

**USES AND CONSERVATION OF PLANT
DIVERSITY IN BEN EN NATIONAL PARK
VIETNAM**

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VIETNAM**

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NATIONAL HERBARIUM OF THE NETHERLANDS
LEIDEN UNIVERSITY BRANCH
2009

Hoang S.V.
Uses and conservation of plant diversity in Ben En National Park, Vietnam

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GENERAL INTRODUCTION

TROPICAL FORESTS

This thesis concerns the interactions between plant diversity and plant uses by the local population in Ben En National Park, Vietnam. The study should be viewed against the background of global concerns about the current status and future sustainability of tropical forests.

Tropical forests are characterized by very high plant diversity; covering less than 10% of the total land areas; they possess more than 50% of all known plant species on earth (Wilson 1988; Mayaux et al. 2005). The international Convention on Biological Diversity signed in Rio de Janeiro in 1992 strongly emphasized the need for biodiversity conservation. From that global perspective, despite numerous efforts to conserve biodiversity, tropical forests have severely declined in the last 16 years and still continue to decline (Johnson 1993; Achard et al. 2002; Chien 2006; Butler & Laurance 2008; Putz et al. 2008). During the past decades, around 6 million ha of tropical forests have been lost (Achard et al. 2002). The main causes are agricultural expansion, over-harvesting of tropical hardwoods, development of plantations, mining operations, industry, urbanization, and road building (Geist & Lambin 2002; Chien 2006). Among tropical areas, South-East Asia has the highest relative rate of deforestation (Achard et al. 2002; Brook et al. 2006; Chien 2006). Tropical forests are important for global environmental ecosystem function (Fearnside 1997; Laurance 1999), they also provide subsistence needs and income for hundreds of millions of people worldwide (Iqbal 1993; Walter 2001), often the very poor (Ticktin 2004).

A successful biodiversity conservation strategy requires a good understanding of the relationships among natural resources and social conditions. This is particularly important for tropical countries, where the forests are very rich in biodiversity, but are being lost at an alarming rate (Whitmore 1997; Sodhi et al. 2004; Chien 2006).

FORESTS AND BIODIVERSITY IN VIETNAM

Vietnam is a country rich in biodiversity (Thin 1997). The country was ranked as the 16th most biologically diverse country in the world (WCMC 1992; Hoang et al. 2008 a). Forests covered around 43% of Vietnam before 1954 (Maurand 1943; Lung 2001). However, the forests of Vietnam were severely damaged by many causes, such as the war with the United States of America, overexploitation, shifting

cultivation, and agricultural expansion. As a result, the forest cover declined to an estimated 30% in 1985, and 28% in 1995 (Lung 2001; Hoang et al. 2008 a). In 1998, the 5 million ha Reforestation Program was launched by the Vietnamese government with a target to plant 5 million ha of forests by 2010, restoring the forest cover to 43% (Lung 2001). The program aims not only to reforest, but also to protect existing natural forests. In recent years the forest cover of Vietnam has gradually increased (Hung 2004; Lan et al. 2006; Hoang et al. 2008 a). However, the quality of the forests is still low as most of the forests are poor in timber volume and tree species diversity and density as a result of a long time of overexploitation (Dang 2001; Chien 2006). On the other hand, to protect the rich and threatened biodiversity, the Vietnamese government has established a system of protected areas (Tai 1995; VN 2003; Hoang et al. 2008 a); in 2006, Vietnam had 126 protected areas, with a total area of 2.54 million ha (Hoang et al. 2008 a).

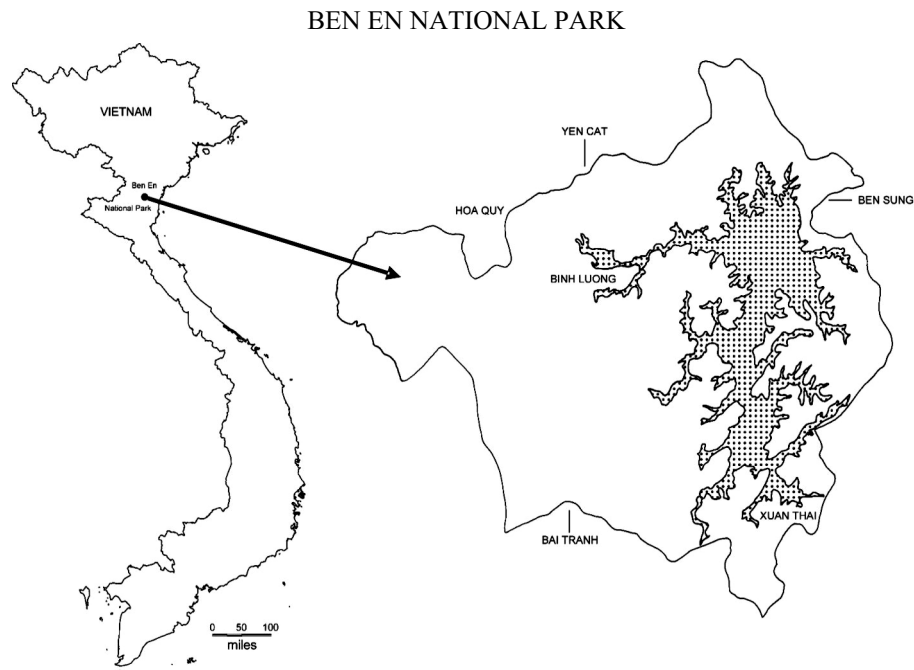


Fig. 1.1. Map of Ben En National Park in Vietnam (inset – lakes are dotted)

Our study focuses on Ben En National Park, one of the 30 National Parks in Vietnam (Forest Protection Department 2006). Ben En National Park is situated in Nhu Thanh and Nhu Xuan districts of the Thanh Hoa province in Vietnam $19^{\circ} 30'$ to $19^{\circ} 40'$ N by $105^{\circ} 21'$ to $105^{\circ} 35'$ E (Fig. 1.1). The Park was established in 1992 to conserve the rich, but seriously threatened biodiversity of the country. The Park is inhabited by 18,000 local people belonging to five ethnic groups. The majorities of the people who are living in the National Park belong to the Kinh, Thai, Muong and Tay ethnic groups; although there are also a small number of Tho people. Their life

still depends on forest resources, Non Timber Forest Products, as well as timber (Hoang et al. 2008 b & c). The vegetation of Ben En National Park has been strongly influenced by human exploitation (Khoi 1996; Hoang et al. 2008 a). The forests were commercially logged as late as 1992, and small-scale, illegal logging continues to this date (Tordoff et al. 2000; Hoang et al. 2008 a & c).

OBJECTIVES OF THIS STUDY

The aims of this thesis are:

- To inventory plant species diversity, their life forms and their conservation status, and the vegetation types in Ben En National Park.
- To survey medicinal and non-medicinal plant uses and the role of plant resources in the economy of the indigenous communities in Ben En National Park.
- To analyze the impact of human and environmental factors on plant diversity and composition in Ben En National Park.
- To use the resulting information and understanding to underpin recommendations for future management of Ben En National Park and other protected areas.

OUTLINE OF THE THESIS

Following a general introduction, **Chapter 2** focuses on the diversity of plant families, genera, species, life forms, conservation status, and the vegetation types recorded during a two years survey in Ben En National Park from 2005 to 2007. In addition we briefly review the status of forest biodiversity and causes of biodiversity loss in Vietnam.

Chapter 3 deals with the numerous medicinal plant species and their uses by local people in Ben En National Park, and analyzes the role of medicinal plants in the indigenous communities. In addition this chapter presents a comparison of the situation in Ben En National Park with other local communities depending on natural forest resources in and beyond Vietnam.

Chapter 4 addresses the great diversity of non medicinal useful plants in food, construction, firewood, household tools and related products, and other uses; and analyses the impact of local use on the conservation status of some of the utilized species.

Chapter 5 focuses on the impact of human and environmental factors (mainly soils) on plant diversity and forest structure in Ben En National Park, and gives some recommendations for developing a sustainable management of Ben En National Park based on the results of the analysis.

PLANT BIODIVERSITY IN BEN EN NATIONAL PARK, VIETNAM

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Agricultural Publishing House, Hanoi, Vietnam. 2008

SUMMARY

The plant species diversity and vegetation types of Ben En National Park were studied to provide baseline information for conservation and sustainable use management within the Park. A total of 1389 vascular plant species are recorded in Ben En National Park belonging to 650 genera and 173 families. Together with earlier inventories this brings the total species number of vascular plants to about 1600. Three species found here are new to the flora of Vietnam (*Myristica yunnanensis* Y.H. Li - Myristicaceae, *Glyptopetalum sclerocarpum* (Kurz) M.A. Lawson - Celastraceae, and *Timonius arborea* Elmer - Rubiaceae); 7 families, 43 genera and 252 species are new records for the flora of Ben En National Park. Euphorbiaceae constitute the most diverse family with 113 species, while 47 families are represented only with one species. Phanerophytes are the dominant component (76% of all species), with chamaephytes (6%), hemicryptophytes (8.5%), cryptophytes (6%), and therophytes (4%) constituting minor proportions of the local flora.

Major parts of the forest in Ben En National Park have been impacted by man; before it became a National Park in 1992 the area was a timber concession, and use of wild and cultivated plant resources by local people in the Park continues to this day. Three man-made ecosystems are present on 29% of the surface area: 1) agricultural fields about 650 ha, 2) plantation forests about 110 ha, and 3) mixed bamboo and timber tree stands about 3800 ha. Two main vegetation types are recognized with heavily and slightly disturbed subtypes, depending on the intensity of plant use and illegal logging by the local population.

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- 1) Tropical evergreen limestone forest (subtypes: slightly disturbed, heavily disturbed, and shrubland on limestone).
- 2) Tropical evergreen lowland forest on other soils (mainly ferralitic, and in a small area on alluvial soil). Subtypes: slightly disturbed forest on ferralitic or alluvial soil, heavily disturbed forest on ferralitic soil, and shrubland vegetation outside the limestone hills.

A small area of virgin forest on limestone could not be described, because of its inaccessibility.

A total of 386 plant species are used by local people in Ben En National Park. The Park is of great importance for plant species conservation: a total of 29 plant species are listed in the red data list of IUCN (2006), and 42 species are listed in the Red Data Book of Vietnam (Ban 2007), which recognizes a total of 448 endangered species. In addition, 89 species were found to be endangered locally.

INTRODUCTION

Tropical rainforests are the most species-rich terrestrial ecosystems on earth, but these forests are rapidly disappearing as land is cleared for timber, agriculture, and other uses (Fimbel et al. 2001; Meijaard et al. 2005). Vietnam's forests contain a wealth of biodiversity (Thin 1997). The country was ranked as the 16th most biologically diverse country in the world (WCMC 1992). The forests of Vietnam have dramatically declined during the last 60 years (Chien 2006). Research on plant diversity in Vietnam has a long history, but there are relatively few detailed site studies. The botanical survey of Cuc Phuong National Park, the first National Park established in 1962, is perhaps the most complete (Thin 2000).

In this book, we briefly review the status of forest biodiversity and causes of biodiversity loss in Vietnam. Our study focuses on Ben En National Park, one of the 30 National Parks in Vietnam (Forest Protection Department 2006). The Ben En area was designated for the protection of fauna in 1979, and as a nature reserve in 1986, and National Park in 1992 to conserve the rich, but seriously threatened biodiversity of the country. The park is inhabited by 18,000 local people belonging to five ethnic groups. The vegetation of Ben En National Park has been strongly influenced by human exploitation (Khoi 1996; Hoang et al. 2008 c). The forests were commercially logged as late as 1992, and small-scale, illegal logging continues to this date (Tordoff et al. 2000; Hoang et al. 2008 c).

This study deals with the diversity of plant families, genera, species, life form, their conservation status, useful plants, and the vegetation types recorded during a two years survey in Ben En National Park from 2005 to 2007.

The status of forest and biodiversity in Vietnam

Before 1945, forests covered around 43% of Vietnam (Maurand 1943; Lung 2001). From 1954 to 1975, the forests of Vietnam were severely damaged by the long war with the United States of America. By 1976, the total area of forests had been

reduced to 11.2 million ha (33.8%), of which only 10% were primary forests (Lung 2001; Chien 2006). Since 1976, more forests have still been destroyed for many reasons, such as overexploitation, shifting cultivation, and agricultural extension. As a result, the forest cover declined to an estimated 30% in 1985, and 28% in 1995 (Lung 2001; Chien 2006). In 1998, the 5 million ha Reforestation Program was launched by the Vietnamese government with a target to plant 5 million ha of forests by 2010, restoring the forest cover to 43% (Lung 2001). The program aims not only to reforest, but also to protect existing natural forests. As a result, the forest cover of Vietnam has gradually increased. In 2003, the forested area of Vietnam was 36.1% (Hung 2004; Lan et al. 2006). However, the quality of forests is still low as most of the forests are poor in timber volume and tree species diversity and density as a result of a long time of overexploitation (Dang 2001; Chien 2006). According to Dang (2001) natural forests rich in timber resources cover only 1.4 million ha (13% of the total forest area) while poor and young plantations or naturally regenerating forests comprise around 6 million ha (55% of the total forest area).

There are many reasons for the rapid loss of forests in Vietnam, but the war played a major role (Quy 1985). More than 2 million ha of natural forests, of which 500,000 ha of closed upland forests and 30,000 ha of mangroves were completely destroyed (Westing 1971; Quy 1985; Hong 1988; Sam 2005); many large forest areas were heavily logged to support people and the war effort. Subsequently, to rebuild the country after the war, around 1.3-1.4 million m³ of timber were exploited annually (Nhat 2001; Chien 2006). Overexploitation is also an important reason for the decrease in forest resources in Vietnam. As a developing country with 80% of the population being farmers living in the countryside and remote areas, the need for firewood is huge. Annually, 22 to 23 million tons of firewood are harvested (Dang 2001). In addition, illegal logging is a serious problem as it has annually destroyed around 30,000 ha of forests in the last few decades (GoVN 1994; Chien 2006). The population of Vietnam has increased quickly, and this has also a large impact on the forests. From the beginning of the last century until 2007, the population of Vietnam increased from about 15 million to 85 million (Chien 2006). Such a large population puts the forest under heavy pressure, not only through practices of shifting cultivation, but also by transforming forested land into arable land and urban areas (Sam 1996).

