3914a	1	-
	gen.	sp. 2		CPC 3936a		-
Menispermaceae						
	Arcangelisia	*flava*	(L.) Merr.	CPC 4209	5	LC
	Cyclea	*polypetala*	Dunn	CPC 4183	4	LC
	Stephania	*sinica*	Diels	CPC 4110	1	LC
Moraceae						
	Artocarpus	*borneensis*	Merr.	CPC 3927	3	LC
	Artocarpus	*nitidus*	Trécul	CPC 4445	5	LC
	Artocarpus	*styracifolia*	Pierre	**CPC 4156**	4	LC
	Artocarpus	sp.		CPC 4216	5	-
	Ficus	*altissima*	Blume	CPC 4210	5	LC
	Ficus	*chartacea*	Wall. ex King	**CPC 4082**	1	LC
	Ficus	*nervosa*	Heyne & Roth	CPC 4134	1	LC

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Ficus	*sagittata*	Vahl	CPC 4324	5	LC
	Ficus	*variolosa*	Lind. ex Benth.	CPC 3721	2	LC
	Maclura	*cochinchinensis*	(Lour.) Corn.	CPC 4022, CPC 4409	1, 3	LC
Myristicaceae						
	Horsfieldia	*amygdalina*	(Wall.) Warb.	CPC 4146	1	LC
	Knema	*pierrei*	Warb.	CPC 3665	1	LC
Myrsinaceae						
	Ardisia	*brevicaulis*	Diels	CPC 3875	1	LC
	Ardisia	*colorata*	Roxb.	CPC 4309	5	LC
	Ardisia	*gigantifolia*	Stapf	CPC 4202	5	LC
	Ardisia	*maclurei*	Merr.	CPC 3881	1	LC
	Ardisia	*tinctoria*	Pit.	CPC 4057	1	LC
	Ardisia	sp. 1		CPC 4181	4	-
	Ardisia	sp. 2		CPC 3751	2	-
	Ardisia	sp. 3		CPC 3770	3	-
	Ardisia	sp. 4		CPC 3844	3	-
	Ardisia	sp. 5		CPC 3901	4	-
	Ardisia	sp. 6		CPC 3898a	1	-
	Ardisia	sp. 7		CPC 3940	4	-
	Ardisia	sp. 8		CPC 3996	1	-
	Ardisia	sp. 9		CPC 3798a		-
	Rapanea	*neriifolia*	(Sieb. & Zucc.) Mez	CPC 4089, CPC 4249	1, 3	LC
Myrtaceae						
	Syzygium	sp.		CPC 4315	5	-
Nyssaceae						
	Diplopanax	*vietnamensis*	Aver. & H.T.Nguyen	**CPC 4312**; CPC 4395	5	NT
Oleaceae						
	Fraxinus	*griffithii*	C.B.Clarke	CPC 4408	3	NT
	gen.	sp.		CPC 4245	3	-
Pentaphragmatac.						
	Pentaphragma	*sinense*	Hemsl. & Wils.	CPC 3710, CPC 3907a	1, 2	LC
Piperaceae						
	Peperomia	*leptostachya*	Hook. & Arn.	CPC 4227	3	LC
	Piper	*albispicum*	C.DC.	CPC 3761, CPC 4356	1, 3	LC
	Piper	*densum*	Blume	CPC 4135	1	LC
	Piper	*gymnostachyum*	C.DC.	CPC 3905a, CPC 3916a, CPC 3993	1	LC
	Zippelia	*begoniifolia*	Blume	CPC 3678	1	LC
Pitttosporaceae						
	Pittosporum	*pauciflorum*	Wight & Arn.	CPC 3771, **CPC 4079**	1, 3	NT
Polygalaceae						
	Polygala	*tatarinowi*	Reg.	CPC 4258	3	LC
	Polygala	*tonkinensis*	Chodat	CPC 3895a	1	LC
Primulaceae						
	Lysimachia	*insignis*	Hemsl.	CPC 3658, CPC 3921a, CPC 4334	1, 4, 5	NT
Proteaceae						
	Helicia	*obovatifolia*	Merr.	CPC 4170	4	LC
	Polyosma	sp.		CPC 3718	2	-
Ranunculaceae						
	Anemone	*poilanei*	Gagnep.	**CPC 3742**	2	NT
	Clematis	*uncinata*	Champ.?	CPC 4101	1	LC
Rhamnaceae						
	Berchemia	*loureiriana*	H.Lec.	CPC 3982	1	LC
	Rhamnella	*tonkinensis*?	(Pit.) Miyasake	CPC 4410	3	-
	Rhamnus	sp.?		CPC 3984	1	-
	Ventilago	*ochrocarpa*	Pierre	CPC 4132	1	LC

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Ventilago	sp.		**CPC 4177**	4	-
	Ziziphus	*poilanei*	Muell.Arg.	CPC 3980, CPC 4225	1	LC
	gen.	sp.		CPC 3693	1	-
Rubiaceae						
	Aidia	*oxyodonta*	(Drake) Yamazaki	CPC 3904a, CPC 4162	1, 4	LC
	Aidia	*pycnantha*	(Drake) Tirv.	CPC 4341	5	LC
	Aidia	sp.		CPC 4361	5	-
	Brachytome	*wallichii*?	Hook.f.	CPC 3784	3	-
	Gardenia	*annamensis*	Pit.	CPC 4367	5	LC
	Gaertnera	*vaginans*	(DC.) Merr.	CPC 3983	1	LC
	Hedyotis	*acutangula*	Champ. ex Benth.	CPC 3769, CPC 3879	1, 3	LC
	Hedyotis	*biflora*	(L.) Lam.	CPC 3970	1	LC
	Hedyotis	*hedyotidea*	(DC.) Hand.-Mazz.	CPC 4281	3	LC
	Hedyotis	*pterita*	Blume	CPC 4259	3	LC
	Ixora	*cuneifolia*	Roxb.	CPC 4058	1	LC
	Ixora	*grandifolia*	Zoll. & Moritzi	CPC 3991	1	LC
	Ixora	*henryi*	H.Lév.	CPC 4329	5	LC
	Ixora	*krewanhensis*	Pierre ex Pit.	CPC 4382	5	LC
	Lasianthus	*biflorus*	(Blume) M.Gangop. & Chakrab.	CPC 3888; **CPC 4299**	5	LC
	Lasianthus	*chinensis*	Benth.	CPC 4164	4	LC
	Lasianthus	*cyanocarpus*	Jack	CPC 3725	2	LC
	Lasianthus	*foetidissimus*	A.Chev. ex Pit.	CPC 3690	1	LC
	Lasianthus	*japonicus*	Miq.	CPC 3912	3	LC
	Lasianthus	*kamputensis*	Pierre ex Pit.	CPC 3906a, CPC 3934	1, 4	LC
	Lasianthus	sp.		CPC 3923a	4	-
	Morinda	*umbellata*	L.	CPC 3781	3	LC
	Morinda	*officinalis*	How	**CPC 4358, CPC 4411**	3, 5	LC
	Mussaenda	*bonii*?	Pit.	CPC 3933	4	-
	Mycetia	*balansae*	Drake	CPC 3897, **CPC 4123**, CPC 4300	1, 4, 5	LC
	Myrioneuron	*tonkinense*	Pit.	CPC 3684	1	LC
	Ophiorrhiza	*sanguinea*?	Blume	CPC 3790	3	-
	Ophiorrhiza	*tonkinensis*?	Pit.	CPC 3974	1	-
	Paederia	sp.		CPC 4174	4	-
	Pavetta	*annamensis*	Pit.	CPC 4391; CPC 4397	5	LC
	Pavetta	sp.		CPC 4167	4	-
	Prismatomeris	*memecyloides*	Craib	CPC 3910a	1	LC
	Psychotria	*bonii*?	Pit.	CPC 3675	1	-
	Psychotria	*curviflora*	Wall.	CPC 3990	1	LC
	Psychotria	*sarmentosa*	Blume	CPC 4090, CPC 4250, CPC 4413, CPC 3795	1, 3	LC
	Psychotria	sp.		CPC 3852	3	-
	Randia	*turgida*	Roxb.	CPC 4192	5	LC
	Wendlandia	*glabrata*	DC.	CPC 3973	1	LC
	Wendlandia	sp.?		CPC 4100	1	-
	Xantonneopsis	sp.?		CPC 4069	1	-
	gen.	sp.		CPC 3897a	1	-
Rutaceae						
	Citrus	*macroptera*	Montr.	CPC 4028	1	LC
	Clausena	*austrosinica*?	Stone & Nair	CPC 3928, CPC 4218, CPC 3808, CPC 3841	1, 3	LC
	Glycosmis	*ovoidea*	Pierre	CPC 3728	2	LC
	Glycosmis	*puberula*	Lindl. ex Oliv.	**CPC 4083**	1	LC
	Glycosmis	*tricanthera*	Guill.	CPC 3764	3	LC
	Glycosmis	*stenocarpa*	(Drake) Tanaka	CPC 4310	5	-
Sapindaceae						

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Allophylus	*viridis*	Radlk.	CPC 4138	1	**LC**
	Allophylus	sp.		CPC 4388	5	-
	Amesiodendron	*sinense*	(Merr.) Hu	CPC 3941	4	**LC**
	Delavaya?	*toxocarpa*	Franch.	**CPC 4447**	5	**LC**
	Dimocarpus	sp.?		CPC 4005	1	-
	Nephelium	*chryseum*	Blume	CPC 4340	5	**NT**
	Xerospermum	*microcarpum*	Pierre	CPC 3799, **CPC 3802**, **CPC 3921**	3	**NT**
	gen.	sp.		CPC 4173	4	-
Sapotaceae						
	Sinosideroxylon	*wightianum*	(Sieb. & Zucc.) Aubr.	CPC 3800, CPC 3853	3	**NT**
Saurauiaceae						
	Saurauia	*tristyla*	DC.	CPC 4392	5	**LC**
Schisandraceae						
	Kadsura	*grandiflora*	(Wall.) Hook.f. & Thoms.	CPC 4368	5	**NT**
Scrophulariaceae						
	Brandisia	*glabrescens*	Rehd.	CPC 4096	1	**LC**
Simaroubaceae						
	Ailanthus	*integrifolia*	Lam.	CPC 3831	1	**LC**
	Picrasma	*javanica*	Blume	CPC 3953	1	**LC**
Sterculiaceae						
	Byttneria	*tortilis*	Gagnep.	**CPC 4027**, CPC 4207	1, 5	**LC**
	Pterocymbium	*tinctorium*?	(Blanco) Merr.	CPC 4114	1	-
	Sterculia	*hymenocalyx*	K.Schum.	CPC 3688, CPC 4180, CPC 3887, CPC 4387	1, 4, 5	**LC**
	Sterculia	sp.		CPC 3833	1	-
Styracaceae						
	Styrax	*litseoides*	J.E.Vidal	**CPC 3867**, CPC 4070, CPC 4385	1, 5	**LC**
Symplocaceae						
	Symplocos	*adenophylla*	Wall. ex G.Don	CPC 4302, CPC 4366	5	**LC**
	Symplocos	*sumuntia*	Buch.-Ham. ex G.Don	CPC 4203	5	**LC**
	Symplocos	sp.		CPC 3736	2	-
Theaceae						
	Adinandra	sp.		CPC 3857	3	-
	Camellia	*lutescens*?	Dyer	CPC 3720	2	-
	Schima	*wallichii*	(DC.) Choisy	CPC 4007, CPC 4191, **CPC 4314**	1, 5	**LC**
	gen.	sp.		CPC 3733	2	-
Thymellaeaceae						
	Aquilaria	*crassna*	Pierre ex H.Lec.	CPC 3884, CPC 4228	1, 3	**LC**
	Wikstroemia	*meyenianum*	Warb.	**CPC 4080**	1	**NT**
Tiliaceae						
	Burretiodendron?	*brilletii*	Kost.	**CPC 3650**	1	**NT**
	Grewia	*bulot*	Gagnep.	**CPC 4347**	5	**LC**
Ulmaceae						
	Celtis	*philippense*	Blanco	**CPC 4113**	1	**LC**
	Gironniera	*subequalis*	Planch.	**CPC 4171**, CPC 4374, CPC 4374	4, 5	**LC**
Urticaceae						
	Elatostema	*balansae*	Gagnep.	CPC 3819	1	**LC**
	Elatostema	*dissectum*	Wedd.	CPC 3753	2	**LC**
	Elatostema	*scabra*	Hall.f.	CPC 4047	1	**LC**
	Pilea	*baviensis*	Gagnep.	CPC 3891, CPC 4019,	1, 3	**LC**

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
				CPC 4128, CPC 4235		
Verbenaceae						
	Callicarpa	*nudiflora*	Hook. & Arn.	CPC 3788, CPC 3965	1, 3	LC
	Clerodendrum	*kaempferi*	(Jacq.) Sieb. & Hassk.	CPC 4338	5	LC
	Vitex	*glabrata*	R.Br.	CPC 4163	4	LC
Vitaceae						
	Tetrastigma	sp. 1		CPC 3943	4	-
	Tetrastigma	sp. 2		CPC 4143	1	-
Xanthophyllaceae						
	gen.	sp.		CPC 3734	2	-
ANGIOSPERMAE- MONOCOTYLEDONS						
Araceae						
	Aglaonema	*ovatum*	Engl.	CPC 3942	4	LC
	Aglaonema	*siamense*	Engl.	CPC 3692	1	LC
	Alocasia	*longifolia*	Miq.	CPC 3757		LC
	Amorphophallus	sp.		CPC 4204	5	-
	Arisaema	sp.		CPC 4236	3	-
	Homalomena	*occulta*	(Lour.) Schott	CPC 4420	1	LC
	Rhaphidophora	*decursiva*	(Roxb.) Schott	**CPC 3915**	3	LC
	Schismatoglottis	*calyptrata*	(Roxb.) Zoll. & Moritzi	CPC 3909, CPC 3669, CPC 3945	1, 4	LC
	Scindapsus	*poilanei*	Gagnep.	**CPC 3910**	4	LC
Arecaceae						
	Calamus	sp.		CPC 4438	1	-
	Caryota	*maxima*	Blume	CPC 4139	1	LC
	Licuala	sp.?		CPC 4179	4	-
	Licuala	sp.		CPC 4280	3	-
	Pinanga	*annamensis*	Magalon	CPC 4107	1	LC
	Rhapis	*laosensis*	Becc.	CPC 3763	3	LC
	Rhapis	sp.		CPC 4279	3	-
Commelinaceae						
	Amischotolype	*mollissima*	(Blume) Hassk.	CPC 3969, CPC 4003, CPC 4136	1	LC
	Pollia	*secundiflora*	(Blume) Bakh.f.	CPC 3992	1	LC
Convallariaceae						
	Aspidistra	*coccigera*	Aver. & Tillich	**CPC 3748** ,**CPC 3659**	1, 2	LC
	Tupistra	*theana*	Aver. & N.Tanaka	CPC 3649, **CPC 3870**, **CPC 3952**	1	VU
	Disporopsis	*longifolia*	Craib	CPC 4117, CPC 4242, CPC 4422	1, 3	NT
	Disporum	*trabeculatum*	Gagnep.	CPC 3714, CPC 4189	2, 5	NT
	Ophiopogon	*reptans*	Hook.f.	**CPC 3766,** CPC 3787, CPC 4224	1, 3	LC
	Ophiopogon	sp.		CPC 4335	5	-
	Peliosanthes	*argenteostriata*	Aver. & N.Tanaka	**CPC 3824**	1	LC
Costaceae						
	Costus	*tonkinensis*	Gagnep.	**CPC 3918, CPC 5002**	3	LC
Cyperaceae						
	Carex	sp.		CPC 3817	1	-
	Hypolytrum	*nemorum*	(Vahl) & Spreng.	CPC 3908a, CPC 4357	1, 5	LC
	Mapania	*palustris*	(Boeckl.) F.Vill.	CPC 3994	1	LC
Hypoxidaceae						
	Curculigo	*latifolia*	Dryand. ex Ait.	CPC 3834, **CPC 5003**	1	LC
Marantaceae						
	Phrynium	*dispermum*	Gagnep.	CPC 3835, CPC 4008	1	LC
Orchidaceae						

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Anoectochilus	*annamensis**	Aver.?	CPC 4375	5	VU
	Anoectochilus	*calcareus**	Aver.	CPC 4085, **CPC 4199**	1, 5	VU
	Aphyllorchis	*montana**	Rchb.f.	**CPC 4129**	1	EN
	Apostasia	*wallichii**	R.Br.	CPC 4362	5	NT
	Appendicula	*hexandra**	(J.Koenig) J.J.Sm.	CPC 3708, CPC 3792, CPC 4285	1, 2, 3	NT
	Biermannia	*calcarata**	Aver.	CPC 3947	1	NT
	Bulbophyllum	*ambrosia**	(Hance) Schltr.	CPC 4157	4	LC
	Bulbophyllum	*delitescens**	Hance	**CPC 3913**, CPC 3950, CPC 4178, CPC 4239, CPC 4428	1, 3, 4	LC
	Bulbophyllum	*depressum**	King & Pantl.	CPC 3754, **CPC 3807**, CPC 4062, CPC 4260	1, 2, 3	NT
	Bulbophyllum	*hymenanthum**	Hook.f.?	CPC 3864	3	NT
	Bulbophyllum	*macranthum**	Lindl.?	CPC 4436	1	LC
	Bulbophyllum	*retusiusculum**	Rchb.f.	CPC 3740; **CPC 3758**; CPC 3975; CPC 4076, CPC 4230, CPC 4426	1, 2, 3	NT
	Bulbophyllum	*salmoneum**	Aver. & Verm.	**CPC 3657**, CPC 3803, CPC 3854, CPC 3919, CPC 4104	1, 3	LC
	Bulbophyllum	sp.*		CPC 4261	3	-
	Calanthe	*alismifolia**	Lindl.	CPC 3654, **CPC 3749**, CPC 4141, CPC 4198, CPC 4435	1, 2, 5	LC
	Calanthe	*odora**	Griff.	**CPC 3698,** CPC 3979, CPC 4012, CPC 4437,	1	NT
	Callostylis	*rigida**	Blume	CPC 3656	1	LC
	Ceratostylis	*subulata**	Blume	CPC 3791, CPC 4064	1, 3	NT
	Cheirostylis	*chinensis**	Rolfe	CPC 3767, CPC 4067, CPC 4431	1, 3	LC
	Cleisostoma	*birmanicum**	(Schltr.) Garay	CPC 4072	1	NT
	Cleisostoma	*striatum**	(Rchb.f.) N.E.Br.	CPC 3646, **CPC 3739**, CPC 3774, **CPC 3916**, **CPC 4105**, CPC 4349	1, 2, 3, 5	NT
	Collabium	*chinense**	(Rolfe) Tang & F.T.Wang	CPC 3709, CPC 4197, **CPC 4371**	2, 5	NT
	Corymborkis	*veratrifolia**	(Reinw.) Blume	CPC 3697	1	NT
	Cymbidium	*cyperifolium*?*		CPC 4186	5	-
	Cyrtosia	*nana**	(Rolfe ex Downie) Garay	**CPC 4443**	5	EN
	Dendrobium	*aduncum**	Lindl.	CPC 4086	1	NT
	Dendrobium	*nobile**	Lindl.	CPC 4077	1	NT
	Dendrobium	*salaccense**	(Blume) Lindl.	CPC 3759, CPC 4088, CPC 4432	1, 3	NT
	Dendrobium	*spatella**	Rchb.f.	CPC 3778, CPC 3905, CPC 4246, CPC 4276	3, 4	LC
	Dendrobium	*terminale**	C.S.P.Parish & Rchb.f.	CPC 4039, CPC 4223, CPC 4263, CPC 4429	1, 3	LC
	Dendrobium	*thyrsiflorum* var. *thyrsiflorum**	Rchb.f.	CPC 3920, CPC 4370	2, 3	NT
	Dendrobium	*thyrsiflorum* var. *munutiflorum**	Aver.	CPC 3753a	2, 3	NT
	Dendrobium	*truncatum**	Lindl.	CPC 4042, CPC 4275	1, 3	LC
	Eria	*paniculata**	Lindl.	**CPC 3715**, CPC 4071	1, 2	LC
	Eria	*pannea**	Lindl.	CPC 4369	5	LC
	Eria	*spirodela**	Aver.	**CPC 3805**, CPC 4061, CPC 4251	1, 3	NT
	Eria	*thao**	Gagnep.	CPC 4188	5	NT
	Eria	*tomentosa**	(K.D.Koen.)	CPC 4269	3	NT

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
			Hook.f.?			
	Erythrodes	*hirsuta**	(Griff.) Ormerod	**CPC 4330**	5	LC
	Flickingeria	*angustifolia**	(Blume) A.D.Hawkes	**CPC 3861**, CPC 4091	1, 3	LC
	Flickingeria	*fimbriata**	(Blume) A.D.Hawkes	CPC 3777, **CPC 4087**	1, 3	LC
	Galeola	*nudiflora**	Lour.	**CPC 4373**	5	NT
	Gastrochilus	*calceolaris**	(Sm.) D.Don	CPC 3661	1	NT
	Gastrochilus	sp.*		CPC 4434	1	-
	Goodyera	*fumata*?*	Thwaites	CPC 3648	1	-
	Goodyera	*hispida**	Lindl.	CPC 4142, CPC 4108	1	VU
	Habenaria	*calcicola*?*	Aver.	CPC 3772	3	-
	Kingidium	*deliciosum**	(Rchb.f.) H.R.Sweet	CPC 3652, CPC 3918 a, **CPC 4035**	1	LC
	Liparis	*distans**	C.B.Clarke	CPC 4287	1	LC
	Liparis	*nigra**	Seidenf.	CPC 3673, CPC 4332	1	NT
	Liparis	*pumila**	Aver.?	CPC 4348	5	NT
	Mischobulbum	*cordifolium**	Schltr.	CPC 3909a	1	NT
	Mischobulbum	*ovifolium**	(Z.H.Tsi & Chen) Aver.	CPC 3957	1, 3	VU
	Nephelaphyllum	*tenuiflorum**	Blume	**CPC 3793**, CPC 4427, CPC 4277	1, 3, 5	NT
	Nervilia	*muratana**	S.W.Gale & S.K.Wu.	CPC 4350, CPC 4433	1	NT
	Oberonia	*cavaleriei**	Finet	CPC 3806	3	VU
	Oberonia	*kwangsiensis**	Seidenf.	CPC 4262	3	VU
	Oberonia	sp. 1*		CPC 4127	1	-
	Oberonia	sp. 2*		CPC 4376	5	-
	Odontochilus	*elwesii**	(Hook.f.) Ormerod	CPC 4232, **CPC 4333**	3	VU
	Panisea	*garrettii**	(I.D.Lund) Aver.	CPC 4084; CPC 4266	1	VU
	Parapterocera s	*elobe**	(Seidenf.) Aver.	CPC 3804, **CPC 3958**	1, 3	VU
	Phaius	*flavus**	(Blume) Lindl.	CPC 4231	3	NT
	Pholidota	*chinensis**	Lindl.	**CPC 3738**	2	NT
	Pholidota	*levelleana**	Schltr.	CPC 4040, CPC 4066, CPC 4222	1	NT
	Phreatia	*plantaginifolia**	(J.Koenig) Ormerod?	CPC 4425	1	VU
	Phreatia	sp.*		CPC 4081	1	-
	Podochilus	*khasianus**	Hook.f.	CPC 3756, CPC 4286	1, 2	VU
	Rhomboda	*petelottii**	(Gagnep.) Ormerod	CPC 3755, CPC 3825, CPC 4284	1, 2	VU
	Schoenorchis	*gemmata**	(Lindl.) J.J.Sm.	CPC 3699, CPC 4200	1, 5	NT
	Taeniophyllum	*glandulosum**	Blume	CPC 3768	3	VU
	Tainia	sp.*		CPC 4291	5	-
	Thelasis	*pygmaea**	(Griff.) Lindl.	CPC 3786, **CPC 3967**	1, 3	NT
	Thrixspermum	*centipeda**	Lour.	CPC 3651, CPC 4194	1, 5	NT
	Trichotosia	*pulvinata**	(Lindl.) Kraenzl.?	**CPC 3747**, CPC 3966, CPC 4274, CPC 4430	1, 2	NT
	Tropidia	*angulosa**	(Lindl.) Blume	CPC 4037	1	LC
	Tropidia	*curculigoides**	Lindl.	CPC 3822, **CPC 3872**, **CPC 4056**	1	LC
Phormiaceae						
	Chlorophytum	*laxum*	R.Br.	CPC 3647	1	LC
Smilacaceae						
	Smilax	*corbularia*	Kunth	CPC 4305	5	LC
Taccaceae						
	Tacca	*chantrieri*	André	CPC 3667, CPC 4011, CPC 4393	1, 5	LC
Trilliaceae						

Family	Genus	Species epithet	Author	Voucher specimens	Habitat	Note
	Paris	*polyphylla*	Sm.	CPC 3896a	1	NT
Zingiberaceae						
	Alpinia	sp. 1		CPC 3903	1	-
	Alpinia	sp. 2		CPC 3903a	1	-
	Alpinia	sp. 3		CPC 4442	1	-
	Amomum	sp. 1		CPC 4327	5	-
	Amomum	sp. 2		CPC 4379	5	-
	Amomum	sp 3		CPC 4115	1	-
	Amomum	sp. 4		CPC 4116	1	-
	Amomum	sp. 5		CPC 4165	4	-
	Curcuma	sp. 1		CPC 3915a	1	-
	Distichochlamys	*citrea*	Newman	CPC 4111	1	LC
	Siliquamomum	*tonkinense*	Baill.	CPC 4187	5	LC
	Zingiber	*purpureum*	Rosc.	CPC 3926a	4	LC
Unknown families						
	gen.	sp. 1		CPC 3929a	4	-
	gen.	sp. 2		CPC 4032	1	-
	gen.	sp. 3		CPC 4400	1	-
	gen.	sp. 4		CPC 3737	2	-
	gen.	sp. 5		CPC 3845	3	-
	gen.	sp. 6		CPC 3846	3	-
	gen.	sp. 7		CPC 4130	1	-
	gen.	sp. 8		CPC 4133	1	-

Annex 2.
VEGETATION DESCRIPTIONS IN MODEL PLOTS

Plot № 1.

Date: 24 July 2011. **Made by:** Averyanov L., N.T.Hiep N.S.Khang, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°39'11.6"N, 105°54'53"E.

Geomorphology position: alluvial seasonally flooded stream valley and low terrace between of remnant limestone mountains and hills composed with solid highly eroded rocky limestone.

Elevation: 465 m a.s.l. Slope exposition: S. Slope inclination: 5°.

Exposed rock outcrops: 3%.

Parental soil material: White solid limestone and black shale-limestone gravel.

Leaf litter: 3-5 cm in depth, with coverage about 85%.

Soil: Light yellow–brown (20-30 cm) clay; deeper - fine gravel; deeper - large rock rough limestone gravel.

Zonal (elevational) plant community: Closed primary evergreen seasonal tropical lowland broad-leaved forests on wet flat seasonally flooded stream valleys and on low flat river/stream terraces on crystalline eroded limestone and shaly limestone.

Available photo documentation: figures - 3-5, 10-12, 18, 35, 36-39, 42, 43, 45, 49, 65, 66, 95-97, 109.

Plant community structure

Plot size: 20 x 20 m.

Emergents:

Plant name:	Number	Height in m.	Diameter (in cm at BH)	Projective coverage in%.
Dracontomelum duperreanum	1	35-37 m	170 cm + buttresses to 7.5 m wide	30%

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20-25 m	6	40-70 cm	50%

Dominants: *Allospondias lakonensis* (30-35 m tall), *Aglaia* sp., *Artocarpus borneensis, Nephelium* sp. (2), *Wrightia macrocarpa, Actinodaphne* sp.

Associates: *Aglaia* sp., *Ailanthus* sp., *Allospondias lakonensis* (30-35 m tall), *Artocarpus borneensis*, *Canarium nigrum*, *Dipterocarpus hasseltii, Elaeocarpus grandiflorus*, *Manglietia chevalieri*, *Magnolia masticata*, *Pometia pinnata, Sloanea sinensis* (to 30 m tall).

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-15(20) m	10	10-40 cm	50-60%

Dominants: *Aglaia* sp. (1), *Pometia pinnata* (1), *Streblus macrophyllus* (8).

Associates: *Elaeocarpus grandiflorus*, *Michelia* sp.

3 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 m	25-30%

Dominants: *Antidesma* sp., *Knema pierrei*, *Microdesmis* ? sp., *Streblus macrophyllus,* Icacinaceae gen. sp.

4 stratum (herbs):

Height in m.	Projective coverage in %.
0.05-3 m	80-85%

Dominants: *Aglaonema* sp., *Alpinia* sp., *Amischotolype mollissima*, *Amomum* sp., *Amorphophallus* sp., *Ardisia* spp. (2 sp.), *Asarum wulingense, Aspidistra* spp. (2 species), *Blastus* sp.?, *Calamus* sp. (juv), *Calanthe odora*, *Capparis* sp. (juv), *Caryota sympetala* (juv), *Colysis* sp., *Corymborkis veratrifolia*, *Elatostema* sp., *Gomphandra* sp., *Goodyera fumata*, *Homalonema occulta*, *Hydnocarpus* sp., *Impatiens* sp., *Laportea* sp. (*Dendrocnide* sp.?) (juv), *Lasianthus* sp., *Leea indica*, *Miliusa sinensis*, *Ophiorrhiza* sp., *Pilea* sp., *Polystichum* sp., *Psychotria* sp., *Schismatoglottis calyptrata*, *Sterculia* sp., *Strychnos* sp. (juv), *Tacca chantrieri*, *Tectaria* spp. (2 species), *Trevesia palmata* (juv), *Zippelia begoniifolia*. Acanthaceae gen.sp., Euphorbiaceae gen.sp., Gesneriaceae gen.sp., Meliaceae (*Aglaia* sp.? juv), Rubiaceae gen.sp., + seedlings and saplings of higher strata trees.

5 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
To 5 cm	1-2%

Dominants: several species, mainly xylophytes

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Asplenium nidus, Ceratostylis subulata, Dendrobium truncatum, Eria paniculata, Flickingeria angustifolia, Lemmaphyllum microphyllum, Pothos repens*, *Pyrrosia lanceolata, Rhaphidophora* sp., *Schoenorchis gemmata, Trichotosia pulvinata*?

Climbers & lianas:

Dominants: *Anamirta cocculus*, *Bauhinia ornata, B. oxysepala* (to 20 m long), *Dischidia acuminata*, *Ficus racemosa*, *Piper albispicum*, *Scindapsus poilanei*, *Vandenboschia auriculata*.

Associates: *Ficus pumila, Lomariopsis spectabilis, Tetrastigma* sp.

Plot № 2.

Date: 25 July 2011. **Made by:** Averyanov L., N.S.Khang, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°38'00.4"N, 105°55'57.9"E.

Geomorphology position: Summit and higher part of steep slope of remnant mountain composed with solid highly eroded solid crystalline limestone.

Elevation: 804 m. Slope exposition N. Slope inclination: 50 to 70°.

Exposed rock outcrops: 3%.

Parental soil material: Fine gray limestone gravel, deeper rough gravel, deeper solid gray limestone.

Leaf litter: Conifer and broadleaf leaf litter 5-10 cm in depth.

Soil: Dark brown, 5 to 10 cm (35 cm in depressions).

Zonal (elevational) plant community: Closed primary evergreen seasonal tropical submontane broad-leaved, mixed and coniferous forests (with *Dacrydium elatum* and *Dacrycarpus imbricatus*) on steep rocky slopes and on mountain tops on crystalline highly eroded limestone.

Available photo documentation: figures - 23, 78-81, 88, 93, 94, 107, 126, 131-134.

Plant community structure

Plot size: 10 x 40 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
25-30 m	4	60-80 cm	40–50%

Dominants: *Dacrydium elatum*.

Associates: *Hopea siamensis, Dacrycarpus imbricatus*.

