

**Proceedings of Seminar & Workshop**

**Biodiversity Value of**

**Hoang Lien Mountains & Strategies for Conservation**

**Frontier-Vietnam**

in conjunction with

**Institute of Ecology and Biological Resources**

**Edited by R. T. Sobey**

7<sup>th</sup> - 9<sup>th</sup> December 1997  
Sa Pa District, Lao Cai Province  
Vietnam

## **PREFACE**

### **The Society for Environmental Exploration**

The Society for Environmental Exploration (SEE) is a UK-based, non profit-making organisation, formed in 1989. The Society's objectives are to advance biodiversity research and implement practical projects contributing to the conservation of natural resources. Attention is focused on the protection of wildlife and biological diversity in natural habitats whose survival is threatened by human activity. The Society also acts to promote co-operation between scientists from collaborating institutions and government agencies, and has strong links with scientific expertise around the globe. The Society promotes the work of Frontier-Vietnam which is one of SEE's country-based programmes.

### **Frontier Vietnam**

In Vietnam, the Frontier programme is operating under a five year Memorandum of Understanding between SEE and the Institute of Ecology and Biological Resources. The agreement is ratified by the National Centre for Natural Science and Technology. Frontier-Vietnam operates financially through the donation of core funds from the Society for Environmental Exploration. This funding is augmented for specific project activities by a number of corporate sponsors and government agencies (for example Embassies).



## Editors Note

Whilst every effort has been made to truly reproduce the statements contained in these proceedings, the editors must take full responsibility for any inaccuracies that have occurred during translation from Vietnamese to English language and vice versa.

These proceedings are also published in Vietnamese language.

## CONTENTS

[Preface](#)

[Acknowledgements](#)

Editors Note

Contents Page

[Introduction](#)

*Mr. Richard Sobey, Programme Manager, Frontier-Vietnam*

[Opening Address of the Seminar and Workshop](#)

*Dr. Nguyen Duc Thang, Vice Chairman, Lao Cai Provincial People's Committee*

## **PART ONE Biodiversity of Hoang Lien Mountains**

[Frontier-Vietnam Forest Research Programme - Aims & Strategies](#)

*Mr. Andrew Tordoff, Scientific Research Coordinator, Frontier-Vietnam*

[Flora and Vegetation Structure of Hoang Lien Mountains](#)

*Dr. Ha Van Tue, Botanist, Institute of Ecology & Biological Resources*

[Flora of Fansipan Mountain](#)

*Mr. Andrey Kouznetsov & Mr. Pham Luong, Vietnam Russian Tropical Centre*

[Mammal Fauna of Hoang Lien Nature Reserve](#)

*Mr. Pham Duc Tien, Mammologist, IEBR*

[Butterfly Fauna of Protected Areas in Northern Vietnam with Special Reference to Hoang Lien Mountains \(Lao Cai\), Collections 1994-1995](#)

*Dr. Alexander Monastyrskij, Head of Ecology, Vietnam Russian Tropical Centre*

[Amphibians of the Hoang Lien Nature Reserve](#)

*Mr. Steven Swan, Assistant Research Coordinator, Frontier-Vietnam*

[Birds of the Hoang Lien Mountains](#)

*Mr. Andrew Tordoff, Scientific Research Coordinator, Frontier-Vietnam*

## **PART TWO An Interest in the Hoang Lien Nature Reserve: Organisations and People**

### **Conservation of Plant and Animal Resources in Vietnam**

*Dr. Le Xuan Canh, Vice- Director, IEBR*

### **Hoang Lien Nature Reserve**

*Mr. Tran Van Phi, Vice Director, Hoang Lien Mountains Nature Reserve*

### **Medicinal Plants of the Hoang Lien Mountain Range**

*Mr. Dinh Van My, Director, Medicinal Plant Centre, Sa Pa*

### **The Orchid Garden and Ham Rong (Dragon's Jaw) Tourism Area, Sa Pa**

*Mr. Le Duc Luan, Director Lao Cai Lotteries & Ham Rong Tourism Project*

### **Cultural & Socio-Economic Practices of Ethnic Minorities in Lao Cai**

*Mr. Sung A Sai, Dept. of Minorities & Religion, Lao Cai*

### **Tourism in and Around Sa Pa District; A Preliminary Study**

*Mr. Mark Grindley, Assistant Research Coordinator, Frontier-Vietnam*

## **PART THREE Strategies for Conservation & Sustainable Tourism in Sa Pa**

### **Introduction**

Is there a need for a tourism committee in Sa Pa?

- a. How do you see the future development of tourism in Sa Pa?
- b. Is there a need for directing the activities of tourism?
- c. A tourism committee? If so, why? What role would it fulfill? Who would comprise the committee and how would they operate?

What are the threats to and priorities for conservation in Hoang Lien Nature Reserve?

What action can be taken?

- a. establishment of a nature trail coupled with an entrance fee.
- b. establishment of village/commune tourism development committees.
- c. development of an environmental education programme.

### **Appendices**

#### **1. Contributors and Participants**

## **INTRODUCTION**

The Northern Highlands are recognised by the government of the Socialist Republic of Vietnam to be a 'Special Needs Area'. These needs are particularly evident when viewed in the context of the mountainous

peoples' livelihoods; their subsistence agricultural practices such as rotational swidden farming and their reliance on the forest resources including illegal hunting.

Frontier-Vietnam in association with the Institute of Ecology and Biological Resources began discussions in July 1996 with the Lao Cai and Sa Pa People's Committees to develop a conservation strategy for the Hoang Lien Nature Reserve. It was envisaged that the programme would highlight the importance of natural resources found within the reserve and aim to promote strategies for sustainable rural development. Obviously a task of this nature needs careful planning and necessarily includes a number of facets.

Frontier-Vietnam first visited the area in 1994 and conducted a three month baseline biodiversity survey. This was again repeated in 1995 in order to account for seasonal variations. Further to the resulting reports, it was decided to develop a more comprehensive programme that took into account a number of 'needs' in the Sa Pa district.

Central to the programme itself is the Hoang Lien Nature Reserve. It is one of 87 protected forests areas in Vietnam and not only contains virtually the country's best examples of sub-tropical montane forest and tropical montane deciduous forest, but also exhibits the highest peak in the Indo-China region. The Vietnam National Action Plan on Biological Diversity (1995) lists the mountain reserve as having a 'very important' biodiversity value, with threats from hunting and encroachment being marked as 'high', but also considers the reserve as a priority project area for a 'management and conservation field programme'. This is in accordance with articles 8 and 10 of the Convention on Biological Diversity signed by Vietnam in 1993.

The need for a comprehensive programme has more recently been identified by the Hoang Lien Nature Reserve Management Plan (1997) which includes the following objectives: to protect the ecosystem; to conserve the diversity of the genetic resources of flora and fauna; to raise economic potential in the project area and to contribute to the protection of the Song Hong (Red river) watershed.

In order to achieve these objectives Frontier-Vietnam in association with the Institute of Ecology and Biological Resources began in October 1997 to implement an ecological monitoring programme and augment strategies for sustainable upland development in the area.

The seminar and workshop was thus designed to provide an opportunity for discussing conservation, natural resource use and economic stability in the Sa Pa area. One of the aims was to strengthen the capacity of local institutions to identify problems, raise awareness and implement projects that move towards sustainable livelihoods for the local people.

Frontier-Vietnam believes that part of the solution for economic success in Sa Pa lies with the Hoang Lien mountains and the management of the nature reserve itself. Sa Pa is a well known for its natural beauty and is a popular tourist destination. Our argument is that if the nature reserve is irrevocably damaged through unsustainable use, a significant opportunity for economic development will have been lost. It follows that if tourist numbers decline then the ability of local residents (both villagers and town people) to generate an extra source of income will be severely curtailed, causing perhaps further forest destruction and a greater dependence on government aid.

On the positive side, this 'tourism' resource is not yet utilised and could (and we would suggest should) be used as a means for further development.

Without a comprehensive strategy for protecting and enhancing the reserve, other programmes in the future are likely to become more costly. That is not to say there isn't already a strategy being implemented, but what it can not achieve through lack of funding, capacity etc. seriously affects the achievement of its' overall aims. One of the reasons for this workshop was to look at developing these measures which it is hoped will in the future will become in part self-financing. With this in mind a number of local and national organisations were brought together for the three days.

Day one was primarily designed as a seminar on the importance of natural resources in the nature reserve and their uniqueness in Vietnam, as well as an opportunity to provide recommendations for monitoring natural resource use and the protection of its flora and fauna. Eminent research scientists from the Institute of Ecology and Biological Resources and the Vietnam-Russian Tropical Centre gave presentations as well members of the Frontier-Vietnam Forest Research Programme.

Day two was entitled 'An Interest in the Hoang Lien Nature Reserve - Organisations and People' with the invited speakers changing the focus slightly to discuss what has been achieved, what the current situation is and what initiatives are being implemented. In other words, what is the present state of affairs regarding the

management and development of the Hoang Lien mountains and the Hoang Lien Nature Reserve? - Who conserves the biodiversity?; what are the guiding forces behind its' development, bearing in mind the local population?; and who or what is having an impact on its' future conservation and sustainability? On this day speakers representing for example, the Hoang Lien Nature Reserve Management Board, the Department of Minorities and Religions, and the Ham Rong Tourism Project as well as Frontier-Vietnam gave presentations.

Day three, the 'workshop' day was entitled 'Strategies for Conservation and Sustainable Tourism' and was designed to promote dialogue on existing and alternative strategies for conservation in Sa Pa and provide recommendations for development in the area. Questions such as 'What are the priorities for conservation?' and 'What actions can be taken?' were posed. Other discussion topics included 'Is there, for example, a need to establish commune tourism development committees or perhaps a create nature trail within the nature reserve?'

### **Richard Sobey**

Programme Manager, Frontier-Vietnam

## **OPENING ADDRESS OF THE SEMINAR AND WORKSHOP**

### **Dr. Nguyen Duc Thang**

Vice Chairman, Lao Cai Provincial People's Committee

To Mr. Richard Sobey, Frontier-Vietnam

To Ladies and Gentlemen

On behalf of Lao Cai Provincial People's Committee and myself, I would like to say best greetings to you all who participate in this seminar and workshop, and I also give a cheerful reception to the Frontier-Vietnam for its considerable exertions to investigate on the biodiversity resources here - one of most unique areas of Vietnam.

As you know, at present time, the environment is becoming a global problem. Everybody who lives on our planet urgently needs to do some practical work to improve their own environment. There are many questions that need to be answered, with one of those being the recognition of biodiversity on the earth and its protection. Being clearly aware of the problem, the Government of Vietnam signed the International Convention on Biological Diversity and as well as supporting other protocols regarding the environment.

Biodiversity conservation includes many factors, but one of the most important requirements for terrestrial biodiversity is vegetation cover and animal species contained within. It follows that if biodiversity values are to be protected then so should the forest. We totally understand without a shadow of doubt the link between forest destruction and the earth's climate.

Lao Cai province is at the south-eastern end of Himalayan mountain range in an area that we call Hoang Lien mountains. It contains Mount Fansipan peak, which at 3143m is the highest point in the Indochina region. The climate here is typically subtropical and the area maintains very abundant biological resources. Despite, many scientists over the years paying attention to Hoang Lien mountains, there are sure to be new discoveries.

After a long term process of withstanding natural and human impacts, the forested area and animal population sizes are now smaller, and even with our efforts, it is not possible to solve these particular problems in a short time. Therefore it is necessary to check and monitor the biological resource changes, and in fact, Frontier-Vietnam is one of first organisations to do this work.

We always believe that with the funding and human resource potential, and the collaboration between yourselves and IEBR - one of best professional institutions in Vietnam, that Frontier-Vietnam would produce a

comprehensive and credible biodiversity database for the Hoang Lien mountains.

With this data, we hope that research results will not halt with periodic scientific reports, but also contribute to more practical feasible projects that will benefit our Sa Pa and Than Uyen Districts.

In this seminar and workshop, we hope that Frontier-Vietnam, IEBR and Lao Cai's scientists and administrators will be able to highlight some recommendations and socio-economic solutions towards the conservation of Hoang Lien mountains' natural resources; to contribute to raising local minority groups' living standards; and aim for sustainable development in both sides - the environment and local people lives. This seminar should be seen as a opportunity to contribute effectively to the 'Wipe Out Famine & Reduce Poverty' policy for the local people in and around Hoang Lien Nature Reserve.

During this workshop, another area of discussion and concern is the link between biodiversity protection and tourism development. It is a very important concept. The province is paying particular attention to beneficial tourism strategies in this area. The guidance ideology is: Protect the biodiversity in Hoang Lien mountains to serve for tourism development, and tourism will provide feedback towards this area's conservation and the welfare of all resident minority groups.

So the Lao Cai People's Committee is keen to provide the best possible conditions for conducting this work here and I hope that the seminar and workshop will centre on these comments in order to help the Lao Cai provincial authorities develop an informed framework for the future.

I wish Frontier-Vietnam / IEBR collaboration in this venture every success. And once more, I would like to say welcome to all speakers, participants and organisations in attendance.

Thank you very much.

## **PART ONE Biodiversity of Hoang Lien Mountains**

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### **FRONTIER-VIETNAM FOREST RESEARCH PROGRAMME**

#### **AIMS & STRATEGIES**

**Mr. Andrew Tordoff**

Scientific Research Coordinator, Frontier-Vietnam

#### **Introduction**

In 1994 and 1995, Frontier-Vietnam worked in Sa Pa district for two ten week periods. We collected baseline information about the biodiversity of Hoang Lien mountains, the development of tourism in Sa Pa district and the socio-economic situation of local communities. During October and December 1997, Frontier-Vietnam returned to Sa Pa district for the initial phase of a long term project which will, we hope, be of at least 2-3 years in duration.

Frontier-Vietnam's principal aims are to promote conservation of the natural resources of Sa Pa district, with emphasis on Hoang Lien Nature Reserve, and to improve living standards in the communities of Sa Pa district. These two aims are strongly interrelated. Deterioration of the environment will negatively affect local people who rely upon natural resources. Improvements in living standards ought to reduce pressure on these resources. Therefore, we are conducting an integrated work programme of biological research complimented by socio-economic study.

Our work programme has 3 stages:

1. To identify problems

2. To identify causes
3. To identify solutions

We will identify problems via the biological research, a major part of which is an ecological monitoring programme.

We will identify causes through socio-economic research and interviews with concerned parties.

The aim of the socio-economic research is to study the pattern of natural resource use. It is impossible to study this out of context, therefore we will look at the broader picture of the rural economy and culture, in order to evaluate the importance of forest resources to local communities.

We will identify solutions by extensive consultation and feasibility studies. We hope to be able to implement solutions thus identified by a combination of some or all of the following: involving specialist expertise, raising funds from external sources and conducting pilot projects.

One way in which the natural resources of an area can be exploited in a sustainable way is tourism, and tourism research forms a central part of our work in Sa Pa district. One question we will ask is 'How can tourism support conservation in Hoang Lien Nature Reserve?' During the current survey, we aimed to identify areas for future research and to highlight how Frontier-Vietnam can aid the sustainable development of tourism. This workshop and seminar forms part of this process.

### **An Ecological Monitoring Programme**

The central focus of Frontier-Vietnam's work will be the establishment of an ecological monitoring programme. Ecological monitoring (making repeated observations of the same area) allow us to observe changes over time. Therefore, we can: study the dynamics of the ecosystem; identify threats; identify priority areas for conservation; assess the effectiveness of conservation measures; and monitor the effects of tourism on the environment.

The ecological monitoring programme will study 24 forest transects; 6 per phase for one year. The forest transects will be returned to after intervals of 12 months. The forest transects are positioned so as to reflect variation in habitat type, altitude and aspect within the reserve. At each, we will look at vegetation, amphibians, birds and lepidoptera.

Mammals will be studied but will not form part of the ecological monitoring programme due to the difficulty in obtaining meaningful quantitative data due to low sample sizes. Instead, the aim of the mammal research will be to produce a comprehensive species inventory based upon small mammal trapping, bat netting and interviews with local people.

The vegetation survey comprises two aspects: vegetation mapping and permanent plots. Vegetation mapping provides information about changes in forest extent, whilst permanent plots provide information relating to changes in forest quality. For vegetation mapping, we intend to use remote sensing data and to conduct ground truthing by use of a hand-held G.P.S.

Permanent plots will be located in areas of homogeneous vegetation so as to represent all the vegetation types present in Hoang Lien mountains. Using standardised and repeatable methods, we will look at both trees and ground flora. Permanent plots will be returned to at 12 month intervals, allowing disturbance or regeneration to be observed. By studying, for example, the size of trees being cut down, we will be able to infer the causes of this disturbance.

Taken together, the vegetation mapping and permanent plot data will allow us to identify those areas which are most at threat from over-exploitation. We will also be in a position to observe any improvements in forest quality.

Although permanent plots will involve much work during their establishment, returning to monitor them in following years will be considerably less effort. Therefore, there is potential for the ecological monitoring programme to continue long after the cessation of Frontier-Vietnam's involvement in the area. Indeed, we hope to train nature reserve staff in the relevant techniques during the course of our work here.

As mammals will not form part of the ecological monitoring programme, the best indicator of vertebrate diversity may be amphibians. Amphibians have been used as ecological indicators in other areas because they



are very sensitive to environmental change, they are present in sufficiently large numbers to permit quantitative study, and they can be studied without extensive collection of specimens.

Birds are good indicators of habitat quality because many species are restricted to relatively undisturbed forest habitats. They also provide information on the intensity of hunting pressure.

Birds are observed in their natural habitat via direct observation or by recognition of their calls.

Lepidoptera will be studied as indicators of invertebrate diversity. They are a well-studied and, therefore, relatively easy to identify. In addition, the distributions of many species are strongly correlated with habitat type. Butterflies are collected during the day with hand-held nets, whilst hawk moths (Sphingidae) are collected at night using an ultra-violet light trap.

Taken together, the various aspects of the ecological monitoring programme will allow us to identify the most significant threats to conservation in and around Hoang Lien Nature Reserve.

## **FLORA & VEGETATION STRUCTURE OF HOANG LIEN MOUNTAINS SOME INITIAL RESULTS OF THE RESEARCH**

**Dr. Ha Van Tue**

Institute of Ecology & Biological Resources

### **Preface**

The histories of tectonics and evolution have made Vietnam into a country with many places famous for both landscape and creatures. The Hoang Lien mountains are one in such place. It continues to attract many scientists interested in different fields such as geology, geography, climatology, hydrology, biology and the environment.

From the early years of the 20th century, French researchers looked for access to the Fansipan peak. In 1903, a group of scientists belonging to the Department of Geography in the French Army and lead by Lieutenant Bellot reached an altitude of 3000m and in 1905, Denis, Scherdlin and Benoit worked in this area at 2932m. In 1935 Sallet claimed to reach the highest peak at 3143m.

Since 1990, many researchers have been to the top of the mountain. In April of 1995, a research group from the Institute of Ecology and Biological Resources went via the Sin Chai path to reach Fansipan peak. For some of the above reasons, Frontier-Vietnam in collaboration with IEBR have been conducting a programme in the Hoang Lien mountains.