Plant biodiversity in Vietnam

Vietnam possesses a rich and diverse flora, with around 28% of its total species considered endemic (Thin 1997). However, many species formerly recorded as endemic species in Vietnam also occur in China, Laos, or Thailand (Hoang et al. 2004). Thin (1997) indicated that Vietnam has 11,373 plant species, belonging to 2524 genera, 378 families and 7 major plant groups (Table 2.1). A few years later Thin (2000) estimated the Vietnamese flora to number 12,000 species.

To protect the threatened biodiversity, the Vietnamese government has established a system of protected areas with the aim of conserving the main ecosystems present in Vietnam, as well as the threatened and endemic species of flora and fauna, and the valuable landscapes for culture, ecology and biodiversity (Tai 1995; VN 2003; Chien 2006). The first National Park, Cuc Phuong, was established in 1962 as an

important landmark for forest protection and conservation in Vietnam (Thu 2002). Since then, the National Park and nature reserve system of Vietnam has developed quickly. By the year 2006, Vietnam had 126 areas of special purpose forests with a total area of 2.54 million ha (Table 2. 2), occupying 7.7% of the total area of the country (Forest Protection Department 2006).

Table 2.1. Components of the flora of Vietnam (Thin 1997)

Taxa	Number of families	Number of genera	Number of species
Bryophyta	60	182	793
Psilotophyta	1	1	2
Lycopodiophyta	3	5	57
Equisetophyta	1	1	2
Polypodiophyta	25	137	669
Gymnospermae	8	23	63
Angiospermae	299	2.175	9.787
Total	378	2.524	11.373
Endemic (%)	0	3	27.7

Table 2.2. Protected forest areas in Vietnam (Forest Protection Department 2006)

Classification	Number	Area (ha)
National Parks	30	1157.56
Nature reserve areas	46	1082.98
Species/habitat management protected areas	11	85.85
Protected landscape or seascape areas	39	215.29
Total	126	2541.68

The 4 kinds of protected areas are defined below (Forest Techniques and Science Association of Vietnam (FTSA) 2001; Chien 2006).

National Park: An area on the mainland or in the sea that has not or only slightly been impacted by human activities. It contains rare, precious or endemic species or has popular landscapes at national or international levels. The objectives of establishing a National Park are to protect the ecosystem of threatened species, as they have important roles for the country and the world, and to provide facilities for scientific study and eco-tourism.

Nature Reserve: A large area having typical ecosystems or containing populations of valuable species that need conservation. Nature Reserves are to protect and maintain ecosystems and floral and faunal species in their natural conditions. They aim also to provide for scientific research and environmental management. However, in contrast to National Parks, eco-tourism is limited in nature reserves.

Species/Habitat management protected area: A forest area established to protect, maintain and favor particular threatened species and their environment.

Protected landscape or seascape area: A protected landscape or seascape established to protect famous natural landscapes or national cultural properties. It is also to protect the natural beauty of forests, caves, waterfalls, sand dunes, coral islands and volcanic craters.

The total protected area in Vietnam is about 8% of the country (Forest Protection Department 2006). This is low compared to the minimum of 10% recommended by IUCN (1997). Control of human activities in protected areas has proved difficult due to the large number of people relying on forest resources for a living (Quy 1985; Nhat 2001; Chien 2006). Local people continue to practice agriculture in the forests, also extract timber, collect firewood, medicinal plants and other forest products, hunt and fish (Hoang et al. 2008 b & c). Although this is allowed in the buffer zones of National Parks, it is not sufficient to provide a sustainable strategy of protection and conservation if the living standard of local people is not improved. Local people should be taught new methods of cultivation, sustainable harvesting and production or should be provided with other ways to improve their living conditions. Recently the Vietnamese government issued some policies and carried out many projects to help poor local people to improve their livelihoods (GoVN 2006).

Ben En National Park

Ben En National Park is situated in Nhu Thanh and Nhu Xuan districts of the Thanh Hoa province in Vietnam 19° 30' to 19° 40' N by 105° 21' to 105° 35' E (Fig. 2.1). Before its establishment in 1986, the park was a logging enterprise. At that time many of the timber trees were cut, resulting in the fact that big trees with a diameter at breast height of over one meter were rarely observed during our field work from 2005 to 2007. Ben En National Park was established in 1992. Since then all logging activities are illegal. The core zone of the National Park covers 15,800 ha, while the buffer zone covers around 12,000 ha. About 18,000 people live in the buffer and core zones of the National Park (Tordoff et al. 2000; Hoang et al. 2008 b & c). The majority of the people who are living in the National Park belong to the Kinh, Thai, Muong, and Tay ethnic groups; although there are also a small number of Tho people. Their life still depends on forest resources, Non Timber Forest Products, as well as timber trees (Hoang et al. 2008 c).

Several studies have been carried out on the plants of Ben En National Park. Frontier phase VN 9703 conducted the first large-scale, field-based survey of the biodiversity of Ben En National Park (Khoi 1996) and reported 593 vascular plant species. Another study by Frontier-Vietnam biodiversity survey between July and September 1997 recorded 737 vascular plant species (Tordoff et al. 2000). In 2000, scientists from the Sub-institute of Forest Inventory and Planning II, Nghe An extended the list to 1347 species (Anonymous 2000).

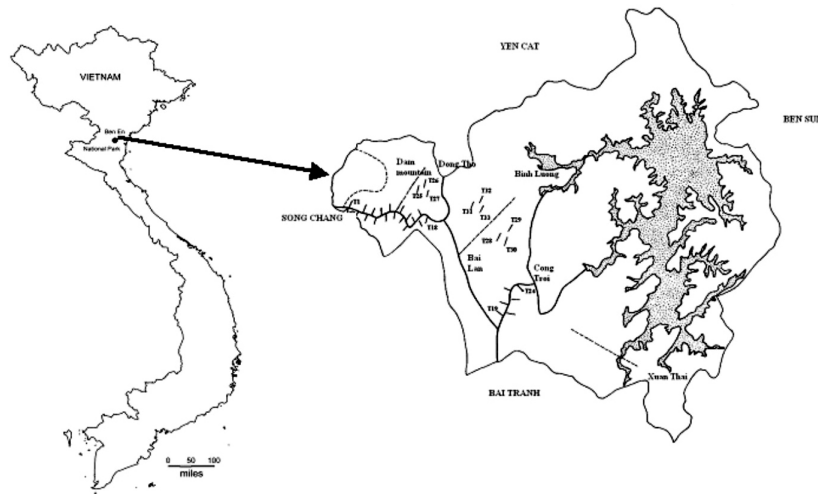


Fig. 2.1. Map of Ben En National Park in Vietnam (inset with plot transects - lakes are dotted).

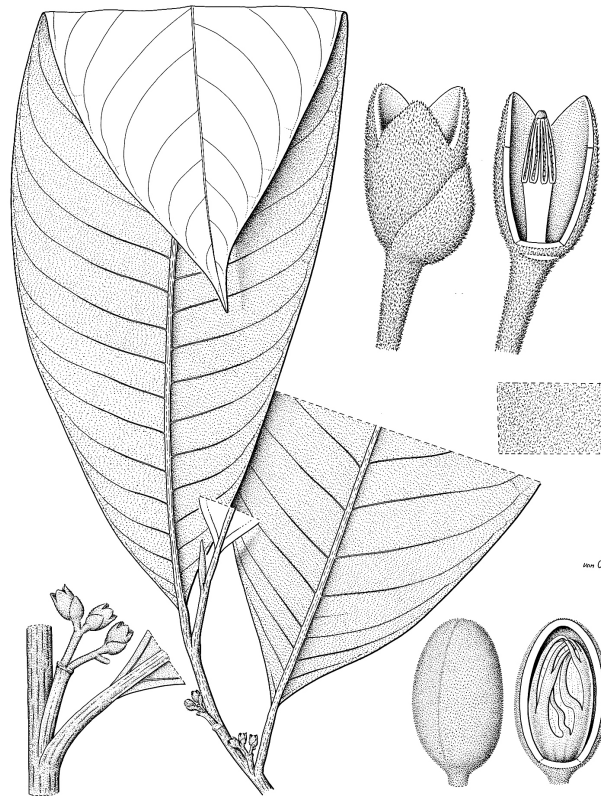


Fig. 2.2. *Myristica yunnanensis* Y.H. Li (Myristicaceae).
A new record for the flora of Vietnam.

METHODOLOGY

We used a plot design that would not only allow a comprehensive inventory of the plant species in Ben En National Park (Fig. 2.1), but that would also enable us to analyze the impact of human disturbance and exploitation (Hoang et al., in prep.). We established 41 transects, 200 m long and 2 m wide, at 250 m intervals at right angles to and along the old logging road from the Song Chang forest ranger station to Cong Troi. The total length of these transects combined is ca. 7.4 km. In each transect we noted all vascular plant species. We also established four 10 x 10 m plots at 50 m from the logging road and at 40 m forward intervals on each transect, resulting in ca. 147 plots for all transects combined (in some transects we were not able to establish four plots, because of steep, inaccessible limestone slopes). In the 147 plots (10 x 10 m) all trees with a dbh $\geq$ 5 cm were identified. All trees and treelets with a dbh < 5 cm, and h $\geq$ 1 m high were identified in 5 x 5 m subplots within each 10 x 10 m plot.

We also established six transects to cover the rest of the Park (Fig. 2.1). Transect 1 from Bai Tron to Song Chang via Bo Cung Mountain (about 5 km), transect 2 from Ben Cay Chanh to Cong Troi (4.5 km), transect 3 from Xuan Thai commune to Dong Tho Doc Dai (about 3.5 km), transect 4 from Rung Giong to Dam Mountain (about 4 km), transect 5 from Bai Lan to Bao Khe (about 4 km), and transect 6 from Nga Ba Dong Tho to Bao Cu (about 5 km). In each transect we noted all species and collected specimens of plants which could not be identified in the field. In all six transects we established 30 random plots of 10 x 10 m, and identified all species in the plots. Furthermore we also collected many plants outside the plots and transects, to make sure that our inventory was as representative as possible of the entire species richness of the local flora.

One voucher of each specimen was deposited at the herbarium of the Vietnam Forestry University, additional vouchers were sent to the National Herbarium of the Netherlands and other specialists for identification.

Useful plants in Ben En were determined by surveys and interviews with 135 randomly-selected households. Additionally special collecting trips were organized with indigenous experts: traditional doctors, village elders and other local people who knew about useful plants (Prance et al. 1987; PID & NES 1989; Ngai 2001; Hoang et al. 2008 b & c). The endangered species were defined based on the Red Data Book of Vietnam, Vol. 2 (Ban 2007), IUCN (2006), interviews with local people and forest rangers, and frequency of trees and stumps found during the field inventory (Hoang et al. 2008 b & c; Hoang et al. in prep.).

Life forms of plants in Ben En National Park were determined based on the classification of Raunkiaer (1934), modified according to Trung (1978) and Thin (1997):

1. Phanerophytes (Ph)
2. Chamaephytes (Ch)
3. Hemicryptophytes (Hm)
4. Cryptophytes (Cr)
5. Therophytes (Th)

In the group of Phanerophytes, the life-forms found in wet tropical areas are further divided by Raunkiaer (1934), and modified by Trung (1978) and Thin (1997).

1. Mega- and Meso-phanerophytes (MM)
2. Nan-phanerophytes (Na)
3. Lianas-phanerophytes (Lp)
4. Epiphytes-phanerophytes (Ep)
5. Hemi- and parasitic phanerophytes (Pp)
6. Succulent phanerophytes (Sp)

The vegetation types of Ben En National Park were classified according to UNESCO 1973; Trung 1978; Trung 1998; Vidal 2000; the United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC) 2004, and Lan et al. 2006. Additionally the human disturbance levels of the vegetation were determined by noting the number of tree stumps and number of foot paths in the plots (Hoang et al. in prep.).

RESULTS

Floristic diversity in Ben En National Park

Diversity of taxa of Ben En National Park

A total of 1389 vascular plant species were recorded in Ben En National Park, belonging to 650 genera and 173 families. 117 species could be identified to genus level only. The list of plant species in Ben En is given in the Appendix 2.1. Their distribution over the major plant groups is shown in Table 2.3.

The ten families with the highest diversity of species (dominant families) in Ben En National Park (Table 2.4), although representing only 5.9% of the total number of families, include 560 species (40.3% of the total). The most species rich family is Euphorbiaceae with 113 species. In contrast to the ten dominant families, 47 families are represented by only a single species (Appendix 2.1). The number of species in Ben En National Park is about 13% of the total species number in Vietnam (Table 2.3).

Table 2.3. Major plant groups in Ben En National Park and Vietnam

Taxa	Number of families	Number of genera	Number of species in Ben En	Number of species in Vietnam
Psilotophyta	1	1	1	2
Lycopodiophyta	2	3	5	57
Equisetophyta	1	1	1	2
Polypodiophyta	22	41	77	644
Pinophyta	4	4	10	63
Magnoliophyta	141	599	1.295	9.812
Total	173	650	1.389	10.580

Table 2.4. Top 10 families ranked according to numbers of species

Scientific name	Species	% of total species
Euphorbiaceae	113	8.1
Fabaceae	97	7.0
Lauraceae	71	5.1
Rubiaceae	61	4.4
Poaceae	52	3.7
Asteraceae	45	3.2
Annonaceae	33	2.4
Moraceae	33	2.4
Rutaceae	28	2.0
Verbenaceae	27	1.9
Total	560	40.3

New records for the flora of Vietnam and Ben En National Park

Three species are new records for the flora of Vietnam: *Myristica yunnanensis* Y.H. Li (Myristicaceae) (Hoang 2008 a - Fig. 2.2), *Glyptopetalum sclerocarpum* (Kurz) M.A. Lawson, (Celastraceae) (Hoang 2008 b - Fig. 2.3), and *Timonius arborea* Elmer (Rubiaceae - Fig. 2.4). Seven families are newly recorded for the flora of Ben En National Park: Cyatheaceae, Betulaceae, Daphniphyllaceae, Ericaceae, Gesneriaceae, Lecythidaceae, and Woodsiaceae. Our study also found 43 new genera and 252 new species for the flora of Ben En National Park (see Appendix 2.1). A total of 210 species listed by Tordoff et al. (2000) and Anonymous (2000) was not found in our inventories or was treated as a taxonomic synonym of one species in our list (see the addendum of the Appendix 2.1).