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-20 m	20	10-20 cm	70%

Dominants: *Camellia* sp.? (1), *Cinnamomum* sp.? (7), *Diospyros* sp. (2), *Garcinia* sp. (2), *Symplocos* sp., Euphorbiaceae gen.sp. (1), Fagaceae gen.sp. (1), Magnoliaceae gen.sp. (1), Rubiaceae gen.sp. (1), Theaceae gen.sp. (2), Fam.? (4).

Associates: *Archidendron clypearia, Hopea siamensis, Magnolia* sp., *Podocarpus neriifolius.*

3 stratum (shrubs):

Height in m.	Projective coverage in %.
4-10 m	60-70%

Dominants: *Calophyllum* sp., *Camellia lutescens*?, *Cinnamomum* sp. (very common), *Dacrycarpus imbricatus*, *Diospyros* sp., *Enkianthus quinquiflorus* (very common), *Ficus variolosa, Garcinia* sp., *Glycosmis ovoidea, Illicium cambodianum*, *Ixora* sp., *Lasianthus cyanocarpus, Lithocarpus* sp.?, *Magnolia* spp., *Medinilla* (or *Blastus* sp.) sp.?, *Phoebe tavoyana* (very common), *Podocarpus neriifolius,* Annonaceae gen.sp., Magnoliaceae gen.sp., Fam.? (3).

Associates: *Calophyllum balansae, Polyosma* sp.?

4 stratum (herbs):

Height in m.	Projective coverage in %.
0.01-4 m	20-40%

Dominants: *Adiantum flabellulatum*?, *Alpinia* sp., *Amorphophallus* sp., *Archidendron* sp.? (juv), *Ardisia silvestris*, *Ardisia* sp., *Arenga westerhoutii* (juv), *Asplenium* sp., *Begonia* sp., *Calamus* sp. (juv), *Carex indica, Dryopteris sparsa, Korthalsia* sp.? (juv), *Alsophila podophylla* (juv), *Dacrycarpus imbricatus* (juv), *Dianella nemorosa, Polystichum grande*, *Disporum trabeculatum, Hypolytrum nemorum, Illicium cambodianum, Lasianthus* sp., *Pandanus* spp. (2 species), *Phyllagathis* sp. (2 species), *Plagiogyria adnata, Polygala* sp., *Polystichum* spp. (3 species), *Selaginella* sp., Poaceae gen. sp. + seedlings and saplings of trees of higher strata.

Associates: *Acrorumohra diffracta, Anemone poilanei, Ardisia* sp., *Aspidistra coccigera, Asplenium ensiforme, Bolbitis appendiculata, Calanthe alismifolia, Collabium chinense, Cyclosorus truncatus, Disporum trabeculatum, Pentaphragma sinense, Pteris vittata, Rhomboda petelottii*.

5 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
To 1 cm	About 5%

Dominants: terrestrial *Sphagnum*–like pillows.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Appendicula hexandra, Asplenium nidus, Bulbophyllum ambrosia, Bulbophyllum depressum, Ceratostylis subulata, Cleisostoma striatum, Cymbidium dayanum, Dendrobium spatella, Eria paniculata, Eria thao, Eria* sp., *Flickingeria angustifolia, Pholidota chinensis, Pyrrosia lanceolata, Pyrrosia lingua*, *Trichotosia pulvinata*.

Associates: *Belvisia annamensis, Bulbophyllum retusiusculum, Podochilus khasianum, Teratophyllum hainanense, Trichomanes* sp.

Climbers & lianas:

Dominants: *Entada phaseoloides, Menispermaceae* (2 species, juv), *Piper* sp., *Psychotria serpens,* Rutaceae (*Luvunga* sp.?), *Smilax* sp., *Tetrastigma* sp.

Plot № 3.

Date: 26 July 2011. **Made by:** Averyanov L., N.S.Khang, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°39'36.7"N, 105°54'35.7"E.

Geomorphology position: Narrow ridge edge on top of remnant limestone mountain coming from N to S, bordered on perimeter by high cliffs.

Elevation: 612 m. Slope exposition: almost flat mountain top. Slope inclination: 0, almost flat.

Exposed rock outcrops: 90-95%.

Parental soil material: Solid highly eroded light gray limestone.

Leaf litter: 0 to 20 cm depth in depressions (to 1 m in deep pockets and crevices).

Soil: dark brown to nearly black, 0- to 50 cm in pockets.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on rocky mountain tops on crystalline highly eroded limestone (wind-formed and/or other specific modifications).

Available photo documentation: figures - 2, 6, 7, 21, 77, 89, 100-102, 120, 127-130, 139.

Plant community structure

Plot size: about 25 x 5 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
4-6 m	No data	10-25 cm	40%

Dominants: *Abelia chinensis, Ardisia* sp., *Calophyllum balansae*, *Garcinia oblongifolia*, *Hopea siamensis* (very common, main co-dominant), *Phyllanthus insularis, Pistacia cucphuongensis, Pittosporum pauciflorum*, *Sinosideroxylon wightianum*, *Xerospermum microcarpum*.

2 stratum (shrubs):

Height in m.	Projective coverage in %.
2-4 m	30-40%

Dominants: *Alstonia guanxiensis*, *Ardisia* sp., *Brachytome wallichii, Callicarpa nudiflora*, *Campylotropis henryi*, *Glycosmis tricanthera, Glyptopelatum sclerocarpum*, *Litsea* sp.?, *Psychotria sarmentosa*.

Associates: *Desmos pedunculosus, Rhapis laosensis* – mostly on slope near to top.

3 Bamboo thicket:

Height in cm.	Projective coverage in %.
1-2 m	90%

Dominants: Poaceae (Bambusoideae) gen. sp.

4 stratum (herbs): Terrestrial and lithophytes

Height in m.	Projective coverage in %.
0.05-1 m	5-10%

Dominants: *Ardisia* spp. (2 species), *Asplenium tenuifolium*, *Begonia crassula*, *Begonia* sp., *Carex* sp., *Cheirostylis chinensis*, *Hedyotis acutangula*, *Ophiopogon reptans, Ophiopogon* sp., *Ophiorrhiza sanguinea,* + seedlings and saplings of trees and shrubs of higher strata.

Associates: *Habenaria calcicola*, *Nephelaphyllum tenuiflorum, Piper albispicum* - all mostly on slope near to the top.

5 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
Less then 1 cm	Less then 1%

Dominants: juvenile, unidentified.

Non strata vegetation:

Epiphytes, semi-epiphytes and lithophytes:

Dominants: *Appendicula hexandra* (very common)*, Bulbophyllum depressum, Bulbophyllum retusiusculum*, *Bulbophyllum salmoneum*, *Ceratostylis subulata* (very common), *Cleisostoma striatum*, *Coelogyne fimbriata*, *Dendrobium terminale*, *Dendrobium spatella*, *Eria pannea*, *Eria spirodela* (abundant), *Eria thao*, *Flickingeria fimbriata, Flickingeria angustifolia*, *Oberonia cavaleriei, Ornithochilus difformis, Parapteroceras elobe, Pholidota articulata, Pholidota yunnanensis*?, *Taeniophyllum glandulosum* (canopy epiphyte), *Thelasis pygmaea* (very common), *Vaccinium dunalianum* (very common).

Associates: *Dendrobium salaccense, Liparis viridiflora*, *Vittaria elongata* - mostly on slope near to the mountain top.

Climbers & lianas:

Dominants: *Alyxia hainanensis*, *Bauhinia ornata*?, *Morinda umbellata*, *Clematis* sp.

Plot № 4.

Date: 27 July 2011. **Made by:** Averyanov L., N.S.Khang, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°39'21.7"N, 105°54'59.5"E.

Geomorphology position: middle part of slope of remnant limestone mountain with summit about 750 a.s.l at a top.

Elevation: 556 m. Slope exposition: NE. Slope inclination: 80% + vertical cliffs.

Exposed rock outcrops: 85-90%.

Parental soil material: Light gray to almost white solid crystalline limestone.

Leaf litter: 5, to 60 cm in depth (in pockets).

Soil: Light brown, about 3-5 cm in depth; deeper - yellow–brown clay; deeper - few rough gravel; deeper - solid limestone.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 60-63, 72, 115, 137, 138.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20–30(35) m	12	18-50 cm	40-50%

Dominants: *Ailanthus integrifolia, Diospyros mun* (DBH about 20 cm), *Grewia* sp., *Hopea siamensis* (4), *Polyalthia* sp.?, *Pometia pinnata*, *Pterospermum* sp.?, Moraceae gen.sp., Fam. gen.sp.?

Associates: *Alangium ridleyi* (very common), *Phoebe* sp.

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-20 m	20	10-22 cm	60-70%

Dominants: *Cinnamomum* sp., *Dendrocnide urentisssima*, *Diospyros* sp., *Ficus* sp., *Grewia* sp., *Hopea siamensis*, *Knema pierrei*, *Magnolia* spp., *Pittosporum pauciflorum*, *Pometia pinnata*, *Pterospermum* sp., *Streblus macrophyllus*, *Syzygium* sp., Sapindaceae gen.sp.

3 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 m	40-50%

Dominants: *Clausena austroindica*, *Diospyros rufogemmata, Ficus* sp., *Hopea* sp., *Illicium cambodianum, Knema pierrei*, *Lasianthus* sp., *Ormosia* sp.?, *Phoebe tavoyana, Pittosporum pauciflorum*, *Polyalthia intermedia, Pometia pinnata*, *Psychotria* sp., *Radermachera* sp., *Streblus macrophyllus, Sumbaviopsis albicans*, Sapindaceae gen.sp.

Associates: *Miliusa sinensis.*

4 stratum (herbs):

Height in m.	Projective coverage in %.
0.05-3 m	30%

Dominants: *Aglaonema* sp., *Alocasia* sp., *Alpinia* sp., *Amorphophallus* sp., *Ardisia silvestris*, *Ardisia* sp., *Arenga westerhoutii* (juv), *Aspidistra coccigera*, *Calamus* sp. (juv), *Calanthe odora*, *Carex* sp., *Caryota* sp. (juv), *Chirita* spp. (2 species), *Elatostema balansae, Elatostema* spp. (3 species), *Goodyera fumata*, *Lasianthus* sp., *Lepisorus* sp., *Ophiorrhiza* sp., *Pandanus* sp., *Peliosanthes argenteostriata*, *Phyllanthus* sp., *Piper* sp., *Polystichum deltodon*, *Polystichum* sp., *Pseudodracontium* sp., *Pteris grevilleana*, *Rhynchotechum* sp., *Selaginella* sp., *Strobilanthes* sp., *Tectaria* spp. (3 species), *Tropidia curculigoides, Zeuxine nervosa,* + seedlings and saplings of trees of higher strata.

Associates: *Asplenium cardiophyllum, Rhomboda petelottii.*

5 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
1-5 cm	To 60%

Dominants: juvenile, unidentifiable, all lithophytes and xylophytes.

Non strata vegetation:

Epiphytes, semi-epiphytes and lithophytes:

Dominants: *Aglaomorpha coronans*, *Antrophyum* sp., *Asplenium antrophioides, Asplenium nidus, Begonia* spp. (2 species), *Bulbophyllum retusiusculum, Dendrobium terminale, Flickingeria fimbriata, Liparis viridiflora, Paraboea* sp., *Pyrrosia lanceolata, Pyrrosia lingua*.

Associates: *Aeschynanthus* spp. (2 species), *Primulina* sp.

Climbers & lianas:

Dominants: *Aeschynanthus* sp., *Bauhinia* sp. (diam. to 20 cm), *Ficus pumila*, *Fissistigma* sp. (diam. to 15 cm), *Hoya* sp., *Lomariopsis spectabilis, Medinilla* sp., *Piper* sp. (long creeping vine), *Pothos* sp. (long creeping vine), *Epipremnum pinnatum*, *Scindapsus* sp., *Smilax* sp. (juv), *Stephania* sp.?, *Strychnos* sp. (diam. to 20 cm).

Associates: *Uvaria grandiflora.*

Plot № 5.

Date: 27 July 2011. **Made by:** N.T.Hiep, Averyanov L., N.S.Khang, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°39'31.7"N, 105°54'48.2"E.

Geomorphology position: lower part of very steep rocky slope of remnant limestone mountain faced to humid stream canyon, at about 50 m above riverbed.

Elevation: 422 m. Slope exposition: E. Slope inclination: 40-50°.

Exposed rock outcrops: 45-50%.

Parental soil material: White solid eroded limestone.

Leaf litter: 5-10 cm in depth, to 40 cm in depressions and pockets.

Soil: Dark brown–gray; deeper - brown clay; deeper - few rough gravel; deeper - rocky limestone.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 46, 47, 48, 52, 68, 118, 119, 142, 143, 144.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20–35 m	2	60-70 cm	30%

Dominants: *Burretiodendron brilletii, Dipterocarpus hasseltii.*

Associates: *Aglaia* sp., *Ailanthus* sp., *Allospondias lakonensis* (30-35 m tall), *Artocarpus borneensis*, *Canarium nigrum*, *Cassia* sp.?, *Dipterocarpus* sp., *Elaeocarpus grandiflorus*, *Manglietia fordiana*, *Michelia* sp., *Pometia pinnata*, *Sloanea sinensis*.

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-20(25) m	11	10-40 cm	70%

Dominants: *Arenga westerhoutii* (1), *Hydnocarpus* sp. (1), *Knema pierrei* (2), *Machilus* sp. (1), *Magnolia liliifera* (1), *Polyalthia jucunda, Streblus macrophyllus* (2), Fam. gen. sp. (1).

Associates: *Hydnocarpus* sp., *Dipterocarpus* sp.

3 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 m	50%

Dominants: *Caryota sympetala, Knema pierrei, Streblus macrophyllus.*

Associates: *Albizia* sp.

4 stratum (herbs):

Height in m.	Projective coverage in %.
0.05-3 m	15%

Dominants: *Aglaonema ovatum*, *Alocasia longifolia*, *Amomum* sp., *Amorphophallus* sp., *Ardisia* sp., *Arenga westerhoutii* (juv), *Aspidistra coccigera, Aspidistra* sp., *Asplenium unilaterale*, *Begonia acetosella, Calanthe alismifolia, Caryota sympetala* (juv), *Colysis digitata*, *Distichochlamys citrea, Elatostema balansae, Elatostema scabra*, *Goodyera fumata, Impatiens* sp., *Magnolia liliifera* (juv), *Microdesmis* sp. (juv), *Ophiorrhiza tonkinensis*?, *Pilea baviensis*, *Pinanga* sp. (juv), *Piper* sp., *Polystichum* sp., *Pseudodracontium* sp., *Psychotria* sp., *Rhaphidophora decursiva*, *Schismatoglottis calyptrata, Sterculia* sp., *Streblus macrophyllus, Strobilanthes* sp., *Tacca chantrieri, Tectaria* spp. (2 species), Annonaceae gen.sp., Dipterocarpaceae gen.sp. (juv), Euphorbiaceae gen. spp. (2 species), + seedlings and saplings of trees of higher strata.

Associates: *Angiopteris cochinchinensis, Alpinia* sp., *Costus tonkinensis, Homalomena occulta*.

5 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
to 0.5 cm	30-40%

Dominants: juvenile, unidentifiable, all lithophytes and xylophytes.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Asplenium nidus*, *Bulbophyllum ambrosia*, *Bulbophyllum salmoneum*, *Callostylis rigida, Cleisostoma striatum, Davallia repens, Dendrobium spatella, Dendrobium truncatum, Eria paniculata, Eria thao, Flickingeria angustifilia, Huperzia carinata, Pyrrosia lanceolata, Pyrrosia lingua*, *Thelasis pygmaea*, *Vaccinium bullatum* (tuberiferous epiphytic vine).

Climbers & lianas:

Dominants: *Bauhinia ornata*, *Combretum sundaicum*, *Dischidia acuminata, Dischidia* sp., *Ficus pumila, Gnetum montanum, Illigera* sp., *Piper* sp. (long creeping vine), *Pothos repens*, *Rhaphidophora pinnata, Scindapsus poilanei*, *Tetrastigma* sp.

Associates: *Byttneria aspera* (to 4 cm in diam.), *Entada phaseoloides*, *Strychnos wallichii.*

Plot № 6.

Date: 28 July 2011. **Made by:** Averyanov L., N.S.Khang.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°39’21.1’’N, 105°54’41.7’’E.

Geomorphology position: narrow ridge on top of remnant limestone mountain coming from E to W, bordered on perimeter by high cliffs.

Elevation: 570 m. Slope exposition: almost flat mountain top. Slope inclination: almost 0.

Exposed rock outcrops: 60-70%.

Parental soil material: Light gray to white solid crystalline very highly eroded limestone.

Leaf litter: 0, to 20-30 cm in depth in deep pockets and crevices.

Soil: Dark brown, to 20 cm depth in pockets and deep crevices only.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on rocky mountain tops on crystalline highly eroded limestone (wind-formed and/or other specific modifications).

Available photo documentation: figures - 22, 69, 73-76, 82-87, 112-114, 124.

Plant community structure

Plot size: about 20 x 5 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
5–10(12) m	26	5-15(25) cm	10%

Dominants: *Adinandra* sp.? (2), *Garcinia oblongifolia* (1), *Homalium phanerophlebium* (1), *Memecylon edule* (1), *Pistacia cucphuongensis* (2), *Radermachera* sp. (2), *Hopea siamensis* (14), Lauraceae gen.sp. (3).

Associates: *Antidesma bunius, Magnolia liliifera, Miliusa fusca, Styrax litseoides* mainly on slope near to mountain top.

2 stratum (shrubs):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
3-5 m	15	3-4 cm	15%

Dominants: *Calophyllum* sp. (2), *Campylotropis henryi* (2), *Garcinia* sp. (2), *Psychotria* sp. (2), *Sinosideroxylon wightianum* (2), *Tirpitzia sinensis* (1), *Hopea siamensis* (4).
Associates: *Glochidion pilosum* (very common), *Litsea* sp.

3 stratum (undershrubs):

Height in m.	Projective coverage in %.
1-3 m	10-15%

Dominants: *Alstonia guanxiensis*, *Ardisia* sp., *Callicarpa nudiflora, Calophyllum balansae*, *Garcinia oblongifolia*, *Psychotria* sp., *Sinosideroxylon wightianum*, Poaceae (Bambusoideae) gen.sp.

4 stratum (herbs):

Height in m.	Projective coverage in %.
0.03-1 m	5%

Dominants: *Ardisia* sp., *Aspidistra* sp., *Asplenium antrophioides*, *Asplenium tenuifolium*, *Begonia crassula*, *Hedyotis acutangula*, *Impatiens verrucifer*, *Tupistra theana, +* seedlings and saplings of trees and shrubs of higher strata.
Associates: *Asplenium cardiophyllum, Asplenium thunbergii, Cyclopeltis crenata, Selaginella* sp., *Tropidia curculigoides*, mainly on slope near to mountain top.

5 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
0.1-3 cm	5-10%

Dominants: juvenile, unidentified, all lithophytes.
Non strata vegetation:
Epiphytes, semi-epiphytes and lithophytes:
Dominants: *Bulbophyllum depressum, Bulbophyllum hymenanthum, Bulbophyllum salmoneum, Bulbophyllum* sp., *Callostylis rigida, Ceratostylis subulata, Cleisostoma striatum, Dendrobium spatella, Dendrobium terminale, Dendrobium truncatum, Epigeneium labuanum, Eria paniculata, Eria spirodela* (abundant), *Eria thao* (very common), *Flickingeria angustifolia* (very common), *Flickingeria fimbriata, Liparis pumila, Pholidota yunnanensis* (very common), *Pyrrosia lanceolata* (very common), *Pyrrosia lingua* (very common), *Schoenorchis gemmata, Thelasis pygmaea* (very common), *Vaccinium dunalianum* (tuberiferous lithophyte and semi-epiphyte).
Climbers & lianas:
Dominants: *Dischidia acuminata*, *Morinda umbellata, Morinda officinalis*, *Vaccinium dunalianum*.
Associate: *Pottsia grandiflora.*
Plants of specific life forms: *Loranthus* sp. (canopy parasitic undershrub).

Plot № 7.
Date: 29 July 2011. **Made by:** Averyanov L., N.T.Hiep N.S.Khang, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°40'03.6"N, 105°55'08.5"E.

Geomorphology position: low flat seasonally flooded alluvial river terrace on limestone and lime shale.

Elevation: 336 m. Slope exposition: 0, almost flat. Slope inclination: 0, almost flat.

Exposed rock outcrops: 5%.

Parental soil material: alluvial clay; deeper white solid crystalline eroded limestone.

Leaf litter: to 5 cm in depth, with coverage about 70%.

Soil: Brown 5-15 cm depth; deeper - light brown alluvial clay to at least 1m depth and deeper.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on wet flat seasonally flooded river/stream valleys and on low flat river/stream terraces on crystalline eroded limestone and shaly limestone.

Available photo documentation: figures - 9, 17, 40, 41.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20–25 m	2	35 cm	15%

Dominants: *Cryptocarya concinna.*

Associates: *Syzygium* sp.

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-20 m	12	12-40 cm	90%

Dominants: *Antidesma* sp., *Ardisia* sp., *Streblus macrophyllus,* Euphorbiaceae gen.sp.

3 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 m	35%

Dominants: *Antidesma* sp., *Litsea* sp., *Streblus macrophyllus*.

4 stratum (herbs):

Height in m.	Projective coverage in %.
0.05 m	60%

Dominants: *Aglaonema ovatum*, *Amorphophallus* sp., *Ardisia* sp., *Aspidistra* sp. (abundant, with 90% coverage), *Asplenium obscurum, Calamus* sp. (juv), *Caryota sympetala* (juv), *Clausena* sp. (juv), *Colysis* sp., *Croton* sp., *Diplazium* sp., *Elatostema* sp., *Gynostemma pubescens* (creeping terrestrial vine), *Ophiopogon* sp., *Peliosanthes* sp., *Pseudodracontium* sp., *Pteris grevilleana*, *Sambucus hookeri* (juv), *Schismatoglottis calyptrata, Tectaria* sp. (juv), *Thelypteris* sp., Rubiaceae gen.sp. (juv), + seedlings and saplings of trees and shrubs of higher strata.

5 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
to 1 cm	3-5%

Dominants: juvenile, unidentified, xylophytes and epiphytes only.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Dendrobium terminale*, *Pothos* sp. (large creeping epiphytic vine).

Climbers & lianas:

Dominants: *Bauhinia ornata* (diam. to 20 cm and 25 m long), *Callerya reticulata* (diam. to 15 cm and 20 m long), *Dischidia* sp. (small epiphytic vine), *Gynostemma pubescens* (mostly creeping, terrestrial vine), *Hiptage* sp., *Pothos repens* (long creeping epiphytic vine), *Paederia* sp., *Scindapsus poilanei*, *Stephania sinica*? (juv), Asclepiadaceae gen. spp.? (2 species), Sterculiaceae gen. sp.

Plot № 8.

Date: 5 August 2011. **Made by:** N.T.Hiep, N.Tap, N.S.Khang, L.T.Kien.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°41'28.7"N, 105°53'41.7"E.

Geomorphology position: leveled more or less flat ridge edge of low ridge directed in N-S direction.

Elevation: 532 m. Slope exposition: NE. Slope inclination: less than 5°, to almost flat.

Exposed rock outcrops: 5%.

Parental soil material: dark to light brown lime shale basic rocks.

Leaf litter: to 3 cm in depth, with 100% coverage.

Soil: Light yellow to brown-yellow, to 50 cm in depth.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 19, 51, 56.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
30-35 m	3	50-55 cm	15%

Dominants: *Actinodaphne* sp. (*CPC 3900a*), *Vatica cinerea* (*CPC 3924a, CPC 3960*).

Associates: *Alangium ridleyi, Amoora oligosperma* (*CPC 4160*), *Artocarpus styracifolia* (*CPC 4156*), *Canarium bengalense, Cinnamomum ovatum* (*CPC 4172*), *Ficus altissima, Gironniera subequalis* (*CPC 4171*), *Litsea* sp. (*CPC 4154*), *Lithocarpus* sp., *Michelia macclurei* (*CPC 4159*), *Phoebe tavoyana* (*CPC 4182*).

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20-30 m	8	22-55 cm	70%

Dominants: *Vatica cinerea* (6), *Engelhardia roxburghiana* (1), *Actinodaphne* sp. (1).

3 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-19 m	11	10-15 cm	40%

Dominants: *Aglaia* sp. (1), *Vatica cinerea* (6), *Actinodaphne* sp. (3), *Miliusa* sp. (1).

4 stratum (shrubs):

Height in m.	Projective coverage in %.
3-7 m (to 15 cm DBH)	10%

Dominants: *Antidesma costulatum*, *Ardisia* sp., *Dalbergia* sp, *Litsea* spp. (2 sp.), *Sloanea sinensis*.

5 stratum (herbs):

Height in m.	Projective coverage in %.
0.5-3 m	70%

Dominants: *Aglaia* sp. (juv), *Albizia* sp. (juv), *Ardisia* sp., *Camellia* sp., *Carex* sp., *Cinnamomum* sp. (juv), *Clinacanthus* sp., *Desmos* sp., *Diplazium donianum*, *Garcinia* sp., *Alangium ridleyi* (juv), *Hypolytrum nemorum, Lasianthus* spp. (2 sp.), *Litsea verticillata* (juv), *Psychotria* spp. (2 sp.), *Tectaria decurrens*, *Uvaria* sp., *Vatica cinerea* (juv), *Zingiber zerumbet,* Sapindaceae gen.sp. (juv).

6 stratum (mosses & lichens): no data.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Pothos repens, Epipremnum pinnatum, Scindapsus poilanei, Hoya* sp.

Climbers & lianas:

Dominants: *Erythropalum scandens*, *Artabotrys hexapelalus*, *Desmos* sp., *Melodinus* sp., *Piper gymnostachyum*, *Strychnos* sp.

Plot № 9.

Date: 5 August 2011. **Made by:** Averyanov L., P.V.The, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality vicinity of Mo O O O village.

Coordinates: 17°41’31.7’’N, 105°53’14.1’’E.

Geomorphology position: higher part of slope near the top of remnant limestone mountain with top about 750 m a.s.l. composed with highly eroded rocky limestone.

Elevation: 680 m. Slope exposition: E. Slope inclination: 70%.

Exposed rock outcrops: 80%.

Parental soil material: white crystalline highly eroded limestone.

Leaf litter: 5-10 cm, to 50 cm in pockets.

Soil: dark brown to nearly black, in pockets to 50 cm depth; deeper - solid limestone.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 110, 111, 121, 122, 162.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10–18 m	22	8-30 cm	80%

Dominants: *Calophyllum balansae* (3), *Hopea siamensis* (8), *Ilex* sp. (1), *Phyllanthus insularis* (1), *Sapium rotundifolium* (1), *Sinosideroxylon wightianum* (1), *Vatica cinerea* (2), *Xerospermum microcarpum* (2), Annonaceae gen. sp. (1), Sapotaceae gen. sp. (1), Theaceae gen. sp. (1).

2 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 cm (to 15 cm) DBH	60%

Dominants: *Breynia* sp., *Callicarpa* sp., *Calophyllum balansae, Diospyros* sp., *Lasianthus* sp., *Memecylon edule, Phyllanthus insularis, Pittosporum pauciflorum, Vatica cinerea*?, *Wendlandia* sp., *Xerospermum microcarpum,* Annonaceae gen.sp., Rubiaceae gen.sp.

3 stratum (terrestrial and lithophytic herbs):

Height in m.	Projective coverage in %.
0.01-3 m	20%

Dominants: *Alpinia* sp., *Amischotolype mollissima*, *Amorphophallus* spp. (2 sp.), *Ardisia* sp., *Asplenium saxicola*, *Asplenium* sp., *Begonia crassula*, *Campylotropis henryi*, *Carex* sp., *Canthium* sp., *Cheirostylis chinensis, Coelogyne fimbriata, Elatostema balansae, Hedyotis acutangula, Hedyotis biflora*, *Impatiens verrucifer*, *Lasianthus* sp., *Lemmaphyllum microphyllum, Lepisorus* sp., *Liparis viridiflora, Liparis* sp., *Mischobulbum longiscapum, Ophiorrhiza tonkinensis*?, *Pandanus* sp., *Pholidota levelleana*, *Pilea baviensis*, *Pilea peltata, Pseudodracontium* sp., *Sterculia lanceolata, Tupistra theana,* Gesneriaceae gen. sp, Poaceae (Bambusoideae - less than 1%).

6 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
to 3 cm	30%

Dominants: juvenile, unidentified, mostly lithophytes.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Asplenium nidus, Bulbophyllum delitescens, Bulbophyllum retusiusculum, Bulbophyllum* spp. (2 sp.), *Cleisostoma racimiferum, Cleisostoma rostratum, Cleisostoma striatum, Cleisostoma williamsonii, Coelogyne fimbriata, Dendrobium aduncum, Dendrobium spatella, Dendrobium terminale, Eria paniculata, Eria thao, Eria* sp., *Flickingeria angustifolia, Flickingeria fimbriata, Gastrochilus* sp., *Parapteroceras elobe, Pyrrosia lanceolata, Pyrrosia lingua, Thelasis pygmaea* (abundant), *Trichotosia pulvinata*.

Associates: *Laportea interrupta* (very common in shady places).

Climbers & lianas:

Dominants: *Afgekia filipes* (to 6 cm in diam.), *Alyxia hainanensis, Bauhinia ornata, Berchemia loureiriana*, *Caesalpinia* sp., *Clematis uncinata*, *Connarus* sp. (to 10 m long), *Dischidia acuminata, Hoya carnosa, Hiepia corymbosa*, *Jasminum* sp., *Pothos grandis, Pothos repens, Radermachera* sp., *Epipremnum pinnatum* (juv), *Schefflera*

pauciflora, *Smilax* sp., *Tetrastigma* sp., *Vaccinium dunalianum,* Menispermaceae gen. sp. (to 6 cm in diam.).

Plot № 10.

Date: 6 August 2011. **Made by:** N.T.Hiep, N.Tap, N.S.Khang, L.T.Kien.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°41'25.6"N, 105°53'40.0"E.

Geomorphology position: lower part of slope of remnant limestone mountain faced to narrow flat shady river canyon directed from N to S.

Elevation: 460 m. Slope exposition: E-W. Slope inclination: 10°.

Exposed rock outcrops: 10%.

Parental soil material: white crystalline highly eroded limestone.

Leaf litter: 3-5 cm in depth, with coverage about 100%.

Soil: Dark brown, more than 50- 60 cm in depth.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 47, 48, 53, 57, 64, 70, 98, 99.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
25-35 m	3	55-150 cm	20%

Dominants: *Aglaia* sp. (1), *Actinodaphne* sp. (*CPC 3900a,* 2 samples; buttresses to 5 m wide).

Associates: *Actinodaphne* sp. (*CPC 3900a*, very common outside plot), *Beilschmiedia pergamentacea* (*CPC 3995*), *Cryptocarya annamensis* (*CPC 4015*), *Gironniera subequalis* (*CPC 4171*), *Litsea* sp.1 (*CPC 4154*), *Litsea* sp.2, *Michelia gioi* (*CPC 3930*), *Pometia pinnata*, *Schima wallichii* (*CPC 4007*), *Zenia insignis* (*CPC 4025*).

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
15-25 m	6	12-56 cm	30%

Dominants: *Diospyros* sp. (1), *Alangium ridleyi* (*CPC 3920*, 1 sample), *Hydnocarpus annamensis* (1), *Actinodaphne* sp. (*CPC 3900a*, 1 sample), Rubiaceae gen. sp. (2).

3 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
7-15 m	3	10-20 cm	5%

Dominants: *Ardisia* sp. (1), *Polyalthia jucunda* (1), *Wrightia macrocarpa* (*CPC 4009*, 1 sample).

4 stratum (shrubs):

Height in m.	Projective coverage in %.
3-7 m	5%

Dominants: *Pometia pinnata, Streblus macrophyllus*, *Amoora oligosperma* (*CPC 4160*), *Sumbaviopsis albicans* (*CPC 3827*).