### **Natural Vegetation**

*Natural vegetation* types are those undisturbed by human activities. This type of area is now very small, covering only about 15-20% of the total nature reserve. It is situated at around 1800m altitude in difficult access areas, such as deep valleys or steep slopes. Altitude is the overriding factor with respect to forest structure and plant species composition.

Tropical evergreen forest in lowland areas ranges from 1800m to 2200m with the forest usually classified in to 4 strata:

- Highest stratum: Dominated by species from families such as Fagaceae, Styracaceae. One species of Styracaceae - *Rehderodendron indichinense* is very unique for this area, growing up to 30 - 40m high and 0.8 - 1m in diameter. Some of the biggest trees belong to the Talauma genus (Magnoliaceae) reaching over 1m in diameter.
- Second stratum: Dominated by species from families such as Fagaceae, Lauraceae, Theaceae, and Araliaceae. The presence of the Aceraceae family is a difference from other strata.
- Third stratum: Includes some regenerating trees, small trees and in places bamboo (Poaceae). The most common genus and families in this stratum are *Illicium*, Theaceae and Araliaceae.
- Low stratum: Grass and ferns reaching 0.4-0.6m metres in height, with many individuals belonging to the families such as Melastomataceae, Acanthaceae, Urticaceae. In addition, some species of the

Lythraceae family are present only in this area.

*Elfin-Moss* forest ranges from 2200 to 2900m. The absence of high trees, reaching only 10-15m is characteristic. They are often early-branched and support many mosses and lichens especially around the root base.

- First stratum: Composed of some gymnosperm species such as *Tsuga indochinensis*, *Fokienia hodginsii*, *Abies pindow* and some species of the *Talauma* genus (Magnoliaceae).
- Second stratum: Dominated by species of *Rhododendron* and *Vaccinium* genera from Ericaceae family, with some species of Theaceae and Illicaceae and Homalidaceae families.
- Third stratum: This stratum is not very clearly separated from second stratum, but usually includes some lianas, epiphytic ferns and Lythraceae which grow on rock and trees.

## Secondary Vegetation

*Woody secondary vegetation* is quite similar to other regions in northern Vietnam with the presence of some light-loving species from Poaceae family such as *Miscanthus japonica* and *Themeda* species. There are several remaining trees from Magnoliaceae, Juglandaceae, Euphorbiaceae, Theaceae, Lauraceae, Styracaceae families.

*Secondary vegetation dominated by Poaceae* species and ferns: Logging, farming and grazing activities have caused degeneration of soil quality, the humus layer is thin and dry. Climax societies include species from the Poaceae family, *Miscanthus japonica*, *Imperata cylindrica* and some bamboo species. Scattered are light-loving species from Melastomataceae, Rosaceae, Rubiaceae,

Theaceae, Lauraceae families. Overall the dominance is by the grass species (Poaceae).

*Low grass savanna* has been affected by forest fires and grazing activities. It is dominated by species from some genera of the Poaceae family such as *Passpalum*, *Eulalia*, *Eragrostis*. Some scrub species of the Theaceae, Lauraceae, Rubiaceae, Melastomataceae and Rosaceae families are present.

## Vegetation Structure

Between 1800 - 2200m altitude: 'Subtropical evergreen forest in low montane area' Frontier-Vietnam / IEBC surveys were carried out at 6 forest transects:

1. Forest near Tram Ton
2. Forest near O Qui Ho
3. Forest near Sin Chai
4. Forest near Cat Cat
5. Forest near Y Lien Ho
6. Forest near Tram Ton

At each site, one 50 x 50m plot was set up and marked using barrier tape. Within these plots, every tree (woody plant with diameter at breast height (DBH) > 10 cm) was identified and recorded. Ground flora was studied using twenty five 2 x 2m quadrats. Within each quadrat, all tree seedling (DBH < 10 cm), lianas, shrubs and herbs identified. For each species, the number of individuals and percentage cover of the quadrat were recorded.

All the primary forest plots show the dominance of Fagaceae species (from 2 genera, *Castanopsis* and *Lithocarpus*), with the number of individuals reaching 40-50% of the total number. Some species from other families such as Lauraceae, Magnoliaceae, Araliaceae were also common. The presence of Illicaceae and Aceraceae bears the stamp of subtropical evergreen forest in low montane belt.

Plot 6 on the west side of the reserve contained a plant composition which was very different from the east side of the reserve. Present were tree species from the Meliaceae and Sapindaceae families, and woody lianas from the Anonaceae and Arecaceae families. This area would be described as tropical monsoon evergreen forest in low montane belt.

The plot near Cat Cat village is secondary forested land after cultivation with the trees around 18-20 years old. The species type is *Talauma* in the Magnoliaceae.

The species composition in the secondary forest compared to primary is very different. In the secondary areas

the number of individuals is highest in families such as Lauraceae, Styracaceae (*Styrax*), Juglandaceae, Theaceae, Euphorbiaceae, and Magnoliaceae. The absence of the Fagaceae family should be studied.

From the research conducted suggests that delineated forest regeneration area would be far more economic and feasible than reforestation.

### **The Flora of Hoang Lien Nature Reserve**

Very little is still known about the floral composition of the nature reserve. At the present, 167 plant families are found here which covers about 70% of total number of plant families in Vietnamese flora. This indicates the high biodiversity found here. The number of most species-rich family is Orchidaceae with over 60 known species, (which is considered to be less than the actual number).

### **The role of vegetation and flora in Hoang Lien Nature Reserve**

The vegetation and flora in the reserve is very diverse. It could be considered a sample picture for northern Vietnamese flora. Moreover, it is the only site in south-east Asia that can support high montane flora. It has a worthy name - 'the roof of Indo-China' - in many respects.

The reserve supports many precious species:

Ornamental plants:	Ericaceae Orchidaceae Araliaceae Asteraceae	Precious timber trees:	Fokienia Lauraceae Fagaceae
Medicinal plants:	Araliaceae Polygalaceae Ranunculaceae Gesneraceae		

In conclusion I have presented here some preliminary comments about Hoang Lien Nature Reserve. Everybody should do their best to protect and improve it.

## **FLORA OF FANSIPAN MOUNTAIN**

**Kouznetsov A. N., Phan Luong**

Vietnam - Russia Centre for Tropical Science and Technology

### **Introduction**

In December of 1996 and January of 1997, the Vietnam - Russian Centre for Tropical Sciences and Technologies conducted research on the bio-geography of the Fansipan mountain area near San Sa Ho commune, Sa Pa district. Fansipan mountain is situated in the Hoang Lien mountains which begins in the Yunnan mountain area - Ailao Shan range. Fansipan mountain contains many bio-geographical elements found in the Yunnan mountain area. The Fansipan area which is also affected by the monsoon in Vietnam exhibits conditions to allow tropical flora to flourish in a similar pattern to areas of central Vietnam. In the Hoang Lien mountains, the forests situated in the low hills contain the highest diversity in comparison to the high hills. At present there is very little primary forest maintained in Hoang Lien mountains. In northern Vietnam, the Hoang Lien mountains are the largest range containing some primary forest cover. Geographical and climatic characteristics of the Hoang Lien Son province (old) made the systematic study of plant geography difficult. For this reason the data on its botany is poor and sometimes antagonistic. Our work aimed to describe the vegetation in accessible research sites and also to make a plant specimen collection.

### **Research methodology**

Following a route, provisional satellite camps were set up at different altitudes. The main camp was located at an altitude of 1800m and research was executed in nearby and adjacent forest for 3 weeks over December 1996 and January 1997. Other satellite camps were located at 2500m and 2700m. Nine investigating routes were made in a number of directions several kilometres in radius from the main camp to form a net of analysis ranging from 1200m to the Fansipan peak at 3,143m altitude. Soil samples were taken from 1200m to 1600m; along mountain veins, level areas, edges, narrow valleys, ravines and steep slopes. On these routes, at the typical site, we described the botanical geography.

In our description of the Fansipan area, we attempted to conduct a detailed study of the characteristics of each mountain band. For the research, vegetation bands (mountain belts) were divided like contour lines ranging from 200 to 300m in height. The medium belt was sub-divided into two belts from 1400m to 1600m and from 1600m to 1800m. In each belt small sites which mountain veins were studied: a narrow vein with a width of 2-5m, maintaining forests with endemic structure and a wide vein, greater than 20m connecting soil types and soil plants. When describing the vegetation types, we measured diameter at breast height (dbh) at 1.3m high. Some abbreviations used are: D - the diameter at 1.3m height; H - tree height;  $H_{CR}^0$  - height up to the beginning of canopy;  $R_{CR}$  - canopy's radius;  $M_{mnB}$  - altitude above sea level.

### Distribution map of vegetation bands and scenery of Fansipan Mountain

When considering the altitudinal limits of different plant bands, the main criteria is the difference in floral composition and structure of these plant communities. In our opinion, there is not enough evidence to confirm plant distribution bands on official maps. The following distribution map is a result of studies from 1200m (Muong Hoa valley) to 3143m altitude (Fansipan peak), in an area mostly belonging to the San Sa Ho commune.

- **Lowland mountain soils (1200m to 1400m).** The tropical forest soils in lowland, humid and multi-dominated (regeneration forests). At the present time, the primary forests are degenerating and disturbed due to human disturbance: timber logging, livestock grazing, terraced fields, cardamom (*Amomum*) plantations and new tree plantations (*Cunninghamia lanceolata*).
- **Lower medium - altitude mountain (1400m to 1800m).** The tropical humid multi-dominated forests with the prevalent families being Cupressaceae, Podocarpaceae (regenerating), Hamamelidaceae, Dilleniaceae, Fagaceae, Lauraceae, Magnoliaceae, Juglandaceae, Euphorbiaceae, Rubiaceae, Cyatheaceae, and some other families. As with the lowland band, human activities here include selective timber exploitation (*Fokienia*, Lauraceae, Fagaceae), which in part is responsible for the destruction of water source valleys.
- **Higher medium altitude mountain (1800m to 2300m).** Tropical forest in the cloud mountain with a prevalence of mosses and epiphytic plants (Orchidaceae, Ericaceae, Pteridophyta). In some level areas the families of Fagaceae, Platanaceae, Elaeocarpaceae, Ericaceae and Araliaceae are dominant. The families Theaceae, Ericaceae are dominant on the steep slopes including in the 'Elfin' forest. In this band, there was evidence of *Fokienia* logging and cardamom plantations in the valleys.
- **High altitude band (2300m to 2800m).** The 'Elfin' forest is dominated by Ericaceae, Rhodoleiaceae, Theaceae, Aquifoliaceae, Lauraceae and Araliaceae. The elfin-pointed leaf forest (sub-tropical) has *Tsuga* as the dominant species with the presence of Magnoliaceae, Rosaceae and many different epiphytic plants (Ericaceae) growing in the old trees.
- **Top adjacent band (2800m to 3143m).** This mountain band mostly is dominated by small bamboo (*Bambusa* - 'truc') and scattered with some trees (Ericaceae, Rosaceae). Also present are thick, low shrubs (Berberindaceae, Theaceae), the herbs of Asteraceae, Ranunculaceae, Cyperaceae, Lycopodiaceae, Apiaceae etc., and some 'Elfin' forest species (mosses) with *Rhododendron* in some narrow valleys and mountain crevices.

Besides our classification, we would like to present here a classification made by Mr. Nguyen Thien Hung who established the route to Fansipan peak himself in 1986 and has conducted years of voluntary study on the mysteries of the Fansipan. The names of the mountain bands used by him and other guides are affected by romantic ideals, but still aptly describe the characteristics of plant communities. Among the hunters, path finders and tourism guides these names have become common and acceptable.

- The lowest band on the mountain at 1200-1500m is bare, the forest has nearly disappeared with only weeds and shrubs remaining. Several patches of secondary forest remain with some fig trees (*Ficus* spp.) and woody ferns (*Cyathea* sp.). There are many fruit trees and shrubs in this area, so in the mornings many birds concentrate here for feeding.
- The mountain band from 1500m to 2300m is an area of primary forest which has been selectively exploited. No big trees of *Fokienia* remain, neither does the big *Shorea* sp.
- From 2300m to 2500m is the 'Fruit and Flower' mountain - the scenery is so picturesque as to made us think of the 'Fruit and Flower' mountain and the 'Pure Water' cave in the traditional story of the Monkey

King. In spring and the beginning of summer there are many Rosaceae flowers here. Between 2100m and 2400m, the path is very steep and long, and is named 'Sky's Gate' slope.

- From 2500m to 2700m is the 'Fairy Scenery' forest. The shrubs here are low, bending and covered by mosses; an area usually sunk in cloud which gives us a romantic and miraculous feeling. This area is characterised by old conifers with rounded or pointed leaves, being climbed upon by the Ericaceae shrubs and other epiphytic plants, which looks very beautiful and impressive.
- Above 2700m is the forest of short bamboo (also called feather-duster bamboo). This kind of bamboo is 40-150 cm in height, depending on the site and effect of the elements. The bamboo stem is skinny, ivory yellow, and resembles a feather duster.

## Results

### **Lowland mountain soils (1200m to 1400m)**

Local minority peoples have been resident for a long time and most of the big trees have been cut from whole mountain sides near villages. Also areas along the streams and valleys have been cut. The minority peoples live by cultivation, hunting and fishing in the Muong Hoa river. On the hillsides and valleys is a system of terrace fields for paddy rice, maize and cassava. The productivity of these crops is very low and especially after opium production was banned, living standards have remained low. Hunting is a traditional habit of the H'mong people. The rifles (muskets) are made by the H'mong people themselves and gun powder is and sold cheaply in Sa Pa market; in the mountains the echo of gunshots and the noise of trees being felled is common. They shoot almost any animal found in the mountain including birds, small rodents, civets and forest cats.

The H'mong houses are made from wooden planks cut and sawn in the forest, each plank about 2m long, 30-50cm wide, 4-5cm thick. They use fuelwood for cooking, heating and cardamom drying. In winter months, many people go to the forest to make charcoal for sale in Sa Pa. A few small forest patches exist; they are secondary or retrograde primary forest (along Vang river near the route to Fansipan). The topography is not very steep (about 20° -30°), the surface soil layer (1.5-2cm) is feralitic. The woody vegetation contains the families Podocarpaceae, Cupressaceae, Fabaceae, Elaeocarpaceae, Lauraceae, Burseraceae, Simaroubaceae, Myrtaceae, Theaceae, Meliaceae, Juglandaceae, Moraceae, Sapindaceae, Euphorbiaceae, Ulmaceae, Annonaceae, Sterculiaceae, and maybe Taxaceae, Sapotaceae, Anacardiaceae, and some individuals from Dipterocarpaceae. The dominant species usually come from the genera *Podocarpus*, *Dacrydium*, *Fokienia*, *Lithocarpus*, *Quercus*, *Castanopsis*, *Michelia*, *Elaeocarpus*, *Lindera*, *Litsea*, *Caryodaphnopsis*, *Amoora*, *Dillenia*, *Engelhardtia* and *Hopea* and *Vatica* from Dipterocarpaceae. At the present time, there are some single fig trees (*Ficus*) and some bamboo (cf. *Dendrocalamus*) up to 12-14m high. On the mountain sides, the woody ferns (cf. *Cyathea*) (2-6m high) are present.

Even though the forest is all but destroyed, soil erosion on these mountain slopes is not considerable. This is a result of its soft and absorbent characteristics so that it reduces surface rain streams and surface erosion. This characteristic is very favourable for the process of regeneration.

### **Lower medium altitude mountain (1400m to 1800m)**

There are some small patches (1-3ha) of forest here which we considered to be primary forest. The topography here is more complex. Besides the forest covered slopes (20-30°) and some relatively flat areas, there are also some steep slopes up to 60°. In this mountain band, there has been selective logging. The illegal loggers work in groups and when they find trees, they cut down and plank on the spot. The first choice of these loggers are the big trees from Fagaceae (*Lithocarpus*) and Lauraceae (*Caryodaphnopsis*). These trees are often 35-40m high, D = 70-90cm, with an estimated age of 120-160 years. The composition of this forest was identified essentially by some remaining large trees, the young trees, natural seedlings and tree stumps. The vegetation structure here is complex and includes many strata.

1<sup>st</sup> stratum (H = 40-50 m): none-closed canopy with the presence of 'Po Mu' (*Fokienia*) - with some stumps 150cm in diameter, *Podocarpus* - H - 45m, D - 120cm; young trees H - 30m, D - 70cm, Fagaceae (*Lithocarpus*, *Castanopsis*) - still young and quite common) and Lauraceae (*Lindera*, *Cinnamomum*, *Caryodaphnopsis*) - growing and common.

2<sup>nd</sup> stratum (H = 20-30m): patches in this stratum were conserved and represented by Magnoliaceae (*Manglietia*, *Michelia*), Elaeocarpaceae (*Elaeocarpus*), Juglandaceae (*Engelhardtia*, *Juglans* spp.), Rubiaceae, Hamamelidaceae, Rhodoleiaceae (*Rhodoleia*), Sterculiaceae (*Pterospermum*, *Sterculia*).

3<sup>rd</sup> stratum (H = 10-20m): *Acer*, *Ficus*, *Ostodes*, *Gonocarium*, *Dillenia*, *Ternstroemia*, *Diospiros*, *Schefflera*,

*Trevesia*, Annonaceae, Meliaceae.

4<sup>th</sup> stratum: the major participants are Rubiaceae (*Lasianthus*, *Hedyotis*), Myrsinaceae (*Ardisia*), Euphorbiaceae (*Phyllanthus*, *Antidesma*), Rutaceae. The shrub stratum (under canopy stratum) were separated and dominated by Rosaceae (*Rubus*), Melastomataceae.

Herbs growing along streams essentially come from Begoniaceae (*Begonia*), Balsaminaceae (*Impatiens*), Urticaceae (*Pelionia*, *Pouzolia*), Pandanaceae (*Pandanus*), Aristolochiaceae (*Asarum*), Cyperaceae, Rubiaceae (*Ophiorrhiza*, *Hedyotis*), Zingiberaceae (*Zingiber*, *Alpinia*, *Amomum*), Selaginellaceae, Polygonaceae (*Polygonum*), Polygalaceae (*Polygala*), Araceae (*Colocasia*, *Amorphophalus*, *Arisaema*), Asteraceae, Solanaceae, Convalariaceae (*Polygonatum*, *Disporum*, *Liriope*, *Peliosanthes*, *Ophiopogon*), Hypoxidaceae (*Curculigo*), Marratiaceae (*Angioperis*), Acanthaceae, Trilliaceae, Melastomataceae, Scrophulariaceae, Commeliaceae, Poaceae, Verbenaceae, Platiagiaceae, Rosaceae, Ranunculaceae, Juncaceae, Pteridaceae, Costaceae (*Costus*).

The vegetation outside these strata includes some semi-epiphytic species: Araceae (cf. *Epipremnum montanum*); epiphytes: *Asplenium* cf. *Nidus*, *Drynaria*, Orchidaceae, Ericaceae, Gesneriaceae, Asclepiaceae (*Hoya*), Polypodiaceae, Hymenophyllaceae. The lianas of genera *Uncaria*, *Albizia*, *Bauhinia*, *Smilax*, *Ficus*, *Piper*, *Stepania*, *Dioscorea*, *Tetrastigma*, *Cissus*, *Gnetum*, *Calamus*, *Vernonia*, *Schizandra*, *Uvaria* and also Curcubiaceae, Apocynaceae, Annonaceae families are present.