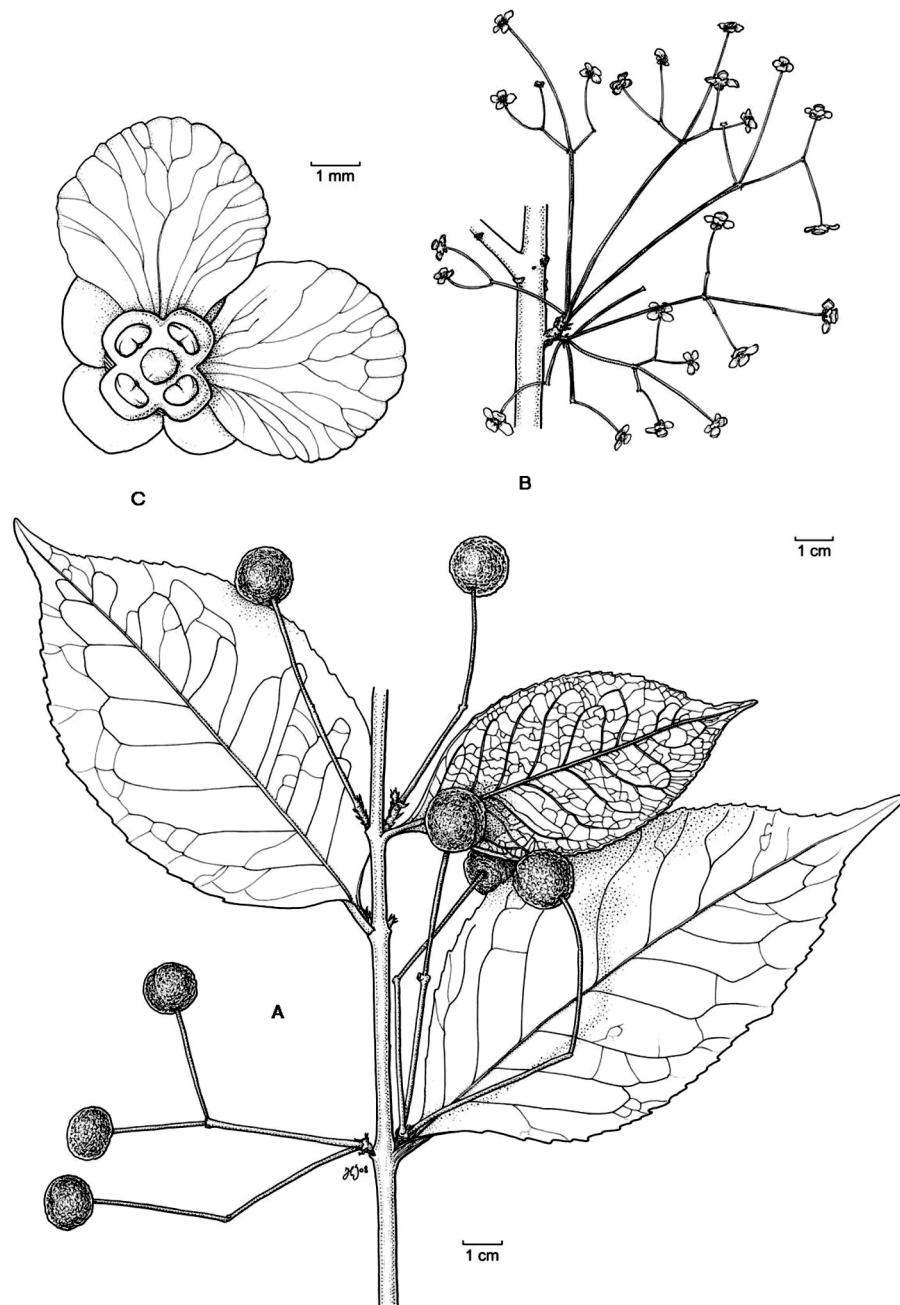


Fig. 2.3. *Glyptopetalum sclerocarpum* (Kurz) M.A Lawson (Celastraceae).
A new record for flora of Vietnam.

Diversity of life form

All species were classified by life form (Raunkiaer 1934; Trung 1978; Thin 1997). The existence of a variety of life forms reflects the typically tropical characteristics of the flora at the Ben En National Park. Phanerophytes are the most dominant life forms with about 76% of total plant species in the area (Table 2.5).

Table 2.5. Diversity of life forms in the flora of Ben En National Park

Life-forms	Number of species	% of total species
Phanerophytes	1054	75.9
Mega- / Meso-phanerophytes	575	41.4
Nano-phanerophytes	270	19.4
Lianas phanerophytes	169	12.2
Epiphytic phanerophytes	36	2.6
Hemi- and parasitic phanerophytes	2	0.1
Succulent phanerophytes	2	0.1
Chamaephytes	81	5.8
Hemicryptophytes	118	8.5
Cryptophytes	85	6.1
Therophytes	51	3.7
Total	1389	100%

Useful plant species

A total of 386 plant species are used by local people in Ben En National Park (Table 2.6) (Hoang et al. 2008 b & c), of which 52 species have more than one application. Medicinal plant species predominate among these useful plants with 230 species applied in 68 different diseases treatments (Hoang et al. 2008 b).

Table 2.6. Commodity groups of useful plants in Ben En National Park

Commodity group	Number of plant species	Percent/total (%)
Medicine	230	60
Food	142	37
Construction	40	10
Firewood	25	6
Household tools and related products	18	5
Other	16	4

Conservation status

A total of 29 plant species from Ben En National Park are listed in the Red Data list of IUCN (2006), and 42 species are listed in the Red Data Book of Vietnam (Ban 2007). However, based on our plot inventories (density of living trees and stumps) and interviews with forest rangers and local people as many as 89 species appear to be locally endangered (See species marked in Appendix 2.1).

Vegetation types in Ben En National Park

In Ben En National Park the highest peak is about 490 m, so all vegetation in the Park belongs to lowland forest types (UNESCO 1973; Trung 1978; Lan et al. 2006; UNEP-WCMC 2004). Among the natural vegetations of the Park there is a major dichotomy between the evergreen forests on limestone and those on other soil types. Each of these substrate-dependent forest types has a heavily disturbed and slightly disturbed subtype. The other four vegetation types are (almost) entirely anthropogenic: shrublands, agricultural fields, plantation forests and mixed bamboo and timber tree stands. In the following descriptions typical plant species are listed in declining order of their density (number of individuals per plot).

Tropical evergreen limestone forest

Slightly disturbed subtype

This forest type occurs in the limestone hills where local people hardly have access for cutting and transporting timber trees, e.g. on steep slopes with sharp edges that make the terrain dangerous. This forest type covers only about 90 ha. There are no stumps at all, and foot paths in this forest type are very rare. However, traces from collecting Non Timber Forest Products are present. This type can be found in Thung Sen, and a small area on Dam Mountain. The structure of this forest type includes four layers: The canopy layer is formed by trees over 15 m tall. Dominant species are *Actinodaphne obovata*, *Caryodaphnopsis tonkinensis*, *Aglaia spectabilis*, *Saraca dives*, *Pavieasia anamensis*, *Castanopsis tonkinensis*, *Aglaia silvestris*, *Aphanamixis grandiflora*. The subcanopy layer is characterised by small trees up to 15 m in height. Species occurring in this layer are shade tolerant species. Dominant species are *Callicarpa macrophylla*, *Acanthus ilicifolius*, *Acanthus leucostachyus*, *Callicarpa dichotoma*, *Diospyros montana*, *Miliusa balansae*, *Knema conferta*, *Melientha suavis*, *Lithocarpus pseudosundaicus*, *Antidesma hainanensis*, *Antidesma acidum*, *Baccaurea ramiflora*, *Antidesma montanum*, *Streblus macrophylla*, *Heritiera macrophylla*, *Streblus indicus*, *Sterculia lanceolata*, *Aidia pycnantha*, *Litsea mollifolia*, *Machilus bonii*, and *Phoebe macrocarpa*. The shrub layer includes only few species, like *Dracaena cambodiana*, *Dracaena cochinchinensis*, *Antidesma buniis*, *Streblus macrophylla*, *Miliusa balansae*, *Diospyros hirsuta*, *Litsea impressa*, *Cryptocarya lenticellata* and *Millettia boniana*. The herb layer is composed of a few

species of Balsaminaceae, Smilacaceae, Acanthaceae, Urticaceae, and Euphorbiaceae.

Heavily disturbed subtype

This forest type is the most common in the limestone hills where local people have easy access for cutting, transporting timber trees, e.g. near villages, or far from the forest ranger station. This forest type covers about 300 ha. Typical sites are Yen Ngua, along the old logging road, Ba Bai, Bo Cum mountain, and some small areas in the centre of the Park. Big trees are absent; stumps and foot paths are common (2 to 5 stumps, and more than one foot path in each 0.04 ha plot). The forest structure is simple with three layers: The canopy layer is composed mainly of *Callicarpa macrophylla*, *Callicarpa dichotoma*, *Acanthus ilicifolius*, *Streblus macrophylla*, *Streblus indicus*, *Diospyros montana*, *Lagerstroemia calyculata*, *Pterospermum truncatolobatum*, *Pterospermum heterophyllum*, *Antidesma montanum*, *Acanthus leucostachyus*, *Diospyros hirsuta*, *Koilocarpus longifolium*, *Hydnocarpus anthelmintica*, and *Machilus bonii*. The shrub layer is composed of few species, *Randia oxyodonta*, *Sterculia gracilipes*, *Streblus macrophylla*, *Antidesma bunioides*, *Heritiera littoralis*, *Dracaena cambodiana*, *Dracaena cochinchinensis*, *Sterculia lanceolata*, *Acanthus leucostachyus*, *Diospyros hirsuta*, and *Aidia acuminatissima*. The herb layer is very simple with a few species of Acanthaceae, Balsaminaceae, Euphorbiaceae, and Smilacaceae.

Shrubland on limestone

This vegetation type is the result of heavy logging. It occurs along the old logging road, near villages, and is dominant in the buffer zone near Hai Van and Hai Long. This forest type covers a small area (about 40 ha). The shrubland is species-rich; dominant are *Dracaena cambodiana*, *Dracaena cochinchinensis*, *Memecylon edule*, *Ixora balansae*, *Melastoma* sp., *Randia pycnantha*, *Callicarpa arborea*, *Vitex trifolia*, *Acanthus ilicifolius*, *Desmos cochinchinensis*, *Uvaria micrantha*, *Alchornea tiliifolia*, *Psychotria montana*, *Aporosa microcalyx*, *Jasminum subtriplinerne*, *Helicteres angustifolia*, and species of Dryopteridaceae, Polypodiaceae, and Urticaceae.

Tropical evergreen lowland forest on other soils (mainly ferralitic and in a small area on alluvial soil)

Slightly disturbed subtype on ferralitic or alluvial soil

This forest type occurs in areas where it is difficult to transport the timber after harvesting, or where illegal logging meets with other obstacles, e.g. in steep valleys, on islands or in the vicinity of a station of the forest ranger. This forest type covers about 2140 ha. In the plots stumps are absent or at most one in each plot, foot paths are also rare (usually one in each plot). However, traces from collecting Non Timber

forest products are common. This forest type was found mainly in Thung Sen, Rung Giong, Thu Lon, Bai Lan, Khe Chuon, and some areas in the Bo Cum mountain. This forest type has four layers: The canopy layer is characterized by trees over 15 m tall: *Peltophorum tonkinensis*, *Erythrophleum fordii*, *Aglaia spectabilis*, *Saraca dives*, *Pavieasia annamensis*, *Aphanamixis grandiflora*, *Actinodaphne obovata*, *Phoebe paniculata*, *Dysoxylum caudiflorum*, *Pterospermum truncatolobatum*, *Lagerstroemia calyculata*, and *Machilus bonii*. The subcanopy layer is composed of small timber trees below 15 m in height. Dominant species are *Diospyros montana*, *Antidesma montanum*, *Diospyros hirsuta*, *Sterculia lanceolata*, *Aidia pycnantha*, *Litsea monopetala*, *Machilus chinensis*, *Phoebe macrocarpa*, *Koilocarpus longifolium*, *Hydnocarpus anthelmintica*, *Syzygium wightianum*, and *Cryptocarya lenticellata*. The shrub layer is composed of many species, with as dominant ones *Antidesma bunioides*, *Mallotus decipiens*, *Excoecaria cochinchinensis*, *Diospyros hirsuta*, *Miliusa balansae*, *Koilocarpus longifolium*, *Litsea verticillata*, *Millettia boniana*, *Goniothalamus amuyon*, *Aidia oxydonta*, and *Randia* sp. The herb layer is composed mainly of species of the families Zingiberaceae, Poaceae, Acanthaceae, Rutaceae, Rubiaceae, Euphorbiaceae, Asteraceae, and ferns.

Heavily disturbed subtype on ferrallitic soil

This type of forest occurs in the lowland where local people have easy access to cut and transport timber trees, e.g. near villages, or the old logging road. This is the most extensive forest type in Ben En National Park (about 4100 ha). Stumps are common (usually 3 to 5 stumps per plot), and more than one foot path traverses each plot. There are three layers. The canopy layer is composed mainly of *Syzygium wightianum*, *Callicarpa dichotoma*, *Litsea balansae*, *Diospyros hirsuta*, *Beilschmiedia balansae*, *Koilocarpus longifolium*, *Callicarpa dichotoma*, *Claoxylon indicum*, *Microcos paniculata*, *Ficus hispida*, *Alangium chinense*, *Machilus bonii*, *Pterospermum truncatolobatum*, *Mallotus paniculatus*, *Antidesma montanum*, *Cryptocarya chinensis*, *Ilex cymosa*, *Flacourtia balansae*, *Lithocarpus pseudosundaicus*, *Litsea rotundifolia*, *Machilus grandifolia*, *Dysoxylum caudiflorum*, *Mischocarpus pentapetalus*, *Canarium album*, *Canarium tramdenum*, and *Erythrophleum fordii*. The shrub layer is formed by many species, mainly treelets of the canopy layer. Dominant species are *Diospyros hirsuta*, *Goniothalamus amuyon*, *Litsea rotundifolia*, *Mallotus paniculatus*, *Macaranga auriculata*, *Excoecaria cochinchinensis*, *Miliusa balansae*, *Antidesma bunioides*, *Cryptocarya* sp., *Machilus bonii*, *Dysoxylum caudiflorum*, *Millettia boniana*, and *Dalbergia lanceolaria*. The herb layer is composed mainly of species of the Zingiberaceae, Poaceae, Annonaceae, Rubiaceae, Asteraceae, Acanthaceae, Euphorbiaceae, and ferns.