5 stratum (herbs):

Height in m.	Projective coverage in %.
0.5-3 m	85%

Dominants: *Achyranthes* sp., *Aglaia* sp., *Aglaonema siamense*, *Alangium ridleyi*, *Alocasia macrorrhiza*, *Amischotolype mollissima, Amischotolype hookeri, Angiopteris cochinchinensis, Antidesma* sp., *Aquilaria crassna*, *Ardisia* sp., *Calanthe odora*, *Caryota* sp. (juv), *Cinnamomum* sp. (juv), *Dichroa febrifuga*, *Ficus hispida*, *Gonocaryum* sp. (juv), *Homalonema occulta, Impatiens* sp., *Knema pierrei* (juv), *Laportea thorelli*, *Lasianthus* spp. (2 sp.), *Litsea* sp. (juv), *Mapania palustris, Pandanus* sp., *Peliosanthes* sp., *Pometia pinnata* (juv), *Pterospermum* sp. (juv), *Schismatoglottis calyptrata*, *Sterculia lanceolata* (juv), *Tacca chantrieri* (*CPC 4011*), *Tectaria* sp., *Wrightia macrocarpa, Wrightia* sp. (juv), *Zingiber zerumbet, Zippelia begoniifolia* + seedlings and saplings of other trees and shrubs of higher strata.

6 stratum (mosses & lichens): no data.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Asplenium nidus, Asplenium unilaterale* (*CPC 4000*), *Cleisostoma birmanicum, Davallia repens* (*CPC 4012*), *Diplazium esculentum*?, *Diplazium* sp., *Heterogonium sagenoides* (*CPC 3999*), *Kingidium deliciosum, Tectaria decurrens* (*CPC 4002*), *Thelypteris* sp. (*CPC 4001*), *Thrixspermum centipeda*.

Climbers & lianas:

Dominants: *Bauhinia ornata*, *Byttneria tortilis*, *Calamus nilletii*?, *Clematis uncinata*, *Derris* sp., *Epipremnum pinnatum, Erythropalum scandens*, *Ficus racemosa*, *Lomariopsis spectabilis*, *Piper gymnostachyum, Pothos repens*, *Scindapsus poilanei*, *Smilax corbularia*, *Strychnos* sp., *Tetrastigma* sp., *Trichosanthes* spp. (2 sp.).

Associates: *Combretum sundaicum, Entada phaseoloides, Mussaenda bonii*?

Plot № 11.

Date: 6 August 2011. **Made by:** Averyanov L., P.V.The, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°41'22.8"N, 105°53'37.51"E.

Geomorphology position: lower part of slope of remnant limestone mountain (with top about 750 m a.s.l.) composed with highly eroded rocky limestone faced to narrow shady stream canyon.

Elevation: 504 m. Slope exposition: N. Slope inclination: 45%.

Exposed rock outcrops: 15%.

Parental soil material: dark grey solid limestone mixed with black indistinctly stratified solid shale limestone.

Leaf litter: 5-10 cm with coverage about 90%.

Soil: dark grey-brown with rough lime grovel, more than 40 cm in depth.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 135, 136.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
35-40 m	6	60-100 cm	45%

Dominants: *Canarium* sp. (1), *Dracontomelum duppereanum* (1), *Hopea siamensis* (1), *Pometia pinnata* (3).

Associates: *Pterospermum* sp., *Zenia insignis*.

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20-30 (35) m	6	25-35 cm	40%

Dominants: *Neolitsea* sp., *Polyalthia jucunda* (2 sp)., *Pometia pinnata,* Anacardiaceae gen. sp. + 2 fallen died trees.

Associates: *Hopea siamensis*, *Syzygium* sp., *Vatica cinerea*.

3 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-20 m	7	8-20 cm	40%

Dominants: *Hydnocarpus annamensis*?*, Knema pierrei, Polyalthia* sp., *Sumbaviopsis albicans.*

4 stratum (shrubs; 31 total, 4-10 cm diam.):

Height in m.	Projective coverage in %.
2-10 cm	60%

Dominants: *Baccaurea* sp., *Citrus macroptera, Knema pierrei, Psychotria* sp., *Streblus macrophyllus*.

5 stratum (herbs, terrestrial and lithophytic):

Height in m.	Projective coverage in %.
0.01-2 m	10%

Dominants: *Aglaonema siamense*, *Alpinia* sp., *Amorphophallus* sp., *Arenga westerhoutii* (juv), *Aspidistra* spp. (2 sp.), *Asplenium unilaterale, Calamus* sp, (juv), *Calanthe odora, Caryota* sp. (juv), *Distichochlamys citrea, Elatostema* sp., *Ophiopogon* sp., *Pilea* sp., *Pleocnemia leuzeana* (juv), *Pseudodracontium* sp., *Schismatoglottis calyptrata, Sterculiaceae* sp., *Streblus macrophyllus* (juv), *Tectaria decurrens* (juv), *Tropidia angulosa, Tropidia curculigoides, Zippelia begoniifolia,* Gesneriaceae gen. spp. (2 sp., juv), + many seedling of trees of higher strata (mainly – *Pometia pinnata* and *Streblus macrophyllus*).

6 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
to 3 cm	30%

Dominants: juvenile, unidentified, mostly xylophytes and lithophytes.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Bulbophyllum salmoneum, Bulbophyllum* spp. (2 sp.), *Dendrobium spatella, Dendrobium truncatum, Flickingeria angustifolia, Kingidium deliciosum, Pyrrosia lanceolata, Pyrrosia lingua.*

Climbers & lianas:

Dominants: *Bauhinia ornata*, *Dischidia tonkinensis*? (abundant), *Gnetum* sp. (to 45 m long and to 20 cm in diam.), *Lomariopsis spectabilis, Pothos repens* (creeping epiphytic vine to 15 m long), *Scindapsus* spp. (2 sp., both creeping epiphytic vines), *Tetrastigma* sp. (juv), Fabaceae gen. sp. (juv).

Associates: large woody vines - *Erythropalum scandens, Entada phaseoloides* (to 45 m long with flat undulate stem to 30 cm wide), *Tetrastigma* sp.

Plot № 12.

Date: 6 August 2011**. Made by:** Averyanov L., P.V.The, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°41'10.9"N, 105°53'28.0"E.

Geomorphology position: top of ridge edge (coming in N – S direction) of remnant limestone mountain composed with very highly eroded rocky solid crystalline limestone bordered with very steep slopes and cliffs.

Elevation: 680 m. Slope exposition: narrow rocky top of ridge edge. Slope inclination: almost 0°.

Exposed rock outcrops: 90%.

Parental soil material: white crystalline very highly eroded rocky limestone.

Leaf litter: 5-20 cm in depth, in pockets and crevices only.

Soil: dark brown to nearly black, to 20 cm in depth, in pockets and crevices only.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on rocky mountain tops on crystalline highly eroded limestone (wind-formed modification).

Available photo documentation: figures - 90, 116, 117, 123, 125.

Plant community structure

Plot size: 10 x 30 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
4-8 m	No data	10-20 cm	40%

Dominants: *Abelia chinensis* (most usual forest co-dominant), *Calophyllum dryobalanoides, Campylotropis henryi* (most usual forest co-dominant), *Cinnamomum* sp., *Garcinia* sp., *Hopea siamensis* (forest dominant), *Illicium cambodianum, Ixora cuneifolia, Pistacia cucphuongensis, Pittosporum pauciflorum, Podocarpus neriifolius* (rare), *Psychotria*

sp., *Sinosideroxylon wightianum, Tirpitzia sinensis,* Euphorbiaceae gen. sp., Rubiaceae gen. sp.

Associates: *Beilschmiedia pergamentacea, Caryota maxima, Diospyros* sp., *Phoebe tavoyana, Styrax litseoides*, *Xerospermum microcarpum* (all mostly on slope near to mountain top).

Note: no *Phyllanthus insularis* observed.

2 stratum (shrubs):

Height in m.	Projective coverage in %.
2-4 m	60%

Dominants: *Alniphyllum* sp.?, *Alstonia guanxiensis, Ardisia tinctoria, Brandisia glabrescens, Breynia* sp., *Callicarpa nudiflora, Campylotropis henryi, Dracaena* sp., *Ficus* sp., *Gardenia* sp.?, *Glycosmis puberula, Homalium* sp., *Illicium cambodianum, Lasianthus* sp., *Memecylon edule* (most usual forest co-dominant), *Pittosporum pauciflorum, Schefflera* sp. (juv), *Wikstroemia meyenianum,* Annonaceae gen.sp., Lauraceae gen.sp.

Associates: *Capparis acutifolia, Myrsine linearis* (no Bamboo species observed).

3 stratum (herbs):

Height in m.	Projective coverage in %.
0.05–2 m	5%

Dominants: *Ardisia* sp., *Begonia crassula*, *Campylotropis henryi* (juv), *Carex* sp., *Impatiens verrucifer, Ophiorrhiza* sp., *Pseudodracontium* sp., Gesneriaceae gen. sp. (undershrub).

Associates: *Aeschynanthus* sp., *Antrophyum* sp., *Colysis dissimilialata, Pteris plumbea, Tupistra theana.*

6 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
to 1 cm	5%

Dominants: juvenile, unidentifiable, only lithophytes on N-faced cliffy rocks and in rock crevices.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Aglaomorpha coronans* (juv), *Bulbophyllum ambrosia, Bulbophyllum depressum, Bulbophyllum retusiusculum, Bulbophyllum salmoneum, Bulbophyllum* spp. (2 sp.), *Ceratostylis subulata, Cleisostoma paniculatum, Cleisostoma striatum, Davallia repens, Dendrobium aduncum, Dendrobium nobile, Dendrobium spatella, Dendrobium terminale, Dendrobium truncatum, Epigeneium labuanum, Eria paniculata, Eria spirodela* (abundant), *Eria thao, Eria* sp., *Flickingeria angustifolia, Flickingeria fimbriata, Hedyotis acutangula*, *Lepisorus* sp., *Liparis pumila, Neocheiropteris phyllomanes, Panisea tricallosa* var. *garrettii, Pholidota anticulata, Pholidota levelleana* (abundant), *Phreatia* sp., *Pyrrosia lanceolata, Pyrrosia lingua, Thelasis pygmaea* (abundant), *Trichotosia pulvinata.*

Associates: *Anoectochilus calcareus, Dendrobium salaccence, Rhomboda petelottii* (mostly on slope near to mountain top).

Climbers & lianas:

Dominants: *Dischidia tonkinensis*, *Secamone* sp.?, *Clematis uncinata*, *Entada phaseoloides*? (juv), *Alyxia pisiformis, Ventilago* sp.?

Plot № 13.

Date: 7 August 2011. **Made by:** N.T.Hiep, N.Tap, N.S.Khang, L.T.Kien.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°41'19"N, 105°53'35.5"E.

Geomorphology position: higher part of slope of remnant limestone mountain faced to broad humid stream valley (plot bordered in perimeter by large rocky boulders.

Elevation: 556 m. Slope exposition: S-N. Slope inclination: Almost 0°.

Exposed rock outcrops: 5%

Parental soil material: white crystalline highly eroded limestone.

Leaf litter: to 3-5 cm in depth, with coverage about 100%.

Soil: dark yellow-brown, more than 50-60 cm in depth.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: no.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
25-35 m	5	60-120 cm	50%

Dominants: *Aglaia* sp. (1), *Ficus altissima* (1), *Ficus glaberrima* (1), *Vatica cinerea* (2).

Associates: *Actinodaphne* sp. (*CPC 3900a*), *Celtis philippense* (*CPC 4113*), *Michelia doltsopa*, *Polyalthia jucunda, Pometia pinnata, Prunus zippeliana.*

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20-25 m	4	20-30 cm	10%

Dominants: *Alangium ridleyi* (2), *Michelia doltsopa* (1), *Vatica cinerea* (1).

3 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-15 (20) m	4	10-20 cm	10%

Dominants: *Streblus macrophyllus* (2), *Sumbaviopsis albicans* (1), *Syzygium* sp. (1), *Vatica cinerea* (1).

4 stratum (shrubs):

Height in m.	Projective coverage in %.
4-7(10) m	10%

Dominants: *Aglaia lawii*, *Alangium ridleyi, Grewia bulot*, *Vatica cinerea*, *Villebrunea integrifolia.*

5 stratum (herbs):

Height in m.	Projective coverage in %.
0.5–4 m	80%

Dominants: *Pometia pinnata* (juv), *Xerospermum microcarpum* (juv), *Villebrunea integrifolia, Aquilaria crassna* (juv), *Zippelia begoniifolia, Schismatoglottis calyptrata, Aglaonema siamense, Homalomena occulta, Alocasia macrorrhiza, Alpinia* sp., *Ardisia* sp., *Caryota maxima* (juv), *Croton cascarilloides*, *Ficus langkokensis*, *Vatica cinerea* (juv), *Ixora grandifolia*, *Lasianthus chinensis, Pandanus* sp., *Phyllanthus insularis* (juv), *Psychotria sarmentosa, Sterculia hymenocalyx* (juv), *Antidesma yunnanensis.*

6 stratum (mosses & lichens): juvenile, unidentifiable, very poor.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Hoya carnosa, Pothos grandis, Pothos repens, Scindapsus poilanei.*

Climbers & lianas:

Dominants: *Ficus subulata, Ficus tomentosa, Epipremnum pinnatum, Entada phaseoloides, Erythropalum scandens, Gnetum montanum, Byttneria tortilis, Anamirta cocculus*, *Bauhinia* sp., *Calamus poilanei* (woody vine to 5 m long), *Scindapsus poilanei*, *Stephania sinica*, *Piper gymnostachyum, Illigera rhodantha, Hoya carnosa, Stephania sinica, Strychnos* sp.

Plot № 14.

Date: 7 August 2011. **Made by:** Averyanov L., P.V.The, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°41'42.3"N, 105°53'14.1"E.

Geomorphology position: lower part of slope of remnant limestone mountain (with top about 750 m a.s.l.) composed with highly eroded rocky limestone faced to narrow shady stream canyon.

Elevation: 422 m. Slope exposition: NEE. Slope inclination: 30°.

Exposed rock outcrops: 45%.

Parental soil material: dark grey solid crystalline limestone.

Leaf litter: to 10 cm in depth with 100% coverage.

Soil: light brown 15 cm; deeper - yellow brown to minimum 60 cm in depth, mixed with weathered fine limestone gravel (Photo 25).

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 25, 44, 59.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
35-45 m	6	50-140 cm	65%

Dominants: *Bischofia javanica, Chukrasia tabularis, Endospermum chinense, Pometia pinnata, Sapindus* sp.?, *Sterculia* sp.?

Associates: *Dipterocarpus* sp.

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20-35 m	5	25-50 cm	60%

Dominants: *Celtis philippense, Hydnocarpus annamensis*, *Sapindus* sp.?

Associates: *Castanopsis* sp.? (*Lithocarpus* sp.).

3 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-20 m	10	10-40 cm	60%

Dominants: *Ardisia* sp. (1), *Hydnocarpus annamensis* (1), *Sapindus* sp.? (1), *Streblus macrophyllus* (5), *Sumbaviopsis albicans* (1), Flacourtiaceae gen. sp.? (1).

Associates: *Diospyros hasseltii*?

4 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 m	80%

Dominants: *Antidesma* sp. (1), *Baccaurea* sp. (1), *Polyalthia* sp. (1), *Streblus macrophyllus* (17).

5 stratum (herbs, terrestrial and lithophytic):

Height in m.	Projective coverage in %.
0.05 –3 m	80%

Dominants: *Alpinia* sp., *Asplenium ensiforme*? (epiphyte at base of mossy trees), *Amorphophallus* sp., *Arenga westerhoutii* (juv), *Aspidistra* sp., *Asplenium unilaterale, Calamus* sp. (juv), *Caryota* sp. (juv), *Corymborkis veratrifolia, Diplazium* sp., *Elatostema* sp., *Homalomena occulta*, *Impatiens* sp., *Litsea* sp. (juv), *Pandanus* sp. (juv), *Peliosanthes* sp., *Pilea* sp., *Piper* sp., *Pleocnemia leuzeana* (juv), *Pometia pinnata* (juv), *Pseudodracontium* sp., *Rhynchotechum latifolium* (undershrub), *Schismatoglottis calyptrata, Scindapsus* sp. (juv), *Strychnos* sp. (juv), *Tacca chantrieri*, *Tectaria decurrens, Tectaria* sp., *Tetrastigma* sp. (juv), *Tropidia curculigoides, Zeuxine nervosa, Zippelia begoniifolia.*

6 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
to 3 cm	50%

Dominants: juvenile, unidentifiable, only lithophytes and xylophytes.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Asplenium nidus, Asplenium* sp., *Bulbophyllum* sp., *Colysis digitata, Cymbidium dayanum, Dendrobium truncatum, Eria paniculata, Flickingeria angustifolia, Lemmaphyllum microphyllum, Oberonia* sp., *Pyrrosia lingua.*

Climbers & lianas:

Dominants: *Arthropteris palisotii, Combretum* sp. (large woody vine), *Entada phaseoloides* (vine to 45 m long with flat undulate stem to 25 cm wide), *Epipremnum pinnatum* (juv), *Hoya* sp., *Lomariopsis spectabilis* (juv), *Piper* sp., *Pothos repens* (creeping vine to 30 m long), *Scindapsus* sp., *Vandenboschia auriculata,* Menispermaceae gen. sp. (juv).

Plot № 15.

Date: 8 August 2011. **Made by:** Averyanov L., P.V.The, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°41'10.9"N, 105°53'28.0"E.

Geomorphology position: higher part of slope (below from mountain top at about 100-150 m; plot square with large rocky boulders) of remnant limestone mountain (with top about 750-800 m a.s.l.) composed with highly eroded rocky limestone bordered in lower part of plot by cliff.

Elevation: 680 m. Slope exposition: E. Slope inclination: 35°.

Exposed rock outcrops: 70% including large boulders.

Parental soil material: dark grey solid crystalline limestone.

Leaf litter: 5-10 cm in depth, to 40 cm in pockets and depressions, cover about 90%.

Soil: 15 cm in depth - light brown; deeper - yellow brown at least 40 cm in depth, mixed with line rocks, very good structured (Photo 26).

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 26, 141.

Plant community structure

Plot size: 25 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
30-35 m	3	200-80 cm	35%

Dominants: *Bischofia javanica* (2 m DBH), *Elaeocarpus* sp. (80 cm DBH)., *Dysoxylum loureiri* (1.2 m DBH).

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20-30 m	7	30-50 cm	70%

Dominants: *Deutzianthus tonkinensis* (1), *Lagerstroemia* sp. (2), *Machilus* sp. (1), *Polyalthia* sp. (1), *Pometia pinnata* (1), Dipterocarpaceae gen. sp. (*Hopea* sp. or *Vatica* sp.) (1), + 1 died unidentified tree (80 cm DBH).

Associates: *Cassia* sp.?, *Dracontomelum duppereanum*, *Ficus* sp., *Xerospermum microcarpum* (yellow fruits).

3 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-20 m	7	15-25 cm	60%

Dominants: *Knema pierrei* (1), *Polyalthia* sp. (4), *Streblus macrophyllus* (1), Euphorbiaceae gen. sp. (1).

4 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 m	80%

Dominants (total number 56): *Aglaia* sp., *Antidesma* sp., *Arenga westerhoutii, Calamus* sp., *Caryota* sp., *Dendrocnide* sp., *Deutzianthus tonkinensis, Ficus* sp., *Knema pierrei, Lithocarpus* sp., *Nephelium* sp. (longan), *Phoebe* sp., *Polyalthia* spp. (2 sp.), *Schefflera* sp., *Syzygium* sp., *Sterculia* sp., *Streblus macrophyllus, Sumbaviopsis albicans, Vatica* sp., Euphorbiaceae gen. sp., Lauraceae gen. sp.

5 stratum (herbs):

Height in m.	Projective coverage in %.
0.05–3 m	40%

Dominants: *Aglaonema* sp., *Amischotolype mollissima, Amomum* sp., *Amorphophallus* spp. (3 sp.), *Ardisia* sp., *Arenga westerhoutii* (juv, to 3 m tall), *Aspidistra* sp., *Asplenium unilaterale, Athyrium mackinnonii*, *Calamus* sp. (juv), *Corymborkis veratrifolia, Caryota* sp. (juv), *Distichochlamys citrea, Elatostema* sp., *Geophila repens, Goodyera fumata, Hedyotis* sp., *Impatiens* sp., *Knema pierrei* (juv), *Liparis nervosa, Ophiopogon* sp., *Ophiorrhiza* sp., *Pandanus* sp. (juv), *Peliosanthes* sp., *Pilea baviensis*, *Pleocnemia leuzeana*, *Pollia secundiflora*, *Pometia pinnata* (seedlings), *Pseudodracontium* spp. (2 sp.), *Strobilanthes* sp., *Tectaria decurrens*, *Tectaria* sp., *Tetrastigma* sp. (juv), *Tropidia curculigoides*, *Zeuxine nervosa, Zippelia begoniifolia*.

6 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
to 3 cm	30%

Dominants: juvenile, unidentifiable, mostly lithophytes.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Antrophyum callifolium*, *Arthropteris palisotii* (creeping lithophytic and epiphytic vine to 4 m long), *Asplenium nidus, Bulbophyllum ambrosia, Epipremnum pinnatum* (creeping epiphytic vine to 15 m long), *Gastrochilus* sp., *Piper* sp. (creeping epiphytic vine to 10 m long), *Pyrrosia lanceolata, Pyrrosia lingua.*

Lithophytes: *Loxogramme acrostichoides.*

Climbers & lianas:

Dominants: *Colysis digitata, Connarus* sp. (large woody vine), *Dischidia tonkinensis* (in tree canopies), *Erythropalum scandens* (woody vine to 30 m long and to 5 cm in diam.), *Fissistigma* sp. (woody vine to 40 m long and to 20 cm in diam.), *Gynostemma pentaphyllum, Hoya* sp. (in tree canopies), *Illigera* sp. (woody vine to 40 m long and to 5 cm in diam.), *Pothos grandis* (creeping epiphytic vine to 30 m long), *Pothos repens* (creeping epiphytic vine to 30 m long), *Scindapsus* sp., *Smilax* sp. (juv), Fabaceae gen. sp. (Xuong ca).

Plot № 16.

Date: 8 August 2011. **Made by:** Averyanov L., P.V.The, N.Q.Vinh.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Municipality, vicinity of Mo O O O village.

Coordinates: 17°41'14.3"N, 105°53'28.9"E.

Geomorphology position: bottom of anticline depression between tops of narrow ridge coming in S-N direction composed with highly eroded rocky limestone.

Elevation: 650 m. Slope exposition: S and N. Slope inclination: bottom almost flat, S slope - 45° and N slope - 60°.

Exposed rock outcrops: 65%.

Parental soil material: light grey solid crystalline limestone.

Leaf litter: 5-10 cm with coverage 70% (no on rocks).

Soil: light yellow–brown, minimum 40 cm in depth placed just on mother rocks (Photo 24).

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures - 20, 24, 103-105.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
30-35 m	1	120 cm	20%

Dominants: *Vatica cinerea*.

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20-30 m	5	25-60 cm	40%

Dominants: *Hopea siamensis, Vatica cinerea*?

Associates: *Ficus* sp., *Polyalthia jucunda*?

3 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
10-20 m	8	10-20 cm	65%

Dominants: *Ardisia* sp. (1), *Diospyros* sp. (1), *Garcinia oblongifolia* (1), *Streblus macrophyllus* (1), *Vatica cinerea*?, Lauraceae gen. sp. (1).

4 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 m	70%

Dominants (totally 22): *Arenga westerhoutii, Diospyros* sp. (1), *Streblus macrophyllus* (19), *Vatica cinerea*? (1).

5 stratum (herbs):

Height in m.	Projective coverage in %.
0.05–3 m	80%

Dominants: *Aglaonema siamense*, *Allophylus viridis, Alpinia* sp, *Amischotolype mollissima, Amorphophallus* spp. (2 sp.), *Aphyllorchis montana, Ardisia* sp, *Arenga westerhoutii* (juv), *Aspidistra* sp., *Breynia* sp., *Calamus* sp. (juv), *Caryota* sp. (juv), *Celtis* sp. (juv), *Deutzianthus tonkinensis* (juv), *Gardenia* sp.?, *Hedyotis* sp., *Impatiens* sp., *Lasianthus* spp. (2 sp.), *Mallotus* sp. (juv), *Nephelium* sp. (juv), *Ophiopogon* sp., *Peliosanthes argenteostriata*, *Peliosanthes* sp., *Pilea baviensis*, *Piper* sp., *Polyalthia jucunda*? (juv), *Pseudodracontium* sp., *Psychotria* sp., *Pterospermum* sp. (juv), *Schismatoglottis calyptrata, Tropidia curculigoides, Vitex* sp. (juv), *Xanthosoma* sp.?, Oleaceae gen. sp. (juv).

6 stratum (mosses & lichens):

Height in cm.	Projective coverage in %.
to 1 cm	50%

Dominants: juvenile, unidentifiable, lithophytes only.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Aeschynanthus* sp., *Asplenium antrophioides* (also lithophytic), *Asplenium nidus*, *Cleisostoma striatum, Schefflera* sp. (epiphytic treelet).

Climbers & lianas:

Dominants: *Bauhinia ornata* (woody vine to 2 cm in diam.), *Epipremnum pinnatum* (long creeping epiphytic vine to 15 m long), *Ficus pumila* (small creeping lithophytic vine), *Gnetum* sp. (woody vine to 1 cm in diam.), *Pothos grandis* (large creeping epiphytic vine to 15 m long), *Pothos repens* (large creeping epiphytic vine to 15 m long), *Secamone* sp.? (semi-woody vine 3-5 m long), *Tetrastigma* sp. (juv), Asclepiadaceae gen. sp. (semi-woody vine 3-5 m long), Rubiaceae gen. sp. (juv), Fam.? – 2 species (large woody vines 25 m long and to 5 cm in diam.

Plot № 17.

Date: 25 July 2011. **Made by:** P.K.Loc, N.Tap, L.T.Kien.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Thuong Hoa Comm., Ban On village, Pa Nun valley.

Coordinates: 17°40'22"N, 105°58'22"E.

Geomorphology position: alluvial valley between of remnant limestone mountains and hills composed with solid highly eroded limestone.

Elevation: 250 m. Slope exposition: NE. Slope inclination: NE.

Exposed rock outcrops: 5%.

Parental soil material: limestone. Data incomplete.

Leaf litter: 2-3 cm in depth, with cover about 90%.

Soil: brownish-grey mixed with fine weathered limestone gravel, rather poor.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on wet flat seasonally flooded river/stream valleys and on low flat river/stream terraces on crystalline eroded limestone and shaly limestone.

Available photo documentation: figures - 50, 91, 92.

Plant community structure

Plot size 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
25-30 m	2	60-80 cm	15%

Dominants: *Elaeocarpus grandiflorus*, *Pometia pinnata*.

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
15-25 m	5	25-40 cm	30%

Dominants: *Castanopsis* sp., *Cinnamomum* sp.?, *Dipterocarpus retusus*, *Pometia pinnata*, *Sarcosperma kachinensis.*

3 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
7-15 m	5	15-25 cm	25%

Dominants: *Actinodaphne* sp., *Aglaia* sp., *Hydnocarpus annamensis*?, *Knema pierrei*, *Polyalthia* sp.

4 stratum (shrubs):

Height in m.	Projective coverage in %.
3-7 m	30%

Dominants: *Adenanthera microsperma* (juv), *Arenga westerhautii*, *Calamus* spp. (2 sp.), *Callicarpa* sp., *Camellia* sp., *Caryota sympetala*, *Ficus nervosa*, *Leea indica*, *Pinanga* sp., *Saurauia tristyla*, *Syzygium* sp.

5 stratum (herbs):

Height in m.	Projective coverage in %.
0.2-2.5 m	25%

Dominants: *Aglaonema siamense*?, *Alocasia* sp., *Amorphophallus* spp. (2 sp.), *Angiopteris evecta, Aspidistra* sp., *Asplenium obscurum* (abundant), *Begonia tetraptera, Clinacanthus* sp., *Costus tonkinensis, Curculigo latifolia, Diplazium donianum* (abundant), *Hydrocotyle javanica, Musa* sp., *Phrynium* sp., *Pollia thyrsiflora, Rhynchotechum latifolium, Schismatoglottis calyptrata, Tacca chantrieri, Tectaria decurrens* (abundant), *Zippelia begoniifolia.*

Lithophytic herbs: *Begonia lanternaria, Ficus pumila, Piper* sp., *Epipremnum pinnatum*.

6 stratum (mosses & lichens): no data.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Aglaomorpha coronans, Asplenium nidus, Asplenium pseudo-laserpitifolium, Ficus cordata, Liparis* spp., (2 sp.), *Lomariopsis spectabilis, Pothos repens, Scindapsus* sp., Orchidaceae spp. (some unidentified juvenile species).

Climbers & lianas:

Dominants: *Bauhinia* sp., *Fissistigma* sp., *Millettia pachyloba, Strychnos* sp., *Trichosanthes* sp.

Plot № 18.

Date: 15 August 2011. **Made by:** N.T.Hiep, N.S.Khang, N.V.Tap, L.T.Kien.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Hoa Son Municipality (foothills of, B'Lam Lang limestone mt.).

Coordinates: 17°42'13.9"N, 105°47'45.8"E.

Geomorphology position: lower part of slope of remnant limestone mountain (with top about 704m m a.s.l.) faced to shady flat river valley.

Elevation: 542 m. Slope exposition: S-N. Slope inclination: 5°.

Exposed rock outcrops: 0.

Parental soil material: white solid limestone.

Leaf litter: 5-10 cm in depth, with coverage about 100%.

Soil: yellow, more than 50 cm in depth.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on steep rocky mountain slopes on crystalline highly eroded limestone.

Available photo documentation: figures: 54, 58, 67, 71.

Plant community structure

Plot size: 20 x 20 m.

Emergents:

Plant name:	Number	Height in m.	Diameter (in cm at BH)	Projective coverage in%.
Elaeocarpus grandiflorus	1	45 m	100 cm, + buttresses to 2.5 m wide	30%
Rubiaceae, gen. sp.	1	40 m	80 cm	10%

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
15-25 m	11	20-50 cm	60%

Dominants: *Actinodaphne* sp. (*CPC 3000a,* 1 sample), *Alangium ridleyi* (4), *Dipterocarpus retusus* (1), *Hydnocarpus* sp. (1), *Phoebe sheareri* (1), *Polyalthia jucunda* (1), *Pterospermum truncatolobatum* (1), Rubiaceae gen. sp. (1).

Associates: *Actinodaphne* sp. (*CPC 3900a*), *Artocarpus* sp. (*CPC 4216*), *Dipterocarpus retusus* (*CPC 4342*), *Lithocarpus pseudoreinwardtii, Pometia pinnata, Schima wallichii* (*CPC 4314*), *Sloanea sigun.*

2 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10(15) m	40%

Dominants: *Aglaia lawii, Alangium ridleyi* (2), *Flacourtia rukam*, *Gironniera subequalis, Knema pierrei, Magnolia dandyi, Magnolia liliifera, Magnolia masticata*, *Miliusa sinensis*, *Polyalthia jucunda, Syzygium* sp., Rubiaceae (gen. sp., young tree of Rubiaceae mentioned as emergent).