The slopes here are more or less steep, but there are nearly no areas of flat topographical forest. In our opinion, the band (1750-1800m) is an original plant-geographical border line between the humid tropical forest in lower belt and the cloud / moss forest in the higher belt. The band of altitude here should be separated in an independent belt, because its plant composition is similar to the band of 1400-1600m, but with differences in topography elements.

From 1700m to 1750m, first appeared plants of *Betula* and *Platanus* which can not find in lower altitudes. The vegetation is very complex as there are some big trees up to 40m high, the trunks sometimes up to 170cm (Rubiceaea). Most dominant are Fagaceae (*Lithocarpus*, *Castanopsis*). There are some *Fokienia* stumps remaining (100-120cm in diameter). Other tree families which are also common are Magnoliaceae, Aceraceae, Betulaceae, Lauraceae, Euphorbiaceae, Rubiaceae, Fabaceae and some Rosaceae.

#### **Higher medium altitude mountain (1800m to 2300m)**

The topography here is very multiform: the mountain veins alternated with steep slopes and some relatively flat areas appearing like soil hills. The forest was protected from human activity by the long and high slopes, so that it appeared in primary condition. However there was evidence of man's intervention, for example the *Fokienia* were cut, there were poaching paths across the area, cardamom (*Amomum costatum*) plantations along streams with even some of the bigger trees cut out.

From an altitude of 1800m, besides species from the families of Fagaceae and Lauraceae, Ericaceae (*Rhododendron*) was present as well as Theaceae (*Ternstroemia*) and Platanaceae (*Platanus*). It is difficult to determine the most dominant family. On slight slopes and relatively flat places, the dominance belong to Fagaceae, Lauraceae, Platanaceae, Sterculiaceae, Elaeocarpaceae, Magnoliaceae, Araliaceae, Aceraceae, Betulaceae, Ericaceae, Theaceae, Rhodoleiaceae, Cupressaceae (young trees), Verbenaceae, Rosaceae, Juglandaceae and Aquifoliaceae.

One specific characteristic of this mountain band is the bamboo forest under canopy (cf. *Arundinaria*). On the mountain veins and steep slopes, Theaceae, Ericaceae, Magnoliaceae, Rhodoleiaceae, Lauraceae, Cupressaceae, Aceraceae, Betulaceae, Rosaceae families are present.

The epiphytic plants include Orchidaceae, Licopodiaceae, Polypodiaceae, Aspleniaceae, Davalliaceae, Hymenophyllaceae, Vittaraceae, Lepidopteridaceae, Gesneriaceae, Ericaceae, Bryophyta and also Rosaceae, Araliaceae.

#### **High altitude band (2300m to 2800m)**

The band is covered by rattans, mosses and pointed leaved trees (Fruit and Flower mountain, Fairy Scenery forest and Sky's Gate slope); the rocky outcrops and ridgelines are bare. The mountain vein is between 2 and 60m wide, with the slope from 2300 to 2600m being relatively flat (20-30°) and the sides of the mountain ridges (veins) being 30-40° (sometimes 40-60°). The whole area is still covered with forests. These forest structures

vary depending on their geographical conditions. On the narrow ridges, stone-grown species exist close together, with a morphology of bending stems and triangular canopies ranging from 2 to 4m high. Mosses are present on stems and major branches and lichens present on small sprigs. The mosses are bound around the stem increasing the diameter from 8-14cm to around 16-25cm. On the wider ridges trees reach up to 12-16m with diameters from 30 to 90cm. The canopy here is thick, rounded or oval with the  $R_{Cr} = 3-6m$ .

The vegetation contains some dominant gymnosperms from the Pinaceae family. Other dominant families include Magnoliaceae, Rhodoleiaceae, Ericaceae, Rosaceae. Also present are Theaceae, Fagaceae, Lauraceae, Aquifoliaceae, Illiciaceae, and individual species from Verbenaceae, Elaeocarpaceae, Betulaceae, Araliaceae.

Epiphytes include Orchidaceae, Polypodiaceae, Hymenophyllaceae, Ericaceae, Rosaceae, Melastomataceae, Convallariaceae; lianas: Smilacaceae, Schizandraceae, Myrsinaceae. Parasites include the Viscaceae family. Herb families represented are Bambusoideae, Cyperaceae, Balsaminaceae, Gesneriaceae, Asteraceae, Araceae, Melastomataceae, Rubiaceae, Convallariaceae, Orchidaceae, Selaginellaceae, Lycopodiaceae, Aspleniaceae, Aspidiaceae, Pteridaceae, Dryopteridaceae, Gleicheniaceae.

On stone surfaces water mosses (*Sphagnum* sp.) grow amongst green mosses. *Sphagnum* does not appear on the stems or branches. Among these mosses, lichens are common. Moss species include - *Russula*, *Amanita*, *Xerocomus*.

+ The vegetation on mountain veins

On slight slopes (10-30°) in a 2300-2600m band the vegetation is similar to the vegetation from the 1600-1800m band, for example *Platanus*, *Betula* are not present and very few *Acer* individuals which disappear after 2400m.

The first conifers (*Tsuga*) are present from 2350-2400m. The forest here contains 2-3 strata and normally possess a closed canopy.

First stratum contains trees 20-22m high, dominated by Fagaceae (*Lithocarpus*, D = 70-90cm), Rhodoleiaceae (*Rhodoleia*, D = 40-50cm), Magnoliaceae (cf. *Manglietia*, *Michelia*, D = 30-40cm), and occasionally Lauraceae (D = 40-50cm), Theaceae (cf. *Schima*, D = 40cm). The canopy is dense, rounded or oval,  $R_{Cr}$  4-6m.

Second stratum is sparse, usually 5-12m high containing families Ericaceae (*Rhododendron*, H = 7- 12m, D = 30-40cm), Theaceae (*Eurya*, *Ternstroemia*, H = 10m, D = 20cm), Verbenaceae (*Vitex*), Rosaceae (*Cotoneaster*, *Prunus*, *Pygeum*), Aquifoliaceae (*Ilex*), Araliaceae (*Schefflera*), Lauraceae. Tree stems are twisted which is characteristic for *Rhododendron* sp.. At the trunk base of some species (Fagaceae, Lauraceae) the root system is modified in to a plate on the ground with a tap-root 2-3m deep.

Third stratum is composed of some individuals of Rubiaceae (*Lasianthus*), *Ilex* (H = 1.5-2m, fruited), Annonaceae.

The herb layer contains Bambusoideae (cf. *Arundinaria*, H = 1.2-2m, D = 8-12m with a density up to 300 stems/1m<sup>2</sup>). Beneath the bamboo layer Convallariaceae (*Liriope*, 20-30cm high, ratio of covering is 30-50%), Aspleniaceae, Melastomataceae, and some individuals of Orchidaceae, Cyperaceae, Polygalaceae are present.

Trans-strata plants include epiphytes on stems and a canopy of Orchidaceae (mostly *Pholidota* and *Caelogyne*). Also present are Pteridophyta (found on branches with *Lepisorus*, *Hymenophyllum*, *Grammitis*, *Polypodium*, solitary examples of *Vittaria*, *Asplenium*, *Phymatodes*), Lycopodiaceae (*Lycopodium* on branches), Convallariaceae (*Polygonatum* cf. *punctatum*, on stem bases amongst mosses). There are not many lianas, just some examples of Smilacaceae (*Smilax*), Myrsinaceae (*Embelia*) creeping on the bamboo. In the Fansipan area, *Smilax* is distributed from 2900 to 3143m altitude. At fruiting time birds feed on the fruit. Other species such as *Embelia* is quite common in North Vietnam from 600-700m altitude., but is present here at 2900m. The fruit is small (2-5mm), succulent and scarlet with a long fruiting period.

+ The large mountain ridge from 2500m

This ridge area reaches up to about 2700m, being 700-900m long, with a 10-20° gradient. The vegetation is sparse (canopy covered ratio about 0.4 to 0.6). The plant composition here is different compared with the lower

area. The most dominant family is Pinaceae, and other families present being Magnoliaceae and Rhodoleiaceae. Fagaceae which very dominant in lower bands is rare at this altitude. Tree health status here is not very good: many small branches were dry and on the bark, horse hoof fungi (*Formes*) is present. For the lower layer Ericaceae, Rosaceae, Theaceae, Lauraceae, Aquifoliaceae, *Vitex* and sometimes *Schefflera* are present.

+ Fairy Scenery Forest (2300-2700m), the vegetation on narrow mountain ridges

The Fairy Scenery forest is distributed from 2300 to 2700-2900m but at 2900m only a few small patches are found behind the mountain, being protected from strong winds. The plants grow on narrow veins of 2-4m wide, with a soil layer 15-30 cm thick and root systems which go through crevices and under stones; stems lean and are twisted; stem bases are larger and branching begins at 0.5-1.5m height; the canopy is very dense at 2-4m high with stem diameters ranging from 8-20cm (mostly 10-14cm). Stems and low branches are covered by a moss bed. The structure of forest on the mountain veins and slopes are similar. On the narrow veins, the foundation species is bamboo - 'truc' (H = 3-4m, D = 2-3cm). On the slopes, 'truc' grows sparsely. The ground here is a moss bed 15-20cm thick, and apart from green mosses and *Sphagnum*, lichens such as *Cladonia* are present.

+ Mountain belt from 2600-2800m

The mountain ridge is 2-4m wide, with a general gradient of 10-30° (occasionally 40-60°); dark-black soil, 20-40cm thick with deposits of calcium and granite gleys; moss covered stones; a layer of fallen leaves (mostly bamboo); some small worm casts (7cm high). Trees H = 2-5m, D = 13-20cm; moss covered base in a layer 5-8cm thick, mosses were also present on main branches with small branches being lichen covered; canopy is low ( $H^0_{cr} = 0.4-1.5$ ) and very dense. Plant composition includes Theaceae (*Eurya*, *Ternstroemia*, *Thea*, *Adinandra*), Rhodoleiaceae (*Rhodoleia*), Ericaceae (*Rhododendron*), Magnoliaceae, Aquifoliaceae (*Ilex*), Lauraceae (cf. *Lindera*, *Cinnamomum*), Fagaceae (solitary - *Quercus*), Rosaceae (solitary - cf. *Prunus*, leafless), Araliaceae (*Schefflera*), Pinaceae (*Tsuga*, solitary - *Abies*). the distance between stems is 0.1-1.5m (commonly 0.3-0.7m).

The under canopy stratum is not clearly presented or is fragmented containing some representatives of the Rubiaceae and Aquifoliaceae families. Ground plants include Poaceae (Bambusoideae) with H = 3-5m, D = 2-3cm and at a density of 30 stems/m<sup>2</sup>, about 20% of these bamboo tillers were dead with the bases covered by moss species. Some solitary plants of Gesneriaceae (*Boae*), Convallariaceae (*Liriope*, *Polygonatum*), Cyperaceae (*Carex*) were present. Epiphytes included Parmelia, Ramalia, Stricta with an absence of orchids and ferns. Parasites included Lauraceae (cf. *Korthalsela*) and Viscaceae (*Viscum*).

Slopes mostly face to North and Northwest with many outcropped steps 1-3m wide and covered by a layer of moss species (20-25cm thick) from families Polytrichaceae, Bryaceae, Sphagnaceae. The fallen leaf layer is very thin on the slopes and very thick (15-20cm thick) in depressed areas and terraces with leaves mostly from woody trees. Identifying the leaf slabs under 10-12cm, we found the representatives of Ericaceae, Pinaceae, Theaceae, Magnoliaceae. There are many small rootlets in the leaf layer with a surface root system, which in places is exhibited on soil or stone grounds. The height of trees on the slopes and terraces are different; on the terraces, normally H = 5-6m, D = 15-25cm and on the slopes H = 3-4m, D = 5-12(16)cm. The tree canopy is thick, multiform ( $R_{cr} = 1-3m$ ,  $H^0_{cr} = 1-2m$ ) and creates a closed canopy forest. The trees are almost deciduous from *Rhododendron*, *Michelia*, *Rhodoleia*, *Eurya*, cf. *Prunus* (leafless at the time of observation). *Tsuga* was present on the higher part of slopes. In this area moss species were present but not grasses. The plant composition at 2700-2800m is thick clumps of bamboo (truc), some solitary trees and shrubs and also particular vegetation types in some narrow valleys and mountain crevices.

### **Top adjacent band (2800m to 3143m)**

There is much low bamboo (truc) in this area. The mountain ridges (veins), peaks, sides and ravines dominated by bamboo of *Arundinaria* and *Phyllostachis*. The height of bamboo depends on mountain aspect, gradient and topography; in depressed areas and relatively flat slopes: H = 3-4m, D = 2-3cm (*Phyllostachis*); on the mountain veins, steep slopes and peaks: H = 0.4-1.7m, D = 0.8-1.2cm (*Arundinaria*). Under the low bamboo a thick layer of green moss and water moss species (15-25cm thick) is present. Lycopods (*Lycopodium*), *Rhododendron*, Theaceae, Rosaceae and *Smilax* climbers grow on the moss layer; and on the sun bathed stones Asteraceae (*Solidago*), Apiaceae, Poaceae, Cyperaceae, Rubiaceae (cf. *Galium*) are present. Among the bamboo clumps, there are some medium sized trees of *Rhododendron* (H = 2.5-3m, D = 14-20cm,  $R_{cr} = 1-11.5m$ ,  $H^0_{cr} = 1.2-1.5m$ ), cf. *Prunus* (leafless when observed), small shrubs with canopies (R = 0.3-0.6m) from the family Theaceae (*Thea*, cf. *Camellia*), Ericaceae (*Vaccinium*, *Rhododendron*),



Magnoliaceae, cf. Rutaceae, Rosaceae, Berberidaceae (*Berberis*). The shrubs normally grow on the peaks and the higher part of slopes facing to South. Some *Berberis wallichiana* (a foundation species in the sub-Alpine band) reaching up to 1.6m high and 0.8m in canopy radius. Mosses and lichens grow on the stones; and in the crevices there are some vegetative regeneration of Ericaceae and Theaceae.

### Fairy Scenery Forest in narrow valleys (Moss/Cloud forest)

A layer of soil deposition is present in the narrow valleys of the top adjacent band (sub-Alps) and on the mountain splits. An area of dominant *Rhododendron* vegetation has taken shape with evidence of surface water under the soil layer. The valleys beneath the slopes have a watershed function. Rainwater and condensed water (from clouds and fog) flow along the crevices and slopes to the valleys and take shape in system of small streams under deposited soil layer. In the narrow valleys there is a particular micro-climate: the clouds blow up along mountain sides in morning and day time and blow down in evening. During the day the cloud usually condenses on stones and moss.

The vegetation has only one stratum with some species of *Rhododendron*, H = 6-8m (particularly H = 10m), D = 20-40 cm, R<sub>cr</sub> = 2-4m, H<sup>0</sup><sub>cr</sub> = 3-4m. The canopies are triangular or oval. Leaves grow in horizontal planes, are big (20-30cm long, 8-10cm wide), tough, with short petioles. Other woody families found here are the Magnoliaceae, Verbenaceae (*Vitex*), Lauraceae, Rosaceae, Araliaceae (*Schefflera*), Theaceae (*Thea*, *Eurya* H = 1-4m), Aquifoliaceae (*Ilex*) and some individuals of Fagaceae. On stems small leaved epiphytes are present - Ericaceae (cf. *Vaccinium*). Common shrubs are *Berberis* H = 1,5m, R<sub>cr</sub> = 1.2m (fruiting when observed with many vegetative small plants), *Rubus* (long stems, creeping in the moss layer and formed into bushes 1.5m high). Rocks, stems and branches often covered by a coat of green and yellow mosses and ferns. In some areas of rock, the communities of ferns are thick and abundant so the green mosses are not observable. The common ferns are *Vittaria*, cf. *Nephrolepis*, *Polypodium*, *Grammitis*, *Calymnodon*, *Hymenophyllum* and *Sphenomeris*.

On the stone surface and in the moss layer is *Rumohra*, other species off Urticaceae, Melastomataceae, Cyperaceae, Convallariaceae (*Polygonatum*, *Liriope*), Balsaminaceae (*Impatiens*), Polygalaceae (*Polygala*), Polygonaceae, Gesneriaceae, Rubiaceae (cf. *Galium*) Violaceae (*Viola*), and *Vaccinium*. The small bamboo *Arundinaria* is present are the lianas *Smilax* (fruiting) and *Kadsura*.

All the trees are deciduous with the time of leaf fall varying between species: In December and January, *Vitex* leaf fall is heavy, Rosaceae (cf. *Prunus*) in leaflets and *Rhododendron* leaves falling singularly. Fallen leaves are deposited on stone walls and crevices reaching 20-30cm thickness in places. Through identification down to 15cm, we found Ericaceae (3-4 species). Under the leaf litter there is a bed of coarse humus and peat with dense roots. Tree root systems are well developed in the soil layer (calcium, sand, gneiss), with the roots on the ground being 20-30cm in diameter (stem diameter is only 30-45cm). These roots spread 2-4m from bases and turn down to the soil layer.

### Bare rock outcrops at 2500m, 2900m and 3143m

The plants are sealed within organic matter deposition places such as crevices, slits, and stone holes etc. At 2500m altitude on stone surfaces, lichen from genus *Cladonia* is present. Orchid genera *Caelogine* and *Bulbophyllum* are also presence. In soil humus areas, there are Gentianaceae (*Gentiana* with purple-blue flowers), Poaceae, Cyperaceae, Pteridaceae (cf. *Pteris* - the fern with tough, comb shaped leaves), Saxifragaceae and *Tsuga* (above 2500m), Theaceae, Ericaceae, Rosaceae. The habitats approach drought and sub-drought. In December and January, the stones and plants covered by hoarfrost, sometimes snow.

### Fansipan Peak - 3143m

Total peak area is about 100-150m<sup>2</sup>, the rock surface rough and covered by a thick layer of mosses (5-10cm). The foundation plant is bamboo (cf. *Arundinaria*), 0.5-1.2m high (bamboo on the slopes can be 2-3m high, cf. *Phyllostachis*), shrubs present are *Thea*, *Berberis*, *Cotoneaster*, *Rubus*, Magnoliaceae, *Vaccinium* - H = 0.5-0.9, R<sub>cr</sub> = 0.2-0.5m, and also small trees *Rhododendron*, cf. *Prunus* (H = 2-2.3m). Herbs include *Carex*, cf. *Galium*, *Solidago*, *Lycopodium*, Ranunculaceae, Apiaceae, Poaceae and the lianas: *Smilax*. On the Fansipan slope, at 2900-3000m, we saw solitary plants of *Arisaema*.

### Conclusion

Fansipan mountain and adjacent areas in Lai Chau province (western section of the Hoang Lien mountains) are a very unique region of northern Vietnam, where there still remains a large area of closed canopy primary

forest in a mountain habitat. The flora of the west part less closely resembles mountain area of Yunnan, China. At high altitude and adjacent areas the dominant taxa are typical for Yunnan mountain area.