Shrubland vegetation outside the limestone hills

As in the limestone shrublands, this vegetation type is the result of heavy logging, shifting cultivation and other former agricultural activities in the Park. This

vegetation covers about 2950 ha. It occurs along the old logging road, near villages and in places inside the Park where agriculture used to be practiced before the Park was established in 1992. These shrublands occur around Xuan Thai, Duc Luong, Dong Tho, Bai Bong, and Nga Ba Dong Tho. Dominant species are *Breynia fleuryi*, *Wikstroemia indica*, *Melastoma candidum*, *Memecylon edule*, *Aporosa microcalyx*, *Rhodomyrtus tomentosa*, *Cleistanthus petelotii*, *Mallotus barbatus*, *Macaranga denticulata*, *Desmodium heterocarpon*, *Tephrosia indica*, *Senna tora*, *Cratoxylum polyanthum*, *Cratoxylum prunifolium*, *Antidesma scandens*, *Phyllanthus reticulatus*, *Smilax corbularia*, *Thysanolaena maxima*, *Saccharum spontaneum*, *Saccharum arundinaceum*, and *Imperata cylindrica*. This type of vegetation was also found around Muc Lake, where it is dominated by *Mimosa pigra*.

Plantation forest

Plantation forest scarcely occurs in the Park, it occurs in Trai Bo, Bai village, Roc Khoan, Dong Tho, and Xuan Binh (about 110 ha). The following species are planted: *Acacia auriculaeformis*, *Acacia mangium*, *Canarium tonkinensis*, *Cassia siamea*, *Eucalyptus camaldulensis*, *Hevea brasiliensis*, *Magnolia conifera*, and *Michelia mediocris*. The structure of this forest type is simple; it includes the tree layer and a ground layer with mainly weedy species belonging to Asteraceae, Poaceae, Amaranthaceae, Rubiaceae, Euphorbiaceae, Acanthaceae, and ferns.

Bamboo mixed with timber trees

This vegetation type is due to human activity. The growth of natural bamboo is stimulated by extraction of trees. This forest type covers a large area in Ben En National Park, about 3800 ha. It was found near Chang River, Bai Lan, Xuan Thai, Xuan Binh, and some areas in the centre of the Park. In some areas there are more timber trees than bamboos, but in other areas only few timber trees occur within the bamboo stands. The bamboos are dominated by *Schizostachyum funghomii*, and a few individuals of *Bambusa flexuosa*, *Indosasa sibataeoides*, and *Indosasa sinica*. Many timber tree species are mixed with the bamboo forest. The most important ones are *Pterospermum heterophyllum*, *Beilschmiedia balansae*, *Machilus bonii*, *Lagerstroemia calyculata*, *Endospermum chinense*, *Mallotus paniculatus*, *Aglaia spectabilis*, *Saraca dives*, *Phoebe paniculata*, and *Actinodaphne obovata*. The ground layer is formed by few species of Zingiberaceae, Asteraceae, Poaceae, Amaranthaceae, Rubiaceae, Euphorbiaceae, Acanthaceae, and ferns. Bamboo stands dominated by *Schizostachyum funghomii* have no herb layer at all.

Agricultural land

Agricultural land occurs on a small scale close to the villages in Ben En National Park, in total about 650 ha of home gardens and forest land that is allocated to individual households for protection and re-plantation (GoVN 1994). The land is used for growing sugar cane, cassava, beans, peanuts, vegetables and fruit trees such

as mango, banana, jack fruit, papaya, and orange. Paddy rice (*Oryza sativa*) is grown in irrigated fields along the Muc River and in some areas close to villages.

DISCUSSION

Floristic diversity in Ben En National Park

With 1389 vascular plant species recorded in Ben En National Park in this study the species number continues to increase from the 596 species found in the first inventory (Khoi 1996), via 737 species (Tordoff et al. 2000) and 1347 species (Anonymous 2000). From our list of taxa, 7 families, 43 genera and 252 species have never been recorded in any earlier studies; e.g., in Annonaceae we found 3 new genera and 13 new species for Ben En National Park, Euphorbiaceae has 2 new genera and 37 new species. Most of the newly recorded species are found in the forest, but some of them were found in home gardens of local people in the Park where the earlier studies might not have paid attention, such as *Punica granatum* (Lythraceae), and *Barringtonia acutangula* (Lecythidaceae).

The number of new families, genera and species found in the Park indicate that the flora of Ben En National Park is highly diverse. Moreover, 14 families, 32 genera and 210 species recorded in the earlier survey (Anonymous 2000; Tordoff et al. 2000), were not found during our inventory (Addendum of Appendix 2.1). For instance, 26 species of Orchidaceae were listed by Anonymous (2000), but we only found 16 species. This means that our inventory also may not be complete or that species numbers may be unreliable due to confused taxonomy or erroneous identifications. However, it also indicates that the number of plant species in Ben En National Park is not 1389 species, but could be about 1600 species. More research will probably yield more species records, especially in the undisturbed and poorly accessible areas.

The life forms of plant species in Ben En National Park are diverse. This study demonstrates the importance of Phanerophytes, which represent about 76% of the entire local flora. This is similar to Pu Mat National Park (74.1% phanerophytes; Thin & Nhan 2003), but seemingly different from Cuc Phuong National Park (Lan et al. 1996). However, in Cuc Phuong the percentage of Phanerophytes is lower (57.8%) than in Ben En, because Bryophytes were included in the survey and omitted from ours.

Vegetation types

The vegetation of Vietnam has been studied and classified from the beginning of the last century (Chevalier 1918). Earlier studies have yielded a range of partly overlapping vegetation classifications for Vietnam (Chien 2006; Lan et al. 2006). Trung 1998 recognized 14 vegetation types in Vietnam; Canh & Ly (2004) only 4 main types, Chien (2006) and Lan et al. (2006) each 8 types. Most authors use the

term “closed tropical forest” for primary forest. However, due to logging and other human disturbance most initially closed forests have evolved into a disturbed or open subtype, with two or even only one tree layer(s).

In Ben En National Park, the main forest types depend on whether the substrate is limestone or another type of soil. Within these two evergreen tropical lowland forest types we recognize two subtypes depending on whether disturbance levels were low (“slightly disturbed”) or severe (“heavily disturbed”), as quantified by the presence and frequency of tree stumps and footpaths in the plots. The different levels of disturbance have an impact on species numbers, and tree density, especially of the important timber tree species (Hoang et al. in prep.). In the less disturbed forests, the canopy has two tree layers and the heavily disturbed forest has only one. Some small areas located near Thung Sen, and on the Dam Mountain still have undisturbed limestone forest. However, we could not access these areas, because of the steep and sharp rocky slopes.

Because of its land location and low elevation, mangroves, conifer forests and other high mountain vegetations do not occur in Ben En National Park.

Conservation of plant species

There are differences between the lists of plant species that occur in the Red Data book of Vietnam, Vol. 2 (Ban 2007), and in the Red List of IUCN (2006). The Red List of IUCN (2006) on the flora of Vietnam concentrates on tree species and there is not much information on herbs, shrubs and climbers. But not only tree species are endangered; many herbs, shrubs and climbers species are also threatened such as *Polygonum multiflorum* (Polygonaceae), a small climbing species. At the local level, more species were listed as threatened such as *Stephania longa* (Menispermaceae), *Cibotium barometz* (Dicksoniaceae), *Actinodaphne obovata*, and *Phoebe paniculata* (Lauraceae). They are perhaps not only threatened in Ben En, but also in other parts of Vietnam. *Chukrasia tabularis* is listed both in the Red List of IUCN 2006, and the Red Data Book of Vietnam (Ban 2007). This species is endangered in natural forests. However, *Chukrasia tabularis* (Meliaceae) is planted in plantation forests throughout Vietnam, and in and around Ben En National Park in particular, so that this species is not threatened here. Another species, *Alstonia scholaris* (Apocynaceae), is listed in the IUCN list of 2006, but this species is also common in plantations throughout the country. From our field surveys, it appeared that some species have become endangered by overcollecting of entire plants, such as *Morinda citrifolia*, *Morinda officinalis* (Rubiaceae), and *Smilax glabra* (Smilacaceae) (Hoang et al. 2008 b), or high intensity of illegal logging, and have become very rare in the field: *Garcinia fagraeoides* (Clusiaceae), *Markhamia stipulata* (Bignoniaceae) (Hoang et al. in prep.). Those species will soon be strongly threatened or extinct, at least locally, if no attempts are made to protect and replant them.

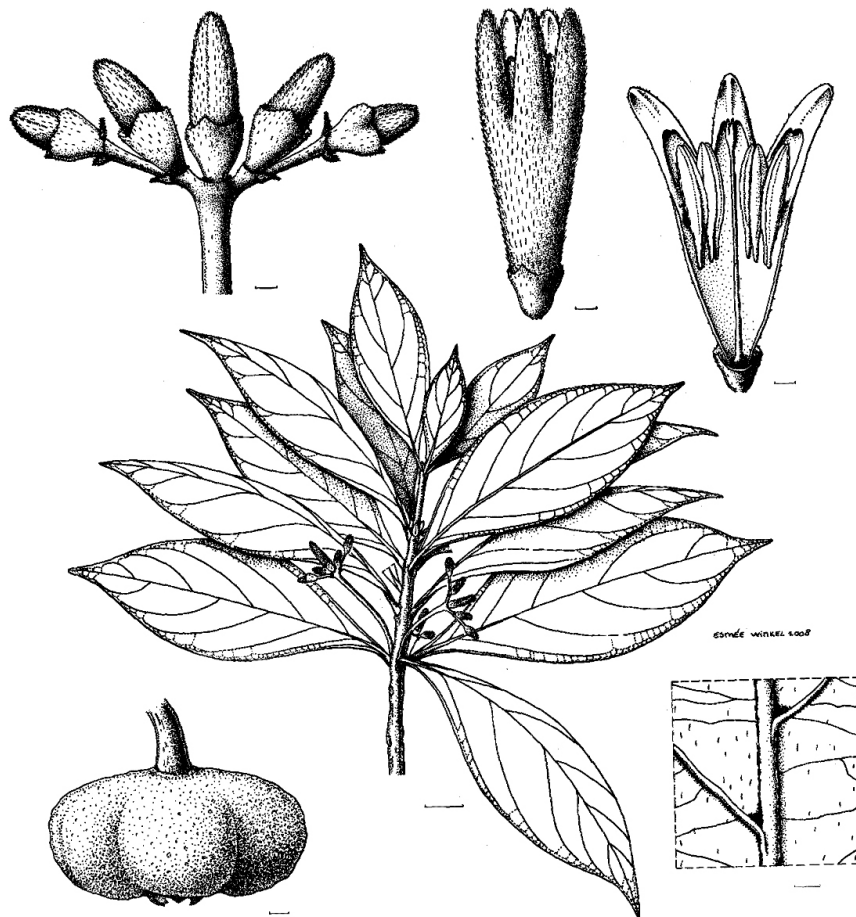


Fig. 2.4. *Timonius arborea* Elmer (Rubiaceae). A new record for flora of Vietnam.

CONCLUSION

Despite very heavy disturbance levels of the most common vegetation types in the Ben En National Park, the number of plant species is still high with an estimated number of 1600 vascular plant species. A large number of plant species provide important commodities for the local communities in Ben En National Park. Thus the plant diversity is still very big and worth conserving. Many species in the Park are threatened at the global, national and local level. Special measures are urgently needed to reverse the effects of disturbance by stopping illegal logging, and making the collection of useful plants more sustainable. In order to reduce the human pressures on the forest resources, more support is needed for local people living in the core zone of the Park, both financially and in acquiring plant cultivation skills. Additionally, a forest restoration program is needed to counteract the heavy anthropogenic disturbance in parts of the Park.

APPENDIX 2.1

List of the vascular plant species in Ben En National Park

Key: LF = life forms: Ph: Phanerophytes; MM: Mega- and Meso-phanerophytes; Na: Nano-phanerophytes; Lp: Lianas-phanerophytes; Ep: Epiphytes-phanerophytes; Pp: Hemi- and parasitic phanerophytes; Sp: Succulent phanerophytes; Ch: Chamaephytes; Hm: Hemicryptophytes; Cr: Cryptophytes; Th: Therophytes. - RDB = Red Data Book of Flora of Vietnam (2007). - RD-IUCN = Red list data of IUCN (2006). - RDBE = Red Data of Ben En National Park: CR: Critically endangered; EN: Endangered; V: Vulnerable; R: Rare; T: Threatened; NT: Near threatened; DD: Data deficient; LC, LR - Least concern. - NOTE = NFBE: New family to BENP; NGBE: New genus to BENP; NSBE: New species to BENP; NSVN: New species to Vietnam. - * Species was recorded in the plots.