3. stratum (herbs):

Height in m.	Projective coverage in %.
0.01-3 m	70%

Dominants (terrestrial and lithophytic): *Aglaia lawii* (juv), *Aglaonema ovatum*, *Alangium ridleyi*, *Alpinia* sp., *Aquilaria crassna* (*CPC 4228*), *Ardisia colorata*, *Aspidistra* sp. (2 sp.), *Asplenium cardiophyllum, Begonia acetosella*, *Carex indica, Caryota maxima* (juv), *Chloranthus spicatus*, *Cinnamomum* sp., *Claoxylon indicum* (juv), *Clausena austroindica* (juv), *Dianella nemorosa, Disporum trabeculatum* (*CPC 4189*), *Elatostema scabra, Ficus langkokensis* (juv), *Garcinia oblongifolia* (juv), *Grewia bulot* (juv), *Helicia obovatifolia* (juv), *Homalomena occulta, Lasianthus biflorus, Medinilla assamica, Miliusa sinensis*, *Ophiopogon reptans*, *Paraboea* sp., *Pentaphragma sinense*, *Pilea baviensis*, *Psychotria sarmentosa, Psychotria* spp. (2 spp.), *Schismatoglottis calyptrata, Symplocos sumuntia* (juv), *Ternstroemia* sp. (juv), *Trevesia palmata*, *Tropidia angulosa*, *Zippelia begoniifolia.*

Associates: *Anoectochilus calcareus.*

4 stratum (mosses & lichens): no data.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Cymbidium dayanum.*

Climbers & lianas:

Dominants*: Aristolochia contorta, Bauhinia oxysepala* (1), *Byttneria tortilis*, *Ficus sagittata, Kadsura grandiflora, Lomariopsis spectabilis* (*CPC 4121*)*, Piper gymnostachyum* (common)*, Pothos repens* (creeping epiphytic vine to 10 m long), *Scindapsus poilanei, Scindapsus* sp. (both creeping epiphytic vines), *Smilax corbularia, Stixis suaveolens, Tetrastigma* sp., *Uncaria* sp., *Ventilago ochrocarpa.*

Associates: large woody vines – *Bauhinia ornata, Entada phaseoloides, Erythropalum scandens.*

Plot № 19.

Date: 17 August 2011. **Made by:** N.T.Hiep, N.V.Tap, N.S.Khang, L.T.Kien.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Hoa Son Municipality.

Coordinates: 17°41'42"N, 105°47'59"E.

Geomorphology position: leveled more or less flat ridge edge of low ridge coming in E-W direction.

Elevation: 532 m. Slope exposition: NE. Slope inclination: almost 0°.

Exposed rock outcrops: no data.

Parental soil material: dark to light brown shale mother rocks.

Leaf litter: to 5-10 cm in depth, with 100% coverage.

Soil: Light yellow brown to dark yellow, to 40-60 cm in depth.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on leveled slopes and low ridges composed by stratified shale (modified by recent fractional logging).

Available photo documentation: figures - 8, 15, 27, 30, 32, 55, 108, 140, 145, 146.

Plant community structure

Plot size: 20 x 20 m.

Emergents:

Plant name:	Number	Height in m.	Diameter (in cm at BH)	Projective coverage in%.
Engelhardia roxburghiana	1	40 m	80 cm	20%

Associates: *Canarium bengalense*.
Note: *Engelhardia roxburghiana* is main forest dominant in and outside of the plot № 19.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
20-25 m	2	40-50	10%

Dominants: *Aglaia* sp. (1), *Ficus glaberrima* (1).
Associates: *Artocarpus* sp. (*CPC 4216*), *Dacrycarpus imbricatus.*

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
7-15(20) m	10	15-40 cm	70%

Dominants: *Actinodaphne* sp. (1), *Amesiodendron chinense* (1), *Cinnamomum ovatum* (1), *Elaeocarpus grandiflorus* (1), *Lithocarpus pseudoreinwardtii* (*CPC 4290*, 3 samples), *Schefflera* sp. (1), *Schima wallichii* (1), *Syzygium* sp. (1), *Xerospermum microcarpum* (1).
Associates: *Beilschmiedia* sp. (*CPC 4359*).

3. stratum (shrubs):

Height in m.	Projective coverage in %.
3-7 m (to 15 cm DBH)	10%

Dominants: *Livistona* sp., *Magnolia masticata* (*CPC 4234*), *Michelia* sp. (*CPC 4360*).

4. stratum (herbs):

Height in m.	Projective coverage in %.
0.5-3 m	80%

Dominants: *Alpinia* sp., *Antidesma costulatum, Ardisia gigantifolia, Blastus multiflorus, Carex* sp., *Croton* sp., *Desmos* sp., *Dracaena angustifolia, Eberhardtia tonkinensis* (juv), *Elaeocarpus grandiflorus* (juv), *Euodia lepta, Gironniera subequalis* (seedlings), *Gomphadra mollis* (juv), *Ixora* sp., *Lasianthus* spp. (2 species), *Lithocarpus* sp. (seedlings), *Litsea cubeba* (juv), *Neolitsea* sp. (juv), *Pinanga* sp. (juv), *Archidendron clypearia* (juv), *Psychotria rubra*, *Syzygium* sp. (juv), + seedlings and saplings of other trees and shrubs of higher strata.
Associates: *Pteris* sp., *Tainia* sp., *Tectaria decurrens.*
5 stratum (mosses & lichens): no data.
Non strata vegetation:
Epiphytes & semi-epiphytes:
Dominants: *Asplenium nidus, Bolbitis* sp., *Cyathea* sp., *Dischidia* sp., *Epipremnum pinnatum, Lindera* sp., *Microlepia hookeriana*, *Oberonia* sp., *Pothos repens*, *Scindapsus poilanei*, *Selaginella* sp., *Thrixspermum centipeda.*
Climbers & lianas:

Dominants: *Ancistrocladus tectorius, Artabotrys hexapelalus, Bauhinia* sp., *Bowringia callicarpa, Calamus poilanei, Capparis cantoniensis, Cocculus* sp., *Connarus paniculatus, Erythropalum scandens, Fibraurea tinctoria, Ficus sagittata, Galeola nudiflora, Gnetum momtanum, Gynostemma pentaphyllum, Gynostemma pubescens, Kadsura grandiflora, Microlepia hookeriana, Millettia* sp., *Morinda officinalis* (common), *Smilax glabra, Stauntonia cavaleriana.*

Associates: large woody vines *Entada phaseoloides, Byttneria tortilis, Combretum* sp.

Plot № 20.

Date: 17 August 2011. **Made by:** N.T.Hiep, N.Tap, N.S.Khang, L.T.Kien.

Position: Central Vietnam, Quang Binh Prov., Minh Hoa Distr., Hoa Son Municipality.

Coordinates: 17°42'02.3"N, 105°47'59"E.

Geomorphology position: low flat wet leveled terrace of alluvial river valley on stratified shale (camping military area during Vietnam-American War 1958-1975).

Elevation: 456 m. Slope exposition: 0. Slope inclination: 0°.

Exposed rock outcrops: 0.

Parental soil material: alluvial clay on stratified shale.

Leaf litter: to 5 cm in depth, with coverage about 100%.

Soil: Yellow and light-brown 5-15 cm depth; deeper - light brown alluvial clay to at least 1m depth and deeper.

Zonal (elevational) plant community: closed primary evergreen seasonal tropical lowland broad-leaved forests on leveled slopes and low ridges composed by stratified shale (modified by fractional logging).

Available photo documentation: figures - 16, 28, 29, 31, 33, 34, 106.

Plant community structure

Plot size: 20 x 20 m.

1 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
40-50 m	7	50-95 cm	70%

Dominants: *Allospondias lakonensis* (*CPC 4354*, 1), *Altingia siamensis* (*CPC 4384*, 4 samples), *Diospyros* sp. (1), *Pterospermum* sp. (*CPC 4385*, 1).

Associates: *Actinodaphne* sp. (*CPC 3900a*), *Chukrasia tabularis, Diplopanax vietnamensis*, *Lithocarpus pseudoreinwardtii* (*CPC 4290*), *Magnolia* sp., *Magnolia dandyi, M. masticata.*

2 stratum (tree storey):

Height in m.	Number	Diameter (in cm at BH)	Projective coverage in %.
15-20 m	11	12-40 cm	60%

Dominants: *Alangium ridleyi* (3), *Diospyros latisepala* (2), *Endospermum chinense* (1), *Miliusa sinensis* (1), *Polyalthia jucunda* (1), *Schefflera* sp. (2 samples), *Syzygium* sp. (1).

3 stratum (shrubs):

Height in m.	Projective coverage in %.
3-10 m	80%

Dominants: *Actinodaphne* sp., *Aglaia* sp., *Alangium ridleyi*, *Archidendron clypearia, Diospyros choboensis*, *Elaeocarpus grandiflorus*, *Elaeocarpus* sp., *Ficus langkokensis*, *Ficus variolosa*, *Flacourtia rukam*, *Garcinia* sp., *Gironniera subequalis, Grewia bulot, Lasianthus biflorus, Magnolia masticata, Miliusa sinensis*, *Pometia pinnata*, *Psychotria sarmentosa, Pterospermum* sp., *Styrax litseoides*, *Symplocos adenophylla*, *Tabernaemontana* sp.

4 stratum (herbs):

Height in m.	Projective coverage in %.
0.05-3 m	80%

Dominants: *Actinodaphne* sp. (juv), *Aglaonema siamensis*, *Alangium ridleyi* (juv), *Allophylus cochinchinensis, Antidesma yunnanensis, Ardisia* spp. (2 species), *Begonia acetosella*, *Blastus multiflorus, Calanthe odora, Croton cascarilloides, Desmos* sp., *Dichroa febrifuga, Disporum trabeculatum, Gironniera subequalis* (juv), *Homalomena occulta, Lasianthus* spp. (2 species), *Leea indica, Lophatherum gracile, Medinilla assamica, Ophiorrhiza* sp., *Paraboea* sp., *Phrynium placentarum, Phylogacanthus turgidus, Polyalthia* sp. (juv), *Psychotria rubra, Psychotria* sp., *Pterospermum* sp. (juv), *Schefflera* sp. (juv), *Schismatoglottis calyptrata, Sterculia lanceolata* (juv), *Sterculia* sp. (juv), *Strobilanthes* sp., *Tabernaemontana* sp., *Tacca chantrieri,* + seedlings and saplings of other trees and shrubs of higher strata.

Associates: *Polystichum* sp., *Pteris grevilleana, Selaginella* sp., *Tectaria* spp. (2 species).

5 stratum (mosses & lichens): no data.

Non strata vegetation:

Epiphytes & semi-epiphytes:

Dominants: *Aglaomorpha coronans, Asplenium nidus, Colysis* sp., *Dendrobium* sp., *Nephrolepis cordifolia*?, *Piper albispicum, Pothos repens*, *Scindapsus poilanei.*

Climbers & lianas:

Dominants: *Ancistrocladus tectorius, Artabotrys hexapelalus, Capparis cantoniensis, Combretum* sp., *Derris* sp., *Dioscorea* sp., *Erythropalum scandens, Ficus sagittata, Ficus subulata* (long creeping epiphytic vine), *Gynostemma pubescens, Mussaenda cambodiana*?, *Pothos repens, Tetrastigma* sp., *Thladiantha cordifolia.*

Associates: large woody vines - *Byttneria tortilis, Combretum sundaicum, Combretum* sp., *Entada phaseoloides, Gnetum montanum.*

Annex 3.
GPS READING LIST OF DOCUMENTED SPECIES LOCALITIES IN STUDIED AREA WITH INDICATION OF KEY SPECIES

Key species definition: key plant species – group of taxonomically distinct species that has particular significance in plant geography (including endemic, sub-endemic species and species recently discovered and described in the area as a new for science), nature protection (including VU, EN and CR species according to IUCN criteria and species mentioned in CITES appendices), species mentioned in Vietnam Red Data Book (Part II: Plants- 2007) and in Government Decree No 32/2006/ND-CP on the management of threatened plant and animal species, species - indicators of primary habitat richness and species valuable in economy (timber trees, medicinal, ornamental plants, species with edible fruits and leaves). These species are commonly regarded as priorital group for detailed study in short botanical surveys.

Names of key species are marked in following GPS reading list of documented species locations by underlined font with next categorizations (designated by indexes presented below):

D32 – species cited in Government Decree No 32/2006/ND-CP
RDB – species cited in Vietnam Red Data Book, Part II: Plants, 2007

IE – endemics of Indochina Peninsula
LE – local endemics
NewT – newly discovered taxa (species and varieties)
NewF – new discoveries for flora of Vietnam

NT - near threatened
VU – vulnerable species
EN – endangered species
CR – critically endangered species

CITES – species included into CITES appendices

SI – species - indicators of high primary habitats diversity

TT – "timber trees", trees with timber of high quality
MP – most important medicinal plants used in official and traditional medicine
OP – ornamental plants of certain significance for ornamental horticulture
EF – plant species with edible fruits
VEG – plant species with edible leaves and shoots

PTERIDOPHYTA (ferns and allies)

Aspleniaceae

Asplenium cardiophyllum (Hance) Baker 17°39’21.1”N 105°54’41.7”E CPC 3873; 17°39’21.7”N 105°54’59.5”E CPC 3820; 17°42’38.5”N 105°48’52”E CPC 4418 **VU, SI**

Asplenium cheilosorum Kunze ex Mett. 17°41’28”N 105°53’42.7”E CPC 4106

Asplenium ensiforme Wall. ex Hook. & Grev. 17°38’00.4”N 105°55’57.9”E CPC 3745

Asplenium protractum Tardieu & C.Chr. 17°41’28”N 105°53’42.7”E CPC 3976

Asplenium tenuifolium D.Don 17°39’36.7”N 105°54’55.7”E CPC 3789 **VU, SI**

Asplenium thunbergii Kunze 17°39’21.1”N 105°54’41.7”E CPC 3855

Asplenium unilaterale Lam. 17°39’31.7”N 105°54’48.2”E CPC 3836; 17°41’25.6”N 105°53’40.4”E CPC 4000

Cyatheaceae

Alsophila costularis Baker 17°42’23.8”N 105°47’59”E CPC 4394

Alsophila podophylla Hook. 17°42’13.9”N 105°47’45.8”E CPC 4293; 17°42’15.8”N 105°48’24”E CPC 4381

Davalliaceae

Davallia repens (L.f.) Kuhn 17°41’14.3”N 105°53’28.9”E CPC 4102

Dennstaedtiaceae

Acrorumohra diffracta (Baker) H.Ito 17°38’00.4”N 105°55’57.9”E CPC 3750

Microlepia hookeriana (Wall. ex Hook.) C.Presl 17°42’15.8”N 105°48’24”E CPC 4363; 17°42’15.8”N 105°48’24”E CPC 4378

Dryopteridaceae

Bolbitis appendiculata (Willd.) K.Iwats.? 17°38’00.4”N 105°55’57.9”E CPC 3746; 17°42’13.9”N 105°47’45.8”E CPC 4298

Bolbitis cadieri (H.Christ) Ching 17°42’15.8”N 105°48’24”E CPC 4365

Ctenitis membranifolia Ching & C.H.Wang? 17°40’03.6”N 105°55’08.5”E CPC 3908

Dryopteris sparsa (Buch.-Ham. ex D.Don) Kuntze 17°38’00.4”N 105°55’57.9”E CPC 3752

Polystichum deltodon (Baker) Diels 17°39’21.7”N 105°54’59.5”E CPC 3810

Polystichum grande Ching 17°38’00.4”N 105°55’57.9”E CPC 3729; 17°38’00.4”N 105°55’57.9”E; 17°38’00.4”N 105°55’57.9”E CPC 3743

Teratophyllum hainanense S.Y.Dong & X.C.Zhang 17°38’00.4”N 105°55’57.9”E CPC 3712 **NT**

Hymenophyllaceae

Trichomanes sp. 17°38’00.4”N 105°55’57.9”E CPC 3717

Vandenboschia auriculata (Blume) Copel. 17°40’03.6”N 105°55’08.5”E CPC 3903a; 17°41’19”N 105°53’35.5”E CPC 4124; 17°41’25.6”N 105°53’40.4”E CPC 4023; 17°42’12.1”N 105°47’39.0”E CPC 4229; 17°42’13.9”N 105°47’45.8”E CPC 4295 **NT**

Lomariopsidaceae
Cyclopeltis crenata (Fee) C.Chr.? 17°39’21.1”N 105°54’41.7”E CPC 3874
Lomariopsis lineata (C.Presl) Holttum? 17°39’11.6”N 105°54’53”E CPC 3666
Lomariopsis spectabilis (Kunze) Mett. 17°41’19”N 105°53’35.5”E CPC 4121 **NT**
Nephrolepis cordifolia (L.) C.Presl 17°41’25.6”N 105°53’40.4”E CPC 4046

Lycopodiaceae
Huperzia carinata (Poir.) Trevis 17°39’31.7”N 105°54’48.2”E CPC 3645 **NT, OP**
Huperzia hamiltonii (Spring) Trevis 17°41’25.6”N 105°53’40.4”E CPC 4041 **NT, OP**
Huperzia phlegmaria (L.) Rothm. 17°42’15.8”N 105°48’24”E CPC 4336 **NT, OP**

Marattiaceae
Angiopteris cochinchinensis de Vriese 17°39’11.6”N 105°54’53”E CPC 3677**, OP, IE**

Plagiogyriaceae
Plagiogyria adnata (Blume) Bedd. 17°38’00.4”N 105°55’57.9”E CPC 3730 **NT**

Polypodiaceae
Aglaomorpha coronans (Wall. ex Mett.) Copel. 17°42’13.9”N 105°47’45.8”E CPC 4294
Belvisia annamensis (C.Chr.) Tagawa 17°38’00.4”N 105°55’57.9”E CPC 3705, **IE**
Belvisia spicata (L.f.) Mirb. ex Copel. 17°41’28”N 105°53’42.7”E CPC 3978
Colysis digitata (Baker) Ching 17°41’25.6”N 105°53’40.4”E CPC 4021; 17°41’25.6”N 105°53’40.4”E CPC 4048
Colysis dissimilialata (Bonap.) Ching 17°39’31.7”N 105°54’48.2”E CPC 3893; 17°41’14.3”N 105°53’28.9”E CPC 4050
Colysis pothifolia (D.Don) C.Presl 17°39’31.7”N 105°54’48.2”E CPC 3892
Lepisorus subrostratus (C.Chr.) C.Chr. & Tardieu 17°42’13.7”N 105°47’33.9”E CPC 4282
Loxogramme grammitoides (Baker) C.Chr. 17°41’28”N 105°53’42.7”E CPC 3956
Microsorum scolopendria (Burm.f.) Copel. 17°42’38.5”N 105°48’52”E CPC 4407
Microsorum superficiale (Blume) Ching 17°41’28”N 105°53’42.7”E CPC 3986
Pyrrosia lanceolata (L.) Farw. 17°38’00.4”N 105°55’57.9”E CPC 3711; 17°40’03.6”N 105°55’08.5”E CPC 3917
Pyrrosia lingua (Thunb.) Farw. 17°42’13.9”N 105°47’45.8”E CPC 4306
Pyrrosia porosa (C.Presl) Hovenk. 17°42’13.7”N 105°47’33.9”E CPC 4248
Selliguea griffithianum (Hook.) Fraser-Jenk. 17°41’14.3”N 105°53’28.9”E CPC 4073; 17°42’13.7”N 105°47’33.9”E CPC 4268

Pteridaceae
Antrophyum callifolium Blume 17°39’11.6”N 105°54’53”E CPC 3685; 17°41’14.3”N 105°53’28.9”E CPC 4055; 17°41’25.6”N 105°53’40.4”E CPC 4014; 17°41’28”N 105°53’42.7”E CPC 3931; 17°42’12.1”N 105°47’39.0”E CPC 4220
Mildella nitidula (Hook.) C.C.Hall. & Lellinger 17°42’13.7”N 105°47’33.9”E CPC 4247
Pteris grevilleana Wall. ex C.Agardh 17°42’15.8”N 105°48’24”E CPC 4337
Pteris plumbea C.Chr. 17°41’14.3”N 105°53’28.9”E CPC 4053
Pteris vittata L. 17°38’00.4”N 105°55’57.9”E CPC 3741
Vittaria elongata Sw. 17°39’36.7”N 105°54’55.7”E CPC 3762

Selaginellaceae
Selaginella sp. 17°39’21.1”N 105°54’41.7”E CPC 3878
Selaginella sp. 17°39’21.1”N 105°54’41.7”E CPC 3880

Tectariaceae
Arthropteris palisotii (Desv.) Alston 17°41’28”N 105°53’42.7”E CPC 3977 **NT**
Arthropteris repens (Brack.) C.Chr. 17°41’25.6”N 105°53’40.4”E; 17°41’25.6”N 105°53’40.4”E **NT**
Heterogonium sagenioides (Mett.) Hollt. 17°41’25.6”N 105°53’40.4”E CPC 4030; 17°42’13.9”N 105°47’45.8”E CPC 4296; 17°42’15.8”N 105°48’24”E CPC 4380; 17°41’25.6”N 105°53’40.4”E CPC 3999
Pleocnemia leuzeana (Gaudich.) C.Presl 17°41’14.3”N 105°53’28.9”E CPC 4145; 17°41’25.6”N 105°53’40.4”E CPC 4004; 17°42’13.9”N 105°47’45.8”E CPC 4292; 17°42’13.9”N 105°47’45.8”E CPC 4307
Tectaria decurrens (C.Presl) Copel. 17°41’25.6”N 105°53’40.4”E CPC 4002; 17°41’25.6”N 105°53’40.4”E CPC 4029
Tectaria stenoptera (Baker) Ching 17°39’31.7”N 105°54’48.2”E CPC 3837
Tectaria subtriphylla (Hook. & Arn.) Copel.? 17°39’21.1”N 105°54’41.7”E CPC 3877
Tectaria triglossa Tardieu & C.Chr. 17°39’31.7”N 105°54’48.2”E CPC 3885; 17°39’31.7”N 105°54’48.2”E CPC 3886

Thelypteridaceae
Cyclosorus balansae Ching 17°40’03.6”N 105°55’08.5”E CPC 3904, **IE**
Cyclosorus cuspidatus (Blume) Tardieu ex C.Chr. & Tardieu 17°41’28”N 105°53’42.7”E CPC 3938
Cyclosorus truncatus (Poir.) Tardieu & C.Chr. 17°38’00.4”N 105°55’57.9”E CPC 3704
Thelypteris sp. 17°41’25.6”N 105°53’40.4”E CPC 4001

Woodsiaceae
Athyrium mackinnonii (C.Hope) C.Chr. 17°40’03.6”N 105°55’08.5”E CPC 3906
Diplazium donianum (Mett.) Tardieu 17°39’31.7”N 105°54’48.2”E CPC 3839; 17°41’28”N 105°53’42.7”E CPC 3939
Diplazium mettenianum (Miq.) C.Chr. 17°39’31.7”N 105°54’48.2”E CPC 3838; 17°40’03.6”N 105°55’08.5”E CPC 3907; 17°41’19”N 105°53’35.5”E CPC 4122

PINOPHYTA (Gymnosperms)
Cephalotaxaceae
Cephalotaxus mannii Hook.f. 17°42’09.5”N 105°47’42”E CPC 4318; 17°42’13.7”N 105°47’33.9”E CPC 4237 **VU, OP, SI RDB, D32**

Podocarpaceae
Dacrycarpus imbricatus (Blume) de Laub. 17°38’00.4”N 105°55’57.9”E CPC 3726; 17°42’10.4”N 105°47’57.3”E CPC 4190; 17°42’15.8”N 105°48’24”E CPC 4372 **NT, OP, SI, TT (fig. 27)**

Dacrydium elatum (Roxb.) Wall. ex Hook. 17°38’00.4”N 105°55’57.9” CPC 3727 **NT, OP, SI, TT (fig. 78-81)**

Podocarpus neriifolius D.Don 17°38’00.4”N 105°55’57.9” CPC 3723; 17°41’14.3”N 105°53’28.9”E CPC 4068; 17°42’10.4”N 105°47’57.3”E CPC 4195; 17°42’38.5”N 105°48’52”E CPC 4406 **NT, OP, SI**

MAGNOLIOPHYTA (flowering plants)

Acanthaceae

Phlogacanthus annamensis R.Ben.? 17°41’14.3”N 105°53’28.9”E CPC 4140, **IE**

Psiloestes elongata R.Ben.? 17°39’11.6”N 105°54’53”E CPC 3682

Strobilanthes sp.? 17°42’23.8”N 105°47’59”E CPC 4389

Thunbergia geoffrayi R. Ben. 17°42’13.7”N 105°47’33.9”E CPC 4257

Thunbergia grandiflora (Willd.) Roxb. 17°41’14.3”N 105°53’28.9”E CPC 4150; 17°41’28”N 105°53’42.7”E CPC 3911a

sp. 17°39’11.6”N 105°54’53”E CPC 3683

sp. 17°42’15.8”N 105°48’24”E CPC 4355

sp. 17°42’38.5”N 105°48’52”E CPC 4424

sp. 17°42’38.5”N 105°48’52”E CPC 4441

Actinidiaceae

Actinidia latifolia (Gardn. & Champ.) Merr. 17°42’10.4”N 105°47’57.3”E CPC 4208 **NT, EF**

Alangiaceae

Alangium barbatum (R.Br.) Baill. 17°42’23.8”N 105°47’59”E CPC 4390

Alangium ridleyi King 17°39’21.7”N 105°54’59.5”E CPC 3830; 17°41’28”N 105°53’42.7”E CPC 3920a; 17°42’15.8”N 105°48’24”E CPC 4353, **TT, EF (fig. 57)**

Anacardiaceae

Allospondias lakonensis (Pierre) Stapf 17°42’15.8”N 105°48’24”E CPC 4354, **IE, EF**

Pistacia cucphuongensis Dai & Yakovlev 17°39’36.7”N 105°54’55.7”E CPC 3798, **LE, SI**

sp. 17°42’12.1”N 105°47’39.0”E CPC 4226

Ancistrocladaceae

Ancistrocladus tectorius (Lour.) Merr. 17°39’31.7”N 105°54’48.2”E CPC 3840

Annonaceae

Desmos pedunculosus (A.DC.) Ban 17°39’36.7”N 105°54’55.7”E CPC 3773

Disepalum petelottii (Merr.) D.M.Johnson? 17°42’38.5”N 105°48’52”E CPC 4412

Miliusa elongata Craib 17°40’03.6”N 105°55’08.5”E CPC 3922

Miliusa fusca Pierre? 17°39’21.1”N 105°54’41.7”E CPC 3869

Miliusa sinensis Finet & Gagnep. 17°39’21.7”N 105°54’59.5”E CPC 3828; 17°41’28”N 105°53’42.7”E CPC 3899a; 17°42’13.7”N 105°47’33.9”E CPC 4243; 17°42’13.9”N 105°47’45.8”E CPC 4303

Mitrephora thorelii Pierre 17°41’28”N 105°53’42.7”E CPC 3901a; 17°41’19”N 105°53’35.5”E CPC 4109; 17°41’28”N 105°53’42.7”E CPC 3954, **IE**
Polyalthia intermedia (Pierre) Ban? 17°39’21.7”N 105°54’59.5”E CPC 3809, **IE**
Polyalthia jucunda (Pierre) Finet & Gagnep. 17°39’11.6”N 105°54’53”E CPC 3671; 17°41’25.6”N 105°53’40.4”E CPC 4038, **IE, SI, TT (fig. 47, 48)**
Polyalthia sp.? 17°41’25.6”N 105°53’40.4”E CPC 4044
Popowia pisocarpa Endl. 17°42’13.9”N 105°47’45.8”E CPC 4308
Uvaria dac Pierre ex Finet & Gagnep. 17°41’25.6”N 105°53’40.4”E CPC 4036, **IE**
Uvaria grandiflora Roxb. 17°39’21.7”N 105°54’59.5”E CPC 3823
sp. 17°41’14.3”N 105°53’28.9”E CPC 4144

Apocynaceae
Alstonia guanxiensis D.Fong & X.X.Chen 17°39’21.1”N 105°54’41.7”E CPC 3860;17°39’36.7”N 105°54’55.7”E CPC 3779; 17°42’13.7”N 105°47’33.9”E CPC 4272 **NT, SI (fig. 84, 85)**
Alyxia hainanensis Merr. & Chun 17°39’36.7”N 105°54’55.7”E CPC 3794; 17°41’14.3”N 105°53’28.9”E CPC 4097; 17°42’13.7”N 105°47’33.9”E CPC 4254
Dischidia acuminata Cost. 17°39’21.1”N 105°54’41.7”E CPC 3842**, OP**
Dischidia tonkinensis Cost. 17°41’25.6”N 105°53’40.4”E CPC 4043**, OP**, **IE**
Heterostemma oblongifolium Cost.? 17°41’14.3”N 105°53’28.9”E CPC 4103
Hiepia corymbosa Pham V.T. & Aver. 17°41’28”N 105°53’42.7”E CPC 3894a **NewT, EN, LE**
Hoya carnosa (L.f.) R.Br. 17°41’28”N 105°53’42.7”E CPC 3959**, OP**
Hoya fungii Merr. 17°42’10.4”N 105°47’57.3”E CPC 4196**, OP**
Hoya lockii The P.V. & Aver. 17°42’15.8”N 105°48’24”E CPC 4345; 17°42’15.8”N 105°48’24”E CPC 4383 **NewT, EN, OP, LE**
Kopsia arborea Blume 17°39’11.6”N 105°54’53”E CPC 3662
Marsdenia sp.? 17°42’38.5”N 105°48’52”E CPC 4415
Pentasacme brachyanthum Hand.-Mazz. 17°42’23.8”N 105°47’59”E CPC
Pilostigma inflexum Cost.? 17°40’03.6”N 105°55’08.5”E CPC 3895
Pottsia grandiflora Markgr.? 17°39’21.1”N 105°54’41.7”E CPC 3847
Secamone sp.? 17°41’14.3”N 105°53’28.9”E CPC 4152
Tabernaemontana sp. 17°42’15.8”N 105°48’24”E CPC 4339
Wrightia macrocarpa Pit. 17°41’25.6”N 105°53’40.4”E CPC 4009; 17°41’28”N 105°53’42.7”E CPC 3917a

Araceae
Aglaonema ovatum Engl. 17°41’28”N 105°53’42.7”E CPC 3942
Aglaonema siamense Engl. 17°39’11.6”N 105°54’53”E CPC 3692
Alocasia longifolia Miq. 17°39’11.6”N 105°54’53”E CPC 3757
Amorphophallus sp. 17°42’10.4”N 105°47’57.3”E CPC 4204
Arisaema sp. 17°42’12.1”N 105°47’39.0”E CPC 4236
Homalomena occulta (Lour.) Schott 17°42’38.5”N 105°48’52”E CPC 4420 **MP**
Rhaphidophora decursiva (Roxb.) Schott 17°40’03.6”N 105°55’08.5”E CPC 3915 **MP (fig. 142, 143)**

Schismatoglottis calyptrata (Roxb.) Zoll. & Moritzi 17°40’03.6”N 105°55’08.5”E CPC 3909; 17°39’11.6”N 105°54’53”E CPC 3669; 17°41’28”N 105°53’42.7”E CPC 3945
Scindapsus poilanei Gagnep. 17°40’03.6”N 105°55’08.5”E CPC 3910 **(fig. 144)**

Araliaceae
Heteropanax fragrans (G.Don) Seem. 17°42’10.4”N 105°47’57.3”E CPC 4214 **NT**
Schefflera pauciflora R. Vig. 17°39’11.6”N 105°54’53”E CPC 3672; 17°40’03.6”N 105°55’08.5”E CPC 3923 **(fig. 75, 76)**
Trevesia palmata Vis. 17°39’11.6”N 105°54’53”E CPC 3686

Arecaceae
Calamus sp.? 17°42’38.5”N 105°48’52”E CPC 4438
Caryota maxima Blume 17°41’14.3”N 105°53’28.9”E CPC 4139
Licuala sp. 17°42’13.7”N 105°47’33.9”E CPC 4280
Licuala sp. 17°43’31.6”N 105°53’38.0”E CPC 4179
Pinanga annamensis Magalon 17°41’28”N 105°53’42.7”E CPC 4107, **IE**
Rhapis laosensis Becc. 17°39’36.7”N 105°54’55.7”E CPC 3763**, OP**, **IE, SI**
Rhapis sp. 17°42’13.7”N 105°47’33.9”E CPC 4279

Aristolochiaceae
Aristolochia contorta Bunge 17°42’12.1”N 105°47’39.0”E CPC 4233; 17°42’13.9”N 105°47’45.8”E CPC 4297 **NT, MP**
Asarum wulingense C.F.Liang 17°42’10.4”N 105°47’57.3”E CPC 4185 **MP, NT, D32 (fig. 109)**