By analysing and dividing Fansipan into vegetation belts according to altitude, the spacial structure and botanical characteristics of these belts can be described. The biodiversity is highest in lowland areas. Here used to be tropical rain forest with several domination species. Nowadays due to excessive utilisation tropical rain forest is only just maintained in disconnected patches, but the total number of species still able to be described makes the area wealthy. The exploitation at low and medium altitude areas has resulted in localised extinction of some precious gymnosperms especially on the flatter areas.

We recorded in low and medium bands the presence of Pinaceae and Cupressaceae. In the future with more detailed investigation of this area (especially the narrow valleys, the disguised mountain ravines and steep sides) we hope to discover more species of these families as well as Taxaceae, Cephalotaxaceae, Podocarpaceae. Due to selective exploitation and hill-land cultivation, there are no large *Fokienia* trees in accessible places and the species is only present as young trees in regenerating areas.

## **THE MAMMAL FAUNA OF HOANG LIEN NATURE RESERVE**

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### **Introduction**

The first data about Hoang Lien - Sa Pa mammal fauna was recorded from the French time. In the early years of 20<sup>th</sup> century some foreign scientists, for example Keley - Rosesvelt and Delacour, investigated in the Sa Pa area and published a list of 48 mammal species which included 5 bat species, 21 rodents species, 11 carnivore species, 8 insectivore species, 1 species of artiodactyl and 2 primate species.

During the time of the People's Republic of Vietnam, though there were still many difficulties, the National Committee for Sciences and Technologies and Hanoi National University carried out some expeditions to investigate the baseline information on the mammals of northern Vietnam. In the Hoang Lien mountain area, they collected 18 mammal species including 8 bat species, 3 insectivore species, 5 rodent species and 2 carnivore species.

In addition, bat surveys were carried out by Hungarian scientists in 1966, 1971 and 1985. The results and collection of these surveys are maintained in Budapest Museum and IEBR.

At present time, Frontier-Vietnam in co-operation with Vietnamese scientists continues to study the mammal fauna in Hoang Lien Nature Reserve.

This has been a multilateral collaboration between Frontier-Vietnam, College of Forestry, Hanoi National University, and the Institute of Ecology and Biological Resources. It has operated systematically since 1994 until now and continues with the attendance of many first-rate experts, for example Cao Van Sung, and Pham Nhat, Frontier-Vietnam has a great number of overseas collaborators and researchers who can work in difficult conditions in the high and remote areas for a suitable period of time required by expedition standards and methods.

Data from previous surveys has been inherited, so in some cases it is quite straight forward to expand or further research certain questions, although methods have developed, for example in 1994, the research consisted of 'mammal' interviews and observation; in 1995, the work was supplemented with data on bats; and during this expedition (October- December 1997), in addition to previous methods, a survey on the population structure of small mammals in different forest has been conducted.

Some obstacles were encountered. The nature reserve's natural conditions are changing in an unfavorable way for mammal survival, therefore studies have to be carried out in a more meticulous manner. The research methodology and point of view have also quite reasonably changed, for example, previously it was possible to identify after hunting, whereas now interviews and the observation of tracks and signs is conducted. It is only

certain small mammal groups that are abundant (such as bats and rats) that can be collected by trap and net in order to study population structure and changes. This does not disturb natural development as the mammals are trapped, marked and released. Under these conditions, Frontier-Vietnam and Vietnamese scientists have conducted three expeditions in March to May, 1994; January to March, 1995; and October to December, 1997 in many different sites in the Hoang Lien Nature Reserve area.

### Research methodology

1. Interviews the hunters and local people, observations of horns, antlers, skins, furs etc. in their houses and on the market.
2. Field investigation: transect observation of tracks, dung etc. of large mammals; observations of active species, e.g. squirrels.
3. With some mammal groups with diversified species composition and high density such as bats, rats, insectivores the suitable methods are bat-netting and small mammal traps to collect, identify and research regional fauna, population structure, species density, altitudinal distribution in various ecological habitats.

### Research results

Summarizing the data of investigations, interviews and collections from 3 expeditions of Frontier-Vietnam, we have a list of 66 mammal species belonging to 50 genera, 25 families and 8 orders. The most diverse order is Carnivora with 20 species of 6 families such as Viverridae, Felidae, Mustelidae. The second is Rodentia with 18 species of 5 families including Scuridae, Rhizomyidae, Muridae, Hystricidae. The bat order - Chiroptera although not studied thoroughly so far contains 10 species from 3 families, Peropodidae, Rhinolophidae and Vespertilionidae. The insectivora order of this region is more diverse than other regions with 7 species from 3 families so far identified. However some valuable mammal groups belonging to the orders Perissodactyla, Artiodactyla and Primates are now considered very rare.

In the zoo-geographical relationship, the Sa Pa mammal fauna contains clear elements characteristic of the Indo-Himalayan fauna with 23 species (35%) known. Then follows the Yunnan (14 species - 21%) and Indo-malayan (13 species - 20%) component. The endemic element includes 6 species, under 10% of the total.

Many species from the Hoang Lien mountains mammal fauna are listed in the 'Vietnam Red Data Book - Part 2: Animals'. These species need to be researched and protected.

In 1994 the expedition observed directly the samples and tracks of 38 mammal species; in 1995, this number was 33; and now in the last 2 months, there is evidence of only 25 mammal species, mainly bats and small mammals.

In this recently concluded expedition, the following have been collected and measured: 5 species of rodent and insectivore, 10 species of bat, and by direct observation the evidence of 10 other mammal species such as bear foot prints and dung, foot prints and barking sounds of muntjac and a giant flying squirrel which was shot by local people.

Information regarding distribution and abundance of small mammal species has been collated and the results are in line with general ecological principles. Small mammals such as rats and insectivores are concentrated in secondary forest near cultivated fields or villages, especially in limnophore areas (border effects); in the primary forest, scrub savanna and bare land, the density was much lower. The highest abundance found was 50% (50 individuals/100 traps/night) in the edge of secondary forest; in other forest types, this level was from 5 to 10%.

Detailed data will be analysed and published in Frontier-Vietnam / IEBR technical reports so interested organizations will be able to consult these, however some initial comments are given below for the purposes of this seminar:

1. Small mammal density in the nature reserve area is considered high, but the quantity of carnivores is very low. It is likely that the results of hunting and trapping activities of local people has affected the ecological balance. There may be consequences to the crops with regard to pestilence and disease.
2. The bat fauna in the nature reserve is quite abundant, even for particular species such as the small-toothed whiskered bat and the lesser horseshoe bat. The bats hold a very important role of insect killing and the scattering for the forest fruits and seeds.
3. The wild artiodactyls in the nature reserve (muntjac, serow and wild boar) are step by step being irradiated by hunting or being driven away to far forests and being replaced by the domestic cow, buffalo and goat in an overloaded ecological sense. This could be considered uncontrolled damage to the

natural evolution of the forest with some areas of forest not able to regenerate naturally any longer. This makes forest protection work would be more difficult and costly.

The discussion on common ideas and feasible methods to protect and develop the forest and animal resources of Hoang Lien mountains is very pressing and necessary. It needs the collaboration of many branches and levels and from a professional point of view as a mammalogist, I hope that this paper will contribute.

## **BUTTERFLY FAUNA OF THE HOANG LIEN MOUNTAINS COLLECTIONS 1994-1995**

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### **Introduction**

The butterfly and moth fauna of the south-east Asian region has been relatively well studied, with major identification works published for Thailand (Pinratana, 1979-1997), Malaysia (Corbet & Pendlebury, 1992), Laos (Akira & Negishi, 1989) and the Oriental region as a whole (D'Abrera, 1982-1986). In addition, 'Studies of Chinese Butterflies' edited and published by Satoshi Koiwaya (1989) is valuable in studies of Vietnamese butterflies. In addition, there are a number of detailed taxonomical works, often dealing with individual taxonomic groups, including Evans (1932, 1949 on Hesperidae); Lee (1962-1986); Aoki & Uemura (1982, 1984 on Satyridae); Shirozu & Shima, (1979); Yata (1989-1995), etc. However, work on butterflies in the region has been concentrated in certain areas (notably Thailand, Malay peninsula, Taiwan, China), and relatively little is known about the butterflies of Vietnam.

The first attempt to produce a comprehensive list of Vietnamese and Indochinese Lepidoptera was published in 1919 (Vitalis de Salvaza, 1919) and included 611 butterfly species. Major collections of butterflies were made in the mid twentieth century, and a preliminary checklist of 455 species in Vietnam was published in 1957 (Metaye, 1957). However, from 1957 there are not any other large-scale inventory works. In two Vietnamese works, published in 1973 and in 1975 resulting from inventory survey, the total number of butterfly species collected was much lower than that in previous works. More recent work has been carried out by a team from the Czech Academy of Sciences, who have conducted studies of butterfly ecology in Tam Dao National Park near Hanoi (Leps & Spitzer, 1990; Novotny et al. 1991, Spitzer et al., 1993) and other sites.

In addition, butterfly specimens have been collected from several sites by Vietnam-Russia Tropical Centre (VRTC), Hanoi (Monastyrskii et al. 1995; Monastyrskii & Bui Xuan Phuong, 1997) and by the Frontier-Vietnam Forest Research Programme (FVFRP), which has conducted biodiversity surveys in a range of nature reserves and national parks in the northern and central regions of Vietnam. Since 1994, biodiversity surveys including butterfly collection has been carried out in seven protected areas by FVFRP and in five areas by VRTC: Hoang Lien Nature Reserve (Lao Cai); Pu Mat and Bu Huong NR (Nghe An); Ba Na NR (Quang Nam, Da Nang); Na Hang NR (Tuyen Quang); Muong Nhe NR (Lai Chau); Ba Be National Park (Bac Can); Tam Dao NP (Vinh Phu); Ba Vi NP (Ha Tay); Bach Ma NP; Vu Quang NR (Ha Tinh).

This paper compares the results of work carried out in the Hoang Lien mountains and other Vietnamese sites, and describes records of interest.

### **Biogeographical distribution**

Information on the world-wide geographic distribution for each species collected was derived from previous works on Vietnamese butterflies (Leps and Spitzer, 1990; Spitzer et al, 1993), and those of the Indo-malayan region (Lekagul et al., 1977); Corbet and Pendlebury, 1992). Butterflies in Vietnam fall into one of several biogeographic categories;

**Restricted-range;** found only in northern Vietnam and adjacent areas of China (and sometimes Laos);

**Indo-Malayan;** found throughout the Indo-Malayan (Oriental) region;

**Palaeoarctic**; primarily restricted to the old-world temperate region, but extending into the Indo-malayan region in southern China and northern Vietnam;

**Cosmopolitan**; Wide-ranging, found in several continents (e.g. *Vanessa cardui*, Nymphalidae)

Although the restricted range species are amongst the most important for their conservation value, this category is ill-defined, as the distributions of butterflies in Vietnam, Laos and southern China are not fully known. Particularly in the case certain families (e.g., some of the Satyridae), there is insufficient existing information to estimate ranges.

The biogeographical composition of butterfly communities in all of the areas studied is broadly similar, with the majority of species restricted to the Indo-Malayan (Oriental) region. However, Sa Pa had a particularly high proportion of its fauna made up of typically Palaeoarctic species, in comparison to sites at lower altitude (Ba Be) and further south in Vietnam (Bu Huong, Ba Na). Overall, 10.5% of all species in the Sa Pa list (see appendix) are characteristic of the Palaeoarctic region.

### Species records

To date, the complete list of Papilionoidea (Lepidoptera) of Sa Pa consists of 83 species from 8 families collected on Fansipan (see appendix). There are undoubtedly a large number still to be collected at this site, as the families Hesperidae and Lycaenidae are virtually absent.

The list of butterflies collected by Frontier-Vietnam in Sa Pa contains a number of interesting records, including species previously unknown in Vietnam, or found well outside their previously known ranges.

Of three new species discovered by Frontier-Vietnam in the period 1994-7, one species was caught in Sa Pa; this was a satyrid species of genus *Ypthima*, yet to be described (Uemura and Monastyrskii, in prep.).

Several other species, for example *Graphium glycerion* (Papilionidae) and *Ypthima sakra* (Satyridae) and *Pontia daplidice* (Pieridae) are new records for Vietnam (Y. Uemura, pers. comm.).

Some of the species taken at Sa Pa have not been collected at any of the other Vietnamese sites studied in recent years. A group of species including the papilionid *Graphium glycerion*, pierids *Pontia daplidice*, *Colias fieldi*, *Dercas nina* and *Aporia agathon*, nymphalids *Childrena childreni* and *Auzakia danava*, and satyrids *Neope pulaha* and *Ypthima sakra*, were found only in Sa Pa.

Some species were observed outside their known ranges, as recorded in previous works on the Lepidoptera of Vietnam. These included *Gandaca harina* (Pieridae), the distribution of which is given by Metaye (1957) as 'central' (central Vietnam).

### Conclusions

The butterfly fauna of Sa Pa is unique within Vietnam, and contains a number of species characteristic of the Palaeoarctic region not found in other Vietnamese sites. One new species has been collected recently at Sa Pa, and it is likely that a number of other unknown taxa are also present; a complete list of the butterflies of Fansipan contains few species of Hesperidae or Lycaenidae, although these groups are likely to be highly diverse. Further collection over a period of several seasons is likely to provide highly interesting information on the butterflies of Vietnam.

### Butterfly Species of Fansipan Mountain Massive collected during Frontier-Vietnam & Russian expeditions (with commentary)

\* - Sino-Himalayan species; \*\* - Palaeoarctic species

#### *Papilionidae*

\**Atrophaneura polyeuctes polyeuctes* Doubleday, 1842

1M, March, 1995, (FR). This species is characteristic for south and west China (ssp. *philoxenus* Gray, 1831)

*Pachliopta aristolochiae* Fabricius, 1775

1M, Apr.-May, 1994, (FR).

*Chilasa epycides* Hewitson, 1864,  
1M, April, 1994, (FR). This rare species is well known from Tonkin (Metaye, 1957).

*Graphium (Pathysa) agetes agetes* Westwood, 1841  
1M, Apr.-May, 1994, (FR).

*Graphium agamemnon agamemnon* Linnaeus, 1758.  
1M, April-may 1994, (FR).

\**Graphium cloanthus* Westwood, 1841  
Dubois E. et R. Vitalis de Salvaza (1919): 215

\**Paranticopsis phidias* Oberthur, 1896.  
Few species from several museums in the world are labelled "N. Vietnam, Ngai Tio 4800ft".(D'Abrera, 1983). This species was mentioned in the Metaye's work (1957),but from Annam. Has not been collected for a long time.

*Paranticopsis xenocles* Doubleday, 1842  
N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

*Paranticopsis macareus* Godart, 1819  
N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

\**Pazala glycerion* Gray, 1813.  
Mar., 1993, 1M, (coll. by Dr. G.V.Kouznetsov); Mar.,1994, 1! (FR). Himalayan species which have been recorded in Metaye's list (Metaye, 1957). It was recorded in north Thailand recently (Pinratana,1995). Species was recorded in Sa Pa during spring months

*Papilio helenus* Linnaeus, 1758.  
1M, Apr.-June, 1994 (FR).

\*\**Papilio bianor* Cramer, 1776.  
1M, Apr.-June, 1994 (FR).

*Papilio protenor* Cramer, 1775  
1M, Apr.-June, 1994 (FR).

*Papilio paris* Linnaeus, 1758  
1M, Apr.-June, 1994 (FR).

*Teinopalpus imperialis* Hope,1843  
Dubois E. et R. Vitalis de Salvaza (1919):216

*Meandrusa sciron* Leech, 1890 (=gyas Westwood)  
Dubois E. et R. Vitalis de Salvaza (1919):215

*Meandrusa payeni* Boisduval,1836  
Dubois E. et R. Vitalis de Salvaza (1919):215

### **Pieridae**

*Delias pasithoe tonkiniana* Fruhstorfer, 1905  
Apr.-June, 1994 (FR).

*Delias beladonna beladonna* Fabricius, 1793  
1M, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov);  
1M, Jan.-Mar., 1995 (FR).

*Delias hyparete* Linnaeus, 1758  
1M, Jan.-Mar., 1995 (FR).

*Aporia agathon* Gray, 1831  
1M, Apr.-June, 1994 (FR).

\*\**Pieris erutae* Pouchade  
1F, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).  
1#, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 26.10-3.11.1994, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).  
Sometimes this species has been confused with *Pieris melete* Menetries

\**Pieris cisseis* Vitalis de Salvaza  
1#, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 28.10-3.11.1994, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

\*\**Pieris napi mandarina* Leech, 1893  
Sa Pa, M, No. 40 Jan.-Mar 1995 (FR). O. Yata.

*Pieris rapae* Linnaeus, 1758  
1M, Apr.-June, 1994 (FR);

\*\**Pieris brassicae nepalensis* Doubleday, 1846  
1M, Jan.-Mar, 1995 (FR).

*Pieris canidia* Sparrman, 1768  
1M, Apr.-June, 1994 (FR); 1!, Jan.-Mar, 1995 (FR).

\*\**Pontia daplidice* Linnaeus, 1758  
1M, Apr.-June, 1994 (FR)

*Appias albina* Boisduval, 1836  
1M, Apr.-June, 1994 (FR)

*Appias indra* Moore, 1857  
1M, Apr.-June, 1994 (FR)

*Appias lyncida*, Cramer, 1777  
1M, Apr.-June, 1994 (FR)

*Prioneris thestylis* Doubleday, 1842  
1M, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

*Dercas verhuelli* van der Hoeven, 1839  
1M, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).  
Apr.-June, 1994, (FR); 1!, Jan.-Mar, 1995 (FR).

\**Dercas nina* Mell.  
Sa Pa, M, No. 56, Jan.-Mar., 1995 (FR)

\*\**Colias fieldi* Menetries, 1855  
1F, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov);  
Jan.-Mar, 1995 (FR)

*Gandaca harina* Horsfield, 1819  
Jan.-Mar, 1995 (FR)

## **Danaidae**

*Parantica sita* Kollar, 1844

Apr.-June, 1994, (FR); Jan.-Mar, 1995 (FR)

*Parantica aglea* Stoll, 1782

1\*, Cha-Pa, 20.03.1969, leg. V. Solaynikov (ex coll. Dr.V.Tuzov).

*Parantica pedonga* Fujioka, 1970

5M, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov);

1F, N. Vietnam, Mt. Fansipan, 2200m, .06.1994, leg. V.Sinyaev (ex coll. Dr.V.Tuzov).

This species was described from danaid material collected by Japanese expedition to Nepal in 1963.

According to literature it is spread throughout Sikkim, India and Pedonga (Ackery, Vane-Wright, 1984).

*Parantica melaneus* Cramer, 1775

1M, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

1M, N. Vietnam, Mt. Fansipan, 2200m, .06.1994, leg. V.Sinyaev (ex coll. Dr.V.Tuzov).