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
Psilotophyta	Ngành Quyết lá thông					
Psilotaceae	Họ Quyết lá thông					
<i>Psilotum nudum</i> (L.) Beauv.*	Quyết lá thông	Ch				
Lycopodiophyta	Ngành Thông đất					
Lycopodiaceae	Họ Thông đất					
<i>Huperzia carinata</i> (Desv.) Trevis.	Thông đất	Ch				
<i>Lycopodiella cernua</i> (L.) Pic.Serm.	Thông đất	Ch				
Selaginellaceae	Họ Quyển bá					
<i>Selaginella argentea</i> (Hook. ex Grev.) Spring*	Quyển bá	Ch				
<i>Selaginella delicatula</i> (Desv.) Alston	Quyển bá	Ch				
<i>Selaginella sp.*</i>	Quyển bá	Ch				
Equisetophyta	Ngành Cỏ quần bút					
Equisetaceae	Họ Mộc tặc					
<i>Equisetum diffusum</i> D. Don*	Cỏ quần bút lan	Hm				
Polypodiophyta	Ngành Dương xỉ					
Adiantaceae	Họ Tóc thần vệ nữ					
<i>Adiantum capillus-veneris</i> L.*	Tóc thần vệ nữ	Hm				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Adiantum caudatum</i> L.	Tóc thần vệ nữ	Hm				
<i>Adiantum erylliae</i> Hance*	Ráng	Ch				
<i>Adiantum flabellulatum</i> L.	Tóc thần	Hm				
<i>Adiantum induratum</i> Chr.*	Ráng nguyệt	Hm				
<i>Adiantum stenochlamys</i> Baker	Ráng nguyệt xi	Ch				
<i>Cheilanthes</i> sp.	Thần mô	Hm				
<i>Cheilanthes tenuifolia</i> (Burm. f.) Sw.	Thần mô	Hm				
Angiopteridaceae	Họ Quan âm					
<i>Angiopteris evecta</i> (Forst.) Hoffm.	Toà sen	Na				
Aspleniaceae	Họ Tổ chim					
<i>Asplenium griffithianum</i> Hook.*	Tổ điều	Ep				NSBE
<i>Asplenium nidus</i> L.	Tổ điều	Ep				
<i>Asplenium normale</i> D. Don*	Tổ điều thường	Ep				
<i>Asplenium obscurum</i> Blume	Ráng	Hm				
<i>Asplenium thunbergii</i> Kuntze*	Tổ điều	Hm				
Azollaceae	Họ Bèo tai chuột					
<i>Azolla imbricata</i> (Roxb.) Nakai	Bèo dâu	Cr				
Blechnaceae	Họ Ráng lá dừa					
<i>Blechnum orientale</i> L.*	Ráng lá dừa	Hm				
<i>Stenochlaena palustris</i> (Burm. f.) Bedd.	Chại	Lp				
<i>Woodwardia cochinchinensis</i> Ching	Ráng	Hm				NGBE
Cyatheaceae	Họ Dương xỉ mộc					NFBE
<i>Cyathea contaminans</i> (Hook.) Copel.*	Dương xỉ mộc	MM				NGBE
Davalliaceae	Họ Vẩy lợp					
<i>Davallia denticulata</i> (Burm.) Mett.	Ráng đà	Cr				
<i>Davallia divaricata</i> Blume*	Ráng đà hoa toả	Cr				
<i>Davallia repens</i> (L.f.) Kuhn	Quyết âm thạch	Ep				
<i>Gymnogrammitis dareiformis</i> (Hk.) Ching	Quyết mưa	Ep				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Rumohra sp.</i>	Quyết	Ch				
Dennstaedtiaceae	Họ Ráng đàn tiết					
<i>Lindsaea odorata</i> Roxb.*	Quyết	Hm				
<i>Microlepia trapeziformis</i> (Roxb.) Kuhn	Quyết vảy	Hm				NSBE
Dicksoniaceae	Họ Lông cu li					
<i>Cibotium barometz</i> (L.) J. J. Sm.*	Lông cu li	Ch			T	
Dipteridaceae	Họ Song dực					
<i>Dipteris chinensis</i> (Kaulf.) Reinw.	Quyết quạt	Hm				
Dryopteridaceae	Họ Dương xỉ thường					
<i>Cyrtomium sp.</i>	Quán chúng	Cr				
<i>Dryopteris subtriangularis</i> (Hope.) C.Chr*	Dương xỉ	Hm				
<i>Polystichopsis chinensis</i> (Rosenst.) Holttum	Quyết	Cr				
<i>Tectaria decurrens</i> (C. Presl) Copel.	Quyết ba chạc	Hm				
<i>Tectaria devexa</i> (Mett.) Copel.*	Ráng	Hm				
<i>Tectaria pentagonalis</i> (Bon) C. Chr.	Ráng	Cr				NSBE
<i>Tectaria sp.*</i>	Quyết	Cr				
<i>Tectaria vasta</i> (Blume) Copel.	Ráng	Cr				
Gleicheniaceae	Họ Guột					
<i>Dicranopteris linearis</i> (Burm.) Underw.	Guột	Cr				
Hymenophyllaceae	Họ Lá màng					
<i>Crepidomanes radicans</i> (Sw.) Copel.	Quyết	Cr				
<i>Trichomanes sp.*</i>	Quyết lông	Ep				
Lomariopsidaceae	Họ Ráng sưu xỉ					
<i>Bolbitis heteroclita</i> (Presl) Ching ex C.Chr.	Ráng bích xỉ	Hm				
<i>Piperopteris sp.</i>	Quyết nhung	Ch				
Marattiaceae	Họ Quyết toà sen					
<i>Angiopteris confertinervia</i> Ching	Toà sen	Na				NSBE
<i>Angiopteris evecta</i> (G.Forst.) Hoffm.	Quyết toà sen	Na				
Marsileaceae	Họ Rau bợ					

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Marsilea quadrifolia</i> L.	Rau bợ	Th				
Polypodiaceae	Họ Dương xỉ					
<i>Drynaria bonii</i> H. Christ	Cốt toái bở	Ep	V			DD
<i>Drynaria fortunei</i> (Kuntze ex Mett.) J. Sm.	Cốt toái bở	Ep	EN			R NSBE
<i>Drynaria lanceolata</i> (L.) Farw.	Cốt toái bở lưỡi mác	Ep				
<i>Lemmaphyllum microphyllum</i> C. Presl*	Quyết lá nhỏ	Ep				
<i>Microsorium superficiale</i> (Bedd.) Ching	Ráng	Ep				
<i>Pyrrosia lanceolata</i> (L.) Farw.	Thạch vĩ lưỡi mác	Ep				
<i>Pyrrosia lingua</i> (Thunb.) Farw.	Ráng	Ep				
Pteridaceae	Họ Chân xỉ					
<i>Pteris ensiformis</i> Burm. f.	Seo gà	Ep				
<i>Pteris finotii</i> C. Chr.*	Ráng chân xỉ	Ch				
<i>Pteris grevilleana</i> Wall.	Quyết đuôi gà	Hm				
<i>Pteris longipes</i> D. Don*	Seo gà dài	Cr				
<i>Pteris multifida</i> Poir.	Seo gà xẻ nhiều	Ch				
<i>Pteris sp.*</i>	Chân xỉ	Hm				
<i>Pteris vittata</i> L.	Chân xỉ sọc	Hm				
Schizaeaceae	Họ Bòng bong					
<i>Lygodium conforme</i> C. Chr.*	Bòng bong lá to	Lp				
<i>Lygodium digitatum</i> C. Presl*	Bòng bong	Lp				
<i>Lygodium flexuosum</i> (L.) Sw.	Bòng bong	Lp				
<i>Lygodium scandens</i> (L.) Sw.	Bòng bong lá nhỏ	Lp				
<i>Lygodium sp.*</i>	Bòng bong	Lp				
Thelypteridaceae	Họ Ráng thu dực					
<i>Abacopteris rubra</i> (Ching) Ching	Ráng	Hm				
<i>Christella acuminata</i> (Hout.) Holttum	Quyết lông	Hm				
<i>Christella balansae</i> (Ching) Holttum*	Ráng lông	Hm				
<i>Macrothelypteris torresiana</i> (Gaud.) Ching	Ráng	Cr				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Pneumatopteris truncatus</i> (Poir.) Holttum	Quyết khí	Ch				
<i>Pronephrium</i> sp.	Ráng	Cr				
Vittariaceae	Họ Ráng					
	lưỡi beo					
<i>Antrophyum annamensis</i> C. Chr. & Tardieu	Lưỡi beo	Ep				
Woodsiaceae	Ráng gỗ					NFBE
	nhỏ					
<i>Callipteris esculenta</i> J. Sm.*	Rau dớn	Lp				NGBE
<i>Diplazium esculentum</i> (Retz.) Sw.	Rau rớn	Lp				NGBE
Pinophyta	Ngành					
	thông					
Cycadaceae	Họ Tuế					
<i>Cycas chevalieri</i> Leandri	Nghèn	Na	LR		R	
<i>Cycas immersa</i> Craib	Tuế chim	Na			R	
<i>Cycas pectinata</i> Buch.-Ham.	Tuế lược	Na	V		R	NSBE
<i>Cycas revoluta</i> Thunb.	Vạn tuế	Na			R	
Gnetaceae	Họ Gắm					
<i>Gnetum gnemon</i> L.	Gắm	Lp				NSBE
<i>Gnetum latifolium</i> Blume	Gắm lá rộng	Lp				NSBE
<i>Gnetum montanum</i> Markgr.	Gắm núi	Lp				
Pinaceae	Họ Thông					
<i>Pinus massoniana</i> D. Don	Thông					
	đuôi ngựa	MM				
<i>Pinus merkusii</i> Jungh. & de Vriese	Thông nhựa	MM				
Podocarpaceae	Họ Kim					
	giao					
<i>Nageia fleuryi</i> (Hickel) de Laub.	Kim giao	MM			T	
Magnoliophyta	Ngành					
	Mộc lan					
Magnoliopsida	Lớp 2 lá					
	mâm					
Acanthaceae	Họ Ô rô					
<i>Acanthus leucostachyus</i> Wall.*	Ô rô núi	MM				
<i>Acanthus ilicifolius</i> L.*	Ô rô lá bé	MM				
<i>Baphicacanthus cusia</i> (Nees) Bremek.*	Chàm lá lớn	Na				NGBE
<i>Clinacanthus</i> sp.*	Chàm	Na				
<i>Justicia poilanei</i> Benn.	Thanh táo	Na				NGBE

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<i>Strobilanthes cystolithiger</i> Lind.*	Chuỳ hoa	Na				
<i>Strobilanthes multangulus</i> Benoist	Chàm rừng	Na				
<i>Rhinacanthus nasutus</i> (L.) Kurz*	Bạch hạc	Na				NSBE
<i>Thunbergia fragrans</i> Roxb.	Cát đăng	Lp				
<i>Thunbergia sp.</i> *	Bông xanh	Lp				
Aceraceae	Họ Thích					
<i>Acer decandrum</i> Merr.*	Thích lá nguyên	MM				
<i>Acer laevigatum</i> Wall.*	Thích	MM				NSBE
Alangiaceae	Họ Thôi ba					
<i>Alangium barbatum</i> (R. Br.) Baill.*	Thôi ba	MM				
<i>Alangium chinense</i> (Lour.) Rehd.*	Thôi ba	MM				
<i>Alangium kurzii</i> Craib*	Thôi ba lông	MM				
Amaranthaceae	Họ Rau dền					
<i>Achyranthes aspera</i> L.*	Cỏ xước	Ch				
<i>Achyranthes bidentata</i> Blume	Cỏ xước	Ch				
<i>Alternanthera sessilis</i> (L.) A.DC.	Rau diếp đại	Ch				
<i>Amaranthus spinosus</i> L.	Dền cơm	Th				
<i>Amaranthus tricolor</i> L.	Dền tía	Hm				
<i>Amaranthus viridis</i> L.	Đơn đỏ	Hm				
<i>Celosia argentea</i> L.	Mào gà	Ch				
<i>Cyathula prostrata</i> (L.) Blume	Đơn đỏ	Hm				NGBE
<i>Deeringia polysperma</i> (Roxb.) Miq.	Cúc bách nhật	Ch				NGBE
Anacardiaceae	Họ Xoài					
<i>Buchanania arborescens</i> Blume	Chay lớn	MM				
<i>Buchanania lucida</i> Blume	Chay	MM				
<i>Dracontomelon dao</i> (Blanco) Merr. & Rolfe*	Sầu	MM				
<i>Mangifera indica</i> L.	Xoài	MM				
<i>Mangifera minutiflora</i> Evrard	Xoài rừng	MM		V		
<i>Mangifera reba</i> Pierre	Quéo	MM				
<i>Rhus chinensis</i> Muell.	Muối	MM				
<i>Rhus rhesoides</i> Craib*	Sơn rừng	MM				
<i>Rhus succedanea</i> L.*	Sơn ta	MM				
<i>Spondias axillaris</i> Roxb.	Xoan nhừ	MM				
<i>Spondias lakoensis</i> Pierre*	Dâu da xoan	MM				

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Annonaceae	Họ Na					
<i>Alphonsea hainanensis</i> Merr. & Chun*	Thau linh hải nam	MM				
<i>Alphonsea monogyna</i> Merr. & Chun*	Thau linh	MM				NSBE
<i>Alphonsea squamosa</i> Finet & Gagnep.*	Thau linh trơn	MM				NSBE
<i>Alphonsea tonkinensis</i> A. DC.*	Thau linh bắc bộ	MM				NSBE
<i>Annona muricata</i> L.	Mãng cầu xiêm	MM				
<i>Annona squamosa</i> L.	Na	MM				
<i>Artabotrys hexapetalus</i> (L.f.) Bhandari*	Dây công chúa	Lp				
<i>Artabotrys intermedius</i> Hassk.*	Móng rồng nhỏ	Lp				
<i>Dasymaschalon macrocalyx</i> Finet & Gagnep.	Dắt mèo	Na				NGBE
<i>Desmos chinensis</i> Lour.	Dây công chúa	Lp				
<i>Desmos cochinchinensis</i> Lour.*	Hoa giẻ	Lp				
<i>Desmos pedunculatus</i> (A.DC.) Ban	Hoa giẻ	Lp				
<i>Fissistigma latifolium</i> (Dun.) Merr.*	Cách thư lông	Lp				NSBE
<i>Fissistigma petelotii</i> Merr.	Cách thư	Lp				
<i>Fissistigma villosum</i> (Ast) Merr.	Cách hoa có lông	Lp				NSBE
<i>Friesodielsia fornicata</i> (Roxb.) D. Das	Cườm chài	Lp				NGBE
<i>Goniothalamus amuyon</i> Merr.*	Giác đế	MM				
<i>Goniothalamus macrocalyx</i> Ban*	Giác đế lá lớn	MM	V	V	DD	
<i>Miliusa balansae</i> Finet & Gagnep.*	Màu cau	MM				
<i>Miliusa horsfieldii</i> (Benn.) Pierre*	Màu cau	MM				NSBE
<i>Miliusa sp.</i> *	Màu cau	MM				
<i>Miliusa velutina</i> Hook.f. & Thomson*	Màu cau lông	MM				NSBE
<i>Polyalthia cerasoides</i> (Roxb.) Benth.*	Nhọc lá bé	MM				
<i>Polyalthia jucunda</i> Finet & Gagnep.*	Nhọc lá dài	MM				
<i>Polyalthia laui</i> Merr.*	Nhọc lá to	MM				
<i>Polyalthia nemoralis</i> DC.	Nhọc đen	MM				
<i>Uvaria boniana</i> Finet & Gagnep.	Dây đứt	Lp				