Balanophoraceae
Balanophora laxiflora Hemsl. 17°42’15.8”N 105°48’24”E CPC 4326 **NT, RDB**

Balsaminaceae
Impatiens verrucifer Hook.f. 17°39’21.1”N 105°54’41.7”E CPC 3863; 17°41’14.3”N 105°53’28.9”E CPC 4049; 17°41’28”N 105°53’42.7”E CPC 3949**, OP (fig. 116, 117)**
Impatiens sp. 17°42’13.7”N 105°47’33.9”E CPC 4267

Begoniaceae
Begonia acetosella Craib 17°39’11.6”N 105°54’53”E CPC 3679; 17°41’28”N 105°53’42.7”E CPC 3919a
Begonia crassula Aver. 17°39’21.1”N 105°54’41.7”E CPC 3858; 17°39’36.7”N 105°54’55.7”E CPC 3775; 17°41’28”N 105°53’42.7”E CPC 3962; 17°42’13.7”N 105°47’33.9”E CPC 4264 **NewT, NT, OP, LE, SI (fig. 112-114)**
Begonia palmata D.Don 17°42’10.4”N 105°47’57.3”E CPC 4206
Begonia sp. 17°39’31.7”N 105°54’48.2”E CPC 3655
Begonia sp. 17°39’31.7”N 105°54’48.2”E CPC 3889
Begonia sp. 17°39’36.7”N 105°54’55.7”E CPC 3760
Begonia sp. 17°40’03.6”N 105°55’08.5”E CPC 3925

Begonia sp. 17°40’03.6”N 105°55’08.5”E CPC 3926
Begonia sp. 17°42’11.9”N 105°47’37.4”E CPC 4288
Begonia sp. 17°42’13.7”N 105°47’33.9”E CPC 4238

Bignoniaceae
Radermachera sp. 17°39’21.1”N 105°54’41.7”E CPC 3862
sp. 17°41’28”N 105°53’42.7”E CPC 3972

Campanulaceae
Campanumoea celebica Blume 17°41’25.6”N 105°53’40.4”E CPC 4020 **NT**

Capparaceae
Capparis acutifolia Sw. 17°41’14.3”N 105°53’28.9”E CPC 4052
Capparis cantoniensis Lour. 17°42’23.8”N 105°47’59”E CPC 4396
Stixis suaveolens Pierre 17°43’31.6”N 105°53’38.0”E CPC 4175

Caprifoliaceae
Abelia chinensis R.Br. 17°39’36.7”N 105°54’55.7”E CPC 3797; 17°41’14.3”N 105°53’28.9”E CPC 4075; 17°41’14.3”N 105°53’28.9”E CPC 4099; 17°42’13.7”N 105°47’33.9”E CPC 4271 **NT, SI**
Viburnum punctatum Buch.-Ham. ex D. Don 17°42’15.8”N 105°48’24”E CPC 4343
sp. 17°42’13.7”N 105°47’33.9”E CPC 4270

Celastraceae
Glyptopetalum sclerocarpum Kurz 17°39’36.7”N 105°54’55.7”E CPC 3765

Chloranthaceae
Chloranthus japonicus Sieb. 17°42’38.5”N 105°48’52”E CPC 4440

Clusiaceae
Calophyllum balansae Pit. 17°38’00.4”N 105°55’57.9”E CPC 3735; 17°39’36.7”N 105°54’55.7”E CPC 3785 **NT**, **IE**
Garcinia oblongifolia Champ. ex Benth. 17°39’21.1”N 105°54’41.7”E CPC 3851; 17°39’36.7”N 105°54’55.7”E CPC 3796; 17°41’14.3”N 105°53’28.9”E CPC 4074 **NT**

Combretaceae
Combretum sundaicum Miq. 17°41’19”N 105°53’35.5”E CPC 4126
Combretum sp. 17°42’38.5”N 105°48’52”E CPC 4417

Commelinaceae
Amischotolype mollissima (Blume) Hassk. 17°41’25.6”N 105°53’40.4”E CPC 4003; 17°41’14.3”N 105°53’28.9”E CPC 4136; 17°41’28”N 105°53’42.7”E CPC 3969
Pollia secundiflora (Blume) Bakh.f. 17°41’25.6”N 105°53’40.4”E CPC 3992

Convallariaceae

Aspidistra coccigera Aver. & Tillich 17°38’00.4”N 105°55’57.9”E, CPC 3748; 17°39’11.6”N 105°54’53”E CPC 3659 **NewT, LE (fig. 93, 94)**

Disporopsis longifolia Craib 17°42’13.7”N 105°47’33.9”E CPC 4242; 17°42’38.5”N 105°48’52”E CPC 4422; 17°41’19”N 105°53’35.5”E CPC 4117 **NT**

Disporum trabeculatum Gagnep. 17°38’00.4”N 105°55’57.9”E CPC 3714; 17°42’10.4”N 105°47’57.3”E CPC 4189 **NT**, **IE**

Ophiopogon reptans Hook.f. 17°39’36.7”N 105°54’55.7”E CPC 3766; 17°39’36.7”N 105°54’55.7”E CPC 3787; 17°42’12.1”N 105°47’39.0”E CPC 4224

Ophiopogon sp. 17°42’15.8”N 105°48’24”E CPC 4335

Peliosanthes argenteostriata Aver. & N.Tanaka 17°39’21.7”N 105°54’59.5”E CPC 3824; 17°41’14.3”N 105°53’28.9”E CPC 4085a **NewT, OP, LE, SI (fig. 115)**

Tupistra theana Aver. & N. Tanaka 17°39’31.7”N 105°54’48.2”E CPC 3649; 17°39’21.1”N 105°54’41.7”E CPC 3870; 17°41’28”N 105°53’42.7”E CPC 3952 **NewT, VU, LE, SI (fig. 110, 111)**

Costaceae

Costus tonkinensis Gagnep. 17°40’03.6”N 105°55’08.5”E CPC 3918, **IE (fig. 91, 92)**

Cucurbitaceae

Gynostemma pentaphyllum (Thunb.) Mak. 17°39’31.7”N 105°54’48.2”E CPC 3653 **MP, VEG (fig. 141)**

Gynostemma pubescens (Gagnep.) C.Y.Wu ex C.Y.Wu & S.K.Chen 17°40’03.6”N 105°55’08.5”E CPC 3896; 17°41’25.6”N 105°53’40.4”E CPC 4018; 17°42’15.8”N 105°48’24”E CPC 4377 **MP, VEG**

Thladiantha cordifolia (Blume) Cogn. 17°40’03.6”N 105°55’08.5”E CPC 3894; 17°41’25.6”N 105°53’40.4”E CPC 4024

Cyperaceae

Carex sp. 17°39’21.7”N 105°54’59.5”E CPC 3817

Hypolytrum nemorum (Vahl.) Spreng.C.Rich 17°41’28”N 105°53’42.7”E CPC 3908a; 17°41’42”N 105°47’55.3”E CPC 4357

Mapania palustris (Boeckl.) F.Vill. 17°41’25.6”N 105°53’40.4”E CPC 3994

Daphniphyllaceae

Daphniphyllum majus Muell.Arg. 17°42’10.4”N 105°47’57.3”E CPC 4205

Datiscaceae

Tetrameles nudiflora R.Br. 17°41’42.3”N 105°53’14.1”E CPC 4118

Dipterocarpaceae

Dipterocarpus hasseltii Blume 17°39’11.6”N 105°54’53”E CPC 3703; 17°41’25.6”N 105°53’40.4”E CPC 4016**, SI, TT (fig. 49)**

Dipterocarpus retusus Blume 17°39’21.1”N 105°54’41.7”E CPC 3883; 17°42’13.9”N 105°47’45.8”E CPC 4316; 17°42’15.8”N 105°48’24”E CPC 4342; 17°42’38.5”N 105°48’52”E CPC 4401**, SI, TT (fig. 50)**

Hopea siamensis Heim 17°38’00.4”N 105°55’57.9”E CPC 3706;17°39’21.1”N 105°54’41.7”E CPC 3849; 17°39’21.7”N 105°54’59.5”E CPC 3816; 17°39’36.7”N 105°54’55.7”E CPC 3783; 17°41’14.3”N 105°53’28.9”E CPC 4092**, SI (fig. 51, 73, 74)**

Vatica cinerea King 17°41’28”N 105°53’42.7”E CPC 3924a; 17°41’28”N 105°53’42.7”E CPC 3960, **SI, TT**

sp. 17°41’28”N 105°53’42.7”E CPC 3932

Ebenaceae

Diospyros areolata King & Gamble 17°42’11.9”N 105°47’37.4”E CPC 4283

Diospyros cauliflora Blume? 17°39’11.6”N 105°54’53”E CPC 3664

Diospyros choboensis H.Lec. 17°42’12.1”N 105°47’39.0”E CPC 4219, **IE**

Diospyros hasseltii Zoll.? 17°41’19”N 105°53’35.5”E CPC 4119

Diospyros lancifolia Roxb. 17°40’03.6”N 105°55’08.5”E CPC 3924

Diospyros latisepala Ridl. 17°42’10.4”N 105°47’57.3”E CPC 4446

Diospyros lobata Lour. 17°41’14.3”N 105°53’28.9”E CPC 4059, **IE**

Diospyros longipedicellata H.Lec.? 17°41’28”N 105°53’42.7”E CPC 3948

Diospyros mun A.Chev. ex H.Lec. 17°39’21.7”N 105°54’59.5”E CPC 3829 **CR, LE, SI, D32, RDB (fig. 60-63)**

Diospyros rufogemmata H.Lec. 17°39’21.7”N 105°54’59.5”E CPC 3821, **IE**

Elaeocarpaceae

Elaeocarpus grandiflorus Sm. 17°39’11.6”N 105°54’53”E CPC 3674 **TT (fig. 58)**

Sloanea sigun (Blume) K. Schum.? 17°39’11.6”N 105°54’53”E CPC 3670 **TT (fig. 54)**

sp. 17°41’28”N 105°53’42.7”E CPC 3955

sp. 17°41’28”N 105°53’42.7”E CPC 3968

sp. 17°42’13.9”N 105°47’45.8”E CPC 4313

Ericaceae

Enkianthus quinqueflorus Lour. 17°38’00.4”N 105°55’57.9”E CPC 3724 **NT, OP, SI**

Vaccinium bullatum (Dop) Sleum. 17°41’28”N 105°53’42.7”E CPC 3963 **NT, OP, SI**

Vaccinium dunalianum Wight 17°39’36.7”N 105°54’55.7”E CPC 3780; 17°42’13.7”N 105°47’33.9”E CPC 4252 **NT, OP, SI (fig. 139)**

Erythropalaceae

Erythropalum scandens Blume 17°41’28”N 105°53’42.7”E CPC 3912a **MP, VEG**

Euphorbiaceae

Antidesma bunius Spreng. 17°39’21.1”N 105°54’41.7”E CPC 3868

Antidesma fordii Hemsl. 17°41’28”N 105°53’42.7”E CPC 3925a

Antidesma sp. 17°41’28”N 105°53’42.7”E CPC 3922a

Antidesma sp.? 17°41’25.6”N 105°53’40.4”E CPC 3989

Antidesma yunnanensis Pax & Hoffm. 17°43’31.6”N 105°53’38.0”E CPC 4168

Bischofia javanica Blume 17°41’14.3”N 105°53’28.9”E CPC 4147 **(fig. 44)**
Breynia baudouini Beille 17°41’14.3”N 105°53’28.9”E CPC 4098; 17°41’28”N 105°53’42.7”E CPC 3985
Breynia sp.? 17°43’31.6”N 105°53’38.0”E CPC 4166
Claoxylon indicum (Blume) Endl. ex Hassk. 17°41’14.3”N 105°53’28.9”E CPC 4137
Croton cascarilloides Raeusch. 17°40’03.6”N 105°55’08.5”E CPC 3897b
Endospermum chinense Benth.? 17°41’14.3”N 105°53’28.9”E CPC 4153
Glochidion pilosum (Lour.) Merr. 17°39’21.1”N 105°54’41.7”E CPC 3856
Phyllanthus insularis Beille 17°39’36.7”N 105°54’55.7”E CPC 3776 **NT, SI**
Sapium rotundifolium Hemsl. 17°41’28”N 105°53’42.7”E CPC 3981
Sauropus sp.? 17°42’15.8”N 105°48’24”E CPC 4328
Sumbaviopsis albicans (Blume) J.J.Sm. 17°39’21.7”N 105°54’59.5”E CPC 3827
Trigonostemon thyrsoideus Stapf? 17°39’11.6”N 105°54’53”E CPC 3694
sp. 17°40’03.6”N 105°55’08.5”E CPC 3899
sp. 17°41’14.3”N 105°53’28.9”E CPC 4148
sp. 17°42’15.8”N 105°48’24”E CPC 4321
sp. 17°42’38.5”N 105°48’52”E CPC 4402

Fabaceae
Afgekia filipes (Dunn) R.Geesink 17°41’25.6”N 105°53’40.4”E CPC 3997
Archidendron clypearia (Jack) I.C.Niels. 17°38’00.4”N 105°55’57.9”E CPC 3707
Archidendron tetraphyllum (Gagnep.) I.C.Niels. 17°42’23.8”N 105°47’59”E CPC 4398**, IE, SI**
Bauhinia khasiana Baker? 17°41’28”N 105°53’42.7”E CPC 3946
Bauhinia ornata Kurz 17°41’28”N 105°53’42.7”E CPC 3927a
Bauhinia oxysepala Gagnep. 17°42’13.9”N 105°47’45.8”E CPC 4304**, IE**
Bowringia callicarpa Champ.? 17°41’14.3”N 105°53’28.9”E CPC 4131; 17°43’31.6”N 105°53’38.0”E CPC 4155
Callerya reticulata (Benth.) Schot 17°40’03.6”N 105°55’08.5”E CPC 3902
Campylotropis henryi Schindl. 17°39’36.7”N 105°54’55.7”E CPC 3782; 17°41’14.3”N 105°53’28.9”E CPC 4095; 17°42’13.7”N 105°47’33.9”E CPC 4244 **NT, SI (fig. 82, 83)**
Dalbergia hancei Benth.? 17°41’28”N 105°53’42.7”E CPC 3935; 17°41’28”N 105°53’42.7”E CPC 3964
Dalbergia sp.? 17°41’14.3”N 105°53’28.9”E CPC 4151
Derris sp.? 17°42’15.8”N 105°48’24”E CPC 4319
Entada phaseoloides (L.) Merr. 17°40’03.6”N 105°55’08.5”E CPC 3929; 17°41’19”N 105°53’35.5”E CPC 4120; 17°42’15.8”N 105°48’24”E CPC 4331; 17°42’23.8”N 105°47’59”E CPC 4386 **(fig. 140)**
Gleditsia pachycarpa Balansa ex Gagnep. 17°41’25.6”N 105°53’40.4”E CPC 4013**, IE, SI**
Peltophorum dasyrrhachis (Miq.) Kurz 17°39’21.1”N 105°54’41.7”E CPC 3876
Zenia insignis Chun 17°41’25.6”N 105°53’40.4”E CPC 4025**, OP, IE, TT (fig. 70)**

Fagaceae
Lithocarpus pseudoreinwardtii A.Camus 17°42’13.9”N 105°47’45.8”E CPC 4290; 17°42’15.8”N 105°48’24”E CPC 4323**, SI, TT**
Lithocarpus sp. 17°42’10.4”N 105°47’57.3”E CPC 4212
Lithocarpus sp. 17°42’13.7”N 105°47’33.9”E CPC 4255
Quercus acutissima Carr.? 17°42’12.1”N 105°47’39.0”E CPC 4217**, SI**
Quercus rupestris Hickel & A. Camus 17°42’13.7”N 105°47’33.9”E CPC 4253**, SI**
Quercus sp.? 17°42’10.4”N 105°47’57.3”E CPC 4213

Flacourtiaceae
Flacourtia rukam Zoll. & Moritzi 17°41’19”N 105°53’35.5”E CPC 4125
Homalium ceylanicum (Gardn.) Benth. 17°42’38.5”N 105°48’52”E CPC 4414
Homalium phanerophlebium How & Ko? 17°39’21.1”N 105°54’41.7”E CPC 3843 **NewF**
Hydnocarpus annamensis (Gagnep.) Lescot & Sleumer? 17°39’11.6”N 105°54’53”E CPC 3702**, IE**
Hydnocarpus kurzii (King) Warb. 17°41’28”N 105°53’42.7”E CPC 3928a
sp. 17°39’11.6”N 105°54’53”E CPC 3676

Gesneriaceae
Aeschynanthus mendumiae D.Middleton 17°41’25.6”N 105°53’40.4”E CPC 4026**, OP**
Aeschynanthus sp. 17°39’21.7”N 105°54’59.5”E CPC 3811
Aeschynanthus sp. 17°39’21.7”N 105°54’59.5”E CPC 3818
Aeschynanthus sp. 17°40’03.6”N 105°55’08.5”E CPC 3914
Aeschynanthus sp. 17°41’14.3”N 105°53’28.9”E CPC 4051
Aeschynanthus sp. 17°42’12.1”N 105°47’39.0”E CPC 4221
Aeschynanthus sp. 17°42’38.5”N 105°48’52”E CPC 4423
Aeschynanthus sp.? 17°41’28”N 105°53’42.7”E CPC 3951
Chirita sp.? 17°42’11.9”N 105°47’37.4”E CPC 4289
Chirita sp.? 17°42’13.7”N 105°47’33.9”E CPC 4265
Epithema brunonis Blume? 17°42’13.7”N 105°47’33.9”E CPC 4241
Paraboea sp. 17°40’03.6”N 105°55’08.5”E CPC 3911
Paraboea sp. 17°42’13.7”N 105°47’33.9”E CPC 4240
Primulina sp.? 17°39’21.7”N 105°54’59.5”E CPC 3812
Rhynchothechum ellipticum (Wall. ex D.Dietr.) A.DC. 17°39’11.6”N 105°54’53”E CPC 3681; 17°42’13.9”N 105°47’45.8”E CPC 4301
Stauranthera sp. 17°41’25.6”N 105°53’40.4”E CPC 3998
Paraboea sp. 17°41’25.6”N 105°53’40.4”E CPC 3988
sp. 17°39’11.6”N 105°54’53”E CPC 3668
sp. 17°41’25.6”N 105°53’40.4”E CPC 4031
sp. 17°41’28”N 105°53’42.7”E CPC 3961
sp. 17°41’28”N 105°53’42.7”E CPC 3971
sp. 17°42’38.5”N 105°48’52”E CPC 4419

Hamamelidaceae
Altingia siamensis Craib 17°42’23.8”N 105°47’59”E CPC 4384 **NT, IE, SI, TT (fig. 28, 29)**

Hernandiaceae
Illigera celebica Miq. 17°42’15.8”N 105°48’24”E CPC 4322
Illigera rhodantha Hance 17°41’14.3”N 105°53’28.9”E CPC 4149

Hypoxidaceae
Curculigo latifolia Dryand. ex Ait. 17°39’31.7”N 105°54’48.2”E CPC 3834

Icacinaceae
Gomphandra mollis Merr. 17°41’28”N 105°53’42.7”E CPC 3913a

Illiciaceae
Illicium cambodianum Hance 17°38’00.4”N 105°55’57.9”E CPC 3713; 17°39’21.7”N 105°54’59.5”E CPC 3813; 17°41’14.3”N 105°53’28.9”E CPC 4065 **MP, NT, IE, SI (fig. 88)**

Lamiaceae
Gomphostemma grandiflorum Doan? 17°39’11.6”N 105°54’53”E CPC 3680
Gomphostemma sp.? 17°41’25.6”N 105°53’40.4”E CPC 3987

Lardizabalaceae
Stauntonia cavaleriana Gagnep. 17°39’21.1”N 105°54’41.7”E CPC 3882; 17°42’15.8”N 105°48’24”E CPC 4364**, IE, SI, MP**

Lauraceae
Actinodaphne pilosa (Lour.) Merr.? 17°42’38.5”N 105°48’52”E CPC 4421
Actinodaphne sp.? 17°41’28”N 105°53’42.7”E CPC 3900a **(fig. 53)**
Beilschmiedia percoriacea Allen 17°39’11.6”N 105°54’53”E CPC 3687; 17°42’13.7”N 105°47’33.9”E CPC 4278;17°42’38.5”N 105°48’52”E CPC 4404
Beilschmiedia pergamentacea Allen 17°41’14.3”N 105°53’28.9”E CPC 4060; 17°41’25.6”N 105°53’40.4”E CPC 3995 **TT (fig. 45)**
Beilschmiedia sp. 17°42’15.8”N 105°48’24”E CPC 4359
Cinnamomum ovatum Allen 17°43’31.6”N 105°53’38.0”E CPC 4172 **TT (fig. 55)**
Cinnamomum sp. 17°38’00.4”N 105°55’57.9”E CPC 3732
Cryptocarya annamensis Allen 17°41’25.6”N 105°53’40.4”E CPC 4015**, IE, SI**
Cryptocarya concinna Hance 17°40’03.6”N 105°55’08.5”E CPC 3900
Lindera sp.? 17°41’14.3”N 105°53’28.9”E CPC 4093
Lindera sp.? 17°42’38.5”N 105°48’52”E CPC 4416
Litsea sp. 17°40’03.6”N 105°55’08.5”E CPC 3898
Litsea sp. 17°43’31.6”N 105°53’38.0”E CPC 4154
Litsea sp.? 17°39’21.1”N 105°54’41.7”E CPC 3850
Litsea sp.? 17°39’36.7”N 105°54’55.7”E CPC 3801
Litsea sp.? 17°42’15.8”N 105°48’24”E CPC 4352
Machilus sp.? 17°42’10.4”N 105°47’57.3”E CPC 4211
Neolitsea merrilleana Allen 17°42’13.7”N 105°47’33.9”E CPC 4273

Neolitsea sp.? 17°42’10.4”N 105°47’57.3”E CPC 4444
Phoebe tavoyana (Meisn.) Hoof.f. 17°38’00.4”N 105°55’57.9” CPC 3731; 17°39’21.7”N 105°54’59.5”E CPC 3814; 17°41’14.3”N 105°53’28.9”E CPC 4063; 17°43’31.6”N 105°53’38.0”E CPC 4182 **(fig. 72)**
Phoebe sp. 17°39’21.7”N 105°54’59.5”E CPC 3832
sp. 17°38’00.4”N 105°55’57.9”E CPC 3744
sp. 17°41’25.6”N 105°53’40.4”E CPC 4034

Leeaceae
Leea indica (Burm.f.) Merr. 17°39’11.6”N 105°54’53”E CPC 3689; 17°42’13.9”N 105°47’45.8”E CPC 4311

Linaceae
Tirpitzia sinensis (Hemsl.) Hall. f. 17°39’21.1”N 105°54’41.7”E CPC 3859; 17°41’14.3”N 105°53’28.9”E CPC 4094 **NT, SI (fig. 86, 87)**

Loganiaceae?
sp. 17°39’11.6”N 105°54’53”E CPC 3663

Lythraceae
Lagerstroemia ovalifolia Teijsm. & Binn. 17°41’25.6”N 105°53’40.4”E CPC 4017**, SI (fig. 39)**

Magnoliaceae
Kmeria septentrionalis Dandy 17°38’00.4”N 105°55’57.9” CPC 3719; 17°39’21.1”N 105°54’41.7”E CPC 3865 **NT**
Magnolia dandyi Gagnep. 17°42’10.4”N 105°47’57.3”E CPC 4193 **IE, TT, RDB (fig. 67)**
Magnolia liliifera Baill. 17°39’11.6”N 105°54’53”E CPC 3700; 17°39’21.7”N 105°54’59.5”E CPC 3815; 17°39’21.7”N 105°54’59.5”E CPC 3826; 17°39’21.1”N 105°54’41.7”E CPC 3871; 17°41’14.3”N 105°53’28.9”E CPC 4054; 17°42’10.4”N 105°47’57.3”E CPC 4215; 17°42’13.9”N 105°47’45.8”E CPC 4317; 17°43’31.6”N 105°53’38.0”E CPC 4158 **OP (fig. 68)**
Magnolia masticata (Dandy) Figlar (Michelia masticata Dandy) 17°41’25.6”N 105°53’40.4”E CPC 4006; 17°43’31.6”N 105°53’38.0”E CPC 4169,17°42’10.4”N 105°47’57.3”E CPC 4201; 17°42’12.1”N 105°47’39.0”E CPC 4234; 17°42’15.8”N 105°48’24”E CPC 4320;17°42’15.8”N 105°48’24”E CPC 4325; 17°42’15.8”N 105°48’24”E CPC 4346;17°42’38.5”N 105°48’52”E CPC 4403 **TT**
Magnolia sp. 17°38’00.4”N 105°55’57.9” CPC 3722
Magnolia sp. 17°42’15.8”N 105°48’24”E CPC 4360
Manglietia chevalieri Dandy 17°42’15.8”N 105°48’24”E CPC 4344; 17°39’11.6”N 105°54’53”E CPC 3701 **TT (fig. 66)**
Michelia coriacea Hung T. Chang & B. L. Chen 17°42’38.5”N 105°48’52”E CPC 4405 **TT (fig. 65)**
Michelia doltsopa Buch.-Ham. ex Candolle 17°41’19”N 105°53’35.5”E CPC 4112 **TT**
Michelia gioi (A. Chev.) Sima & Hong Yu. 17°41’28”N 105°53’42.7”E CPC 3930 **MP, EF, TT (fig. 64)**

Michelia macclurei Dandy 17°43’31.6”N 105°53’38.0”E CPC 4159 **TT**

Malvaceae

Hibiscus grewiifolius Hassk. 17°39’11.6”N 105°54’53”E CPC 3660; 17°41’28”N 105°53’42.7”E CPC 4184 **NT, OP**

Marantaceae

Phrynium dispermum Gagnep. 17°39’31.7”N 105°54’48.2”E CPC 3835; 17°41’25.6”N 105°53’40.4”E CPC 4008

Melastomataceae

Blastus borneensis Cogn. 17°41’28”N 105°53’42.7”E CPC 3936
Melastoma sanguineum Sims. 17°42’13.7”N 105°47’33.9”E CPC 4256
Memecylon edule Roxb. 17°39’21.1”N 105°54’41.7”E CPC 3848; 17°41’14.3”N 105°53’28.9”E CPC 4078
Phyllagathis sp. 17°38’00.4”N 105°55’57.9” CPC 3716
Phyllagathis sp. 17°39’31.7”N 105°54’48.2”E CPC 3890
Phyllagathis sp. 17°41’28”N 105°53’42.7”E CPC 3902a

Meliaceae

Aglaia lawii (Wight) C.J.Saldanha 17°39’11.6”N 105°54’53”E CPC 3695; 17°41’28”N 105°53’42.7”E CPC 3944; 17°43’31.6”N 105°53’38.0”E CPC 4173**, SI**
Amoora oligosperma (Pierre) Pellegr 17°43’31.6”N 105°53’38.0”E CPC 4160
Dysoxylum loureirii Pierre? 17°41’25.6”N 105°53’40.4”E CPC 4033**, SI (fig. 43)**
Dysoxylum mollissimum Blume? 17°43’31.6”N 105°53’38.0”E CPC 4176**, SI, MP, TT (fig. 42)**
Walsura sp.? 17°41’25.6”N 105°53’40.4”E CPC 4010
sp. 17°41’28”N 105°53’42.7”E CPC 3914a
sp. 17°41’28”N 105°53’42.7”E CPC 3936a

Menispermaceae

Arcangelisia flava (L.) Merr. 17°42’10.4”N 105°47’57.3”E CPC 4209
Cyclea polypetala Dunn 17°43’31.6”N 105°53’38.0”E CPC 4183
Stephania sinica Diels 17°41’19”N 105°53’35.5”E CPC 4110 **MP**

Moraceae

Artocarpus borneensis Merr. 17°40’03.6”N 105°55’08.5”E CPC 3927 **TT**
Artocarpus nitidus Trecul 17°42’10.4”N 105°47’57.3”E CPC 4445
Artocarpus sp.? 17°42’10.4”N 105°47’57.3”E CPC 4216
Artocarpus styracifolia Pierre 17°43’31.6”N 105°53’38.0”E CPC 4156 **TT (fig. 56)**
Ficus altissima Blume 17°42’10.4”N 105°47’57.3”E CPC 4210
Ficus chartacea Wall. ex King 17°41’14.3”N 105°53’28.9”E CPC 4082
Ficus nervosa Heyne & Roth 17°41’14.3”N 105°53’28.9”E CPC 4134
Ficus sagittata Vahl 17°42’15.8”N 105°48’24”E CPC 4324
Ficus variolosa Lind. ex Benth. 17°38’00.4”N 105°55’57.9” CPC 3721

Maclura cochinchinensis (Lour.) Corn. 17°41’25.6”N 105°53’40.4”E CPC 4022; 17°42’38.5”N 105°48’52”E CPC 4409

Myristicaceae
Horsfieldia amygdalina (Wall.) Warb. 17°41’14.3”N 105°53’28.9”E CPC 4146
Knema pierrei Warb. 17°39’11.6”N 105°54’53”E CPC 3665**, SI**

Myrsinaceae
Ardisia brevicaulis Diels 17°39’21.1”N 105°54’41.7”E CPC 3875
Ardisia colorata Roxb. 17°42’13.9”N 105°47’45.8”E CPC 4309
Ardisia gigantifolia Stapf 17°42’10.4”N 105°47’57.3”E CPC 4202, **MP, SI, RDB (fig. 108)**
Ardisia maclurei Merr. 17°39’21.1”N 105°54’41.7”E CPC 3881
Ardisia tinctoria Pit. 17°41’14.3”N 105°53’28.9”E CPC 4057
Ardisia sp. 17°38’00.4”N 105°55’57.9”E CPC 3751
Ardisia sp. 17°39’21.1”N 105°54’41.7”E CPC 3844
Ardisia sp. 17°39’36.7”N 105°54’55.7”E CPC 3770
Ardisia sp. 17°39’36.7”N 105°54’55.7”E CPC 3798a
Ardisia sp. 17°40’03.6”N 105°55’08.5”E CPC 3901
Ardisia sp. 17°41’25.6”N 105°53’40.4”E CPC 3996
Ardisia sp. 17°41’28”N 105°53’42.7”E CPC 3898a
Ardisia sp. 17°41’28”N 105°53’42.7”E CPC 3940
Ardisia sp. 17°43’31.6”N 105°53’38.0”E CPC 4181
Rapanea neriifolia (Sieb. & Zucc.) Mez 17°41’14.3”N 105°53’28.9”E CPC 4089; 17°42’13.7”N 105°47’33.9”E CPC 4249

Myrtaceae
Syzygium sp. 17°42’13.9”N 105°47’45.8”E CPC 4315

Nyssaceae
Diplopanax vietnamensis Aver. & H.T.Nguyen 17°42’13.9”N 105°47’45.8”E CPC 4312; 17°42’23.8”N 105°47’59”E CPC 4395 **NT, LE, SI, TT (fig. 33, 34)**

Oleaceae
Fraxinus griffithii C.B.Clarke 17°42’38.5”N 105°48’52”E CPC 4408 **NT, NewF, SI**

Orchidaceae CITES (all family species)
Anoectochilus annamensis Aver.? 17°42’15.8”N 105°48’24”E CPC 4375 **MP, VU, OP, LE, SI (fig. 106)**
Anoectochilus calcareus Aver. 17°41’14.3”N 105°53’28.9”E CPC 4085; 17°42’10.4”N 105°47’57.3”E CPC 4199 **MP, VU, OP, LE, SI, D32, RDB**
Aphyllorchis montana Rchb.f. 17°41’14.3”N 105°53’28.9”E CPC 4129 **EN (fig. 105)**
Apostasia wallichii R.Br. 17°42’15.8”N 105°48’24”E CPC 4362 **NT, SI**
Appendicula hexandra (J.Koenig) J.J.Sm. 17°38’00.4”N 105°55’57.9”E CPC 3708; 17°39’36.7”N 105°54’55.7”E CPC 3792; 17°42’11.9”N 105°47’37.4”E CPC 4285 **NT, SI**