*Euploea mulciber* Cramer, 1777

1M, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov);

1M, Apr.-June, 1994 (FR)

*Euploea core* Cramer, 1780

1M, Apr.-June, 1994 (FR)

### **Nymphalidae**

*Acraea issoria* Hubner, 1819 (According to the other nomenclature this species belongs to Acraeidae)

1M, 1F, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg.

V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

*Cethosia biblis* Drury, 1773

1#1\*, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

\*\**Childrena childreni* Gray, 1831

1M, Apr-June, 1994 (FR). Sino-himalayan fauna species which has been discovered in Thailand recently (Dinratana, Eliot, 1996) and the same time is well known from Tonkin (Dubois, Vitalis de Salvaza, 1919; Metaye, 1957).

*Cirrochroa tyche* C. & R. Felder, 1861

1M, Apr-June, 1994 (FR)

\*\**Vanessa indica* Herbst, 1794

1M, Jan.-Mar, 1995 (FR).

\*\**Vanessa cardui* Linnaeus, 1758

1M, Jan.-Mar, 1995 (FR).

\*\**Kaniska canace* Linnaeus, 1763

1M, Jan.-Mar, 1995 (FR).

*Symbrenthia hypselis* Godart, 1824

1M, Apr-June, 1994 (FR); 1M, Jan.-Mar, 1995 (FR).

*Junonia orithya* Linnaeus, 1758

1M, Apr-June, 1994 (FR).

*Hypolimnas sororia* (?author) (= *Hypolimnas diomea* Hewitson)

1M, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex



coll. Dr.V.Tuzov).

Apparently this is a misidentification, so far as *H. sororia* is known from Sulawesi (D'Abrera, 1985). Evidently it is the *Hypolimnas bolina* Linnaeus, 1758 - which has many subspecies and forms in Oriental region

*Hypolimnas bolina* Linnaeus, 1758

1M, Apr-June, 1994 (FR).

*Cyrestis cocles* Fabricius, 1787

1M, Apr-June, 1994 (FR).

*Neptis soma* Moore, 1858

1M, Apr-June, 1994 (FR)

\**Limenitis daraxa* Doubleday, 1848

1M, Apr-June, 1994 (FR)

\**Auzakia danava* Moore, 1858

1M, Apr-June, 1994 (FR).

Sino-himalayan species is known from Tonkin.

*Parthenos sylvia* Cramer, 1775

1M, Apr-June, 1994 (FR); 1M, Jan.-Mar, 1995 (FR).

*Polyura athamas* Drury, 1773

1M, Apr-June, 1994 (FR)

### **Riodinidae**

*Zemeros flegyas* Cramer, 1780

1M, Apr-June, 1994 (FR)

*Dodona adonira*

(probably a misidentification)

2M, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

*Dodona ouida* Moore, 1866

1M, Apr-June, 1994 (FR)

*Dodona egeon* Doubleday & Hewitson, 1851

1M, Apr-June, 1994 (FR)

*Abisara echerius* Stoll, 1790

1M, Jan.-Mar, 1995 (FR).

*Stiboges nymphidia* Butler, 1876

1M, Jan.-Mar, 1995 (FR); 1#, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

### **Satyridae**

*Melanitis leda* Linnaeus, 1758

1#, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov);

1M, Apr-June, 1994 (FR)

*Neorina patria* Leech, 1891

Dubois & Vitalis de Salvaza, 1924:29. Chapa, Tonkin

*Ethope noirei* Janet, 1896

Vane-Wright & Huggins, 1972:5. Lao Kay

*Lethe sura* Doubleday, 1849  
Dubois & Vitalis de Salvaza, 1924:28. Chapa, Tonkin

*Lethe rohria* Fabricius, 1787  
Dubois & Vitalis de Salvaza, 1924:28. Chapa, Tonkin *Lethe* sp.  
1#, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

*Lethe kansa* Moore, 1858  
1M, Jan.-Mar, 1995 (FR).

*Lethe verma* Kollar, 1844  
1M Apr-June, 1994 (FR)

\**Neope pulaha pulahoides* Moore, 1892  
1M, Jan.-Mar, 1995 (FR); Dubois & Vitalis de Salvaza, 1924:29. Chapa, Tonkin

\**Neope armandii* Oberthur, 1876 ssp.  
Dubois & Vitalis de Salvaza, 1924:29. Chapa, Tonkin

*Ypthima baldus* Fabricius, 1775  
1M, Jan.-Mar, 1995 (FR).

\**Ypthima sakra* Moore  
1#, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov);  
New record for Vietnam  
1M, Jan.-Mar, 1995 (FR).

*Ypthima* sp. Uemura & Monastyrskii (in prep.)  
4M, 2F Jan.-Mar, 1995 (FR).

### ***Amathusiidae***

*Faunis aerope excelsa* Fruhstorfer, 1901  
Brooks, 1949:256. Syntypes 2M, 2F, Chapa

*Aemona amathusia tonkinensis* Rothschild, 1916  
Brooks, 1949:256. Holotype 1M, Laokai [Tonkin] (BMNH)

*Stichophthalma howqua tonkiniana* Fruhsorfer, 1901  
Dubois & Vitalis de Salvaza, 1924:32. Chapa, Tonkin; Brooks, 1949: 257-258. Syntypes 4M, 4F, Chapa, Tonkin (BMNH).

\**Stichophthalma neumogeni regulus* Brooks, 1949  
Brooks, 1949: 258. Syntypes 2M, Chapa, Tonkin (BMNH).

*Enispe euthymius sychaeus* Brooks, 1949  
Brooks, 1949: 259. Holotype 1M, Chapa, Tonkin (BMNH).

### ***Lycaenidae***

*Tongeia potanini* Alpheraky, 1889  
1#, N. Vietnam, Mt. Fansipan, N. Side, 1600m, "primary forest", 20-30.10.1995, leg. V.Sinyaev & E.Afonin (ex coll. Dr.V.Tuzov).

\**Heliophorus hybrida* Tytler, 1912  
4M, Jan.-Mar, 1995 (FR).

\**Heliophorus brahma* Moore, 1824  
1M, Jan.-Mar., 1995 (FR).

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## **AMPHIBIANS OF THE HOANG LIEN NATURE RESERVE**

**Mr. Steven R Swan**

Assistant Research Coordinator, Frontier-Vietnam

### **Summary**

The amphibians of the forest have been studied in the Hoang Lien Nature Reserve as a crucial part of the Frontier-Vietnam ecological monitoring programme. As a result of this survey work hundreds of amphibians have been observed and recorded. All except one of these observations were of anurans, the exception being a single urodele record.

A tentative species list of 31 different species has been compiled from the amphibian research of this recent expedition. These species represent the major anuran families to be found in Vietnam: Ranidae (the 'true frogs'), Bufonidae (the 'true toads') and Rhacophoridae (the tree frogs). Final taxonomic determination of species is conducted by one of Frontier-Vietnam's collaborating scientific institutes, namely the Reptile and Amphibian laboratory of the Paris Natural History Museum.

### **Methodology and Results**

The range of species recorded in the Hoang Lien Nature Reserve is a diverse one with respect to size (the largest frog observed being 150 times heavier than the smallest!), colour (from intensely cryptic toad species to bright and conspicuous tree frogs), and form (every shape from slender frogs with exceptionally long limbs to great fat toads of a short and stocky build).

The diversity of these animals was matched by the wide variety of micro habitats which they inhabited: large lower order rivers on valley floors, small trickling streams running straight down the mountain side, ponds and pools, in the trees, in the paddy fields, underground (!), almost anywhere.

Many of the amphibians recorded are either rare or threatened species. Many are also of great value to scientific research and conservation.

To observe these amphibians it was necessary to search the rivers and streams of the forest during the day and at night. 24 different survey sites were established throughout the reserve. At each of these sites Research Assistants would spend 4 hours looking for amphibians during the day and 4 hours at night. Although some amphibians were seen during daylight hours, most were found at night. To locate the frogs each site was scoured, looking in any potential micro habitat that may yield an observation: pools, rocks, foliage, etc. Occasionally the call of a frog or toad was used to locate the animal. However, this method was not employed regularly since our survey was conducted out of the breeding season, and therefore most anurans were silent.

When a frog was discovered detailed notes were made on (a) where the animal was found (altitude, forest type, distance from water, etc.), i.e. specific details on the micro habitat, and (b) the animal itself (it's size, shape, eye colour, colour of the belly, head, back and legs, etc.), information to be used for identification purposes.

All the information recorded on the amphibians will be compiled to produce a scientific paper describing in general terms the species observed, and more specifically their micro habitat requirements.

### **Rationale for the Study of Amphibians**

Having outlined the results and methodology of the amphibian research conducted during the October-December 1997 expedition, it is perhaps important to ask why so much attention and effort is concentrated on this group of animals. Why do we study the amphibians of the forests around Sa Pa? We can answer this question at two different levels.

Firstly in general terms. Amphibians, as a group, are good indicators of general levels of vertebrate diversity. This feature is particularly important when we consider the difficulties in surveying levels of mammal diversity in the reserve. Amphibians are far better candidates, than say mammals, as indicators of vertebrate diversity, for they occur at relatively high densities and can easily be observed, dispensing with the need to trap animals. Amphibians also make good indicators of environmental deterioration as a direct result of their species-specific micro habitat requirements. Employing amphibians in this manner has previously been done for forests in other parts of the world, making any data collected in the Hoang Lien mountains comparable to prior environmental monitoring surveys.

Secondly, with specific respect to the Hoang Lien mountains, amphibian research in this area is of great scientific importance nationally, for the reserve is a unique habitat in Vietnam. In the forests of the Hoang Lien mountains we see the convergence of three distinct biogeographical realms, the Sino-Himalayan, Indo-Malayan and Palaeoartic. The overlap of these three realms leads to a unique species composition of exceptional diversity. Also, since the amphibians of this region have received little attention from the scientific community, there exists genuine opportunity for new and interesting discoveries.

Hopefully, with Frontier-Vietnam / IEBR continued involvement in the Hoang Lien mountain area, we can begin to construct a comprehensive picture of the amphibian populations of the reserve. By comparing the results from different expeditions we may start to observe trends in the seasonal and altitudinal variation in species composition.

Following the dynamics of the frog and toad populations of the forest can also provide us with an understanding of how populations of other vertebrate groups, and indeed the forest itself, changes with time and the varying impact of the local human population.

## **BIRDS OF THE HOANG LIEN MOUNTAIN FOREST**

**Mr. Andrew Tordoff**

Scientific Research Coordinator, Frontier-Vietnam

### **Why are birds important?**

Birds are good indicators of disturbance: many species are restricted to good quality forest and certain species are very sensitive to hunting pressure.

If eco-tourism is ever to be developed in Sa Pa district, the diverse bird fauna of Hoang Lien Nature Reserve will be one of the principal draws for specialist visitors.

Hoang Lien Nature Reserve is home to many rare species, a large proportion of which are only found at high altitudes. Five resident species are listed in the 1996 IUCN Red List of Threatened Animals (IUCN, 1996) as "Vulnerable". These are Ward's Trogon (*Harpactes wardi*), Rufous-necked Hornbill (*Aceros nipalensis*), Woodsnipe (*Gallinago nemoricola*), Beautiful Nuthatch (*Sitta formosa*), and Yellow-billed Nuthatch (*Sitta solangiae*). The nature reserve is, therefore, an important site for conservation of bird diversity globally.

Over the course of Frontier-Vietnam survey October-December 1997, 151 bird species were reliably identified, three of which are listed as "Vulnerable" in the 1996 IUCN Red List of Threatened Animals (IUCN, 1996). If we include a further 115 species recorded during previous Frontier-Vietnam surveys of the nature reserve (Kemp et al., 1995), we arrive at a list of 266 species for the Hoang Lien mountains. This list can be expected to grow over the course of the programme. This represents a large and diverse bird fauna, including many species specialised to high altitude habitats.

During mid-October, a raptor migration of unprecedented proportions for northern Vietnam was observed. Over the course of one week, thousands of raptors were seen flying west over Dinh Deo pass, en route between China and their wintering grounds in China and East Africa. What made this migration extraordinary was not only the numbers of birds but the rarity of some of the species involved. For example, only 3 Amur Falcons (*Falco amurensis*) had ever been recorded in Vietnam before (J. Eames, *pers. comm.*), yet over 1400 were observed during the Frontier-Vietnam survey. One species, the Greater Spotted Eagle (*Aquila clanga*), had not

been recorded for Tonkin previously.

### Threats to the Bird Fauna of Sa Pa District

It is unfortunate that the rich bird fauna of Sa Pa district is currently under threat. This threat comes from three directions:

(1) *Habitat loss*. Many species are restricted to good quality forest; deterioration of this habitat threatens their continued survival. Many species are altitudinal migrants, which spend the summer at high altitudes and migrate to low altitudes during the winter months. Unless suitable habitat is preserved at all altitudes, these species will be lost. This is a particular problem in Sa Pa district where the majority of habitat loss is occurring at low elevations. It is difficult to develop conservation plans for these species without detailed information about these altitudinal movements. Unfortunately, very little research has been carried out in this area. It is one of the principal aims of the Frontier-Vietnam programme to redress this.

Several key areas for bird conservation were identified outside of Hoang Lien Nature Reserve. One area is the patch of forest to the northwest of O Qui Ho village which is home to at least two globally threatened species. Unfortunately, this area is currently under threat from timber extraction. There is a good case for affording protected area status to an area such as this.

(2) *Hunting pressure*. This problem affects larger birds, such as pheasants and hornbills disproportionately. One large bird, the Rufous-necked Hornbill was last recorded in Hoang Lien Son in 1925 (Delacour & Jabouille, 1931). It may be that this species has already been driven locally extinct by hunting pressure. Very few species of large birds were observed during the recent survey, suggesting that their population sizes are already low. Indirect evidence in support of this comes in the form of observations of hunters beginning to hunt small birds.

(3) *Capture for pets*. Several species of bird, such as Red-tailed Laughing thrush (*Garrulax milnei*) and Chestnut-crowned Laughing thrush (*Garrulax erythrocephalus*), can be seen on sale in Sa Pa and Lao Cai markets. One local man claimed to capture over 30 birds per week for sale as pets; exploitation on this scale is unlikely to be sustainable.

Only the third threat, capture for pets, can be effectively targeted directly. Habitat loss and hunting pressure can only be addressed by alleviating their underlying causes; causes which are linked, ultimately, to the economic situation of the local people.

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## PART TWO An Interest on the Nature Reserve: Organisations and People

### CONSERVATION OF PLANT AND ANIMAL RESOURCES IN VIETNAM

Dr. Le Xuan Canh

## Institute of Ecology and Biological Resources

### Introduction

Vietnam is located in Southeast Asia with a total land areas of about 330,000km<sup>2</sup> and a coastline of 3,200km. The borders with neighbouring countries such as China, Laos, and Cambodia are 4,630km long. Three quarters of Vietnam is mountainous with the highest peak, Fansipan reaching 3143m a.s.l. Even though Vietnam is in the tropics climatic conditions vary from north to south and each region has typical characteristics. In the south the variation of temperature between months is about 3°C, but in the north this variation is 10°C. Almost all parts of the country receive an annual rainfall of about 2,000mm and in some places this reaches 3,000mm. These climatic conditions are very suitable for plant and animal development in different ecosystems. These are the reasons why there is high biodiversity in Vietnam.

### Plant resources

Based on an assessment by the Ministry of Agriculture and Rural Development, the remaining forested area in Vietnam is about 9 million hectares occupying about 27.7% of total land area. Vietnam's forests are a source of many important products for the people, the big national programmes and for different industries. The main products are wood and medicinal plants. High quality forest which yields about 150m<sup>3</sup>/ha of wood occupies about 11% of forested areas in Vietnam. Currently it has been estimated that about 35- 45 million cubic metres of wood and fuelwood are extracted from the forest each year with 5-10 million cubic metres extracted for wood construction.

Vietnam's forest contain a very precious gene pool, not only for Vietnam, but for the world. Presented in the Red Data Book of Vietnam Vol. 2, 'Plant Species' (1996) is a list of 356 endangered plant species with some on the verge of extinction. Representatives of this group are *Dulempopinus kremffii*, *Glyptos trobus pensili*, *Taxus chinensis*, *Aguilaria crassa*, *Amenlotaxus argotenria*, *Calocedrus macrollpis*, *Dalbergia oliverii*, *afzelia xylocarpa*, *Sindora cochinchinensis*, *Pterocarpus redatus*, *Chukrasia tabularis*, *Dalbergia cochinchinensis*, *Fokienia hodginsii*, *Diospyros mun*, *Markhamia pierreii*, *Burretiodendron sienmu*, and *Padoearpus henuryi*.

One special resource of Vietnam's forests are the medicinal plants. At the present time it has been estimated that there are about 3,000 medicinal plant distributed over the country. These medicinal plants show a very high diversity of species composition and uses. Many of these are endemic species. As a result of unplanned exploitation, many species are becoming rare and endangered. These number in the region of 80 species. Urgent conservation measures need to be taken.

The flora of Vietnam contains a high level of endemism. Endemic genera represent around 3% and include genera such as *Ducampopinus* and *Calobogyne*, whereas endemic species represent about 10%. These are concentrated in 9 main areas such as Hoang Lien Mountains in the north, Ngoc Linh Mountain in the central region, plateau Tay Nguyen in the south and the north of Trung Bo.

### Animal resources

Vietnam is a country with a very high diversity on fauna. Currently described are 275 species and subspecies of mammals, 1026 species and subspecies of bird, 260 reptile species, 82 amphibian species, 500 freshwater fish species and about 2000 marine fish species and hundred thousand invertebrate species. The fauna of Vietnam is not only rich in composition but also has unique characteristics representative for south-east Asia.

According to the ICBP (1992), Vietnam has 3 Endemic Bird Areas (EBA) from a total of 221. In only 5 years (1992-1997) Vietnam has discovered 5 new large mammal species which are: 'Sao La' (*Pseudoryx nghetinhensis*) found in Nghe An, Ha Tinh provinces; Giant Muntjak (*Megamuntiacus vuquangensis*) distributed in an area from Nghe An to Lam Dong province; Khting Vor (*Pseudonovibos spiralis*) in the Tay Nguyen area discovered through its horns; Truong Son Muntjak (*Canimuntiacus truongsongensis*) discovered in 1997 in Hien district of Quang Nam province; and Puhoat muntjak (*Muntiacus puhoatensis*) discovered in Pu Hoat (Nghe An province). In addition new fish species have been discovered in Song Lam, Vu Quang and Quang Binh. New insect and invertebrate species discovered reach in to the hundreds. Apart from newly discovered species, Vietnam has many species of high economic and scientific value, although many are endangered.