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<i>Uvaria macrophylla</i> Roxb.	Dây đứt nhung	Lp				
<i>Uvaria micrantha</i> Hook.f. & Thomson	Dây đứt na	Lp				
<i>Uvaria tonkinensis</i> Finet & Gagnep.	Dây hoa dẻ	Lp				
<i>Xylopia pierreii</i> Hance	Dền trắng	MM	V	V	R	NSBE
<i>Xylopia poilanei</i> Ast*	Dền trắng	MM				NSBE
<i>Xylopia vielana</i> Pierre*	Dền	MM				
Apiaceae	Họ Hoa tán					
<i>Anethum graveolens</i> L.	Thì là	Th				
<i>Centella asiatica</i> (L.) Urb.	Rau má	Ch				
<i>Coriandrum sativum</i> L.	Rau mùi	Th				
<i>Eryngium foetidum</i> L.	Mùi tàu	Ch				
<i>Hydrocotyle sibthorpioides</i> Lamk.	Rau má to	Ch				
Apocynaceae	Họ Trúc đào					
<i>Alstonia scholaris</i> (L.) R. Br.	Sữa	MM		LR		
<i>Alyxia balansae</i> Pit.	Dây ngôn	Lp				
<i>Beaumontia grandifolia</i> Wall.	Dây cao su	Lp				
<i>Catharanthus roseus</i> L.	Dừa cạn	Na			T	NGBE
<i>Holarrhena antidesenterica</i> (L.) Wall.	Mộc	Na				
<i>Holarrhena pubescens</i> Wall.	Mộc hoa trắng	Na				NSBE
<i>Kibatalia anceps</i> (Dunn & R. Williams) Woodson	Dùi đôi	Lp				
<i>Kibatalia laurifolia</i> (Ridl.) Woodson	Thần linh	Na				
<i>Kibatalia macrophylla</i> (Pierre) Woodson*	Ốt sùng lá lớn	Na				NSBE
<i>Kitabalia microphylla</i> (Pit.) Woodson*	Ốt sùng	Na				
<i>Melodinus brachyphyllus</i> Merr.	Dây cao su	Lp				
<i>Paravallaris macrophylla</i> Pierre ex Hua*	Mức trâu	MM				NGBE
<i>Plumeria rubra</i> L.	Đại	MM				
<i>Pottsia laxiflora</i> Kuntze	Bột hoa thưa	Lp				
<i>Rauvolfia serpentina</i> Baill.*	Ba gác đỏ	Na	CR		R	NSBE
<i>Rauvolfia verticillata</i> Baill.*	Ba gác	Na	V		T	NSBE
<i>Strophanthus caudatus</i> (Burm. f.) Kurz*	Sùng trâu	Na				NSBE
<i>Strophanthus divaricatus</i> Hook. & Arn.	Sùng dê	Na				
<i>Tabernaemontana bovina</i> Lour.	Lài trâu	Na				

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<i>Tabernaemontana pallida</i> Pierre ex Pit.	Ớt rừng lá nhỏ	Na				
<i>Tabernaemontana</i> sp.	Ớt rừng	Na				
<i>Trachelospermum axillare</i> Hook. f.	Lạc thạch	Lp				NGBE
<i>Wrightia annamensis</i> Eberh. & Dub.*	Lòng mức trung bộ	MM				
<i>Wrightia laevis</i> Hook. f.*	Thùng mức trơn	MM		LR		
<i>Wrightia tomentosa</i> Roem. & Schult.*	Mức lông	MM				
Aquifoliaceae	Họ Búi					
<i>Ilex cymosa</i> Champ.*	Vỏ rứt	MM				
<i>Ilex macrocarpa</i> Oliv.	Búi quả to	MM				NSBE
<i>Ilex rotunda</i> Thunb.*	Nhựa ruồi	MM				
Araliaceae	Họ Nhân sâm					
<i>Acanthopanax aculeatum</i> Seem.	Ngũ ra bì	Na				
<i>Aralia armata</i> Seem.	Đơn châu châu	Na				
<i>Aralia toranensis</i> Ha*	Cuồng	Na				
<i>Polyscias fruticosa</i> Harms	Đinh lăng	Na				
<i>Schefflera alpina</i> Grushv. & Skvortsova	Chân chim	MM				
<i>Schefflera octophylla</i> Harms*	Chân chim 8 lá	MM				
<i>Schefflera pauciflora</i> R. Vig.*	Chân chim	MM				
<i>Schefflera tonkinensis</i> Hook.*	Chân chim	MM				
<i>Trevesia burkii</i> Boerl.	Đu đủ rừng	Na				
<i>Trevesia</i> sp.	Đu đủ rừng	Na				
Asclepiadaceae	Họ Thiên lý					
<i>Cryptolepis buehneri</i> Roem. & Schott.	Dây càng cua	Lp				
<i>Dischidia acuminata</i> Costantin	Dây hạt bí	Lp				
<i>Dischidia balansae</i> Costantin	Song ly	Lp				
<i>Dischidia</i> sp.	Tai chuột	Ep				
<i>Gymnema tingens</i> Spreng.	Rau mợ	Lp				NGBE
<i>Hoya villosa</i> Costantin	Hoa sao	Ep				
<i>Streptocaulon griffithii</i> Hook.f.	Hà thủ ô trắng	Ch				

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<i>Telosma cordata</i> Merr.	Hoa thiên lý	Lp				
Asteraceae	Họ Cúc					
<i>Ageratum conyzoides</i> L.	Cứt lợn	Hm				
<i>Artemisia annua</i> L.	Thanh cao hoa vàng	Hm				
<i>Artemisia japonica</i> Thunb.	Ngải cứu rừng	Hm				NSBE
<i>Artemisia vulgaris</i> L.	Ngải cứu	Hm				
<i>Bidens bipinnata</i> L.	Đơn buốt	Hm				
<i>Bidens pilosa</i> L.	Đơn buốt	Hm				
<i>Blumea aromatica</i> DC.	Đại bi xanh	Ch				NSBE
<i>Blumea balsamifera</i> DC.	Đại bi	Ch				
<i>Blumea lacera</i> (Roxb.) DC.	Cúc trời	Hm				
<i>Blumea lanceolaria</i> Druce	Xương sông	Ch				
<i>Blumea megacephala</i> C.T. Chang & C.H.Yu.	Đại bi	Na				NSBE
<i>Conyza canadensis</i> (L.) Cronquist	Cúc dại	Hm				
<i>Crossostephium chinense</i> Makino	Nguyệt bạch	Ch				
<i>Dichrocephala integrifolia</i> Kuntze	Cúc mắt cá	Hm				NGBE
<i>Eclipta prostrata</i> L.	Nhọ nôi	Hm				
<i>Elephantopus mollis</i> Kunth	Chân voi mềm	Ch				
<i>Elephantopus scaber</i> L.*	Cúc chi thiên	Hm				
<i>Elephantopus spicatus</i> Aubl.*	Cúc chi thiên lông	Hm				
<i>Emilia sonchifolia</i> (L.) DC.	Rau má lá rau muống	Hm				
<i>Erechtites hieraciifolia</i> (L.) Raf. & DC.	Rau tàu bay rừng	Hm				
<i>Erigeron crispus</i> Pourr.*	Cúc hôi	Ch				
<i>Eupatorium odoratum</i> L.*	Cỏ lào	Ch				
<i>Gnaphalium polycaulon</i> Pers.	Rau khúc	Th				NGBE
<i>Grangea</i> sp.	Rau dại	Th				
<i>Gynura barbaraefolia</i> Gagnep.	Kim thất cải	Hm				
<i>Gynura crepidioides</i> Benth.	Rau tàu bay	Ch				
<i>Gynura japonica</i> (Thunb.) Juel.	Cúc tam thất	Hm				

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<i>Gynura procumbens</i> (Lour.) Merr.	Kim thất	Lp				
<i>Gynura pseudochina</i> (L.) DC.	Bầu đất	Ch				
<i>Gynura sp.</i>	Kim thất	Hm				
<i>Gynura sp.1</i>	Bầu đất	Hm				
<i>Lactuca indica</i> L.	Bồ công anh	Hm				
<i>Lactuca roborowskii</i> Maxim.	Diếp dại	Th				
<i>Mikania cordata</i> (Burm.f.) B.L.Rob.	Cúc leo	Lp				
<i>Pluchea indica</i> Less.	Cúc tần	Hm				
<i>Sigesbeckia orientalis</i> L.	Cỏ dĩ	Hm				
<i>Spilanthes paniculata</i> Wall.	Cúc nút áo	Hm				NGBE
<i>Synedrella nodiflora</i> Gaertn.	Cúc bọ xít	Hm				
<i>Tagetes erecta</i> L.	Vạn thọ	Ch				
<i>Vernonia andersonii</i> C.B.Clarke	Rau ráu	Lp				
<i>Vernonia arborea</i> Buch-Ham.	Bông bạc	MM				
<i>Vernonia cinerea</i> (L.) Less.	Cúc tím	Hm				
<i>Vernonia cumingiana</i> Benth.	Bông bạc	MM				
<i>Vernonia sp.</i>	Bạch đầu	Na				
<i>Xanthium strumarium</i> L.	Ké đầu ngựa	Ch				
Balsaminaceae	Họ Bóng nước					
<i>Impatiens pygmaea</i> Hook. f.	Bóng nước	Ch				
<i>Impatiens verrucifer</i> Hook.f.	Phượng tiên	Ch				
<i>Impatiens sp.</i>	Phượng tiên	Ch				
Basellaceae	Họ Mồng tơi					
<i>Basella rubra</i> L.	Mồng tơi	Th				
Begoniaceae	Họ Thu hải đường					
<i>Begonia aptera</i> Blume	Thu hải đường	Ch				
<i>Begonia balansae</i> Gagnep.	Thu hải đường	Ch				
<i>Begonia lecomtei</i> Gagnep.	Thu hải đường	Ch				
<i>Begonia pierrei</i> Gagnep.	Thu hải đường	Ch				
<i>Begonia tonkinensis</i> Gagnep.	Thu hải đường bắc bộ	Ch				NSBE

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<i>Begonia sp.</i>	Hải đường	Ch				
Betulaceae	Họ Cánh lò					NFBE
<i>Betula alnoides</i> Buch.-Ham.	Cánh lò	MM				NGBE
Bignoniaceae	Họ Núc nác					
<i>Dolichandrone serrulata</i> Seem.	Quao	MM		LR	R	
<i>Fernandoa brilletii</i> (P.Dop) Steenis*	Đỉnh thối	MM				
<i>Markhamia stipulata</i> Seem. ex Schum.*	Đỉnh	MM	V		E	
<i>Markhamia cauda-felina</i> (Hance) Craib*	Kè đuôi dông	MM				
<i>Oroxylum indicum</i> (L.) Benth. ex Kurz*	Núc nác	MM				
<i>Stereospermum colais</i> (Buch.-Ham. ex Dillwyn) Mabb.	Quao núi	MM				NGBE
Bombacaceae	Họ Gạo					
<i>Bombax ceiba</i> L.	Bông gạo	MM				
<i>Gossampinus malabarica</i> Merr.	Gạo	MM				
Boraginaceae	Họ Vòi voi					
<i>Heliotropium indicum</i> L.	Vòi voi	Hm				
Brassicaceae	Họ Cải					
<i>Brassica chinensis</i> L.	Cải bẹ trắng	Th				
<i>Brassica integrifolia</i> West.	Cải ngọt	Th				
<i>Brassica juncea</i> (L.) Czern.	Cải canh	Th				
<i>Raphanus sativus</i> L.	Cải củ	Th				
<i>Rorippa dubia</i> Pers.	Cải đại	Th				
Buddlejaceae	Họ Bọ chó					
<i>Buddleja asiatica</i> Lour.	Bọ chó	Na				
Burseraceae	Họ Trám					
<i>Canarium album</i> Rausch.*	Trám trắng	MM				
<i>Canarium bengalense</i> Roxb.*	Trám 3 cạnh	MM				
<i>Canarium littorale</i> Blume*	Trám hồng	MM		LR		NSBE
<i>Canarium tonkinensis</i> L.*	Trám chim	MM				
<i>Canarium tramdenum</i> Chan Din Dai & Yakovlev*	Trám đen	MM	V		R	
<i>Garuga pinnata</i> Roxb.*	Trám mao	MM				
Cactaceae	Họ Long cốt					
<i>Epiphyllum oxypetalum</i> Haw.	Quỳnh	Ch				
Caesalpiniaceae	Họ Vang					