Biermannia calcarata Aver. 17°41’28”N 105°53’42.7”E CPC 3947 **NT, LE**

Bulbophyllum ambrosia (Hance) Schltr. 17°43’31.6”N 105°53’38.0”E CPC 4157**, OP**

Bulbophyllum delitescens Hance 17°40’03.6”N 105°55’08.5”E CPC 3913; 17°41’28”N 105°53’42.7”E CPC 3950; 17°42’13.7”N 105°47’33.9”E CPC 4239; 17°42’38.5”N 105°48’52”E CPC 4428; 17°43’31.6”N 105°53’38.0”E CPC 4178**, OP, SI (fig. 121, 122)**

Bulbophyllum depressum King & Pantl. 17°38’00.4”N 105°55’57.9”E CPC 3754; 17°39’36.7”N 105°54’55.7”E CPC 3807; 17°41’14.3”N 105°53’28.9”E CPC 4062; 17°42’13.7”N 105°47’33.9”E CPC 4260 **NT**

Bulbophyllum hymenanthum Hook.f. 17°39’21.1”N 105°54’41.7”E CPC 3864 **NT**

Bulbophyllum macranthum Lindl.? 17°42’38.5”N 105°48’52”E CPC 4436**, OP**

Bulbophyllum retusiusculum Rchb.f. 17°41’28”N 105°53’42.7”E CPC 3975; 17°38’00.4”N 105°55’57.9”E CPC 3740; 17°39’36.7”N 105°54’55.7”E CPC 3758; 17°41’14.3”N 105°53’28.9”E CPC 4076; 17°42’12.1”N 105°47’39.0”E CPC 4230; 17°42’38.5”N 105°48’52”E CPC 4426 **NT, OP (fig. 120)**

Bulbophyllum salmoneum Aver. & J.J.Verm. 17°39’21.1”N 105°54’41.7”E CPC 3854; 17°39’31.7”N 105°54’48.2”E CPC 3657; 17°39’36.7”N 105°54’55.7”E CPC 3803; 17°40’03.6”N 105°55’08.5”E CPC 3919; 17°41’14.3”N 105°53’28.9”E CPC 4104 **NewT, OP, LE (fig. 118, 119)**

Bulbophyllum sp. 17°42’13.7”N 105°47’33.9”E CPC 4261

Calanthe alismifolia Lindl. 17°38’00.4”N 105°55’57.9”E CPC 3749; 17°39’31.7”N 105°54’48.2”E CPC 3654; 17°41’14.3”N 105°53’28.9”E CPC 4141; 17°42’10.4”N 105°47’57.3”E CPC 4198; 17°42’38.5”N 105°48’52”E CPC 4435**, SI (fig. 95-97)**

Calanthe odora Griff. 17°39’11.6”N 105°54’53”E CPC 3698; 17°41’25.6”N 105°53’40.4”E CPC 4012; 17°41’28”N 105°53’42.7”E CPC 3979; 17°42’38.5”N 105°48’52”E CPC 4437 **NT, OP, SI (fig. 98, 99)**

Callostylis rigida Blume 17°39’31.7”N 105°54’48.2”E CPC 3656

Ceratostylis subulata Blume 17°39’36.7”N 105°54’55.7”E CPC 3791; 17°41’14.3”N 105°53’28.9”E CPC 4064 **NT, SI**

Cheirostylis chinensis Rolfe 17°39’36.7”N 105°54’55.7”E CPC 3767; 17°41’14.3”N 105°53’28.9”E CPC 4067; 17°42’38.5”N 105°48’52”E CPC 4431

Cleisostoma birmanicum (Schltr.) Garay 17°41’14.3”N 105°53’28.9”E CPC 4072 **NT, OP, SI**

Cleisostoma striatum (Rchb.f.) Garay 17°41’14.3”N 105°53’28.9”E CPC 4105; 17°42’15.8”N 105°48’24”E CPC 4349; 17°38’00.4”N 105°55’57.9”E CPC 3739; 17°39’31.7”N 105°54’48.2”E CPC 3646; 17°39’36.7”N 105°54’55.7”E CPC 3774; 17°40’03.6”N 105°55’08.5”E CPC 3916 **NT, SI (fig. 134)**

Collabium chinense (Rolfe) T.Tang & F.T.Wang 17°38’00.4”N 105°55’57.9”E CPC 3709; 17°42’10.4”N 105°47’57.3”E CPC 4197; 17°42’15.8”N 105°48’24”E CPC 4371 **NT, OP, SI**

Corymborkis veratrifolia (Reinw.) Blume 17°39’11.6”N 105°54’53”E CPC 3697 **NT, SI**

Cymbidium cyperifolium Wall. ex Lindl.? 17°42’10.4”N 105°47’57.3”E CPC 4186

Cyrtosia nana (Rolfe ex Downie) Garay 17°42’38.5”N 105°48’52”E CPC 4443 **EN, LE**

Dendrobium aduncum Lindl. 17°41’14.3”N 105°53’28.9”E CPC 4086 **NT, OP**

Dendrobium nobile Lindl. 17°41’14.3”N 105°53’28.9”E CPC 4077 **MP, NT, OP, SI, D32, RDB**

Dendrobium salaccense (Blume) Lindl. 17°39’36.7”N 105°54’55.7”E CPC 3759; 17°41’14.3”N 105°53’28.9”E CPC 4088; 17°42’38.5”N 105°48’52”E CPC 4432 **NT**

Dendrobium spatella Rchb.f. 17°39’36.7”N 105°54’55.7”E CPC 3778; 17°40’03.6”N 105°55’08.5”E CPC 3905; 17°42’13.7”N 105°47’33.9”E CPC 4246; 17°42’13.7”N 105°47’33.9”E CPC 4276

Dendrobium terminale C.S.P.Parish & Rchb.f. 17°42’13.7”N 105°47’33.9”E CPC 4263; 17°41’25.6”N 105°53’40.4”E CPC 4039; 17°42’12.1”N 105°47’39.0”E CPC 4223; 17°42’38.5”N 105°48’52”E CPC 4429

Dendrobium thyrsiflorum Rchb.f. var. thyrsiflorum 17°42’15.8”N 105°48’24”E CPC 4370 **NT, OP**

Dendrobium thyrsiflorum Rchb.f. var. minutiflorum Aver. 17°39’11.6”N 105°54’53”E CPC 3753a; 17°40’03.6”N 105°55’08.5”E CPC 3920 **NewT, NT, OP, IE**

Dendrobium truncatum Lindl. 17°41’25.6”N 105°53’40.4”E CPC 4042; 17°42’13.7”N 105°47’33.9”E CPC 4275

Eria paniculata Lindl. 17°38’00.4”N 105°55’57.9”E CPC 3715; 17°41’14.3”N 105°53’28.9”E CPC 4071 **(fig. 126)**

Eria pannea Lindl. 17°42’15.8”N 105°48’24”E CPC 4369

Eria spirodela Aver. 17°39’36.7”N 105°54’55.7”E CPC 3805; 17°41’14.3”N 105°53’28.9”E CPC 4061; 17°42’13.7”N 105°47’33.9”E CPC 4251 **NT, LE, SI, RDB (fig. 127-130)**

Eria thao Gagnep. 17°42’10.4”N 105°47’57.3”E CPC 4188 **NT, OP, LE, SI**

Eria tomentosa (K.D.Koen.) Hook.f.? 17°42’13.7”N 105°47’33.9”E CPC 4269 **NT**

Erythrodes hirsuta (Griff.) Ormerod 17°42’15.8”N 105°48’24”E CPC 4330

Flickingeria angustifolia (Blume) A.D.Hawkes 17°39’21.1”N 105°54’41.7”E CPC 3861; 17°41’14.3”N 105°53’28.9”E CPC 4091**, SI (fig. 124)**

Flickingeria fimbriata (Blume) A.D.Hawkes 17°39’36.7”N 105°54’55.7”E CPC 3777; 17°41’14.3”N 105°53’28.9”E CPC 4087 **MP, SI (fig. 125)**

Galeola nudiflora Lour. 17°42’15.8”N 105°48’24”E CPC 4373 **NT**

Gastrochilus calceolaris (Buch.-Ham. ex Sm.) D.Don 17°39’11.6”N 105°54’53”E CPC 3661 **NT, OP**

Gastrochilus sp. 17°42’38.5”N 105°48’52”E CPC 4434

Goodyera fumata Thwaites 17°39’31.7”N 105°54’48.2”E CPC 3648

Goodyera hispida Lindl. 17°41’14.3”N 105°53’28.9”E CPC 4108; 17°41’14.3”N 105°53’28.9”E CPC 4142 **VU, OP, SI**

Habenaria calcicola Aver. 17°39’36.7”N 105°54’55.7”E CPC 3772 **NewT, LE**

Kingidium deliciosum (Rchb.f.) H.R.Sweet 17°39’31.7”N 105°54’48.2”E CPC 3652; 17°41’28”N 105°53’42.7”E CPC 3918a; 17°41’25.6”N 105°53’40.4”E CPC 4035 **(fig. 135, 136)**

Liparis distans C.B.Clarke 17°42’11.9”N 105°47’37.4”E CPC 4287**, SI**

Liparis nigra Seidenf. 17°39’11.6”N 105°54’53”E CPC 3673; 17°42’15.8”N 105°48’24”E CPC 4332 **NT, OP, IE**

Liparis pumila Aver.? 17°42’15.8”N 105°48’24”E CPC 4348 **NT, LE**

Mischobulbum cordifolium Schltr. 17°41’28”N 105°53’42.7”E CPC 3909a **NT, OP, SI**

Mischobulbum ovifolium (Tsi & S.C.Chen) Aver. 17°41’28”N 105°53’42.7”E CPC 3957 **VU, LE, SI**

Nephelaphyllum tenuiflorum Blume 17°42’13.7”N 105°47’33.9”E CPC 4277; 17°42’38.5”N 105°48’52”E CPC 4427; 17°39’36.7”N 105°54’55.7”E CPC 3793 **NT, SI (fig. 100-102)**

Nervilia muratana S.W. Gale & S.K. Wu 17°42’15.8”N 105°48’24”E CPC 4350; 17°42’38.5”N 105°48’52”E CPC 4433 **NT, LE, D32** (=*N. macroglossa* auct.)

Oberonia cavaleriei Finet 17°39’36.7”N 105°54’55.7”E CPC 3806 **VU, LE, SI**

Oberonia kwangsiensis Seidenf. 17°42’13.7”N 105°47’33.9”E CPC 4262 **VU, LE, SI**

Oberonia sp. 17°41’19”N 105°53’35.5”E CPC 4127

Oberonia sp. 17°42’15.8”N 105°48’24”E CPC 4376

Odontochilus elwesii (Hook.f.) Ormerod 17°42’15.8”N 105°48’24”E CPC 4333; 17°42’12.1”N 105°47’39.0”E CPC 4232 **VU, OP, SI**

Panisea garrettii (I.D.Lund) Aver. 17°42’13.7”N 105°47’33.9”E CPC 4266; 17°41’14.3”N 105°53’28.9”E CPC 4084 **VU, IE**

Parapteroceras elobe (Seidenf.) Aver. 17°39’36.7”N 105°54’55.7”E CPC 3804; 17°41’28”N 105°53’42.7”E CPC 3958 **VU (fig. 137)**

Phaius flavus (Blume) Lindl. 17°42’12.1”N 105°47’39.0”E CPC 4231 **NT, OP, SI**

Pholidota chinensis Lindl. 17°38’00.4”N 105°55’57.9”E CPC 3738 **NT, OP, IE, SI (fig. 132, 133)**

Pholidota levelleana Schltr. 17°42’12.1”N 105°47’39.0”E CPC 4222; 17°41’14.3”N 105°53’28.9”E CPC 4066; 17°41’25.6”N 105°53’40.4”E CPC 4040 **NT, SI**

Phreatia plantaginifolia (J.Koenig) Ormerod? 17°42’38.5”N 105°48’52”E CPC 4425; 17°41’14.3”N 105°53’28.9”E CPC 4081 **VU**

Podochilus khasianum Hook.f. 17°38’00.4”N 105°55’57.9”E CPC 3756; 17°42’11.9”N 105°47’37.4”E CPC 4286 **VU, SI**

Rhomboda petelottii (Gagnep.) Ormerod 17°42’11.9”N 105°47’37.4”E CPC 4284; 17°38’00.4”N 105°55’57.9”E CPC 3755; 17°39’21.7”N 105°54’59.5”E CPC 3825 **VU, LE, SI**

Schoenorchis gemmata (Lindl.) J.J.Sm. 17°39’11.6”N 105°54’53”E CPC 3699; 17°42’10.4”N 105°47’57.3”E CPC 4200 **NT**

Taeniophyllum glandulosum Blume 17°39’36.7”N 105°54’55.7”E CPC 3768 **VU**

Tainia sp. 17°42’13.9”N 105°47’45.8”E CPC 4291

Thelasis pygmaea (Griff.) Blume 17°41’28”N 105°53’42.7”E CPC 3967; 17°39’36.7”N 105°54’55.7”E CPC 3786 **NT, SI (fig. 123)**

Thrixspermum centipeda Lour. 17°39’31.7”N 105°54’48.2”E CPC 3651; 17°42’10.4”N 105°47’57.3”E CPC 4194 **NT**

Trichotosia pulvinata (Lindl.) Kraenzl.? 17°41’28”N 105°53’42.7”E CPC 3966; 17°42’38.5”N 105°48’52”E CPC 4430; 17°38’00.4”N 105°55’57.9”E CPC 3747; 17°42’13.7”N 105°47’33.9”E CPC 4274 **NT, SI (fig. 131)**

Tropidia angulosa (Lindl.) Blume 17°41’25.6”N 105°53’40.4”E CPC 4037

Tropidia curculigoides Lindl. 17°39’21.1”N 105°54’41.7”E CPC 3872; 17°39’21.7”N 105°54’59.5”E CPC 3822; 17°41’14.3”N 105°53’28.9”E CPC 4056 **(fig. 103, 104)**

Pandaceae
Microdesmis sp. 17°39’11.6”N 105°54’53”E CPC 3696
Microdesmis sp.? 17°42’15.8”N 105°48’24”E CPC 4351

Pentaphragmataceae
Pentaphragma sinense Hemsl. & Wils. 17°38’00.4”N 105°55’57.9”E CPC 3710; 17°41’28”N 105°53’42.7”E CPC 3907a**, SI**

Phormiaceae
Chlorophytum laxum R.Br. 17°39’31.7”N 105°54’48.2”E CPC 3647

Piperaceae
Peperomia leptostachya Hook. & Arn. 17°42’12.1”N 105°47’39.0”E CPC 4227
Piper albispicum C.DC. 17°39’36.7”N 105°54’55.7”E CPC 3761; 17°42’15.8”N 105°48’24”E CPC 4356
Piper densum Blume 17°41’14.3”N 105°53’28.9”E CPC 4135
Piper gymnostachyum C.DC. 17°41’25.6”N 105°53’40.4”E CPC 3993; 17°41’28”N 105°53’42.7”E CPC 3905a; 17°41’28”N 105°53’42.7”E CPC 3916a
Zippelia begoniifolia Blume 17°39’11.6”N 105°54’53”E CPC 3678

Pittosporaceae
Pittosporum pauciflorum Hook. & Arn. 17°39’36.7”N 105°54’55.7”E CPC 3771; 17°41’14.3”N 105°53’28.9”E CPC 4079 **NT, SI (fig. 89)**

Polygalaceae
Polygala tatarinowi Reg. 17°42’13.7”N 105°47’33.9”E CPC 4258
Polygala tonkinensis Chodat 17°41’28”N 105°53’42.7”E CPC 3895a**, IE**

Primulaceae
Lysimachia insignis Hemsl. 17°39’11.6”N 105°54’53”E CPC 3658; 17°42’15.8”N 105°48’24”E CPC 4334; 17°41’28”N 105°53’42.7”E CPC 3921a **MP NT, SI**

Proteaceae
Helicia obovatifolia Merr. 17°43’31.6”N 105°53’38.0”E CPC 4170

Ranunculaceae
Anemone poilanei Gagnep. 17°38’00.4”N 105°55’57.9”E CPC 3742 **NT, IE, SI (fig. 107)**
Clematis uncinata Champ.? 17°41’14.3”N 105°53’28.9”E CPC 4101

Rhamnaceae
Berchemia loureiriana H.Lec. 17°41’28”N 105°53’42.7”E CPC 3982**, IE**
Rhamnella tonkinensis (Pit.) Miyasake? 17°42’38.5”N 105°48’52”E CPC 4410**, IE**
Rhamnus sp.? 17°41’28”N 105°53’42.7”E CPC 3984
Ventilago ochrocarpa Pierre 17°43’31.6”N 105°53’38.0”E CPC 4177 **NewF**
Ventilago sp.? 17°41’14.3”N 105°53’28.9”E CPC 4132

Ziziphus poilanei Muell. 17°41’28”N 105°53’42.7”E CPC 3980; 17°42’12.1”N 105°47’39.0”E CPC 4225
sp. 17°39’11.6”N 105°54’53”E CPC 3693

Rubiaceae
Aidia oxyodonta (Drake) Yamazaki 17°41’28”N 105°53’42.7”E CPC 3904a; 17°43’31.6”N 105°53’38.0”E CPC 4162
Aidia pycnantha (Drake) Tirv. 17°42’15.8”N 105°48’24”E CPC 4341
Aidia sp.? 17°42’15.8”N 105°48’24”E CPC 4361
Brachytome wallichii Hook.f.? 17°39’36.7”N 105°54’55.7”E CPC 3784
Gardenia annamensis Pit. 17°42’15.8”N 105°48’24”E CPC 4367**, IE**
Gaertnera vaginans (DC.) Merr. 17°41’28”N 105°53’42.7”E CPC 3983
Hedyotis acutangula Champ. ex Benth. 17°39’21.1”N 105°54’41.7”E CPC 3879; 17°39’36.7”N 105°54’55.7”E CPC 3769**, SI**
Hedyotis biflora (L.) Lam. 17°41’28”N 105°53’42.7”E CPC 3970**, SI**
Hedyotis hedyotidea (DC.) Hand.-Mazz. 17°42’13.7”N 105°47’33.9”E CPC 4281
Hedyotis pterita Blume 17°42’13.7”N 105°47’33.9”E CPC 4259
Ixora cuneifolia Roxb. 17°41’14.3”N 105°53’28.9”E CPC 4058
Ixora grandifolia Zoll. & Moritzi 17°41’25.6”N 105°53’40.4”E CPC 3991
Ixora henryi H.Liv. 17°42’15.8”N 105°48’24”E CPC 4329
Ixora krewanhensis Pierre ex Pit. 17°42’15.8”N 105°48’24”E CPC 4382**, IE**
Lasianthus biflorus (Blume) M.Gangop. & Chakrab. 17°39’31.7”N 105°54’48.2”E CPC 3888; 17°42’13.9”N 105°47’45.8”E CPC 4299 **NewF**
Lasianthus chinensis Benth. 17°43’31.6”N 105°53’38.0”E CPC 4164
Lasianthus cyanocarpus Jack 17°38’00.4”N 105°55’57.9” CPC 3725
Lasianthus foetidissimus A.Chev. ex Pit. 17°39’11.6”N 105°54’53”E CPC 3690; 17°39’11.6”N 105°54’53”E CPC 3691
Lasianthus japonicus Miq. 17°40’03.6”N 105°55’08.5”E CPC 3912
Lasianthus kamputensis Pierre ex Pit. 17°41’28”N 105°53’42.7”E CPC 3906a; 17°41’28”N 105°53’42.7”E CPC 3934
Lasianthus sp. 17°41’28”N 105°53’42.7”E CPC 3923a
Morinda officinalis How 17°42’15.8”N 105°48’24”E CPC 4358; 17°42’38.5”N 105°48’52”E CPC 4411 **MP (fig. 145, 146)**
Morinda umbellata L. 17°39’36.7”N 105°54’55.7”E CPC 3781
Mussaenda bonii Pit.? 17°41’28”N 105°53’42.7”E CPC 3933
Mycetia balansae Drake 17°40’03.6”N 105°55’08.5”E CPC 3897; 17°41’19”N 105°53’35.5”E CPC 4123; 17°42’13.9”N 105°47’45.8”E CPC 4300
Myrioneuron tonkinense Pit. 17°39’11.6”N 105°54’53”E CPC 3684
Ophiorrhiza sanguinea Blume? 17°39’36.7”N 105°54’55.7”E CPC 3790
Ophiorrhiza tonkinensis Pit.? 17°41’28”N 105°53’42.7”E CPC 3974**, IE**
Paederia sp.? 17°43’31.6”N 105°53’38.0”E CPC 4174
Pavetta annamensis Pit.? 17°42’23.8”N 105°47’59”E CPC 4391; 17°42’23.8”N 105°47’59”E CPC 4397**, IE**
Pavetta sp.? 17°43’31.6”N 105°53’38.0”E CPC 4167
Prismatomeris memecyloides Craib 17°41’28”N 105°53’42.7”E CPC 3910a

Psychotria bonii Pit.? 17°39’11.6”N 105°54’53”E CPC 3675
Psychotria curviflora Wall. 17°41’25.6”N 105°53’40.4”E CPC 3990
Psychotria sarmentosa Blume 17°39’36.7”N 105°54’55.7”E CPC 3795; 17°41’14.3”N 105°53’28.9”E CPC 4090; 17°42’13.7”N 105°47’33.9”E CPC 4250; 17°42’38.5”N 105°48’52”E CPC 4413
Psychotria sp.? 17°39’21.1”N 105°54’41.7”E CPC 3852
Randia turgida Roxb. 17°42’10.4”N 105°47’57.3”E CPC 4192
Wendlandia glabrata DC. 17°41’28”N 105°53’42.7”E CPC 3973
Wendlandia sp.? 17°41’14.3”N 105°53’28.9”E CPC 4100
Xantonneopsis sp.? 17°41’14.3”N 105°53’28.9”E CPC 4069
sp. 17°41’28”N 105°53’42.7”E CPC 3897a

Rutaceae
Citrus macroptera Montr. 17°41’25.6”N 105°53’40.4”E CPC 4028
Clausena austroindica Stone & Nair? 17°39’21.7”N 105°54’59.5”E CPC 3808; 17°39’31.7”N 105°54’48.2”E CPC 3841; 17°42’12.1”N 105°47’39.0”E CPC 4218; 17°40’03.6”N 105°55’08.5”E CPC 3928 **MP**
Glycosmis ovoidea Pierre 17°38’00.4”N 105°55’57.9”E CPC 3728**, IE**
Glycosmis puberula Lindl. ex Oliv. 17°41’14.3”N 105°53’28.9”E CPC 4083
Glycosmis stenocarpa (Drake) Tanaka? 17°42’13.9”N 105°47’45.8”E CPC 4310
Glycosmis tricanthera Guill. 17°39’36.7”N 105°54’55.7”E CPC 3764**, IE**
sp. 17°42’13.7”N 105°47’33.9”E CPC 4245

Sapindaceae
Allophylus viridis Radlk. 17°41’14.3”N 105°53’28.9”E CPC 4138
Allophylus sp. 17°42’23.8”N 105°47’59”E CPC 4388
Amesiodendron chinense (Merr.) Hu? 17°41’28”N 105°53’42.7”E CPC 3941
Delavaya toxocarpa Franch.? 17°42’10.4”N 105°47’57.3”E CPC 4447
Dimocarpus sp. 17°41’25.6”N 105°53’40.4”E CPC 4005
Nephelium chryseum Blume 17°42’15.8”N 105°48’24”E CPC 4340 **NT**
Xerospermum microcarpum Pierre 17°39’36.7”N 105°54’55.7”E CPC 3799; 17°39’36.7”N 105°54’55.7”E CPC 3802; 17°40’03.6”N 105°55’08.5”E CPC 3921 **NT, IE, SI (fig. 77)**

Sapotaceae
Sinosideroxylon wightianum (Sieb. & Zucc.) Aubr. 17°39’36.7”N 105°54’55.7”E CPC 3800; 17°39’21.1”N 105°54’41.7”E CPC 3853 **NT, SI**

Saurauiaceae
Saurauia tristyla DC. 17°42’23.8”N 105°47’59”E CPC 4392

Saxifragaceae
Polyosma sp.? 17°38’00.4”N 105°55’57.9” CPC 3718

Schisandraceae
Kadsura grandiflora (Wall.) Hook.f. & Thoms. 17°42'15.8"N 105°48'24"E CPC 4368 **MP, NT**

Scrophulariaceae
Brandisia glabrescens Rehd. 17°41'14.3"N 105°53'28.9"E CPC 4096

Simaroubaceae
Ailanthus integrifolia Lam. 17°39'21.7"N 105°54'59.5"E CPC 3831
Picrasma javanica Blume 17°41'28"N 105°53'42.7"E CPC 3953

Smilacaceae
Smilax corbularia Kunth 17°42'13.9"N 105°47'45.8"E CPC 4305

Sterculiaceae
Byttneria tortilis Gagnep. 17°41'25.6"N 105°53'40.4"E CPC 4027; 17°42'10.4"N 105°47'57.3"E CPC 4207**, IE**
Pterocymbium tinctorium (Blanco) Merr.? 17°41'19"N 105°53'35.5"E CPC 4114
Sterculia hymenocalyx K.Schum. 17°39'11.6"N 105°54'53"E CPC 3688; 17°39'31.7"N 105°54'48.2"E CPC 3887; 17°42'23.8"N 105°47'59"E. CPC 4387; 17°43'31.6"N 105°53'38.0"E CPC 4180
Sterculia sp. 17°39'31.7"N 105°54'48.2"E CPC 3833

Styracaceae
Styrax litseoides J.E.Vidal 17°41'14.3"N 105°53'28.9"E CPC 4070; 17°39'21.1"N 105°54'41.7"E CPC 3867; 17°42'23.8"N 105°47'59"E CPC 4385**, IE (fig. 69)**

Symplocaceae
Symplocos adenophylla Wall. ex G.Don 17°42'13.9"N 105°47'45.8"E CPC 4302; 17°42'15.8"N 105°48'24"E CPC 4366
Symplocos sumuntia Buch.-Ham. ex G.Don 17°42'10.4"N 105°47'57.3"E CPC 4203
Symplocos sp. 17°38'00.4"N 105°55'57.9"E CPC 3736

Taccaceae
Tacca chantrieri Andr 17°42'23.8"N 105°47'59"E CPC 4393; 17°41'25.6"N 105°53'40.4"E CPC 4011; 17°39'11.6"N 105°54'53"E CPC 3667 **MP, OP**

Theaceae
Adinandra sp.? 17°39'21.1"N 105°54'41.7"E CPC 3857
Camellia lutescens Dyer? 17°38'00.4"N 105°55'57.9" CPC 3720
Schima wallichii (DC.) Choisy 17°41'25.6"N 105°53'40.4"E CPC 4007; 17°42'10.4"N 105°47'57.3"E CPC 4191; 17°42'13.9"N 105°47'45.8"E CPC 4314 **(fig. 30)**
sp. 17°38'00.4"N 105°55'57.9"E CPC 3733

Thymelaeaceae
Aquilaria crassna Pierre ex H.Lec. 17°39’21.1”N 105°54’41.7”E CPC 3884; 17°42’12.1”N 105°47’39.0”E CPC 4228 **MP, IE**
Wikstroemia meyenianum Warb. 17°41’14.3”N 105°53’28.9”E CPC 4080 **NT (fig. 90)**

Tiliaceae
Burretiodendron brilletii Kost. 17°39’31.7”N 105°54’48.2”E CPC 3650 **NT, SI, TT (fig. 40, 41)**
Grewia bulot Gagnep. 17°42’15.8”N 105°48’24”E CPC 4347**, IE (fig. 31)**

Trilliaceae
Paris polyphylla Sm. 17°41’28”N 105°53’42.7”E CPC 3896a **RDB, MP, NT, SI**

Ulmaceae
Celtis philippense Blanco 17°41’19”N 105°53’35.5”E CPC 4113
Gironniera subequalis Planch. 17°42’15.8”N 105°48’24”E CPC 4374; 17°43’31.6”N 105°53’38.0”E CPC 4171 **(fig. 71)**

Urticaceae
Elatostema balansae Gagnep. 17°39’21.7”N 105°54’59.5”E CPC 3819**, IE**
Elatostema dissectum Wedd. 17°39’11.6”N 105°54’53”E CPC 3753
Elatostema scabra Hall.f. 17°41’25.6”N 105°53’40.4”E CPC 4047
Pilea baviensis Gagnep. 17°39’31.7”N 105°54’48.2”E CPC 3891; 17°41’19”N 105°53’35.5”E CPC 4128; 17°41’25.6”N 105°53’40.4”E CPC 4019; 17°42’12.1”N 105°47’39.0”E CPC 4235**, IE**

Verbenaceae
Callicarpa nudiflora Hook. & Arn. 17°39’36.7”N 105°54’55.7”E CPC 3788; 17°41’28”N 105°53’42.7”E CPC 3965
Clerodendrum kaempferi (Jacq.) Sieb. & Hassk. 17°42’15.8”N 105°48’24”E CPC 4338
Vitex glabrata R.Br. 17°43’31.6”N 105°53’38.0”E CPC 4163

Vitaceae
Tetrastigma sp. 17°41’14.3”N 105°53’28.9”E CPC 4143
Tetrastigma sp.? 17°41’28”N 105°53’42.7”E CPC 3943

Xanthophyllaceae?
sp. 17°38’00.4”N 105°55’57.9” CPC 3734

Zingiberaceae
Alpinia sp. 17°40’03.6”N 105°55’08.5”E CPC 3903
Alpinia sp. 17°41’28”N 105°53’42.7”E CPC 3903a
Alpinia sp. 17°42’38.5”N 105°48’52”E CPC 4442
Amomum sp. 17°41’19”N 105°53’35.5”E CPC 4115
Amomum sp. 17°42’15.8”N 105°48’24”E CPC 4327

Amomum sp. 17°42’15.8”N 105°48’24”E CPC 4379
Amomum sp. 17°43’31.6”N 105°53’38.0”E CPC 4165
Amomum sp.? 17°41’19”N 105°53’35.5”E CPC 4116
Curcuma sp.? 17°41’28”N 105°53’42.7”E CPC 3915a
Distichochlamys citrea Newman 17°41’19”N 105°53’35.5”E CPC 4111
Siliquamomum tonkinense Baill. 17°42’10.4”N 105°47’57.3”E CPC 4187
Zingiber purpureum Rosc.? 17°41’28”N 105°53’42.7”E CPC 3926a

Fam.? 17°38’00.4”N 105°55’57.9” CPC 3737
Fam.? 17°39’21.1”N 105°54’41.7”E CPC 3845
Fam.? 17°39’21.1”N 105°54’41.7”E CPC 3846
Fam.? 17°40’03.6”N 105°55’08.5”E CPC 3901a
Fam.? 17°41’14.3”N 105°53’28.9”E CPC 4130
Fam.? 17°41’14.3”N 105°53’28.9”E CPC 4133
Fam.? 17°41’25.6”N 105°53’40.4”E CPC 4032
Fam.? 17°41’28”N 105°53’42.7”E CPC 3929a
Fam.? 17°42’38.5”N 105°48’52”E CPC 4400

Annex 4.
LEGEND FOR ILLUSTRATIONS

4.1 Main landforms in studied area

Fig. 1. Inhabited alluvial river valley composed by alluvial clay and waterproof shaly-lime at elevation 250-300 m a.s.l. in foothills of hilly and mountain area accepted for the survey with open secondary scrub, woodlands and secondary grasslands (near point 17°40'21"N, 105°57'59"E). Photo: L.Averyanov.

Fig. 2. Typical landscape of studied area presented by numerous rolling remnant hills and low karstic mountains composed with highly eroded solid marble-like crystalline limestone dissected by stream valleys and canyons in vicinities of field camps 1 & 2. View from plot № 3 (17°39'36.7"N, 105°54'35.7"E, elev. 612 m a.s.l.) to SSW, in vicinity of field camp № 1. Photo: L.Averyanov.