### Table 1: Distribution and status of primate species in Vietnam

Species	Distribution						Status	
	DB	TB	BT	NT	N	DH	SD	IUCN
<u>Family: Lorisidae</u>								
<i>Nycticebus pygmaeus</i>	+	+	+	+	+	+	VU	VU
<i>N. coucang</i>	+	+	+	+	+		VU	
<u>Family: Cercopithecidae</u>								
<i>Macaca nemestrina</i>			+	+			VU	
<i>M. mulatta</i>	+	+	+	+			LR	LR
<i>M. arctoides</i>	+	+	+	+			VU	VU
<i>M. assamensis</i>	+	+	+	+			VU	VU
<i>M. fascicularis</i>						+	LR	LR
<i>Trachypithecus cristatus</i>						+	VU	LR
<i>T. francoisi</i>	+	+	+				EN	VU
<i>T. phayrei</i>		+					VU	DD
<i>Pygathrix avunculus</i>	+						CR	CR
<i>enemaeus</i>				+	+		EN	EN
<u>Family Hylobatidae</u>								
<i>Hylobates concolor</i>	+	+		+			EN	EN
<i>Hylobates gabriellae</i>				+			EN	DD
<i>Hylobates lar</i>					+		EX	LR
<i>Hylobates leucogenys</i>	+	+	+				EN	DD

Key: DB - North east; TB - North West; BT - North of Central; NT - South of Central; N - South; DH - Endemic; SD -Red Data Book of Vietnam, IUCN - According to IUCN Red List; DD - Deficient Data; LR - Low risk, VU -Vulnerable; EN - Endangered; CR - Critically Endangered

In Vietnam there are 16 primate species all of which are described in Red Data Book of Vietnam (1992) under differing categories. Fourteen of these species are described in the Red List of IUCN (1996) with the exceptions being *Nycticebus coucang* and *Macaca nemestrina*. Among the primate species, the Golden Headed Langur (*Trachypithecus francoisi poliocephalus*) occurs only in Cat Ba Island with population numbering less than 200 individuals. Another species the Hatinh langur, *Trachypithecus f. hatinhensis* occurs only in Quang Binh and Ha Tinh provinces.

Population numbers are at about 500 remaining individuals. The Tonkin Snub-nosed monkey (*Pygathrix avunculus*) is an endemic for Vietnam. At present time they occur only in Tuyen Quang and Bac Thai provinces. The population number is at about 180-200 individuals.

Among the carnivore species in the Red Data Book of Vietnam 8 species are endangered. These are Sun bear (*Ursus malayanus*), Black bear (*Ursus tibethanus*), weasel (*Mustela nivalis*), Otter civit (*Cynogale benettii*), the Large spotted civet (*Viverra megaspilla*), Jungle cat (*Felis chaus*), the leopard (*Panthera pardus*), and tiger (*Panthera tigris*). These species were common in Vietnam in the past, but due to loss of habitat and over hunting for medicines and skin they have become very rare. Some of the large carnivores are found only in the national parks and protected areas such as Cat Tien and Yok Don in the south and Muong Nhe in the north.

Elephant were common in Vietnam, but now only few herds remain in some regions along the border with Laos and Cambodia with the population numbering less than 500 individuals. The One horned Rhino (*Rhinoceros sondaicus*) was rediscovered few years ago in the dense forest of Cat Tien (Dong Nai province) and Cat Loc (Lam Dong province) with population numbering 10-12 individuals.

The family Bovidae in Vietnam has some representatives, for example, Banteng (*Bos javanicus*), Gaur (*B. gaurus*), Kouprey (*Bos sauveli*), Water buffalo (*Bubalus bubalis*), Sao la (*Pseudoryx nghetinhensis*) and Wild goat (*Capricornis sumatraensis*). Based on recent observations it appears that the Kouprey has a high probability of existing in the region along the border with Cambodia and Laos, in areas such as Yok Don National Park, Ea Sup forest (Dac Lac province) and Sa Thay, Mon Ray (Kon Tum province), currently with an unknown population. Kouprey is the rarest species in this group. Banteng and Gaur are widely distributed in Vietnam. During three months in the beginning of 1997, IEBR conducted a survey in the Ea Kar district of Dac Lac province in Ea Sup forest. Five groups of Banteng (20 individuals) and 3 groups of Gaur (13 individuals) were observed.

Eld's deer (*Cervus eldi*) is very rare now. The animal can only be found in some area of the Dac Lac and Lam Dong provinces in open forest. Other species of deer such as *Moschus moschiferus* is distributed only in north Vietnam in limestone areas.

Bird fauna is also very diverse. In lowland parts of central Vietnam, 4 endemic species, *Arborophila merlini*,



*Lophura imperialis*, *L. hatinhensis*, and *L. edwardsi* are found. In the Tay Nguyen plateau at elevations greater than 900m 4 endemic species, *Carduelis monguilloti*, *Crocias langbianus*, *Garrulax milleti*, and *Garrulax yersini* can be observed. One of the most important wetland areas in Vietnam is Mekong delta. In 1986, protected area Tram Chim was established for the protection in particular of *Grus antigone sharpii* and at the present time every year from May to November more than 1000 birds visit the area.

Reptile and amphibian species have also become rare too because of the restaurant and medicine trade. About 43 reptile species and 11 amphibian species are described in the Red Data Book of Vietnam.

### Conservation Methods and Exploitation

For conservation purposes, two main methods are used, *in situ* and *ex situ*. The *in situ* method is used for the conservation of whole ecosystems. This method is being used for the protection of endangered endemic species such as the Tonkin Snub Nosed monkey which is distributed only in Tuyen Quang and Bac Can provinces; the Golden Headed Langur distributed only in Cat Ba Island; the Hatinh Langur distributed only in Ha Tinh and Quang Binh provinces and *Lophura hatinhensis* distributed only in Ha Tinh province. The Government of Vietnam has used *in situ* conservation since 1962 by establishing the first national park of Cuc Phuong. There are currently 101 protected areas in Vietnam. The *ex situ* method is important for sustainable development of some plant and animal species which have high scientific and economic value.

There are number of reasons for over exploitation which include: social requirements of the population has increased, but natural resources remain some what limited; deforestation continues; forest fires occur; and hunting pressure is very high.

**Table 2: Number of confiscated animals in 1995-1996**

TT	Locations	Number confiscated	Measures			
			Released	Breeding	Being held	Other
1	TP Ho Chi Minh	57	2	16	12	27
2	Song Be	82	60	4	16	2
3	Lam Dong	52	21	1	26	4
4	Dac Lac	118	6	0	5	107
5	Da Nang	17	11	2	0	4
6	Hue	10	10	0	0	0
7	Nghe An	15	11	3	1	0
8	Ninh Binh	16	4	0	9	3
9	Ha Noi	7	5	2	0	0
10	Hai Phong	2	1	0	1	0
11	Quang Ninh	6	1	0	0	5
12	Lang Son	4	4	0	0	0
13	Son La	4	4	0	0	0
	Total	383	136 = 35.5%	28 = 7.3%	64 = 16.7%	154 = 40.2%

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**HOANG LIEN NATURE RESERVE**

**Mr. Tran Van Phi**

## Vice Director, Hoang Lien Nature Reserve

To all participants,

I would like to present the situation of Hoang Lien Nature Reserve as following:

Hoang Lien Mountains Nature Reserve was approved by the decision No 194/CT dated 9<sup>th</sup> August, 1986 and signed by the Prime Minister.

Ministry of Forestry approved the Technical theoretical factual foundations for the Hoang Lien Mountains Nature Reserve on 5<sup>th</sup> January, 1994.

Lao Cai Provincial People's Committee issued decision No 25/QĐ to set up the Hoang Lien Nature Reserve on 11<sup>th</sup> January, 1994.

### Location

Hoang Lien Nature Reserve is situated from 22°09'30" to 22°21'00" northern latitude and from 103°45'00" to 103°59'40" eastern longitude. It lies in 6 communes and includes 24 sectors belonging to two districts, Sa Pa and Than Uyen:

San Sa Ho Commune	Sa Pa District
Lao Chai Commune	Sa Pa District
Ta Van Commune	Sa Pa District
Ban Ho Commune	Sa Pa District
Than Thuoc Commune	Than Uyen District
Muong Khoa Commune	Than Uyen District

### Main characteristics of the project area

Biological genetic resources:

- The plant and animal species which are found in the nature reserve are very diverse and abundant.
- The nature reserve has many kinds of forest from low altitude tropical forest to high montane temperate forest.
- There are plenty of endemic and endangered plants and animals (50 animal species and 17 vascular plant species are considered threatened), with some species distributed only in the Hoang Lien Mountains.
- Many species are valuable for medicine, perfume, and ornamental purposes.

Scientific research:

- Hoang Lien mountains are considered the best place in Vietnam for scientists to study altitudinal distribution patterns of plants and animals.
- The investigation of species composition and individual density of the plants and animals in nature reserve is very new and interesting.
- Hoang Lien Mountains are a good place for geologists and soil scientists to study the process of rock formation and soil characteristics.
- Basic and applied studies highlight the available resources in the temperate and subtropical forest areas in the Hoang Lien mountain region.

Environmental scenery and historical - cultural legacies:

- The Sa Pa - Hoang Lien mountain area contains ancient stone tablets (an area of 'Cultural Vestiges' issued by the decision of the Ministry of Culture and Communication) which are currently being researched by archaeologists.
- The natural landscape of Sa Pa is very unique and beautiful, and therefore in a good position to serve

tourism, sightseeing and climbing sport.

## Area

Reserve forested areas	
Forest land	17,823 ha
Other land	12,022 ha
Total area	29,845 ha
Functional areas	
Strict protection area	11,875 ha
Ecological restoration area	17,960 ha
Administration and services	70 ha
Buffer zone area	38,724 ha

(source data from 1995's investigation)

## Current socio-economic situation

Population	30,697 people
	4151 households

There are many ethnic minorities living together in Hoang Lien mountains, with their customs being considered as traditional. The literacy level is very low and social vices such as opium use still exist. Some villages are located deep in to the core area, including Seo Mi Ti and Den Thang villages of the Ta Van Commune. These villages have a population of about 300 people in 83 households.

Agricultural production is in the form of paddy rice on terraced fields; dry rice and maize on hill fields; and the cash cropping of species such as cardamom. Sections of the community practice subsistence swidden farming where production areas and housing were not always permanent.

Local infrastructure is not developed and the life is still hard. Some families experience 3-5 months of hunger each year. Due to the lack of roads and transport, socio-economic development is slow.

Also these factors affect forest protection and management work in the area.

## Administration structure of the Nature Reserve

The Lao Cai Provincial People's Committee made the decision to set up a Management Board for Hoang Lien Nature Reserve Project. The total number of current staff is 15 with 8 forest guards in the Forest protection stations and 4 communes.

The Forest Protection Stations: One has been built in San Xa Ho Commune, and it is anticipated that five more will be built in the coming year. It is expected that a total of twenty-two seasonal workers will be required locally.

The project plans in for the rangers and commune leaders in and around the nature reserve area to organize local people for training on the Law of Forest Protection and Development, and the regulations regarding the nature reserve. It is hoped that certain good habits can be created by instigating for example 'an oath-taking ceremony' for forest protection. In addition the project plans to allocate forest land to each family, set up a 'sing and mark system' for forest protection and create 11 forest protection groups in 11 villages.

It is the policy to allocate the forest land to families (or family groups) and also pay for commune staff to take part in the forest protection work. The numbers involved are likely to be four people in each commune (being paid 100,000VNĐ / person / month, although this payment is not yet stable).

## Materials, technical facilities and funding

Forest Office house, Forest Protection stations: 435m<sup>2</sup> (office: 205m<sup>2</sup>, 2 stations: 230m<sup>2</sup>).  
 Means of transport: motorbike  
 Information exchange equipment: mobile telephone.  
 The office equipment and the facilities for prevention of forest fires.

The total investment funding from 1994 - 1997 was 3 billion VND, mostly from Decree 327 funds (local funds). As a result the nature reserve has accomplished the following:

Forest protection: 6635 ha, 409 families were allocated forest land.  
 Delineated area for regeneration: 400 ha, 15 families.  
 New plantation: 736 ha, 187 families.  
 Infrastructure: 435 m<sup>2</sup> of office and Forest Protection Stations.

In four years of the project, the Hoang Lien Nature Reserve has always tried to combine practicable programs with the promotion of forest importance to the local people. Despite some of the above mentioned achievements, the nature reserve still faces many difficulties. These include the following:

- Inadequacy of invested funding, so that the programs are sometimes executed without synchronicity.
- The local people's living standards are low, with some people inside core area still destroying forest for farming.
- The equipment and facilities for forest protection and management are lacking.

## Petitions

The execution of Hoang Lien Nature Reserve Project following the approved 'Technical theoretical factual foundations' still has many difficulties, especially a funding problem. The nature reserve is always willing to invest more funds from the government and also from other international institutions. The nature reserve always welcomes technical expertise to organize and manage the project area better. We hope that interested organizations will pay more attention and wholly support the project in order to protect and develop the biodiversity of Hoang Lien Nature Reserve.

## BIODIVERSITY OF MEDICINAL PLANTS IN HOANG LIEN MOUNTAINS

**Mr. Dinh Van My**

Head of Sa Pa Station for Medicinal Plants

### Introduction

Within the flora of Vietnam, the diversity of medicinal plant species is very large. Some traditional medicinal plants may have been lost through the exploitation of forest products and by encroachment of land for swidden agriculture. Therefore the work of medicinal plant protection has to involve forest conservation and reforestation, which contributes generally to sustaining the ecological balance and conservation of the areas biodiversity.

For many years, the minority peoples who live in the Hoang Lien mountains have been known to use medicinal plants for health protection and treatment of different diseases. Mostly, the medicinal plants in the Hoang Lien mountains were collected and used in a spontaneous manner from area of natural forest where the micro-environments are suitable to their growth. The local people used them following medical prescriptions which have been handed down from their ancestors.

### Recent Developments

However recently collection has occurred without attention to sustainable properties of these medicinal plants. This has been especially the case for precious and rare plants in the Sa Pa area, for example the following collections have occurred:

- From 1973 to 1975: mass exploitation made of Hoang lien ba gai (*Berberis wallichiana* DC.) approaching to extinction.
- From 1981 to 1984: exploitation with a large quantity of Hoang lien chan ga (*Coptis chinensis* Franch.) for sale in Ho Chi Minh city.
- From 1990 to 1993: exploitation of the following species:

Cu binh voi (*Stephania rotunda* Lour.)  
Co nhung (*Anoectochilus lylei* Rolfe ex Downies)  
Tam that rung (*Panax bipinnatidus* Seem.)  
Ba kich (*Morinda officifolis* How)

- From 1996 - 1997: exploitation of Hoang ba (*Phellodendron amurense* Rupr.), Hoang dang (*Fibraurea tinctoria* Lour.), Hoang tinh (*Polygonatum kingianum* Hemls.) for sale in China.

From this chronicled list we are fully aware of the need for the conservation of medicinal plants. There is a definite need for a comprehensive programme to be run in conjunction with the results of plant diversity research in the Hoang Lien mountains. There follows some suggested mechanisms to achieve this:

### Conservation of some medicinal plant species in Hoang Lien mountains

#### (a) *Ex-situ* conservation

To set up a 'field bank' of medicinal plants for the various research institutions, which in Sa Pa include:

- Sa Pa Medicinal Plant Station - Institute for Pharmaceutical Materials, MoH
- Sa Pa Forestry Farm
- Sa Pa Nature Reserve Office
- Ham Rong Tourism Project area

The objective would be the trial planting of selected endangered species from the Hoang Lien mountains to research ideal conditions for future survival and supply needs of, for example the health industry. Below is a list of species that have been identified for such purposes

Tam that hoang	- <i>Panax bipinnatidus</i> Seem.
Hoang lien chan ga	- <i>Coptis quinquesecta</i> Walp.
Hoang lien gai	- <i>Berberis wallichiana</i> DC.
Tho hoang lien	- <i>Thalictrum foliolosum</i> DC.
Hoang lien o ro	- <i>Mahonia nepalensis</i> DC.
Ngu gia bi gai (2 species)	- <i>Acanthopanax</i> spp.
Ngu gia bi chan chim (4 species)	- <i>Schefflera</i> spp.
Don chan chan	- <i>Aralia armata</i> (Wall.) Seem.
Thong thao	- <i>Tetrapanax papyriferus</i> (Hook.) K. Koch.
Hoang tinh vong	- <i>Polygonatum punctatum</i> Royle ex Kunth.
Hoang tinh cach	- <i>Polygonatum</i> sp.
Ngoc truc	- <i>Polygonatum odonatum</i> (Mill.) Druce.
Bay la mot hoa	- <i>Paris polyphylla</i> Sm.
Co nhung	- <i>Anoectochilus lylei</i> Rolfe. Ex Downies
Thien thao	- <i>Basilicum polystachion</i> (L.) Moench.
Binh voi (3 species)	- <i>Stephania</i> spp.

Si to (2 species)	- <i>Didissandra</i> spp.
Te tan (2 species)	- <i>Asarum</i> spp.
Che day	- <i>Ampelopsis cantoniensis</i> (Hook. et Ann.) Planch.
Trong dua	- <i>Ardisia crenata</i> Sias.
Tuc doan	- <i>Dipsacus japonicus</i> Miq.
Dang sam	- <i>Codonopsis javanica</i> (Blume) Hook.f.
Chua du	- <i>Elchontzia blanda</i> (Benth.) Benth.
Cau tich	- <i>Cibotium barometz</i> (L.) J. Sm.
Tho phuc linh	- <i>Smilax glabra</i> Roxb.
Cot toai bo	- <i>Drynaria fortunei</i> (Kuntze) J. Sm.
Bach hop	- <i>Lilium brownii</i> F. E. Brown
Phong ky	- <i>Stephania tetrandra</i> S. Moore
Dam duong hoac	- <i>Epimedium brevicornus</i> Maxim.
Thach xuong bo	- <i>Acorus lataninowii</i> Schott
Huyet dang	- <i>Sargeritodoxa cuneata</i> (Oliv.) Rehd. Et Wils.
Ha thu o do	- <i>Polygonum multiflorum</i> Thunb.
Tien ho	- <i>Peucedanum decursivum</i> (Miq.) Maxim.
Kim ngan	- <i>Lonicera japonica</i> Thunb.
Tuc doan	- <i>Dipsacus japonicus</i> Miq.
Tho nhan sam	- <i>Talinium patens</i> (Gaertn.) Willd.
Nu lang	- <i>Valerian hardwickii</i> Wall.
Mai gung	- <i>Discorea persimilis</i> Prain et Burk.
Sam cau	- <i>Eleutherine subaphylla</i> Gagnep.
Thach hoc	- <i>Dendrobium nobile</i> Linl.
Ba gac	- <i>Rauwolfia verticillata</i> (Lour.) Baill.
Ba kich lun	- <i>Morinda cochinchinensis</i> DC.
Day dau xuong	- <i>Tinospora sinensis</i> (Lour.) Merr.
Bach bo	- <i>Stemona tuberosa</i> Lour.
Thien mon dong	- <i>Asparagus cochinchinensis</i> (Lour.) Merr.
Bach cap	- <i>Bletilla striata</i> (Thunb.) Reichb. f.
Hoi nuoc	- <i>Limnophylla rugosa</i> (Roth.) Merr.
O dau	- <i>Aconitum fortunei</i> Hemsl.
Hoang dang	- <i>Fibraurea tinctoria</i> Lour.
Day kho rach	- <i>Aristolochia tagala</i> Cham.
Ky tu	- <i>Lycium sinense</i> Mill.
Kho sam	- <i>Sphora flavescens</i> Ait.
Nga truat	- <i>Curcuma zedoaria</i> (Berg.) Roscoe

### **(b) In-situ Conservation**

This is one of the best methods for conserving rare medicinal plants through protection in their preferred natural habitats. In the conservation process, the first step is the investigation into geographical distribution followed by population structure and composition. Structure and genetic make-up also need to be researched if

their use and protection is to be effective. Certain locations within their distribution area should be chosen for regeneration and protection thus maintaining adequate genetic sources of these species. Below are given some examples for suggested protection areas.