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<i>Bauhinia championii</i> Benth.	Móng bò	Lp				
<i>Bauhinia coccinea</i> DC.*	Quạch	Lp				NSBE
<i>Bauhinia mastipoda</i> Pierre ex Gagnep.	Móng bò hoa đỏ	Lp				NSBE
<i>Bauhinia ornata</i> Kurz	Móng bò leo	Lp				
<i>Bauhinia</i> sp.*	Móng bò	Lp				
<i>Bauhinia</i> sp.1*	Dây máu	Lp				
<i>Bauhinia</i> sp.2*	Móng bò	Lp				
<i>Bauhinia variegata</i> L.	Ban	MM				NSBE
<i>Caesalpinia bonduc</i> (L.) Roxb.	Móc mèo núi	Lp				
<i>Caesalpinia mimosoides</i> Lam.	Muồng trinh nữ	Lp				
<i>Caesalpinia minax</i> Hance	Vuốt hùm	Lp				
<i>Caesalpinia pubescens</i> (Desf.) Hatt.	Muồng dây	Lp				NSBE
<i>Caesalpinia sappan</i> L.	Vang	MM			R	
<i>Cassia hirsuta</i> (L.) Irwin & Barneby	Muồng hôi	MM				
<i>Cassia mimosoides</i> L.	Muồng trinh nữ	Na				
<i>Cassia</i> sp.	Muồng	Na				
<i>Cassia</i> sp.1*	Muồng	MM				
<i>Delonix regia</i> (Bojer) Rafin.	Phượng	MM				
<i>Gleditsia australis</i> Hemsl.*	Bò kết	MM				
<i>Erythrophleum fordii</i> Oliv.*	Lim xanh	MM			T	
<i>Peltophorum dasyrrachis</i> (Miq.) Kurz*	Lim vàng	MM				
<i>Peltophorum tonkinensis</i> Pierre*	Lim xẹt	MM			V	
<i>Sacara dives</i> Pierre*	Vàng anh	MM				
<i>Senna occidentalis</i> (L.) Link	Cốt khí	Na				
<i>Senna siamea</i> Lam.*	Muồng đen	MM			R	
<i>Senna tora</i> (L.) Roxb.*	Thảo quyết minh	Ch				
<i>Sindora tonkinensis</i> A. Chev.	Gụ lau	MM	EN		E	
<i>Tamarindus indica</i> L.	Me	MM				NGBE
Capparaceae	Họ Mần màn					
<i>Capparis tonkinensis</i> Gagnep.	Cáp	Lp				NSBE
<i>Cleome gynandra</i> L.	Mần màn	Ch				

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<i>Crateva magna</i> (Lour.) DC.*	Cây bún	MM				
<i>Crateva religiosa</i> Forst. f.	Bún	MM				
<i>Stixis scandens</i> Lour.	Trứng cuốc	Lp				
<i>Stixis sp.</i>	Trứng cuốc	Lp				
Caprifoliaceae	Họ Kim ngân					
<i>Lonicera japonica</i> Thunb.	Kim ngân	Ch				
<i>Lonicera macrantha</i> (D. Don) Spreng.	Kim ngân hoa to	Ch				
<i>Sambucus javanica</i> Reinw. ex Blume*	Cơm cháy	MM				
<i>Viburnum lutescens</i> Blume	Vót vàng	Na				NSBE
<i>Viburnum sambucinum</i> Reinw.*	Vót cơm cháy	Na				
Caricaceae	Họ Đu đủ					
<i>Carica papaya</i> L.	Đu đủ	Na				
Celastraceae	Họ Chân danh					
<i>Celastrus annamensis</i> Tardieu*	Gối Trung bộ	Lp				NGBE
<i>Celastrus paniculatus</i> Willd.*	Dây sang máu	Lp				NGBE
<i>Euonymus laxiflorus</i> Champ.	Chân danh	Na				
<i>Glyptopetalum sclerocarpum</i> (Kurz) M.A. Lawson*	Xâm cánh Bền En	MM			R	NSVN
<i>Salacia verrucosa</i> Wight*	Cộc màu	Na				
Chenopodiaceae	Họ Rau muối					
<i>Chenopodium ficifolium</i> Smith	Rau muối	Th				
Chloranthaceae	Họ Hoa sói					
<i>Chloranthus erectus</i> (Benth. & Hook.f.) Verdc.	Sói rừng	Na				
Clusiaceae	Họ Bứa					
<i>Calophyllum calaba</i> L.	Cồng tía	MM				
<i>Calophyllum inophyllum</i> L.*	Mù u	MM	LR		R	NSBE
<i>Calophyllum membranaceum</i> Gardn. & Champ.	Cồng	MM				
<i>Cratoxylum polyanthum</i> Korth.*	Thành ngành	MM				
<i>Cratoxylum prunifolium</i> Kurz*	Đỏ ngọn	Na				
<i>Cratoxylum sp.</i>	Lành ngành	Na				
<i>Garcinia cochinchinensis</i> (Lour.) Choisy*	Bứa nam bộ	MM				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Garcinia cowa</i> Roxb.	Tai chua	MM				
<i>Garcinia multiflora</i> Champ. ex Benth.	Dọc	MM				
<i>Garcinia fagraeoides</i> A. Chev.*	Trai lý	MM			E	
<i>Garcinia oblongifolia</i> Champ. ex Benth.*	Bứa	MM				NSBE
<i>Garcinia</i> sp.	Bứa	MM				
Combretaceae	Họ Bàng					
<i>Combretum catappa</i> L.	Bàng	MM				
<i>Quisqualis indica</i> L.	Dây giun	Lp				
<i>Terminalia alata</i> Roxb.*	Chiêu liêu	MM				
<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Choại	MM				
<i>Terminalia myriocarpa</i> Van Heurck & Müll.Arg.*	Chò xanh	MM				
Connaraceae	Họ Dây khế					
<i>Cnestis palala</i> Merr.	Dây khế	Lp				
<i>Rourea minor</i> Leenh.	Khế rừng	Lp				
Convolvulaceae	Họ Bìm bìm					
<i>Argyreia acuta</i> Lour.	Bạc thau	Ch				
<i>Ipomoea aquatica</i> Forssk.	Rau muống	Lp				
<i>Ipomoea batatas</i> (L.) Lam.	Khoai lang	Lp				
<i>Ipomoea cymosa</i> (Desr.) Roem. & Schult.	Dây lang rừng	Lp				
<i>Ipomoea quamoclit</i> L.	Tóc tiên	Th				
<i>Merremia boissiana</i> (Gagnep.) Ooststr.	Bìm bìm	Lp				NSBE
<i>Merremia</i> sp.	Bìm bìm	Lp				
Crassulaceae	Họ Thuốc bỏng					
<i>Kalanchoe integra</i> Kuntze	Thuốc bỏng	Sp				
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Thuốc bỏng	Sp				
Cucurbitaceae	Họ Bầu bí					
<i>Benincasa hispida</i> (Thunb.) Cogn.	Bí xanh	Th				
<i>Coccinia grandis</i> (L.) Voigt	Mảnh bát	Lp				
<i>Cucumis sativus</i> L.	Dưa chuột	Lp				
<i>Cucurbita maxima</i> Lam.	Bí đỏ	Lp				
<i>Gymnopetalum</i> sp.	Dây loa	Lp				
<i>Gymnopetalum</i> sp.1	Dây loa	Lp				
<i>Hodgsonia macrocarpa</i> Cogn.	Đại hái	Lp				

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<i>Lagenaria siceraria</i> (Molina) Standl.	Bầu	Th				
<i>Luffa cylindrica</i> M. Roem.	Mướp	Th				
<i>Momordica charantia</i> L.	Mướp đắng	Th				
<i>Momordica cochinchinensis</i> (Lour.) Spreng.	Gấc	Th				
<i>Solena heterophylla</i> Lour.	Dây mảnh bát	Th				
<i>Trichosanthes cucumeroides</i> Maxim.*	Dưa núi	Lp				
<i>Zehneria indica</i> (Lour.) M. Keraudren-Aymonin*	Dưa chuột đại	Lp				
Cuscutaceae	Họ Tơ hồng					
<i>Cuscuta chinensis</i> Lam.	Tơ hồng	Pp				
Daphniphyllaceae	Họ Giao phương					NFBE
<i>Daphniphyllum calycinum</i> Benth.*	Giao phương	MM				NGBE
Datiscaceae	Họ Đắng					
<i>Tetrameles nudiflora</i> R.Br.	Đắng	MM				
Dilleniaceae	Họ Sỗ					
<i>Actinidia latifolia</i> Merr.	Đào khi	MM				
<i>Dillenia heterosepala</i> Finet & Gagnep.*	Lọng bàng	MM				
<i>Dillenia indica</i> L.*	Sỗ	MM				
<i>Dillenia pentagyna</i> Roxb.*	Sỗ 5 nhụy	MM				
<i>Saurauia dillenioides</i> Gagnep.*	Nóng sỗ	MM				
<i>Saurauia roxburghii</i> Wall.*	Nóng	MM				NSBE
<i>Saurauia tristyla</i> DC.*	Nóng	MM				
<i>Tetracera indica</i> Merr.*	Chạc chiu	Lp				NSBE
<i>Tetracera scandens</i> Merr.	Chạc chiu	Lp				
Dipterocarpaceae	Họ Dầu					
<i>Dipterocarpus retusus</i> Blume	Chò nâu	MM	V			R
<i>Hopea chinensis</i> (Merr.) Hand.-Mazz.*	Sao hòn gai	MM		CR		
<i>Hopea hainanensis</i> Merr. & Chun*	Sao hải nam	MM	EN			R
<i>Hopea mollissima</i> C.Y. Wu*	Tầu mặt quỷ	MM	V	CR		T
<i>Hopea odorata</i> Roxb.	Sao đen	MM				R
<i>Parashorea chinensis</i> Wang Hsie*	Chò chi	MM		EN		T
<i>Vatica harmandiana</i> Pierre*	Tầu xanh	MM		EN		R
<i>Vatica odorata</i> (Griff.) Symington*	Tầu lá nhỏ	MM				R
<i>Vatica subglabra</i> Merr.	Tầu nước	MM	EN			E

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Ebenaceae	Họ Thị					
<i>Diospyros apiculata</i> Hiern*	Nhọ nôi	MM				
<i>Diospyros crumenata</i> Thwaites*	Thị đá	MM				NSBE
<i>Diospyros decandra</i> Lour.	Thị	MM				
<i>Diospyros eriantha</i> Champ. ex Benth.*	Thị lông đỏ	MM				NSBE
<i>Diospyros hirsuta</i> L.f.*	Thị rừng lông	MM				
<i>Diospyros kaki</i> L.f.	Hồng	MM				NSBE
<i>Diospyros montana</i> Roxb.*	Thị rừng	MM				
<i>Diospyros morrisiana</i> Hance	Hồng rừng	MM				
<i>Diospyros pilosula</i> (A.DC.) Walld. ex Hiern	Thị lông vàng	MM				
<i>Diospyros rubra</i> C.F.Gaertn.*	Thị rừng	MM				NSBE
<i>Diospyros sp.*</i>	Thị rừng	MM				
<i>Diospyros sp.1*</i>	Thị rừng	MM				
<i>Diospyros sylvatica</i> Roxb.*	Thị rừng	MM				NSBE
Elaeagnaceae	Họ Nhót					
<i>Elaeagnus bonii</i> Lecomte	Nhót	Lp				
<i>Elaeagnus tonkinensis</i> Serv.	Nhót nhà	Lp				
Elaeocarpaceae	Họ Côm					
<i>Elaeocarpus apiculatus</i> Mast.	Côm vòng	MM	CR	DD		NSBE
<i>Elaeocarpus dubius</i> Aug. DC.*	Côm tầng	MM				
<i>Elaeocarpus hainanensis</i> Oliver*	Côm hải nam	MM				NSBE
<i>Elaeocarpus petiolatus</i> (Jack) Wall.*	Côm cuống dài	MM				
<i>Elaeocarpus sylvestris</i> Poir.*	Côm trâu	MM				
<i>Elaeocarpus varunua</i> Buch.-Ham.*	Côm xanh	MM				NSBE
Ericaceae	Họ Đỗ quỳên					NFBE
<i>Craibiodendron henryi</i> W.W. Sm*	Hoa bột	MM				NGBE
<i>Craibiodendron stellatum</i> W.W. Sm.*	Hoa bột	MM				NGBE
<i>Rhododendron microphyton</i> Franch.	Đỗ quỳên	Na				NGBE
Euphorbiaceae	Họ Thầu đầu					
<i>Acalypha hispida</i> Burm.f.	Tai tượng đỏ	Na				
<i>Actephila excelsa</i> (Dalzell) Müll.Arg.	Da gà	Na				

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<i>Alchornea annamica</i> Gagnep.	Đom đóm trung bộ	Na				
<i>Alchornea rugosa</i> (Lour.) Müll.Arg.*	Sỏi dai	Na				
<i>Alchornea tiliifolia</i> Müll.Arg.*	Đom đóm	Na				NSBE
<i>Alchornea trewioides</i> Müll.Arg	Đom đóm	Na				
<i>Aleurites moluccana</i> (L.) Willd.	Lai	MM				
<i>Antidesma acidum</i> Retz.*	Chòi mòi	MM				
<i>Antidesma ambiguum</i> Pax & K. Hoffm.	Chòi mòi	Na				NSBE
<i>Antidesma buniis</i> (L.) Spreng.*	Chòi mòi bun	MM				
<i>Antidesma cochinchinense</i> Gagnep.*	Chòi mòi	MM				NSBE
<i>Antidesma fruticosum</i> Müll.Arg.	Chòi mòi bụi	Na				NSBE
<i>Antidesma fleuryi</i> Gagnep.*	Chòi mòi	MM				NSBE
<i>Antidesma hainanensis</i> Merr.*	Chòi mòi hải nam	MM				NSBE
<i>Antidesma microphyllum</i> Hemsl.	Chòi mòi	Na				NSBE
<i>Antidesma montanum</i> Blume*	Chòi mòi núi	MM				NSBE
<i>Antidesma scandens</i> Lour.*	Chòi mòi đất	MM				NSBE
<i>Antidesma sp.*</i>	Chòi mòi	MM				
<i>Antidesma sp.1*</i>	Chòi mòi	Na				
<i>Antidesma sp.2*</i>	Chòi mòi	MM				
<i>Antidesma tonkinensis</i> Gagnep.	Chòi mòi bắc bộ	MM				NSBE
<i>Antidesma velutinum</i> Tul.*	Chòi mòi lông	MM				NSBE
<i>Antidesma yunnanense</i> Pax & K. Hoffm.	Chòi mòi vân nam	MM				NSBE
<i>Aporosa dioica</i> Müll.Arg.	Thầu tấu	MM				
<i>Aporosa macrophylla</i> Müll.Arg.	Thầu tấu	MM				NSBE
<i>Aporosa microcalyx</i> Hassk.*	Thầu tấu	MM				NSBE
<i>Aporosa sp.</i>	Thầu tấu	Na				
<i>Aporosa yunnanensis</i> (Pax & K. Hoffm.) F.P. Metcalf*	Thầu tấu vân nam	MM				NSBE
<i>Baccaurea ramiflora</i> Lour.*	Dâu đất	MM				
<i>Balakata baccata</i> (Roxb.) Esser	Sỏi núi	MM				
<i>Bischofia javanica</i> Blume*	Nhội	MM				