Fig. 3-5. Remnant rocky karstic limestone mountains elevated to 600-800 m a.s.l. with vertical cliffs and very steep slopes covered by primary closed evergreen forest are most characteristic feature of landscape in studied area. View from plot № 3 (17°39'36.7"N, 105°54'35.7"E, elev. 612 m a.s.l.) to NNW (fig. 3, 4) and to SW (fig. 5), in vicinity of field camp № 1. Photos: L.Averyanov.

Fig. 6, 7. Summits of remnant rocky karstic limestone mountains appear commonly as narrow ridge edges or very small-square peaks bordered by inaccessible vertical cliffs and covered on tops by short-tall wind-formed primary evergreen rich forests often damaged by natural fire. View from plot № 3 (17°39'36.7"N, 105°54'35.7"E, elev. 612 m a.s.l.) to NWW (fig. 6) and to SW (fig. 5), in vicinity of field camp № 1. Photos: L.Averyanov.

4.2 Main kinds of forests in studied area

Fig. 8. Closed primary evergreen seasonal tropical lowland broad-leaved forest on stratified shale on low ridge at elev. about 550 m a.s.l., in vicinity of plot № 19 (17°41'42"N, 105°47'59"E, field camp 3 area). Photo: N.T.Hiep.

Fig. 9. Closed primary evergreen seasonal tropical lowland broad-leaved forest on wet flat seasonally flooded low terrace of alluvial stream valley between remnant rocky limestone mountains at elev. about 350 m a.s.l., in vicinity of plot № 7 (17°40'03.6"N, 105°55'08.5"E, field camp 1 area). Photo: L.Averyanov.

Fig. 10. Closed primary evergreen seasonal tropical lowland broad-leaved forest on wet flat seasonally flooded low terrace of alluvial stream valley and on low slope of remnant rocky limestone mountain at elev. about 450 m a.s.l., in vicinity of plot № 1 (17°39'11.6"N, 105°54'53"E, field camp 1 area). Photo: L.Averyanov.

Fig. 11. Closed primary evergreen seasonal tropical lowland broad-leaved forest on low rocky mountain slope of remnant rocky limestone mountain at elev. about 450 m a.s.l., in vicinity of plot № 1 (17°39'11.6"N, 105°54'53"E, field camp 1 area). Photo: L.Averyanov.

Fig. 12. Canopy cover of closed primary evergreen seasonal tropical lowland broad-leaved forest on middle part of steep rocky mountain slope of remnant rocky limestone mountain at elev. 600-700 m a.s.l. View from plot № 3 (17°39'36.7"N, 105°54'35.7"E, elev. 612 m a.s.l.) to E, in vicinity of field camp № 1. Photo: L.Averyanov.

Fig. 13, 14. Secondary woodlands and secondary forest with remnants of highly disturbed primary evergreen seasonal tropical lowland broad-leaved forest on rocky mountain slopes of remnant rocky limestone mountains allied to inhabited river valley at elev. 400-500 m a.s.l. in vicinities of main basal camp (near point 17°40'21"N, 105°57'59"E). Photos: L.Averyanov.

4.3 Physiognomic photo documentation of selected model plots

Examples of model plots for characteristic of closed primary evergreen seasonal tropical lowland broad-leaved forests on stratified shale:

Fig. 15. Square of plot № 19 (17°41'42"N, 105°47'59"E, 532 m a.s.l.). Photo: N.T.Hiep.

Fig. 16. Square of plot № 20 (17°42'02.3"N, 105°47'59"E, 456 m a.s.l.). Photo: N.T.Hiep.

Examples of model plots for characteristic of closed primary evergreen seasonal tropical lowland broad-leaved forest on wet flat seasonally flooded stream/river alluvial valleys and low terraces:

Fig. 17. Square of plot № 7 (17°40'03.6"N, 105°55'08.5"E, 336 m a.s.l.). Photo: L.Averyanov.

Fig. 18. Square of plot № 1 (17°39'11.6"N, 105°54'53"E, 465 m a.s.l.). Photo: L.Averyanov.

Examples of model plots for characteristic of closed primary evergreen seasonal tropical lowland broad-leaved forest on mountain slopes of remnant rocky limestone mountains:

Fig. 19. Square of plot № 8 (17°41'28.7"N, 105°53'41.7"E, 532 m a.s.l.). Photo: N.T.Hiep.

Fig. 20. Square of plot № 16 (17°41'14.3"N, 105°53'28.9"E, 650 m a.s.l.). Photo: L.Averyanov.

Examples of model plots for characteristic of closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on steep mountain slopes and on tops of remnant rocky limestone mountains (wind-formed forest modifications):

Fig. 21. Square of plot № 3, on top of mountain (17°39'36.7"N, 105°54'35.7"E, 612 m a.s.l.). Photo: L.Averyanov.

Fig. 22. Square of plot № 6 (17°39’21.1’’N, 105°54’41.7’’E, 570 m a.s.l.). Photo: L.Averyanov.

Example of model plot for characteristic of closed primary evergreen seasonal tropical submontane mixed and coniferous forests (with *Dacrydium elatum* and *Dacrycarpus imbricatus*) on rocky crystalline highly eroded limestone:

Fig. 23. Square of plot № 2 (17°38'00.4"N, 105°55'57.9"E, 804 m a.s.l.). Photo: L.Averyanov.

Examples of soil profiles in selected model plots with poor, middle and rich soils:

Fig. 24. Soil profile with poor thin humus horizon in plot № 16 (17°41'14.3"N, 105°53'28.9"E, 650 m a.s.l.). Photo: L.Averyanov.

Fig. 25. Soil profile with medium humus horizon in plot № 14 (17°41'42.3"N, 105°53'14.1"E, 422 m a.s.l.). Photo: L.Averyanov.

Fig. 26. Soil profile with rich humus horizon in plot № 15 (17°41'10.9"N, 105°53'28.0"E, 680 m a.s.l.). Photo: L.Averyanov.

4.4 Illustrations of key species in studied area

Main dominants of first forest stratum in closed primary evergreen seasonal tropical lowland broad-leaved forests on stratified shale:

Fig. 27. *Dacrycarpus imbricatus* (Blume) de Laub. (plot № 19, 17°41'42"N, 105°47'59"E). Photo: N.T.Hiep.

Fig. 28, 29. *Altingia siamensis* Craib (CPC 4384, plot № 20, 17°42'02.3"N, 105°47'59"E). Photo: N.T.Hiep.

Fig. 30. *Schima wallichii* (DC.) Choisy (plot № 19, 17°41'42"N, 105°47'59"E). Photo: N.T.Hiep.

Fig. 31. *Grewia bulot* Gagnep. (plot № 20, 17°42'02.3"N, 105°47'59"E). Photo: N.T.Hiep.

Fig. 32. Engelhardia roxburghiana Wall. (plot № 19, 17°41'42"N, 105°47'59"E). Photo: N.T.Hiep.

Fig. 33, 34. Diplopanax vietnamensis Aver. & T.N.Nguyen (plot № 20, 17°42'02.3"N, 105°47'59"E). Photo: N.T.Hiep.

Main dominants of first forest stratum in closed primary evergreen seasonal tropical lowland broad-leaved forest on wet valleys and on flat seasonally flooded low alluvial terraces on limestone:

Fig. 35. *Dracontomelum duperreanum* Pierre (CPC s.n., plot № 1, 17°39'11.6"N, 105°54'53"E). Photo: L.Averyanov.

Fig. 36-38. *Pometia pinnata* J.R.Forst. & G.Forst. (CPC s.n., plot № 1, 17°39'11.6"N, 105°54'53"E). Photo: L.Averyanov.

Fig. 39. *Lagerstroemia ovalifolia* Teijsm. & Binn. (CPC 4017, plot № 1 associate, 17°39'11.6"N, 105°54'53"E.). Photo: L.Averyanov.

Fig. 40, 41. *Burretiodendron brilletii* Kost. (CPC 3650, plot № 7 associate, 17°39'11.6"N, 105°54'53"E.). Photo: L.Averyanov.

Main dominants of first forest stratum in closed primary evergreen seasonal tropical lowland broad-leaved forests on rocky mountain slopes of remnant rocky limestone mountains:

Fig. 42. *Dysoxylum mollissimum* Blume (CPC 4176, plot № 1 associate, 17°43'31.6"N 105°53'38.0"E). Photo: L.Averyanov.

Fig. 43. *Dysoxylum loureirii* Pierre CPC 4033, plot № 1 associate, 17°41'25.6"N 105°53'40.4"E CPC 40330. Photo: L.Averyanov.

Fig. 44. *Bischofia javanica* Blume (CPC 4147, 17°41'14.3"N 105°53'28.9"E, plot №14). Photo: L.Averyanov.

Fig. 45. *Beilschmiedia pergamentacea* Allen (CPC 4060, 17°39'11.6"N, 105°54'53"E, plot № 1 associate). Photo: L.Averyanov.

Fig. 46. *Canarium* sp. (CPC s.n., 17°39'31.7"N, 105°54'48.2"E, plot № 5 associate). Photo: L.Averyanov.

Fig. 47, 48. *Polyalthia jucunda* (Pierre) Finet & Gagnep. (CPC 3671, 17°39'11.6"N 105°54'53"E; CPC 4038, 17°41'25.6"N 105°53'40.4"E, plots № 5, 10). Photo: L.Averyanov.

Fig. 49. *Dipterocarpus hasseltii* Blume (CPC 3703, 17°39'11.6"N 105°54'53"E; CPC 4016, 17°41'25.6"N 105°53'40.4"E, plot № 1 associate). Photo: N.T.Hiep.

Fig. 50. *Dipterocarpus retusus* Blume (CPC 3883, 17°39'21.1"N 105°54'41.7"E; plot № 17). Photo: N.T.Hiep.

Fig. 51. *Hopea siamensis* Heim (CPC 4092, 17°41'14.3"N 105°53'28.9"E, plot № 8 associate). Photo: N.T.Hiep.

Fig. 52. *Litsea* sp. (CPC s.n., plot № 5 associate, 17°39'31.7"N, 105°54'48.2"E). Photo: N.T.Hiep.

Fig. 53. *Actinodaphne* sp. (CPC 3900a, plot 10, 17°41'25.6"N, 105°53'40.0"E). Photo: N.T.Hiep.

Fig. 54. *Sloanea sigun* (Blume) K. Schum. (CPC 3670, 17°39'11.6"N 105°54'53"E, plot № 18 associate). Photo: N.T.Hiep.

Fig. 55. *Cinnamomum ovatum* Allen (CPC 4172, 17°43'31.6"N 105°53'38.0"E, plot № 19). Photo: N.T.Hiep.

Fig. 56. *Artocarpus styracifolia* Pierre (CPC 4156, 17°43’31.6”N 105°53’38.0”E, plot № 8 associate). Photo: N.T.Hiep.

Fig. 57. *Alangium ridleyi* King (CPC 4353, 17°42’15.8”N 105°48’24”E, plot № 10). Photo: N.T.Hiep.

Fig. 58. *Elaeocarpus grandiflorus* Sm. (CPC 3674, 17°39’11.6”N 105°54’53”E, plot № 18). Photo: N.T.Hiep.

Fig. 59. *Lagerstroemia* sp. (CPC s.n., 17°41’14.3”N 105°53’28.9”E, plot № 14). Photo: L.Averyanov.

Fig. 60-63. *Diospyros mun* A.Chev. ex H.Lec. (CPC 3829, 17°39’21.7”N 105°54’59.5”E, plot № 4). Photo: L.Averyanov (60), Photos: N.T.Hiep (61-63).

Fig. 64. *Michelia gioi* (A.Chev.) Sima & Hong Yu. (CPC 3930, 17°41’28”N 105°53’42.7”E, plot № 10 associate). Photo: N.T.Hiep.

Fig. 65. *Michelia coriacea* Hung T.Chang & B.L.Chen (CPC 4405, 17°42’38.5”N 105°48’52”E, plot № 1 associate). Photo: N.T.Hiep.

Fig. 66. *Manglietia chevalieri* Dandy (CPC 3701, 17°39’11.6”N 105°54’53”E, plot № 1 associate). Photo: N.T.Hiep.

Fig. 67. *Magnolia dandyi* Gagnep. (CPC 4193, 17°42’10.4”N 105°47’57.3”E, plot № 18). Photo: N.T.Hiep.

Fig. 68. *Magnolia liliifera* Baill. (CPC 3871, 17°39’21.1”N 105°54’41.7”E, plot № 5 associate). Photo: L.Averyanov.

Fig. 69. *Styrax litseoides* J.E.Vidal (CPC 3867, 17°39’21.1”N 105°54’41.7”E, plot № 6 associate). Photo: P.K.Loc.

Fig. 70. *Zenia insignis* Chun (CPC 4025, 17°41’25.6”N 105°53’40.4”E, plot № 10 associate). Photo: N.T.Hiep.

Fig. 71. *Gironniera subequalis* Planch. (CPC 4171, 17°43’31.6”N 105°53’38.0”E, plot № 18). Photo: N.T.Hiep.

Fig. 72. *Phoebe tavoyana* (Meisn.) Hoof.f. (CPC 4182, 17°43’31.6”N 105°53’38.0”E, plot № 4). Photo: N.T.Hiep.

Main dominants of first forest stratum in closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on steep mountain slopes and on tops of remnant rocky limestone mountains (wind-formed and/or other specific forest modifications):

Fig. 73, 74. *Hopea siamensis* Heim (CPC 3783, 17°39’36.7”N 105°54’55.7”E, plot № 6). Photos: L.Averyanov.

Fig. 75, 76. *Schefflera pauciflora* R.Vig. (CPC 3923, 17°40’03.6”N 105°55’08.5”E, plot № 6 associate). Photos: L.Averyanov.

Fig. 77. *Xerospermum microcarpum* Pierre (CPC 3921, 17°40’03.6”N 105°55’08.5”E, plot № 3). Photo: L.Averyanov.

Main dominants of first forest stratum in closed primary evergreen seasonal tropical submontane mixed and coniferous forests (with Dacrydium elatum and Dacrycarpus imbricatus) on rocky crystalline highly eroded limestone:

Fig. 78-81. *Dacrydium elatum* (Roxb.) Wall. ex Hook. (CPC 3727, 17°38’00.4”N 105°55’57.9”, plot № 2). Photos: L.Averyanov.

Main shrub dominants in closed primary evergreen seasonal tropical lowland broad-leaved short-tall forests on steep mountain slopes and on tops of remnant rocky limestone mountains (wind-formed and/or other specific forest modifications):

Fig. 82, 83. *Campylotropis henryi* Schindl. (CPC 3782, 17°39’36.7”N 105°54’55.7”E, plot № 6). Photos: L.Averyanov.

Fig. 84, 85. *Alstonia guanxiensis* D.Fong & X.X.Chen (CPC 3860, 17°39’21.1”N 105°54’41.7”E, plot № 6). Photos: L.Averyanov.

Fig. 86, 87. *Tirpitzia sinensis* (Hemsl.) Hall.f. (CPC 3859, 17°39’21.1”N 105°54’41.7”E, plot № 6). Photos: L.Averyanov.

Fig. 88. *Illicium cambodianum* Hance (CPC 4065, 17°41’14.3”N 105°53’28.9”E, plot № 2). Photo: P.K.Loc.

Fig. 89. *Pittosporum pauciflorum* Hook. & Arn. (CPC 4079, 17°41’14.3”N 105°53’28.9”E, plot № 3). Photo: P.K.Loc.

Fig. 90. *Wikstroemia meyenianum* Warb. (CPC 4080, 17°41’14.3”N 105°53’28.9”E, plot № 12). Photo: P.K.Loc.

Main herb dominants in closed primary evergreen seasonal tropical lowland broad-leaved forests on steep mountain slopes and on tops of remnant rocky limestone mountains:

Fig. 91, 92. *Costus tonkinensis* Gagnep. (CPC 3918, 17°40’03.6”N 105°55’08.5”E, plot № 5 associate; CPC 5002, 17°40'22"N, 105°58'22"E, plot № 17). Photos: P.K.Loc (90), L.Averyanov (91).

Fig. 93, 94. *Aspidistra coccigera* Aver. & Tillich (CPC 3659, 17°39’11.6”N 105°54’53”E, plot № 2 associate). Photos: L.Averyanov.

Fig. 95-97. *Calanthe alismifolia* Lindl. (CPC 3749, 17°38’00.4”N 105°55’57.9”E, plot № 1 associate). Photos: L.Averyanov.

Fig. 98, 99. *Calanthe odora* Griff. (CPC 3698, 17°39’11.6”N 105°54’53”E, plot № 10). Photos: L.Averyanov.

Fig. 100-102. *Nephelaphyllum tenuiflorum* Blume (CPC 3793, 17°39’36.7”N 105°54’55.7”E, plot № 3 associate). Photos: L.Averyanov.

Fig. 103, 104. *Tropidia curculigoides* Lindl. (CPC 4056, 17°41’14.3”N 105°53’28.9”E, plot № 16). Photos: L.Averyanov.

Fig. 105. *Aphyllorchis montana* Rchb.f. (CPC 4129, 17°41’14.3”N 105°53’28.9”E, plot № 16). Photo: L.Averyanov.

Fig. 106. *Anoectochilus annamensis* Aver. (CPC 4375, 17°42’15.8”N 105°48’24”E, plot № 20 associate). Photos: N.T.Hiep.

Fig. 107. *Anemone poilanei* Gagnep. (CPC 3742, 17°38’00.4”N 105°55’57.9”E, plot № 2). Photo: L.Averyanov.

Fig. 108. *Ardisia gigantifolia* Stapf (CPC 4202, 17°42’10.4”N 105°47’57.3”E, plot № 19). Photo: N.T.Hiep.

Fig. 109. *Asarum wulingense* C.F.Liang (CPC 4185, 17°42’10.4”N 105°47’57.3”E, plot № 1). Photo: N.T.Hiep.

Typical lithophytic herb dominants in closed primary evergreen seasonal tropical lowland broad-leaved wind-formed short-tall forests on cliffs and on tops of remnant rocky limestone mountains:

Fig. 110, 111. *Tupistra theana* Aver. & N.Tanaka (CPC 3952, 17°41’28”N 105°53’42.7”E, plot № 9). Photos: L.Averyanov.

Fig. 112-114. *Begonia crassula* Aver. 17°39’21.1”N 105°54’41.7”E CPC 3858, plot № 6). Photos: L.Averyanov.

Fig. 115. *Peliosanthes argenteostriata* Aver. & N.Tanaka (CPC 3824, 17°39’21.7”N, 105°54’59.5”E, plot № 4). Photo: L.Averyanov.

Fig. 116, 117. *Impatiens verrucifer* Hook.f. (CPC 3863, 17°39’21.1”N 105°54’41.7”E, plot № 12). Photos: L.Averyanov.

Typical dominants of epiphytic plant communities in closed primary evergreen seasonal tropical lowland broad-leaved wind-formed short-tall forests on cliffs and on tops of remnant rocky limestone mountains:

Fig. 118, 119. *Bulbophyllum salmoneum* Aver. & J.J.Verm. (CPC 3657, 17°39'31.7"N 105°54'48.2"E, plot № 5). Photos: L.Averyanov.

Fig. 120. *Bulbophyllum retisiusculum* Rchb.f. (CPC 3758, 17°39'36.7"N 105°54'55.7"E, plot № 3). Photo: L.Averyanov.

Fig. 121, 122. *Bulbophyllum delitescens* Hance (CPC 3913, 17°40'03.6"N 105°55'08.5"E, plot № 9). Photos: L.Averyanov.

Fig. 123. *Thelasis pygmaea* (Griff.) Blume (CPC 3967, 17°41'28"N 105°53'42.7"E, plot № 12). Photo: L.Averyanov.

Fig. 124. *Flickingeria angustifolia* (Blume) A.D.Hawkes (CPC 3861, 17°39'21.1"N 105°54'41.7"E, plot № 6). Photo: L.Averyanov.

Fig. 125. *Flickingeria fimbriata* (Blume) A.D.Hawkes (CPC 4087, 17°41'14.3"N 105°53'28.9"E, plot № 12). Photo: L.Averyanov.

Fig. 126. *Eria paniculata* Lindl. (CPC 3715, 17°38'00.4"N 105°55'57.9"E, plot № 2). Photo: L.Averyanov.

Fig. 127-130. *Eria spirodela* Aver. (CPC 3805, 17°39'36.7"N 105°54'55.7"E, plot № 3). Photos: L.Averyanov.

Fig. 131. *Trichotosia pulvinata* (Lindl.) Kraenzl. (CPC 3747, 17°38'00.4"N 105°55'57.9"E, plot № 2). Photo: P.K.Loc.

Fig. 132, 133. *Pholidota chinensis* Lindl. (CPC 3738, 17°38'00.4"N 105°55'57.9"E, plot № 2). Photos: L.Averyanov.

Fig. 134. *Cleisostoma striatum* (Rchb.f.) Garay (CPC 3739, 17°38'00.4"N 105°55'57.9"E, plot № 2). Photo: L.Averyanov.

Fig. 135, 136. *Kingidium deliciosum* (Rchb.f.) H.R.Sweet (CPC 4035, 17°41'25.6"N 105°53'40.4"E, plot № 11). Photos: L.Averyanov.

Fig. 137. *Parapteroceras elobe* (Seidenf.) Aver. (CPC 3958, 17°41'28"N 105°53'42.7"E, plot № 4). Photo: L.Averyanov.

Fig. 138. *Aeschynanthus* sp. (CPC 3914, 17°40'03.6"N 105°55'08.5"E, plot № 4). Photo: L.Averyanov.

Fig. 139. *Vaccinium dunalianum* Wight (CPC 3780, 17°39'36.7"N 105°54'55.7"E, plot № 3). Photo: L.Averyanov.

Typical climbers and lianas in closed primary evergreen seasonal tropical lowland broad-leaved wind-formed short-tall forests on cliffs and on tops of remnant rocky limestone mountains:

Fig. 140. *Entada phaseoloides* (L.) Merr. (CPC 4386, 17°42'23.8"N 105°47'59"E, plot № 19). Photo: N.T.Hiep.

Fig. 141. *Gynostemma pentaphyllum* (Thunb.) Mak. (CPC 3653, 17°39'31.7"N 105°54'48.2"E, plot № 15 associate). Photo: N.T.Hiep.

Fig. 142, 143. *Rhaphidophora decursiva* (Roxb.) Schott (CPC 3915, 17°40'03.6"N 105°55'08.5"E, plot № 5). Photos: L.Averyanov.

Fig. 144. *Scindapsus poilanei* Gagnep. (CPC 3910, 17°40'03.6"N 105°55'08.5"E, plot № 5). Photo: L.Averyanov.

Fig. 145, 146. *Morinda officinalis* How (CPC 4411, 17°42'38.5"N 105°48'52"E, plot № 19 associate). Photo: N.T.Hiep.

4.5 Common life forms in studied area:

Fig. 147-149. Bees, snake and monkey. Photos: L.Averyanov.

4.6 Expedition team field works:

Fig. 150. Porters, local guides and survey team on the way to field camp № 1. Thuong Hoa municipality. Photo: N.V.Tap.

Fig. 151. Porters, local guides and survey team in field camp № 2. Thuong Hoa municipality. Photo: N.V.Tap.

Fig. 152. Porters, local guides and survey team in field camp № 3. Hoa Son community. Photo: N.T.Hiep.

Fig. 153. Camp site of field camp № 3. Hoa Son community. Photo: N.T.Hiep.

Fig. 154. Crossing river in rainy day, camp № 3. Hoa Son community. Photo: N.T.Hiep.

Fig. 155, 156. Preliminary tree plant species observation. Team leader, N.T.Hiep. Photos: L.Averyanov.

Fig. 157-159. Tree plant species collecting by survey team. Photos: L.Averyanov.

Fig. 160, 161. Climbing for collecting of tree plant species of first forest stratum in plot № 10. Photos: N.T.Hiep.

Fig. 162. Collecting of lithophytic species on vertical cliff. Survey team member, P.V.The collecting *Tupistra theana* near plot № 9. Photo: L.Averyanov.

Fig. 164-166. Plant preliminary identification, writing of labels and field plot documentation in field camp № 2. Photos: N.V.Tap.

4.7 Maps:

Map 1. Topographic map of studied area, itineraries (marked with red line), field camps (marked with black rings 1-3) and model plots (marked with black quadrates 1-20) for field studies of flora and vegetation in extended area of Phong Nha – Ke Bang National Park.

Map 2. Map of vegetation of Phong Nha – Ke Bang extended area.

Annex 5.