- Seo Mi Ti and Den Thang villages of Ta Van commune
- Ngu Chi Son area of Ta Giang Phinh commune
- Can Thang area of Sa Pa commune and Hau Thao commune
- Ta Phin village area
- Ban Khoang commune

### **(c) On-Farm Conservation**

On-farm conservation in the form of forest gardens, farm gardens and protected forest areas could be developed. This involves the policy of land and forest allocation in Sa Pa district. It is suggested here that the government should promulgate these regulations and provide the necessary conditions so that the local people in the mountain area have a vested interest in the conservation process. This is one of the most important factors to be considered for sustainable use of natural resources in the Hoang Lien mountains.

## **THE ORCHID GARDEN & HAM RONG (DRAGON'S JAW) TOURISM AREA**

**Mr. Le Duc Luan**

Director of Lao Cai Provincial Lottery Company  
Director of Management Board, Ham Rong Tourism Project

### **Characteristics of the Ham Rong Tourism Project**

#### **Introduction**

Sa Pa contains many precious features that could become the basis for tourism development in the area.

- **Climate and natural scenery:** The climate is subtropical and temperate, remaining cool in summer. The geological tectonics that have taken shape in the region have created an isolated topography with imposing mountains and hills, that could be considered truly miraculous in nature.
- **Ethnic minorities' cultures:** There are many minority groups that live in Sa Pa, such as H'mong, Dao, Giay and Xa Pho. Each minority has its own particular customs, traditions, cultures and folk arts. It is especially the festivals and religious practices that represent an important part of their culture.
- **Flora and fauna:** The plant and animal species of the region are very numerous as well as being highly diverse. They are also very characteristic for a temperate region and one of the factors that attract visitors. This is especially true of the many native orchids, conifers, 'Acers', and rhododendrons, in addition to the many unique flowering plants.
- **Ham Rong mountain:** With beautiful natural landscape and the diverse rocky blocks, the Ham Rong mountain has enough potential to develop as an attractive and interesting area serving eco-tourism and supporting picnic areas.
- **The Ham Rong tourism area:** Taking into consideration all the above points, the Ham Rong exhibits a number of the features found in the Sa Pa region and provides a focal point with the ability to become an eco-tourism destination in Sa Pa. The Ham Rong tourism area should be able to improve tourism activities in conjunction with protecting the environment and natural scenery of Sa Pa tourism region.

#### **Objectives of the Project**

Tourism activities have an effect on the ecological environment and on ethnic minority culture. However, tourism activities are developing and becoming an important factor in peoples lives. Therefore the solution here

is that we have to develop tourism in a corrected or controlled fashion. Tourism activities have to be executed bearing in mind natural landscape protection, ecological environment protection and conservation of the Sa Pa area integrity, as well as supporting ethnic minority traditions. Therefore, the Ham Rong Tourism Project has defined the following objectives:

1. Set up a mountain tourism area in character with Vietnamese style and suitable for international visitors.
2. Recover the green layer and maintain the endemic and native plant and animal species of Sa Pa.
3. To protect the environment and form a beautiful landscape to serve for tourism development and research on plants such as orchids.

As it is one part of general program for planning and development of Sa Pa, the project would contribute to directing tourism activities, with particular emphasis on its eco-tourism, raising public awareness and being beneficial economically towards the Sa Pa region as a whole. The Ham Rong Tourism Project has a very close relationship with natural conservation.

In order to achieve the above objectives, the Ham Rong Tourism Project area would include some of the following works:

1. *Specified orchard*: Total area up to 70,000m<sup>2</sup> of fruit trees including peach, pear, plum and 'Son Tra' (native tree). The set up of these orchards will be such that areas of natural forest are near by and interspersed by the flower and grass carpets, stones and micro-scenery.
2. *Rocky garden*: Make use of natural rocky ground to construct a rocky garden connected closely to traditional themes, ideals and folk stories of the area. This will be achieved by careful reinstallation and artistic rearrangement of the natural stones.
3. *High altitude garden*: To give expression to forest protection by planting two main trees species which very symbolic for Sa Pa - 'Sa Mu' (*Cunninghamia lanceolata*) and 'Po Mu' (*Fokienia hodginsii*). In addition, other specified species of Sa Pa region will be grown.
4. *Village of Minorities with landscape*: To exhibit and introduce the houses with family equipment and clothes of some of the Lao Cai ethnic minority groups; to exhibit farming implements and farming practices used in the area.
5. *Orchid garden*: Collect and grow the Sa Pa native orchid species in order to serve for sightseeing and scientific research. This place would become an example botanical garden for Sa Pa to conserve the threatened plant species of Hoang Lien mountains.
6. *Auxiliary works*: These include paths, electric system, water supply in order to supplement for above works.

### **Orchid garden**

Facing the possibility of extinction are some endemic plant species, of which orchids are one group. So that the major aim of the orchid garden is the preservation and production of Sa Pa's native orchid species. This is to be achieved in harmonious relationship with landscape architecture to serve for tourism as well as for scientific research purposes.

### **Principles Of Arrangement & Expression**

- The orchid garden's arrangement must be artful, harmonious and sensible to the natural landscape architecture and each individual orchid would be identified. In combination with the hanging bamboo frame system and the upper sections of trees, orchids are being grown. It is hoped that we can express the intervention of man through architecture in a natural garden in a successful way.
- The stone-piled fences, gapped walls, vertical frame system and the tender stone-paved path will make the place appear fresh and in close harmony with nature.
- Each garden is arranged for a particular purpose such as the specimen garden for scientific research, the orchid product garden for visitors and the natural garden for growing orchids in the upper parts of trees.

### **Scale & Amount**

Total area of the orchid garden is 10,000m<sup>2</sup>, within which it is possible to grow about 10,000 orchid plants from 150 native species (excluding some acclimatised species in the productive garden). At the present time, we have 4000 orchid plants ready. The orchid garden also keeps some other native plant groups such as conifers



and rhododendrons (about 100 coniferous trees and 500 rhododendron shrubs are being grown).

### Major Works

- Collection and preservation of all native orchid species in Sa Pa, especially beautiful and threatened species such as *Dendrobium* species.
- Planting and conservation of these collected species.
- Identification and mapping of these species, distributions.
- Breeding of native orchid species and expansion of the orchid garden.
- The arrangement of the gardens up to utility requirements for sightseeing and research etc.
- Experiment and execute a guarantee for the maintenance and development of the orchid garden (watering system, moisture-retention, exhibition room and herbarium).
- Acclimatize and grow the native precious plant species such as rhododendrons, conifers and flowering plants of Sa Pa and the Hoang Lien mountains.
- Develop the orchid garden to become a botanical garden which can conserve the genetic sources of Fansipan, which can in turn serve for tourism and scientific research.
- Trial growing and breeding some imported flower species such as northern European roses, tulips and Dutch gladioli.
- In the future to train bio-technical officers, administrators, and executive staff,

### Petitions

We wish for the technical supports from scientists and interested organizations in order to fully accomplish the aims of the orchid garden project. This would then allow the Orchid Garden to fully participate in the orientation of tourism activities, have a positive effects to the nature reserve and avoid natural resource violation.

## CULTURAL & SOCIO-ECONOMIC PRACTICES OF ETHNIC MINORITIES IN LAO CAI

**Mr. Sung A Sai**

Head of Department of Ethnic Minorities and Religions, Lao Cai

### Introduction

I am very pleased to attend this seminar and workshop about the 'Biodiversity Value of Hoang Lien Nature Reserve and Strategies for Conservation' and we appreciate very much the humanity and precious results of this programme.

As a representative of the Lao Cai Provincial Department of Ethnic Minorities and Religions, I would like to give some opinions regarding the awareness of conservation in Hoang Lien - Sa Pa area. Through this 'seminar and workshop', we hope to realize more clearly our responsibilities to protect the natural areas which still remain in Lao Cai province.

### Cultural and Socio-economic Practices

As a result of the living difficulties and poor education of the local ethnic minority groups, they continue to exploit the forest products; they are removing natural resources and affecting the ecological environment, so that the biodiversity value of the area is being eroded.

In fact, when people disturb the ecological environment, the environment often changes in such a way to make their lives become more difficult in the future. There is a deficiency of water sources for both living and agriculture and natural calamities are common. These factors directly affect local people's lives, and when one considers the lack of sustainability, these people often have limited choices and on occasions have to emigrate to other areas.

Lao Cai contains the remnants of some good forest areas, but these are concentrated in the Hoang Lien mountains in the north-west part of Lao Cai province, belonging to the Bat Xat, Sa Pa and Van Ban districts. The local people in these areas now plant cardamom beneath the forest canopy, so they are aware of the

importance of forest protection. In the eastern part of Lao Cai, the forest has virtually disappeared already, so that in many cases the local people in Lao Cai are trying to preserve and recycle the existing natural resources in Lao Cai.

The chief reasons for natural resource erosion are the survival difficulties faced in everyday life by the local people. They live in high areas, with insufficient agriculture land; their living standard is very low; agricultural farming is at a subsistence level; there is a lack of information, transport and infrastructure, so farming practices which include shifting cultivation are considered normal. In order to practice this, they have to cut down the forest for farming and raise their income from forest products.

In recent years, the Communist Party, government, and provincial authorities have attached special importance to supporting the high mountain people, but so far these efforts have seen little fruition.

The local people's living standard is low because the resources (information, education, roads etc.) necessary for raising their income are lacking. This is evident for example, in Sa Pa market where the local people come mainly to look and meet each other, buying only very necessary farming and household tools. In the last few years, in the time of 'open door policies', tourism has developed and the local people are able to make and sell some handicraft products to raise income.

### **Opinions and petitions for the future**

1. The Central Government and provincial authorities need to issue policies for planning and investigation to protect the forest resources in Hoang Lien mountains, particularly in the Bat Xat, Sa Pa, and Van Ban districts.
2. The first work should be raising the living standard for minority groups that live in high mountain areas. Settled agricultural practices are very important as is the execution of the 'forest allocation to local families' programme. These should be directly supported, especially for cultivation and livestock breeding. ...
3. To make use of overseas and government funds to improve the infrastructure for high areas such as roads, irrigation and communications. Also these funds should be directed towards raising awareness and education for the minority groups in high areas.
4. Issue regulations for management and protection of forest resources; raise awareness about environment for all people from the authorities to local groups, to preserve and recreate the natural resources; and to protect the ecological environment in the region not just for the people of Lao Cai but for Vietnam as a whole.

## **TOURISM IN & AROUND SA PA DISTRICT; A PRELIMINARY STUDY**

**Mr. Mark E Grindley**

Assistant Research Coordinator, Frontier-Vietnam

### **Introduction**

The relationship between tourism and protected areas has undergone rapid change during recent years. Tourism is now seen as one of many non-consumptive uses of protected area resources, as they become more integrated with the local populations which hold the key to their effective survival (KWS 1994; Zube & Busch 1990; Eidsvik). One result has been the evolution of several 'alternative tourism's', which seek, in theory, to provide economic returns to local people for their cooperation in the conservation effort, with minimum cultural and environmental impacts. Ecotourism is one such example, and although not without its problems (Cater, 1994; Wheeler, 1993), it does seem to offer some practical support for conservation by offering economic incentives. Frontier-Vietnam's approach to its work in Sa Pa has been informed by this evolving conservation theory, and by the experiences of protected areas internationally.

Frontier-Vietnam visited the Hoang Lien Nature Reserve (HLNR) from April-June 1994, and January-March 1995, where it conducted a simple tourism survey 'to describe the number and type of tourists [visiting Sa Pa], the existing facilities and needs' (Kemp et. al, 1995). During October and November 1997, a similar study was conducted to qualify changes that had occurred in the nature of tourism focused on Sa Pa, and to investigate the current 'tourism product'. The study also sought to establish possible research questions, and to highlight

ways in which Frontier-Vietnam could assist with the appropriate development of tourism in the area. Of particular concern to Frontier-Vietnam is the actual and potential negative effects of tourism, and the future potential for tourism to better support the conservation aims of the HLNR. This necessarily means giving consideration to aspects of the social and economic welfare of the people living around the reserve, and their relationship with tourism.

## **Methodology and Findings**

During the research period the existing tourism infrastructure was investigated, as well as the attitude of local people towards tourism and the tourist, and the characteristics and perceptions of the tourists themselves. Representatives from Frontier-Vietnam interviewed 20 individuals or groups formally or semi-formally, including local people with a professional interest in tourism, the District Peoples' Committee, the Provincial Lottery Company and the Women's Union, guest house proprietors, tour guides and local teachers.

Discussion with a cross-section of Kinh and minority peoples from the villages around Sa Pa (including Cat Cat, Ta Van, Ta Phin, Ban Khoang, O Qui Ho) has given a broad picture of the local opinion of tourism in the area. Information gathered was mostly qualitative, and saw a general level of agreement between all those consulted. Informal interviews were used to try to establish how people felt about tourism, how they benefited and what they thought the problems were, and this information is integrated in the following discussion section. A tourist questionnaire covering 85 respondents was also used. Due to limitations of space, the following represents a summary of the most important findings, the implications of which are then discussed in the latter portion.

## **The Current State of Tourism and Infrastructure**

Tourism in Sa Pa has grown greatly over the past few years: In 1990 there was only one place to stay in Sa Pa (Lonely Planet, 1997); in 1994, 7 guest-houses provided 165 beds (Kemp et. al, 1995); Now over 50 exist, the 47 largest surveyed by Frontier providing 766 bed spaces. Development of accommodation is continuing, as the popularity of Sa Pa with Vietnamese and Western tourists grows. The impact that this rapid growth is having on the local economy can be seen in the provision of new facilities within the district, from the improvement of the central gardens to the construction of the path from Sa Pa down to the waterfall at the foot of Cat Cat village, nearly complete in two months.

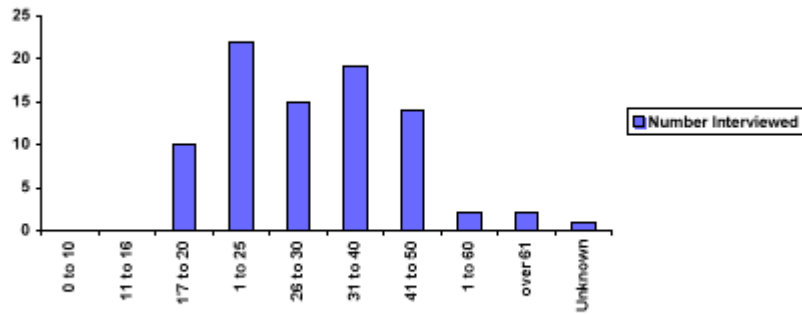
In terms of the tourism infrastructure however, little is yet in place. There is no official tourism reception, and visitors wishing information on Sa Pa have only the Sa Pa Guide (Stubblefield 1994) available to them in the town itself. Frontier-Vietnam could only find this available in four guest houses in the town. Cafes in Sa Pa are offering the only real dedicated tourism service at present, by operating tours to various local villages. These range from one to five days, and there is fierce competition between tour operators to get visitors; currently there is no planning of these tours.

One attempt to remedy the lack of information facilities has been made by the District Lottery Company, with the development of the Ham Rong Tourism Project, introduced elsewhere in these proceedings by its director, Mr Luan. This is a positive step, and one which will help emphasize the region's natural attractions in an informative way. The District People's Committee also wishes to improve Sa Pa's facilities for tourists and residents alike, although is limited by financial constraints.

## **Current visitors characteristics and perceptions**

Tourists were interviewed in groups and individually on an *ad hoc* basis, in Sa Pa and in some of the surrounding popular tourist destination villages (Cat Cat, Ta Phin, Ta Van and Lao Chai). Of those questioned, 31 were Vietnamese and 52 Western. The five best represented nationalities were the French (9 respondents), British (8), German (8), American (6) and Dutch (6). The age distribution of respondents is shown in the figure below. Although limitations on research prohibited a truly representative sample to be gained, the information provided by the 85 individuals spoken to provides some useful information concerning the characteristics and perceptions of visitors to Sa Pa. These are described below.

Figure: Age distribution of questionnaire respondents



Source: Compiled from Frontier-Vietnam visitor survey, October/November 1997

### Logical Details of visit

Length of stay in Sa Pa:	1 day	2 days	3 days	4 days	5 days	6 days	7 days	
No. of respondents	5	14	3	7	2	1	1	
%	15	42	9	21	6	3	3	
No. of weeks in Vietnam:	1	2	3	4	5	6	6+	working
No. of respondents	0	8	16	22	4	2	2	13

Of those questioned, 37 said they were traveling independently, whilst 19 were on tours, most of these arranged from Hanoi. Modes of transport used to reach Sa Pa included train (40), bus/minibus (48), car/jeep (12) and motorbike taxi (7), with most people using a combination of these.

### Background to visit

Main reasons for visiting Sa Pa:

Scenery / mountains	43
Minority groups	27
Recommended	13
Fansipan	7
On tour route in Vietnam	7
Climate	7
On route to / from China	5
Forest	1
Other	11

Sources of information consulted before visits to Sa Pa were given as guidebooks (25 respondents), word of mouth (27), and tourist cafes (4). By far the most popular guide book used is the 'Lonely Planet' (Lonely Planet 1995; 1997). Of those interviewed, only 4 out of 66 giving an answer had purchased the Sa Pa guide, produced by Frontier-Vietnam in 1994 (Stubblefield ed., 1994). On the question of the Hoang Lien Nature Reserve, 16 respondents were aware of it (10 of these being Vietnamese who had studied it in geography classes), whilst 50 were not.

Respondents were also asked if they would like to have had more information available on certain subjects:

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Subject / Response	Yes	No
Nature Reserve	32	0
Minority groups	25	5
Natural history	22	9

### ***Visitor perceptions***

33 respondents had enjoyed their visit at the time of questioning, whilst only 2 said they had not. Approximately one-third (23) of the respondents had or said they would go on an organised tour from Sa Pa (3 having visited the Ham Rong Tourism Project); shortage of time was a frequent reason for people not going on tours when they would have liked to. Most of those who answered the final question said they would recommend their visit to others.

Other

Seasonality of visitors was appraised based on anecdotal evidence. This indicates that two peaks in visitor numbers occur, the first during the summer (June, July and August), the second later in the year, around December. Vietnamese and Western visitors have different patterns, Westerners making up the majority of winter visitors (one estimate was of about 70% of the total), whilst in the summer most visitors are Vietnamese (85% was given as the possible maximum). The Vietnamese appear to be drawn particularly by the climatic advantage of Sa Pa compared with other areas during the hot summer, and come in larger groups than the typical two or three Westerners traveling together. They are also thought to spend more money whilst here, although the majority are still probably making their own travel arrangements.