COLOR ILLUSTRATIONS

PLATES 1-42
MAPS 1-2

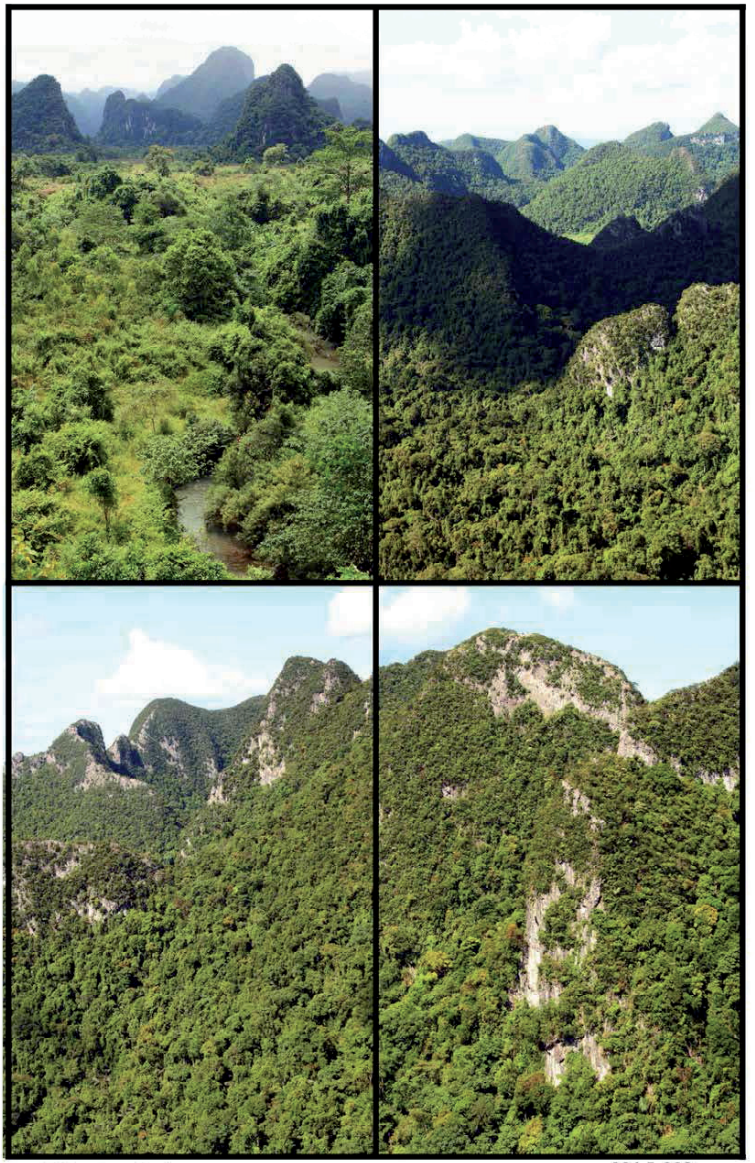


Plate 01

001 | 002
003 | 004

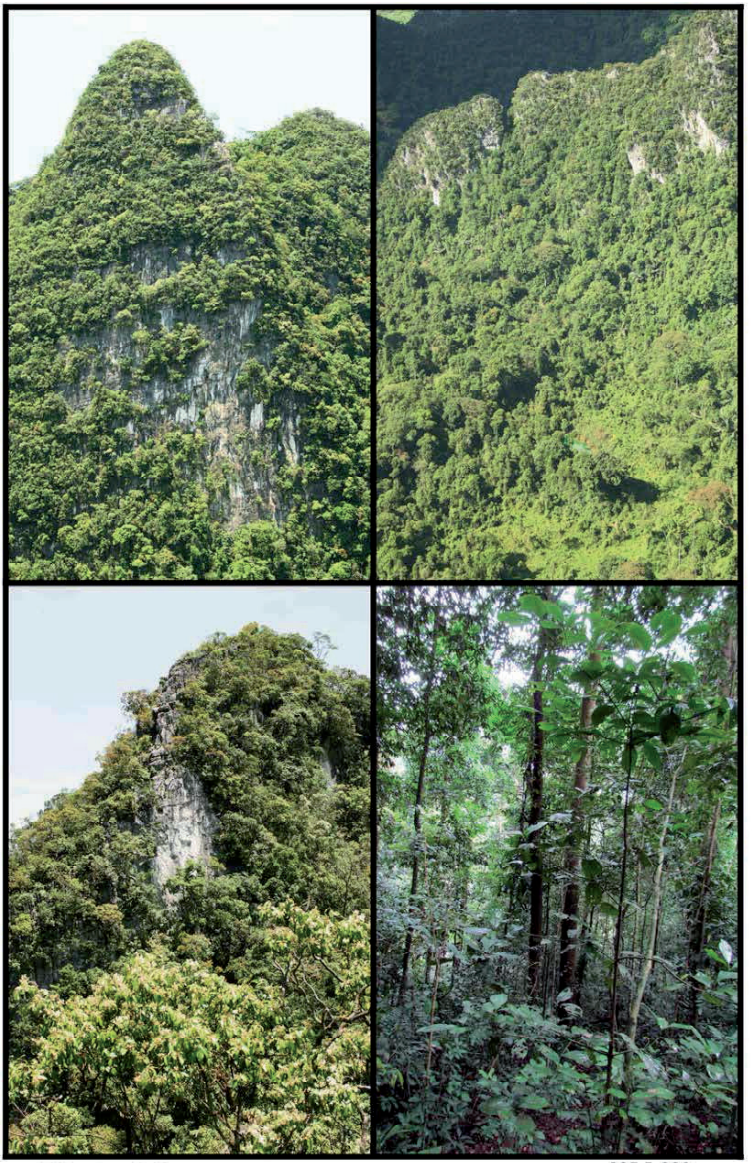


Plate 02

005 | 006
007 | 008

Plate 03

009 | 010
011 | 012

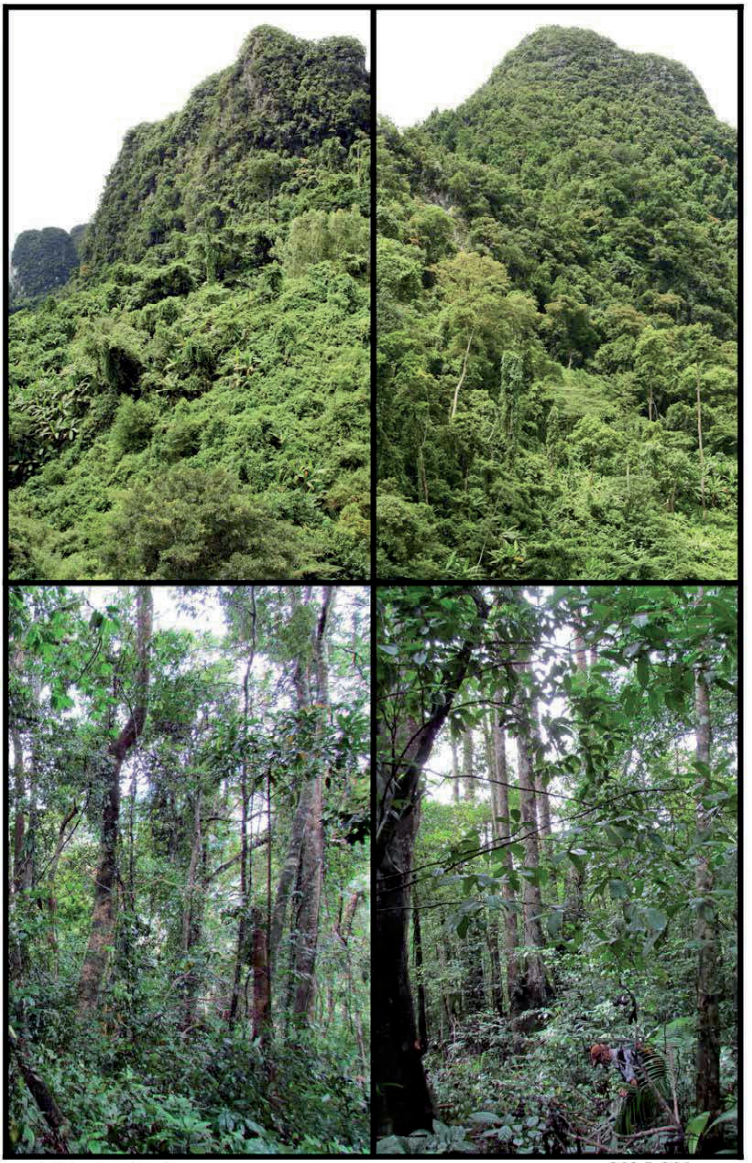


Plate 04

013 | 014
015 | 016

Plate 05

017 | 018
019 | 020

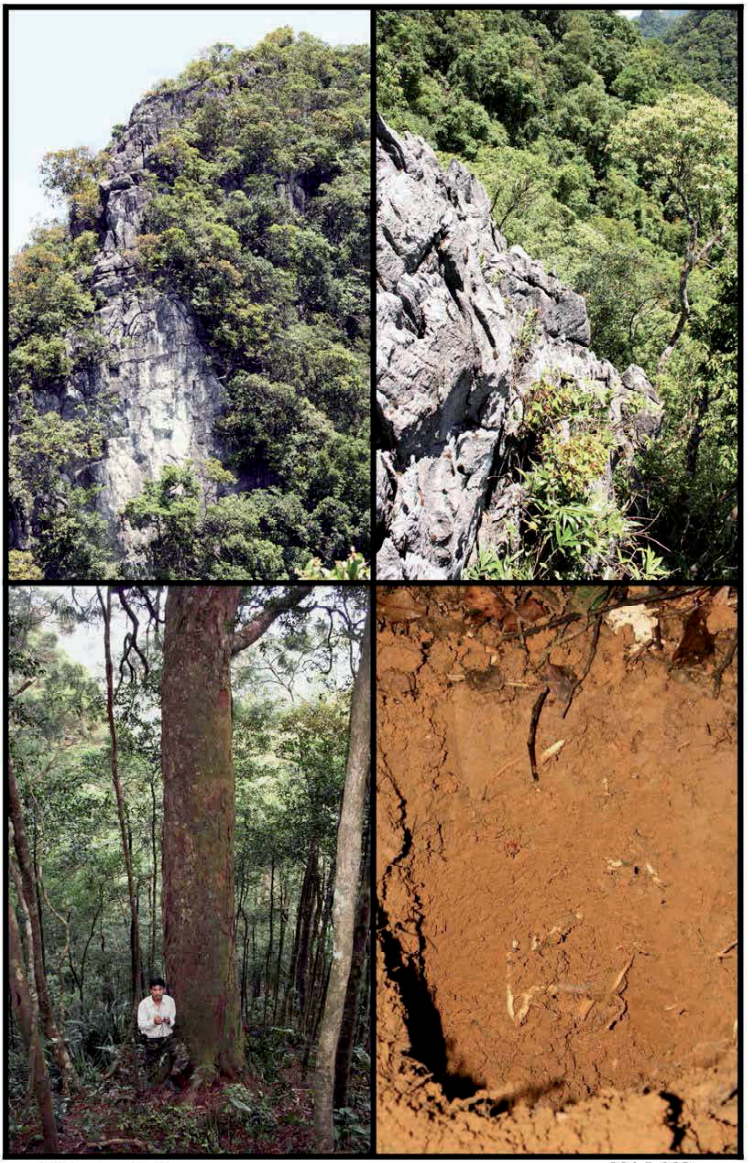


Plate 06

021 | 022
023 | 024

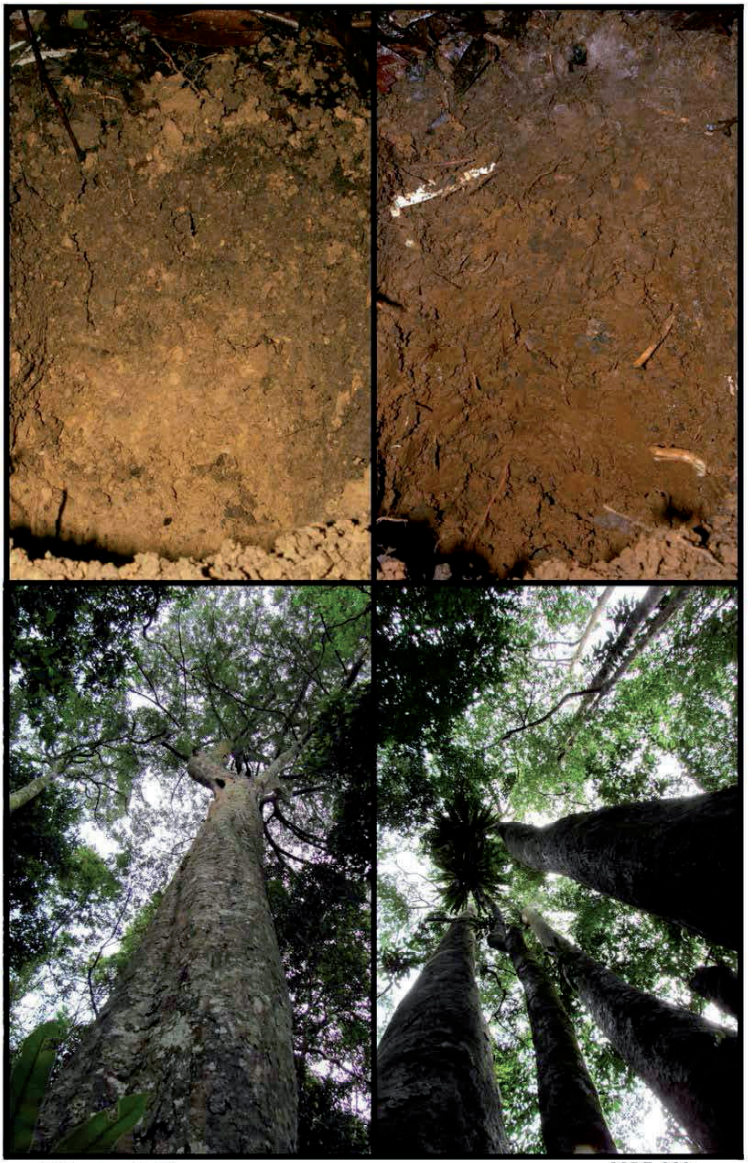


Plate 07

025 026
027 028

Plate 08

029 | 030
031 | 032

Plate 09

033 | 034
035 | 036

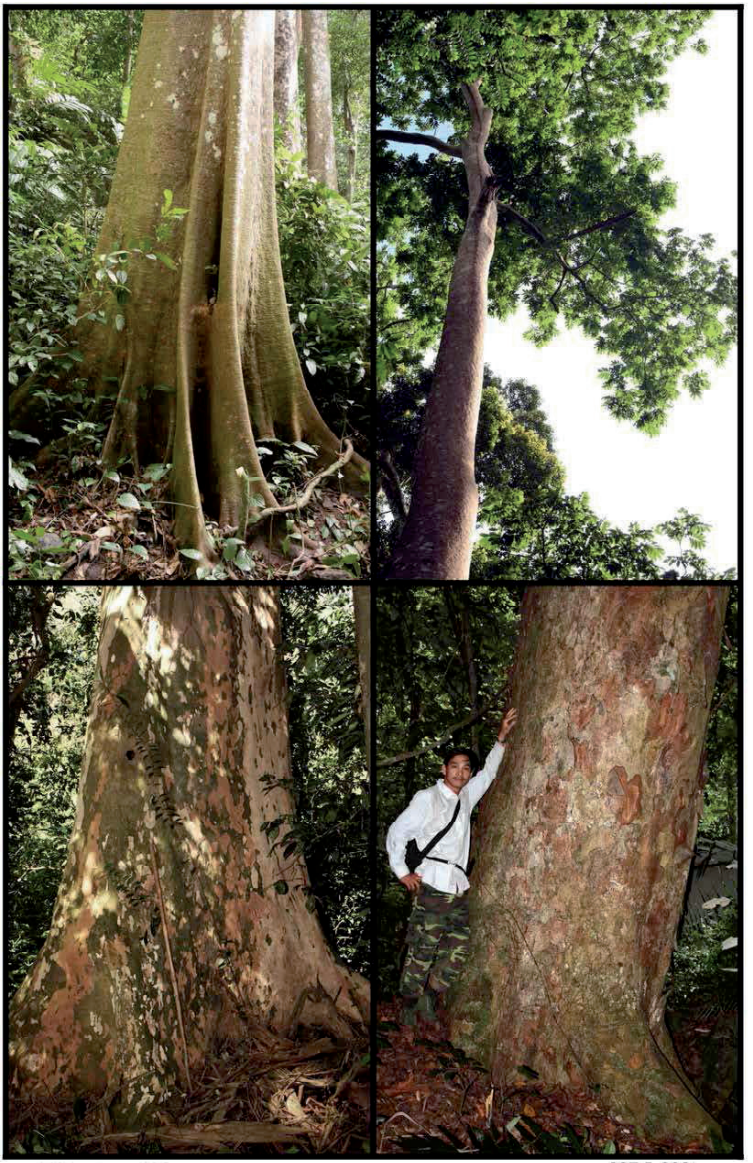


Plate 10

037 | 038
039 | 040

Plate 11

041 | 042
043 | 044

Plate 12

045 | 046
047 | 048

Plate 13

049 | 050
051 | 052

Plate 14

053 | 054
055 | 056

Plate 15

057 | 058
059 | 060

Plate 16

061 062
063 064

Plate 17

065 | 066
067 | 068

Plate 18

069 | 070
071 | 072

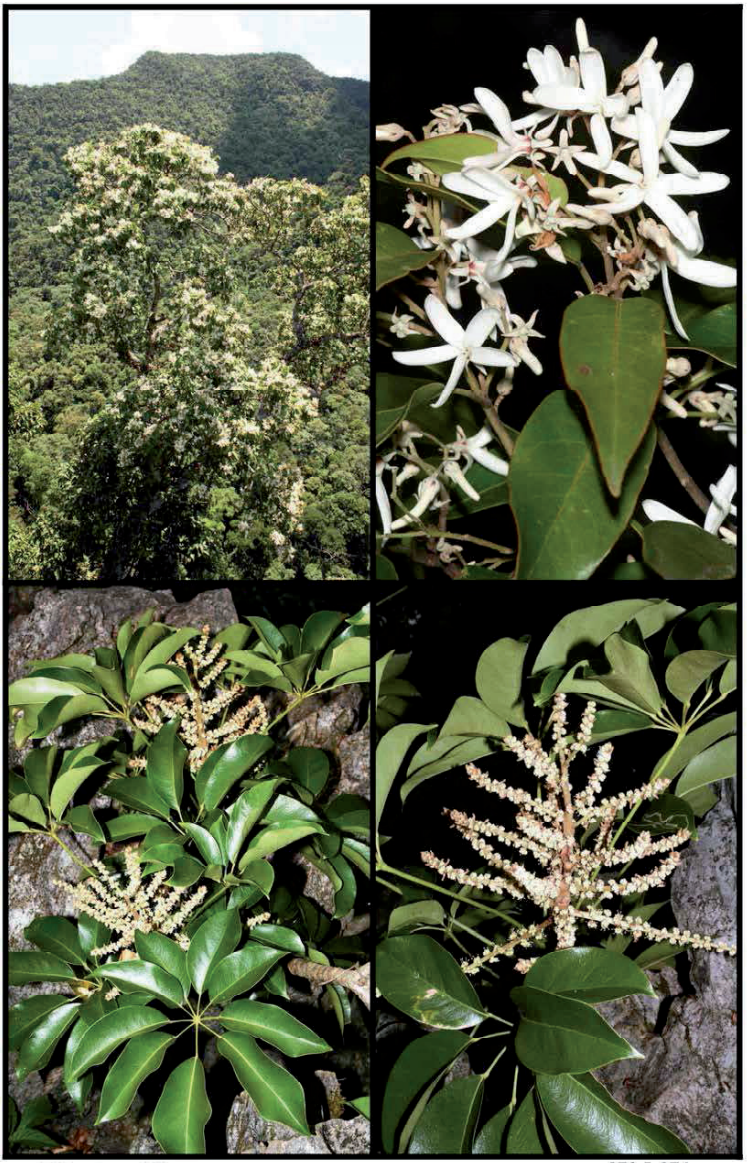


Plate 19

073 | 074
075 | 076

Plate 20

077 | 078
079 | 080

Plate 21

081 | 082
083 | 084

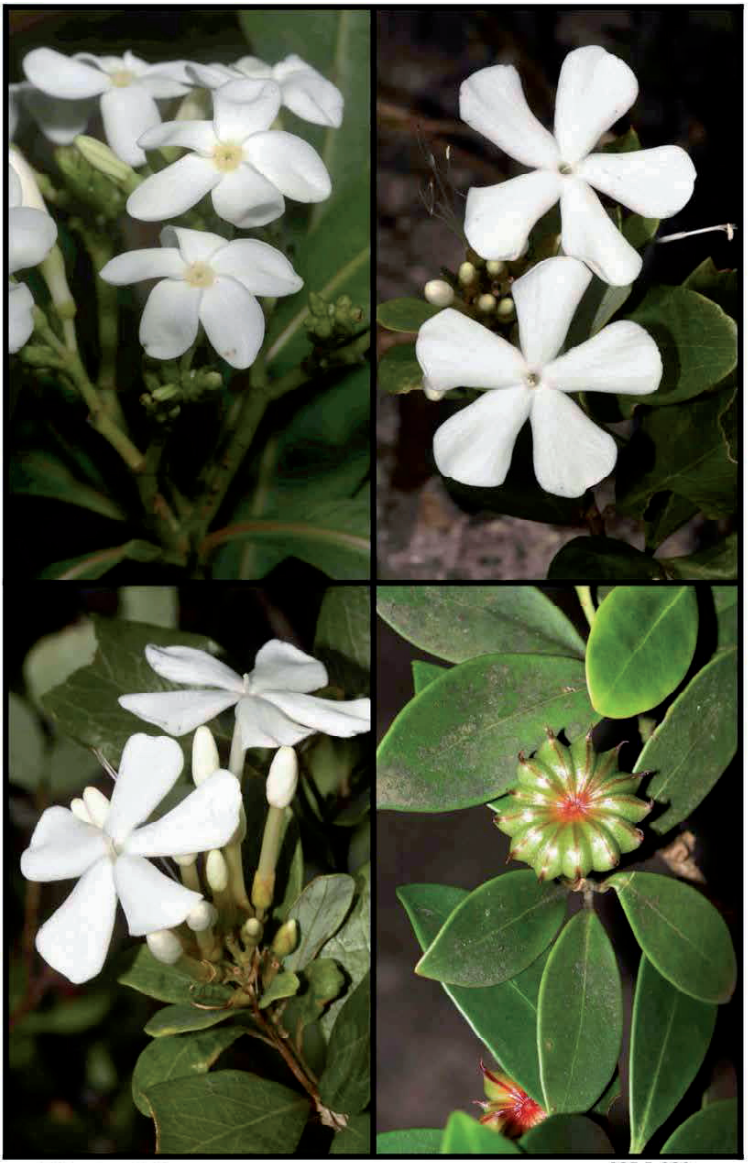


Plate 22

085 | 086
087 | 088

Plate 23

089 | 090
091 | 092

Plate 24

093 | 094
095 | 096

Plate 25

097 | 098
099 | 100

Plate 26

101 | 102
103 | 104

Plate 27

105 | 106
107 | 108

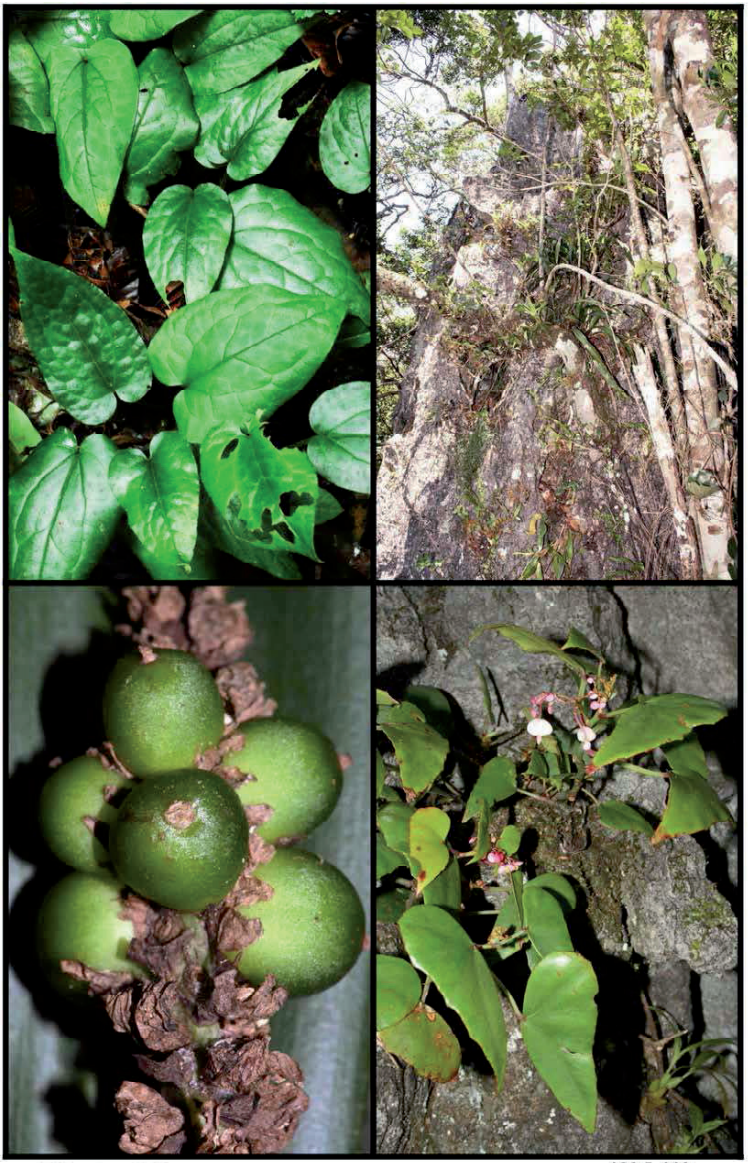


Plate 28

109 | 110
111 | 112

Plate 29

113 | 114
115 | 116

Plate 30

117 | 118
119 | 120

Plate 31

121 | 122
123 | 124

Plate 32

125 | 126
127 | 128

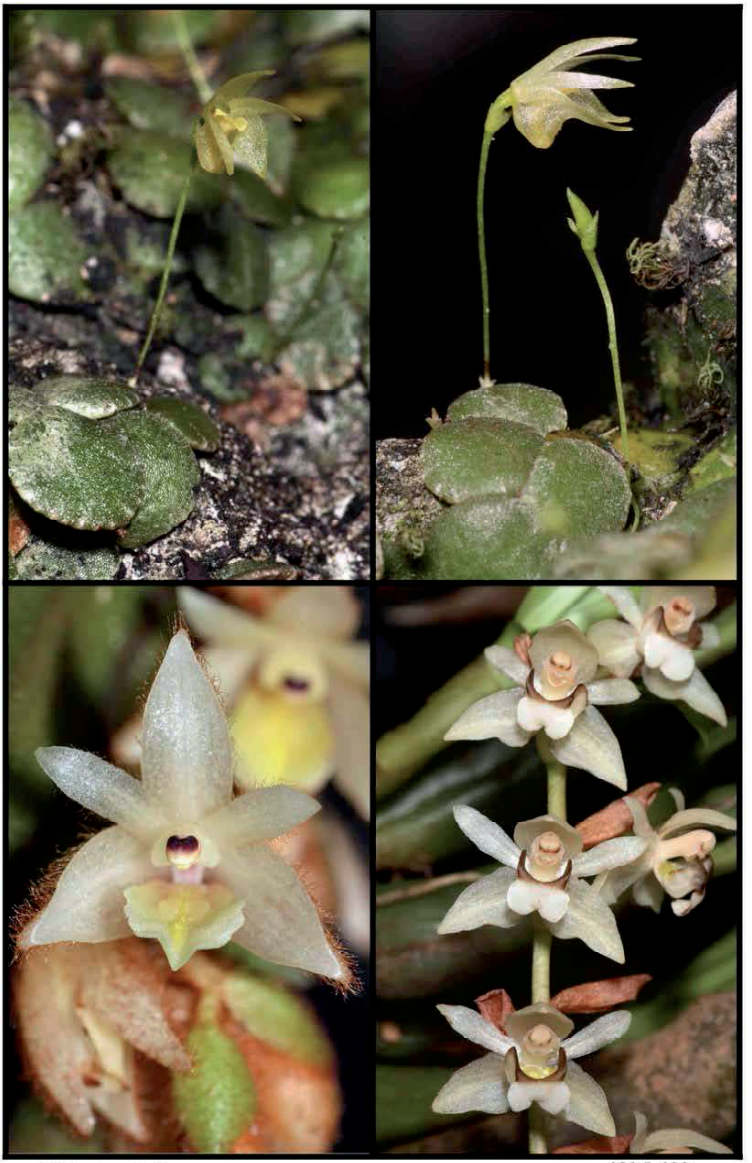


Plate 33

129 | 130
131 | 132

Plate 34

133 | 134
135 | 136

Plate 35

137 | 138
139 | 140

Plate 36

141 | 142
143 | 144

Plate 37

145 | 146
147 | 148

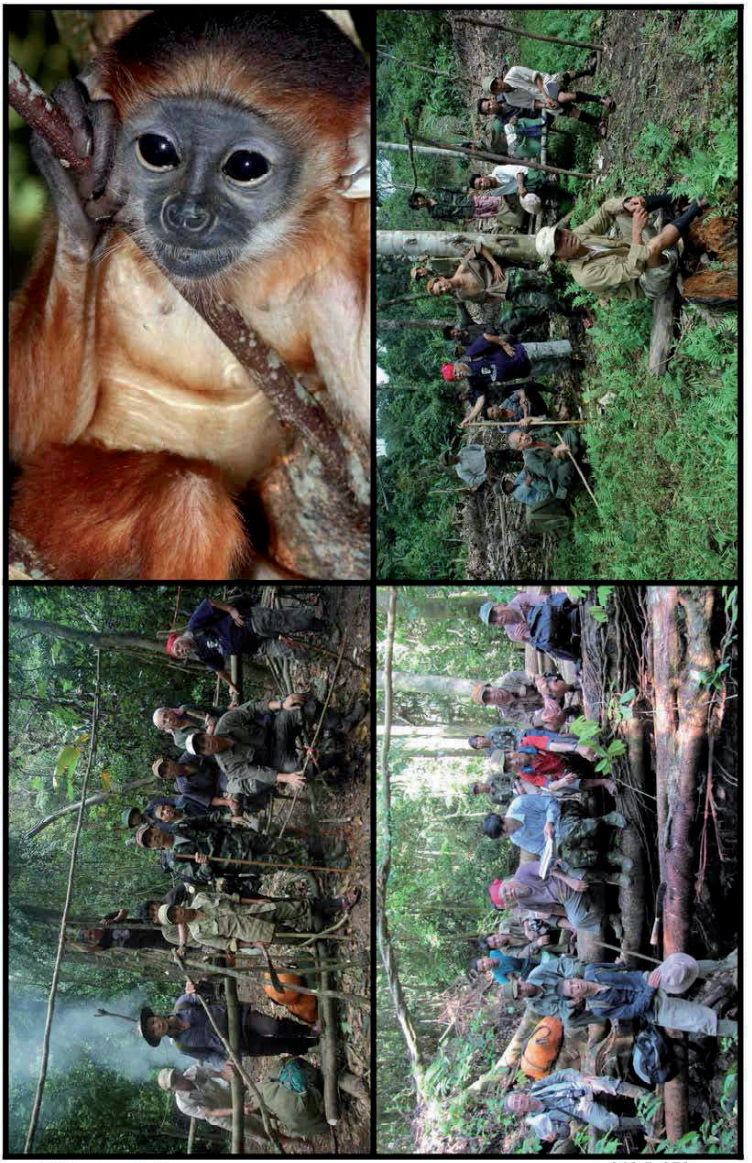


Plate 38

149 | 150
151 | 152

Plate 39

153 | 154
155 | 156

Plate 40

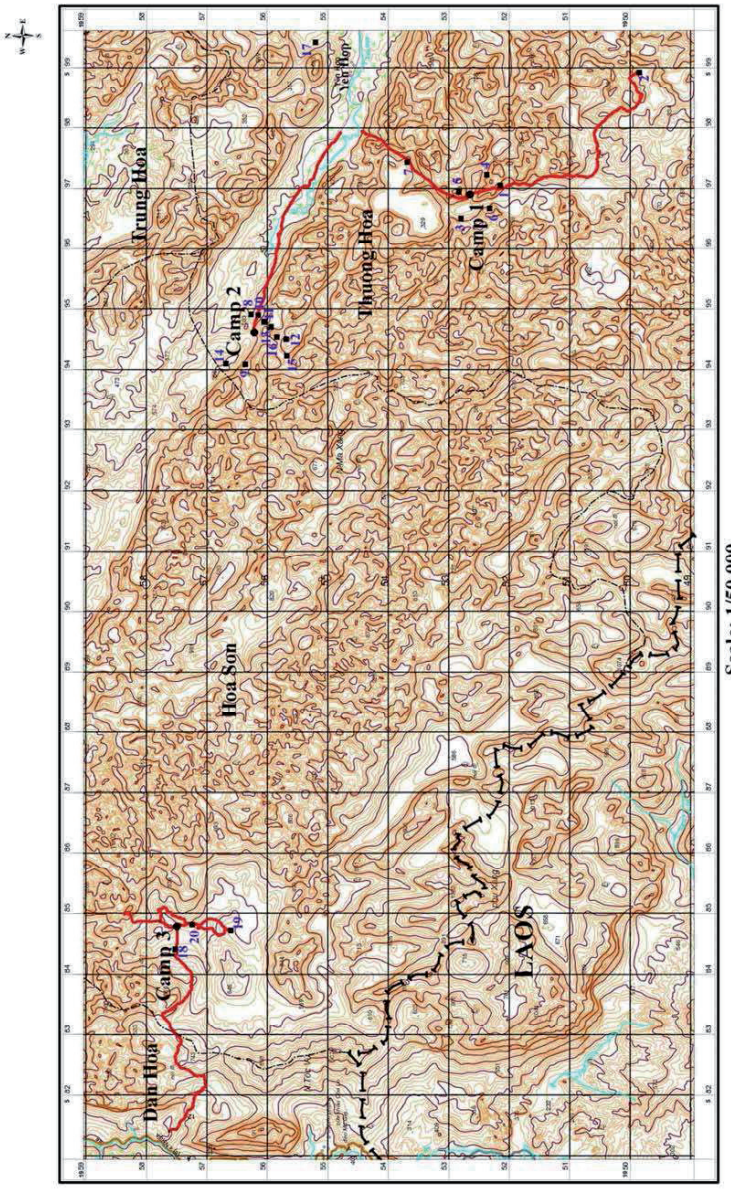
157 | 158
159 | 160

Plate 41

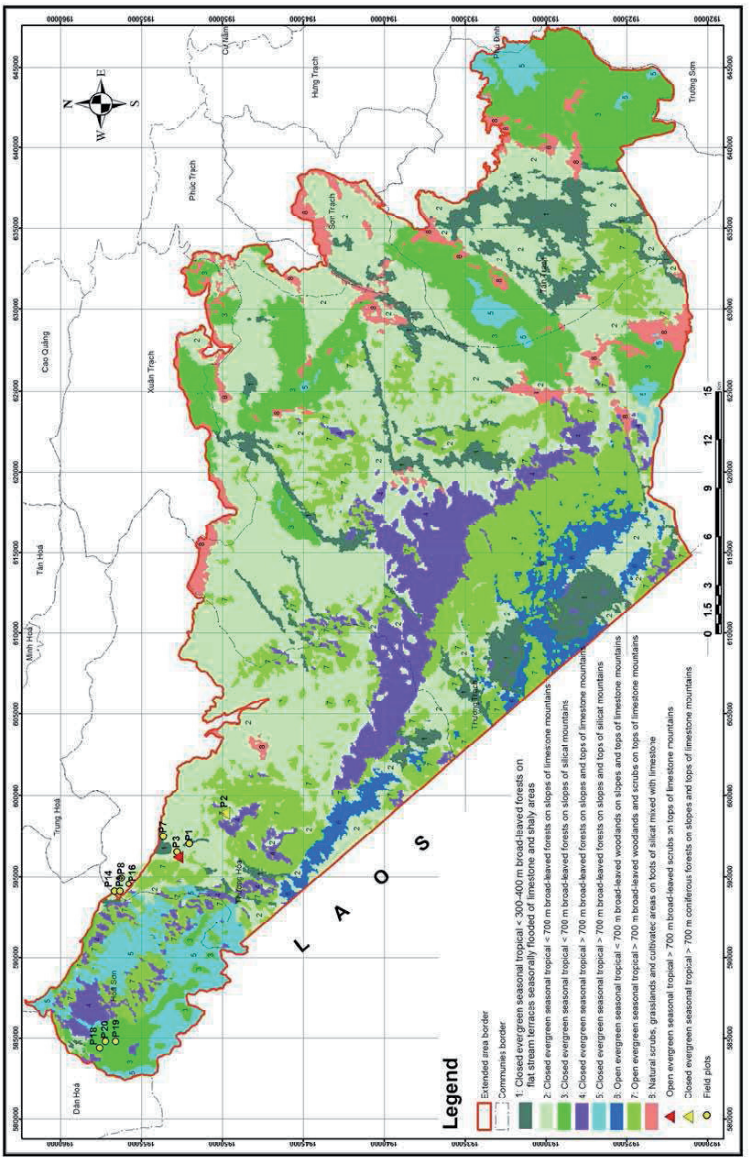
161 | 162
163 | 164

165 | 166

Plate 42



Map 1 Studied area, itineraries, field camps and model plots


Legend
Extended area border
Communes border
1. Closed evergreen seasonal tropical < 300-400 m broad-leaved forests on flat stream terraces seasonally flooded of limestone and shaly areas
2. Closed evergreen seasonal tropical < 700 m broad-leaved forests on slopes of limestone mountains
3. Closed evergreen seasonal tropical < 700 m broad-leaved forests on slopes of silicat mountains
4. Closed evergreen seasonal tropical > 700 m broad-leaved forests on slopes and tops of limestone mountains
5. Closed evergreen seasonal tropical > 700 m broad-leaved forests on slopes and tops of silicat mountains
6. Open evergreen seasonal tropical < 700 m broad-leaved woodlands on slopes and tops of limestone mountains
7. Open evergreen seasonal tropical > 700 m broad-leaved woodlands and scrubs on tops of limestone mountains
8. Natural scrubs, grasslands and cultivatec areas on bots of silicat mixed with limestone
Open evergreen seasonal tropical > 700 m broad-leaved scrubs on tops of limestone mountains
Closed evergreen seasonal tropical > 700 m coniferous forests on slopes and tops of limestone mountains
Field plots
LAOS
Dân Hoá
Trung Hoá
Minh Hoá
Tân Hoá
Cao Quảng
Xuân Trạch
Phúc Trạch
Hưng Trạch
Sơn Trạch
Tuyên Hoá
Minh Hoá
Trường Sơn
P1
P2
P3
P4
P5
P6
P7
P8
P14
P15
P16
P19
P20
P21
0 1.5 3 6 9 12 15 km
W
E
N
S

Map 2

INDEX OF LATIN NAMES

Illustrations are presented on pages marked with bold font