### **Conclusion**

Visitors to Sa Pa can be grouped loosely into three fairly distinct groups: Vietnamese, already described; Western back-packers, on a budget and independent, and; more wealthy Westerners tending to be on organised tours. Visitors are coming to see the minority ethnic groups primarily, with the scenery and the climate, mostly for the Vietnamese, being the two other important attractions. Visitors are generally not staying for very long, and few people are buying the only specific Sa Pa guide available (only available in English). Most tourists are buying souvenirs in Sa Pa itself, and using the restaurant and accommodation facilities there, rather than staying in any of the local villages, which often needs prior arrangements. Organised 'cafe tours' generally tend to supply food to participants, and to use guides that have very little or no English, making it unlikely that they are providing much information about the area. There is also evidence that tours are already looking for more remote and 'unspoilt' ethnic villages, in response to the demand. On the positive side, many visitors indicated they would appreciate more information regarding the Nature Reserve, the minority groups and the natural history. People interviewed were almost unanimous that their visit had been enjoyable and that they would recommend Sa Pa to others, though many wished they had had more time to take advantage of what is on offer. Specific complaints were minimal, though the 'high' number of tourists was offered as an area of concern by a few people.

### **Discussion**

Tourism is undoubtedly of great importance to Sa Pa's growing economy. However, anecdotal evidence from various sources suggests that the number of visitors might be reaching its maximum. In the light of this, and Frontier's concern for the conservation of the area, the findings presented here highlight several issues which warrant some thought and attention.

Firstly, tourism in Sa Pa, although currently having little negative impact and being broadly popular, is being developed with very little forward planning taking place. Tourism's adverse effects often manifest themselves after a considerable time delay (Tourism Concern 1992), and this should be borne in mind, since by then it can be extremely difficult to effect changes.

Secondly, although it is true that the indirect benefits of tourism are percolating through Sa Pa's economy, and contributing to various infrastructural improvements, the direct benefits are accruing to only a privileged few in Sa Pa. Very little economic reward is reaching the minority villagers, mostly because they do not have the experience or resources, nor perhaps motivation, to better capitalise on tourism. This is an important fact to bear in mind when considering how tourism can help to support the conservation of the HLNR; tourism is currently doing little to improve the welfare of those putting most pressure on the Nature Reserve's resources.

Thirdly, this issue is also important in terms of the long term sustainability of Sa Pa's tourism industry. The resources on which it is currently based are the minority groups and the natural environment. The former is one which can easily be over-developed; the most popular guide book used by Western visitors says in its latest edition that Bac Ha 'has emerged as an alternative to Sa Pa' (Lonely Planet 1997, p. 541), principally due to its low number of visitors. Cultural tourism is very easily lost when the 'remoteness' or 'authenticity' of the attraction is lost due to high visitor numbers. The latter resource - scenic beauty and natural history - is currently under-developed, although physical rather than cultural attractions are inherently easier to manage, and are more robust. Furthermore, revenue from tourism is not yet available to help the HLNR, despite the area it protects being a major attraction. 'Ecotourism' of some form has great potential, though is currently not something being pursued in Sa Pa.

Findings suggest that a shift in emphasis of the Sa Pa tourism product could have benefits for the minority groups and conservation efforts, whilst consolidating Sa Pa's position as a major tourist destination in north-west Vietnam. It is the belief of Frontier-Vietnam that conservation and the welfare of local people are closely related, and that the 'right kind' of tourism can help the area pursue both of these aims. From this, a preliminary list of long term goals for Sa Pa's tourism industry includes:

- better tourist education, about cultural and environmental issues; the Sa Pa guide (Stubblefield 1994) is a good source of information, but too long for visitors only staying 2 or 3 days, and not well enough publicised
- more economic benefits to minority groups, which is seen to be due to the attraction offered by the reserve, and which then helps reduce pressure on reserve resources
- better organisation of tours from Sa Pa, so that villages do not become over-exploited
- longer visitor stays
- more control of visitors generally

Some preliminary suggestions of ways of achieving these aims are offered here in summary, as a basis for further discussion:

Organisational Change	Benefits & Possibilities
Sa Pa Tour Operators Association	<ul style="list-style-type: none"> <li>• collective voice</li> <li>• easier to deal with</li> <li>• better cooperation over destinations</li> </ul>
Organised trails within the HLNR	<ul style="list-style-type: none"> <li>• interpretation of the area's best features</li> <li>• coordination with the Ham Rong project</li> <li>• allow longer visitor itineraries</li> <li>• training of reserve guides</li> </ul>
Village tourism committees	<ul style="list-style-type: none"> <li>• charging of village entry fees</li> <li>• organised accommodation/food/sales in villages, rather than entirely based in Sa Pa</li> <li>• organised allocation of tourism revenues e.g. through subsidising kerosene; hydro-power</li> <li>• point of contact for tourism education</li> <li>• louder voice for villagers</li> </ul>
Visitor reception / education centre	<ul style="list-style-type: none"> <li>• improves image</li> <li>• chance to administer park or village entry fees</li> <li>• smaller brochures for specific subjects of interest</li> <li>• point of sale for minority handicrafts</li> <li>• liaison with Hanoi tour operators/guide book publishers</li> </ul>
Other	<ul style="list-style-type: none"> <li>• liaison with schools regarding tourism</li> <li>• advertising materials</li> <li>• specific workshops about conservation/tourism, e.g. with local women, in conjunction with the Women's Union</li> <li>• flexibility regarding whether tourists can stay in a</li> </ul>

Although mostly linked here to organisational changes, many of these ideas could be applied on an individual basis. Frontier-Vietnam has experience and resources which it is willing to apply to any of the above, and is considering the possibility of investigating any of these ideas with further research or with feasibility studies over the next few months of its programme. Feedback is essential here. Any findings could be reported back or presented to the relevant bodies at a later date, in the hope of helping direct the Sa Pa tourism industry for the areas long-term sustainability.

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## PART THREE Strategies for Conservation & Sustainable Tourism in Sapa

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### WORKSHOP DISCUSSIONS & FEEDBACK

#### Introduction

The concept behind these discussions entitled 'Strategies for Conservation and Sustainable Tourism' was to promote dialogue between workshop participants on a few selected themes based on the previous presentations contained within these proceedings. Discussion topics were also given particular *foci* stemming the ideas of key individuals and from the experience of Frontier-Vietnam in the region. Thus local conservation practices in Sa Pa was put into context and the development of these or alternatives were considered. Questions such as 'What are the priorities for conservation?' and 'What actions can be taken?' were posed. Other discussion topics included 'Is there a need for directing the activities of tourism' and if so 'Is there a need for a tourism committee'. Accordingly one of the objectives of the workshop was to look at the existing management of tourism and practical conservation infrastructure in place and to strengthen the capacity of local institutions to identify problems, raise awareness and then formulate strategies for the future.

## Discussion Topics

Is there a need for a tourism committee in Sa Pa?

- a. How do you see the future development of tourism in Sa Pa?
- b. Is there a need for directing the activities of tourism?
- c. A tourism committee? If so, why? What role would it fulfill? Who would comprise the committee and how would they operate?

What are the threats to and priorities for conservation in Hoang Lien Nature Reserve?

What action can be taken?

- a. Establishment of a nature trail coupled with an entrance fee.
- b. Establishment of village/commune tourism development committees.
- c. Development of an environmental education programme.

## Workshop Response

### *How do you see the future development of tourism in Sa Pa?*

In response to the initial question on Sa Pa's future tourism development there was expressed, a great hope for the sustainable development of the industry. However, a number of inter-related problems were identified with the industry as it stands at the moment:

- a. a lack of experience in self-management.
- b. a disproportionately small amount of the revenue generated by the industry reaching the rural minority people of the village tour destinations.
- c. a lack of investment crucial to the industry's development.
- d. the need for a comprehensive strategy for keeping visitors in Sa Pa, and the surrounding area, for longer.

In response to the last two problems mentioned on this list, it was suggested that greater investment, controlled by the proposed tourism committee, would inevitably lead to tourists staying longer (and therefore spending more money) in Sa Pa.

The development of the industry along lines of ecotourism was favorably accepted, since it was acknowledged that Sa Pa is a unique area for Vietnam in terms of its natural beauty and biological diversity (which was deemed to be of international value).

### *Is there a need for directing the activities of tourism?*

The concept of directed development for Sa Pa's tourist industry, is not an alien one to local government officials, and is indeed acknowledged in the existing development plan. The three major economic sectors for the Sa Pa region at present are as follows (listed in descending order of economic importance):

1. Agriculture
2. Forestry
3. Services, i.e. tourism

By the year 2000 it is planned that tourism will supersede both agriculture and forestry, as the region's main source of revenue. Tourism's premier position is then hoped to be maintained indefinitely. Some of the specific plans for the development of the tourist sector include: visits to the stone tablets, the silver waterfall, Cat Cat village, the Ham Rong Gardens, and tours to the summit of Fansipan.

### *Is there a need for a tourism committee in Sa Pa? If so, what role would it fulfill, who would comprise the committee, and how would they operate?*

The idea of a governing body regulating the activities of Sa Pa's tourism industry was considered necessary, but instead of the establishment of a new 'Tourism Committee', it was suggested that a Department of Tourism should be incorporated into the structure of the existing District People's Committee (DPC). This newly created department would not only be responsible for the regulation of the tourism industry in and around Sa Pa, but



would also be responsible for the education of visitors in an environmentally sensitive tourism practice. It was believed that such an education service would work in conjunction with, and support, the overall conservation effort in the Hoang Lien mountains.

The need to regulate the number of tourists visiting minority villages was also considered a necessary function of the tourism department. This regulation would involve controlling both the absolute number of visitors to any one village in a year, and the distribution of those visitors among the villages within the reserve. Such direction of tourist numbers would prevent over visitation in some villages and neglect of others.

To facilitate the operations of the tourism department, the construction of an administrative centre was proposed. From this centre the department could manage the number of visitors entering the reserve, as well as promote the natural and cultural diversity of the Hoang Lien area. The centre would also be the site for coordinating the reserve's income through the administration of an environmental tax and/or the sale of entrance tickets. (see below).

### ***What are the threats to conservation of the Hoang Lien Nature Reserve?***

In the eyes of the workshop, three prime threats to conservation of the reserve could be identified:

1. Local inhabitants of the reserve exploiting forest resources in an unsustainable fashion, e.g. collection of timber, fuelwood, medicinal plants, hunting, etc.
2. Tourists through their littering of the reserve and collection of forest products such as medicinal plants and orchids.
3. Natural disasters such as earthquakes (two have struck the reserve in the last 5 years) and forest fires (192 ha of forest were destroyed in one particular fire in 1994).

In considering the natural disasters that may threaten the reserve, forest fires seemed to be of particular concern. Despite being dubbed a 'natural' disaster, man's exacerbating potential was clearly acknowledged. Forest fires of a manmade origin were identified as having two major sources: (1) fires from traditional 'slash and burn' farming techniques spreading out of control into neighbouring forest, and (2) local children starting fires. Measures to combat the problem of forest fires were also forwarded. These included an inexpensive education programme for local farmers, outlining some practical methods to minimise potential damage to the forest by fire, e.g. the clearing of vegetation from a broad strip surrounding the area to be burnt, thus preventing the spread of the fire into the forest; and the planting of swathes of a tree species with a particularly high water content, again to act as a barrier to the spread of fire.

Tourists were considered not only threats to the conservation of the natural environment, but also the cultural diversity of the reserve. Foreign tourists were acknowledged as having some detrimental impact on the culture of ethnic minorities in the region, albeit a limited one. Here was cited the classic example of the disappearance of the 'Love Market' from Sa Pa town. Prostitution was also considered a minor threat, although it was believed that this industry is in its infancy, and that nearly all of the women involved were Kinh, very few being from any of the minority peoples.

### ***What are the priorities for conservation in the Hoang Lien Nature Reserve?***

The fundamental problem confronting the conservation effort in the reserve was unanimously stated as the low standard of living of the reserve's inhabitants. If the rural minority population is hungry, cold and in need of shelter (which, inevitably, they are), conservation of the reserve's natural resources will not be a priority for these people. The principal priority, therefore, is to raise the living standards of the rural population. Stemming from this basic threat to the reserve came a number of conservation measures that were prioritised in the following order:

1. The need to determine which projects would be most effective in raising living standards of the rural ethnic population. Thus avoiding investment in ineffective conservation strategies.
2. Educating the local population in the value of the natural environment, and how this value can be altered by the activities of tourism. An environmentally aware populous being considered a great support to the conservation effort.
3. Culturally sensitive study of the ethnic populations to permit the implementation of culturally sensitive conservation policies, thus minimising the potential conflict between the environmental agenda, and the interests of local people.
4. Establishment of more environmental monitoring centers.
5. Management of the number of tourists entering the reserve.

### ***What action can be taken?***

Overall, there was a call for specific plans of action, and directed policies of the DPC, for conservation of the reserve, on both a short- and long-term basis. The development of any future conservation strategy must expand from the needs of those living in the reserve, i.e. living standards of these people must be improved. Removal of such basic sufferings like hunger from the rural population will lead directly to the reduction of forest degradation and destruction. For the implementation of any specific strategies, it was agreed that specific funding would be required.

Therefore, local authorities need to submit proposals and requests for project financing to both, national government, and international organisations who are concerned for the reserve's protection.

The idea of an entrance fee was met with a guarded reception. It was agreed that a means of raising revenue from tourists would be beneficial to the nature reserve but it was clear that this was not a simple thing to achieve in practice. The first stumbling block was that an entrance fee cannot be imposed upon visitors without legislation at the provincial level. Secondly, the point was raised that an entrance fee must distinguish between tourists and scientists visiting the reserve for study. It was mentioned that inflexible entrance fee regulations in other areas caused problems to scientists and might stifle valuable research. Thirdly, there was a fear that tourists who were charged to enter the reserve might be disappointed. In response to this, it was suggested that tourists would not be disappointed if they knew that their money was contributing towards protection of the nature reserve. Alternatively, the idea was forwarded that an entrance fee should only be introduced in conjunction with development of tourist facilities. If, for instance, a nature trail was developed then tourists would feel that they were getting something in return for their money.

An alternative means of raising revenue for conservation was proposed, that of collecting money indirectly via an 'environmental tax' on tourism businesses. For example, hotels could impose a 5% surcharge on each guest. The collection of this tax would be one major way for the proposed 'Department of Tourism' to manage and control tourism activities in the area. Such a tax has been used successfully in protected areas in other countries and removes the need for entrance gates, tickets, etc. It was agreed that if such a tax were imposed in Sa Pa district, the revenue must be channeled to conservation.

Little discussion was made of the suggestion of separate village or commune based tourism committees. The overall feeling was that the duties of such committees could and should be absorbed into those of the tourism department of the District People's Committee. It was not considered a benefit to regulate the development of tourism at a level below this. [It should be noted however, that commune and village leaders were not specifically represented at this workshop]

There was a positive response to the idea of an environmental awareness programme. Indeed, environmental education is already taking place ad hoc in primary schools and through training courses run by the agriculture department. A need was identified for environmental education at all levels: from primary school children to the District People's Committee. There was, however, a shortage of relevant literature, posters and expertise.

One obstacle in the way of any proposed environmental education campaign was low levels of literacy, especially among the minority people where environmental education is most needed. It was suggested that posters would be a good means to raise awareness of such issues as the dangers of uncontrolled forest fires. Frontier-Vietnam may be able to support such a campaign. Alternatively, workshops for commune heads or school teachers would be another way of spreading the conservation message.

In addition to the three specific suggestions: a nature trail, a village/commune committee and an environmental education programme) a number of other, short-term, plans of action were also proposed. These are listed below:

1. Development of a nursery/information centre, along similar lines as the Ham Rong project, for medicinal plants of the forest. Such a scheme would not only alleviate pressure on the wild medicinal plants of the reserve, but also provide a source of income for the reserve and the conservation programme in Sa Pa.
2. Introduction of potatoes as a winter crop. By providing an alternative source of food for the rural population of the reserve, the need to supplement the meagre winter diet with food taken from the forest would be reduced.
3. Establishment of a training centre with the primary purpose of raising local people's awareness of conservation issues and improve their management skills.
4. Establishment of more legislation with the specific purpose of protecting the natural environment of the Sa Pa area, and controlling the number of tourists entering the reserve, particularly the minority villages.

## APPENDIX 1

### Speakers

Mr. Richard Sobey, Programme Manager, Frontier-Vietnam  
 Mr. Andrew Tordoff, Science Research Co-ordinator, Frontier-Vietnam  
 Mr. Mark Grindley, Assistant Research Coordinator, Frontier-Vietnam  
 Mr. Steven Swan, Research Assistant, Frontier-Vietnam.  
 Dr. Le Xuan Canh, Vice- Director, Institute of Ecology and Biological Resources  
 Dr. Ha Van Tue, Plant Taxonomist, IEBR  
 Mr. Pham Duc Tien, Mammologist, IEBR  
 Dr. Alexander Monastyrskii, Head of Ecology Dept., Vietnam-Russian Tropical Centre  
 Dr. Phan Luong, Head of Ecology Dept. VRTC  
 Mr. Andrey Kouznetsov, Botanist, VRTC  
 Mr. Tran Van Phi, Vice Director, Hoang Lien Nature Reserve, Sa Pa  
 Mr. Sung A Sai, Director, Department of Minorities & Religious Affairs, Lao Cai  
 Mr. Le Duc Luan, Director Lao Cai Lotteries Company & Ham Rong Tourism Project  
 Mr. Dinh Van My, Director, Medicinal Plant Centre, Sa Pa.

### Participants

Dr. Nguyen Duc Tu, Frontier-Vietnam Development Officer & workshop facilitator  
 Ms. Pham Do Loan, Training & International Co-operation, IEBR  
 Ms. Annalisa Koeman, Sustainable Tourism Advisor, IUCN  
 Mr. Nguyen Van Lam, Sustainable Tourism Project Director, IUCN  
 Mrs. Ha Thi Kim Oanh, International Cooperation Department, Ethnic Minority Development, Committee for Ethnic Minorities & Mountainous Areas.  
 Mr. Nguyen Duc Thang, Vice Chairman, People's Committee, Lao Cai  
 Mr. Giang Seo Phu, Vice Chairman, People's Committee, Lao Cai  
 Mr. Ngo Trong My, Director, Department of Science, Technology & Environment, Lao Cai  
 Mr. Nguyen Van Ha, Director, Department of Agriculture & Rural Development, Lao Cai.  
 Mr. Nguyen Mans Hung, Technical Deputy Director, Dept of Agriculture & Rural Development, Lao Cai.  
 Mr. Bui Quang Binh, Vice Director, Department of Border & International Relations, Lao Cai  
 Mr. Nguyen Quang Hung, Director, Forest Protection Department, Lao Cai  
 Mr. Ma A Chau, Chairman, People's Committee, Sa Pa  
 Mr. Nguyen An Toan, Secretary, District Party Committee, Sa Pa  
 Mrs. Ly Thi Se, Vice Chairman, People's Committee Sa Pa  
 Mrs. Do Thi Nhung, Chairlady, Women's Union, Sa Pa  
 Ms. Nguyen Thi Thu Anh, Research Assistant, IEBR & workshop facilitator