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<i>Breynia angustifolia</i> Hook.f.	Bồ cu vẽ lá hẹp	Na				NSBE
<i>Breynia fleuryi</i> Beille	Bồ cu vẽ	Na				
<i>Breynia fruticosa</i> Hook.f.	Bồ cu vẽ	Na				
<i>Breynia rostrata</i> Merr.	Bồ cu vẽ	Na				NSBE
<i>Bridelia balansae</i> Tutchet*	Đóm gai	MM				
<i>Bridelia minutiflora</i> Hook.f.	Đóm lông	MM				
<i>Bridelia ovata</i> Decne.	Đóm	MM				
<i>Bridelia tomentosa</i> Blume	Đóm	MM				NSBE
<i>Chaetocarpus castanocarpus</i> Thwaites*	Dạ nâu	MM				
<i>Claoxylon indicum</i> Hassk.*	Lộc mại	MM				
<i>Claoxylon longifolium</i> Baill.*	Lộc mại lá dài	MM				NSBE
<i>Cleidion spiciflorum</i> Merr.*	Mỏ chim	MM				
<i>Cleistanthus petelotii</i> Merr. ex Croizat*	Cọc rào	Na		V	DD	NSBE
<i>Cleistanthus tonkinensis</i> Blume	Cọc rào	Na				
<i>Cnesmone tonkinensis</i> Gagnep.	Bọ nẹt	Lp				
<i>Croton joufra</i> Roxb.	Bà đậu	MM				
<i>Croton oblongifolius</i> Roxb.	Bà đậu lá thuôn	MM				NSBE
<i>Croton sp.</i>	Bà đậu	Na				
<i>Croton thorelii</i> Gagnep.*	Bà đậu	MM				NSBE
<i>Croton tiglium</i> L.*	Bà đậu	MM				
<i>Deutzianthus tonkinensis</i> Gagnep.*	Mọ	MM		LR	DD	NGBE
<i>Endospermum chinense</i> Benth.*	Vạng trứng	MM				
<i>Euphorbia antiquorum</i> L.	Xương rồng	Sp				
<i>Euphorbia hirta</i> L.	Cỏ sữa	Hm				
<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch	Trạng nguyên	Na				
<i>Euphorbia thymifolia</i> L.	Cỏ sữa lá nhỏ	Hm				
<i>Euphorbia tirucalli</i> L.	Xương khô	Na				
<i>Excoecaria cochinchinensis</i> Lour.*	Đơn xanh	Na				
<i>Excoecaria cochinchinensis</i> Lour. var. <i>cochinchinensis</i>	Đơn xanh	Na				NSBE
<i>Flueggea virosa</i> (Willd.) Voigt	Bóng nỏ	Na				
<i>Glochidion annamense</i> Beille	Bọt ếch	Na				NSBE

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<i>Glochidion assamicum</i> Hook.f.	Sóc	Na				NSBE
<i>Glochidion balansae</i> Beille	Bọt ếch	Na				NSBE
<i>Glochidion daltonii</i> Kurz	Bọt ếch thuốc	Na				NSBE
<i>Glochidion hirsutum</i> Voigt	Sóc lông	Na				
<i>Glochidion lanceolarium</i> Voigt*	Bọt ếch	Na				NSBE
<i>Glochidion lutescens</i> Blume	Bọt ếch vàng	Na				
<i>Glochidion pilosum</i> (Lour.) Merr.	Bọt ếch	Na				NSBE
<i>Glochidion sp.</i>	Bọt ếch	Na				
<i>Glochidion sp.1</i>	Bọt ếch	Na				
<i>Glochidion thoreli</i> Beille*	Sóc	Na				
<i>Glochidion velutinum</i> Wight*	Bọt ếch	Na				
<i>Homonoia riparia</i> Lour.	Rù ri	Na				
<i>Hura crepitans</i> L.	Vông đồng	MM				
<i>Jatropha curcas</i> L.	Dầu mè	MM				
<i>Koilocedrus longifolium</i> Hook.f.*	Khổng	MM				
<i>Macaranga auriculata</i> (Merr.) Airy Shaw*	Lá nén	MM				NSBE
<i>Macaranga denticulata</i> Müll.Arg.*	Lá nén	MM				
<i>Macaranga indica</i> Wight	Lá nén sáp	Na				
<i>Macaranga kurzii</i> Pax & K. Hoffm.	Lá nén	Na				NSBE
<i>Macaranga trichocarpa</i> Müll.Arg.	Lá nén lông sao	Na				
<i>Mallotus apelta</i> Müll.Arg	Bục trắng	Na				
<i>Mallotus barbatus</i> Müll.Arg.	Bùm búp	Na				
<i>Mallotus cuneatus</i> Ridl.	Ruối rừng	MM				NSBE
<i>Mallotus decipiens</i> Müll.Arg.	Ba bét	Na				NSBE
<i>Mallotus floribundus</i> Müll.Arg.*	Ba soi	Na				
<i>Mallotus metcalfianus</i> Croizat	Ba bét đỏ	Na				
<i>Mallotus microcarpus</i> Pax & K. Hoffm.*	Ba soi	MM				NSBE
<i>Mallotus paniculatus</i> (Lam.) Müll.Arg.*	Ba soi	MM				
<i>Mallotus philippensis</i> (Lam.) Müll.Arg.	Cánh kiến	MM				
<i>Manihot esculenta</i> Crantz	Sắn	Na				
<i>Phyllanthus amarus</i> Schum. & Thoms.	Me vị đắng	Na				
<i>Phyllanthus emblica</i> L.*	Me rừng	MM				
<i>Phyllanthus reticulatus</i> Poir.*	Phèn đen	Na				

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<i>Phyllanthus sp.</i>	Phèn đen	Na				
<i>Phyllanthus urinaria</i> L.	Chó đẻ	Na				
<i>Ricinus communis</i> L.	Thầu dầu	Na				
<i>Sapium discolor</i> Müll.Arg.*	Sòi tía	MM				
<i>Sauropus androgynus</i> Merr.*	Rau ngót	Na				
<i>Sauropus garrettii</i> Craib	Rau ngót la to	Na				
<i>Sauropus racemosus</i> Beille	Rau ngót	Na				
<i>Sauropus rostratus</i> Miq.*	Ngót dài	Na				NSBE
<i>Sauropus sp.</i>	Rau ngót dài	Na				
<i>Sebastiania chamaelea</i> (L.) Müll.Arg.	Cỏ kỳ nhông	Th				
<i>Securinega virosa</i> (Willd.) Baill.	Bóng nỏ	Na				
<i>Strophoblachia fimbriicalyx</i> Boerl.	Mồng sa	Na				NSBE
<i>Suregada cicerosperra</i> (Gagnep.) Croizat*	Kẹn son	Na				NSBE
<i>Suregada multiflora</i> Baill.*	Mần mây	Na				
<i>Suregada sp.</i>	Háo duyên	Na				
<i>Trigonostemon bonianus</i> Gagnep.	Tam tầng	Na				NGBE
<i>Trigonostemon rubescens</i> Gagnep.*	Tam tầng	Na				NGBE
<i>Vernicia montana</i> Lour.*	Trầu	MM				
Fabaceae	Họ Đậu					
<i>Abrus pulchellus</i> Wall.	Cam thảo	Lp				NSBE
<i>Abrus precatorius</i> L.	Cam thảo dây	Lp				
<i>Bowringia callicarpa</i> Champ. ex Benth.	Dây bánh nem	Lp				
<i>Cajanus scarabaeoides</i> (L.) Thouars	Đậu tương dại	Lp				
<i>Crotalaria ferruginea</i> Scheele	Lục lạc	Ch				
<i>Crotalaria montana</i> Roxb.	Lục lạc núi	Ch				
<i>Crotalaria pallida</i> Aiton	Lục lạc trắng xanh	Ch				
<i>Dalbergia balansae</i> Prain*	Trắc	MM	V		R	
<i>Dalbergia boniana</i> Gagnep.*	Trắc bon	MM	DD		DD	NSBE
<i>Dalbergia lanceolaria</i> Moon*	Sưa vẩy ốc	Na				
<i>Dalbergia obovata</i> E. Mey.*	Sưa lá bé	MM				NSBE
<i>Dalbergia tonkinensis</i> Prain	Trắc thối	MM	V		E	
<i>Derris elliptica</i> Benth.*	Dây mật	Lp				

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<i>Derris trifolia</i> Lour.	Dây cóc	Lp				NSBE
<i>Desmodium caudatum</i> DC.	Thóc lép	Hm				
<i>Desmodium gyroides</i> DC.	Tràng hạt	Hm				
<i>Desmodium heterocarpon</i> (L.) DC.	Thóc lép	Hm				
<i>Desmodium heterophyllum</i> (Willd.) DC.	Hàn the	Hm				
<i>Desmodium laxum</i> DC.	Tràng hạt	Hm				
<i>Desmodium podocarpum</i> DC.	Thóc lép	Hm				NSBE
<i>Desmodium sp.</i>	Hàn the	Hm				
<i>Desmodium sp.1</i>	Tràng hạt	Hm				
<i>Desmodium styracifolium</i> Merr.	Vây rồng	Hm				
<i>Desmodium velutinum</i> DC.	Tràng hạt	Hm				
<i>Erythrina fusca</i> Lour.*	Vông đồng	MM				NSBE
<i>Erythrina variegata</i> L.	Vông nem	MM				
<i>Flemingia grahamiana</i> Wight & Arn.	Tóp mỡ	Ch				
<i>Glycine sp.</i>	Dầu vân	Na				
<i>Indigofera hisuta</i> L.*	Chàm	Na				
<i>Indigofera tinctoria</i> L.	Chàm nhuộm	Na				
<i>Lablab purpureus</i> (L.) Sweet	Đậu ván	Lp				
<i>Millettia boniana</i> Gagnep.*	Thàn mát lá bé	MM				NSBE
<i>Millettia ichthyotona</i> Drake*	Thàn mát	MM				
<i>Millettia pachyloba</i> Drake	Thàn mát dây	Lp				NSBE
<i>Mucuna interrupta</i> Gagnep.	Mắc mèo	Lp				
<i>Ormosia balansae</i> Drake*	Ràng ràng mít	MM				
<i>Ormosia fordiana</i> Oliver*	Ràng ràng hom	MM				
<i>Ormosia henryi</i> Prain*	Ràng ràng lông	MM				NSBE
<i>Ormosia microphylla</i> Merr.	Ràng ràng lá nhỏ	MM				
<i>Ormosia pinnata</i> (Lour.) Merr.*	Ràng ràng xanh	MM				
<i>Ormosia sp.</i>	Ràng ràng	MM				
<i>Ormosia tonkinensis</i> Gagnep.	Ràng ràng bắc bộ	MM				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Pachyrhizus erosus</i> (Lour.) Merr.	Củ đậu	Ch				NSBE
<i>Pueraria montana</i> (Lour.) Merr.	Sắn dây rừng	Lp				
<i>Pueraria phaseoloides</i> Benth.	Sắn dây	Lp				
<i>Sophora japonica</i> L.	Hoa hòe	MM				
<i>Spatholobus suberectus</i> Dunn*	Huyết rồng lào	Lp				NGBE
<i>Tephrosia candida</i> DC.	Cốt khí	Na				
<i>Uraria crinita</i> Desv.	Đuôi chồn	Na				
<i>Vigna radiata</i> (L.) Wilczek	Đậu xanh	Th				
<i>Vigna unguiculata</i> (L.) Walp.	Đậu đen	Th				
Fagaceae	Họ Dẻ					
<i>Castanopsis annamensis</i> Hance	Dẻ	MM				
<i>Castanopsis boisii</i> Hickel & A. Camus*	Dẻ bắc giang	MM				NSBE
<i>Castanopsis cerebrina</i> (Hickel & A. Camus) Barnett*	Sồi phảng	MM				NSBE
<i>Castanopsis hystrix</i> DC.*	Dẻ đỏ	MM	V		R	NSBE
<i>Castanopsis indica</i> A.DC.*	Cà ổi ấn độ	MM				
<i>Castanopsis lecontei</i> Hickel & A. Camus*	Dẻ gai	MM	V		R	NSBE
<i>Castanopsis sp.</i>	Dẻ	MM				
<i>Castanopsis tonkinensis</i> Seemen*	Cà ổi bắc bộ	MM				NSBE
<i>Lithocarpus areca</i> (Hickel & A. Camus) A. Camus	Sồi	MM				
<i>Lithocarpus bacgangensis</i> (Hickel & A. Camus) A. Camus	Sồi bắc giang	MM	V		R	
<i>Lithocarpus cornea</i> Rehder*	Sồi ghè	MM				
<i>Lithocarpus dealbata</i> Rehder*	Dẻ lá bạc	MM				NSBE
<i>Lithocarpus ducampii</i> (Hickel & A. Camus) A. Camus	Sồi	MM				
<i>Lithocarpus elegans</i> (Blume) Hatus. ex Soepadmo*	Sồi đỏ	MM			R	
<i>Lithocarpus hemisphaericus</i> (Drake) Barnett	Sồi bán cầu	MM				
<i>Lithocarpus pseudosundaicus</i> (Hickel & A. Camus) A. Camus*	Dẻ xanh	MM				
<i>Lithocarpus sp.</i>	Dẻ	MM				
<i>Lithocarpus sp.1</i> *	Dẻ	MM				

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<i>Quercus acutissima</i> Carruth.	Dẻ	MM				NSBE
<i>Quercus bambusifolia</i> Hance ex Miq.	Dẻ lá tre	MM				NSBE
<i>Quercus chrysocalyx</i> Carruth.*	Dẻ cuông	MM	V		R	NSBE
<i>Quercus platycalyx</i> Hickel & A. Camus*	Giẻ cau	MM	V		R	
<i>Quercus sp.*</i>	Sồi	MM				
Flacourtiaceae	Họ Bồ quân					
<i>Casearia flexuosa</i> Craib	Thủ đào	MM				
<i>Casearia velutina</i> Blume	Thủ đào lông	MM				
<i>Flacourtia balansae</i> Gagnep.*	Mùng quân	MM				
<i>Flacourtia indica</i> Merr.*	Mùng quân	MM				NSBE
<i>Flacourtia jangomas</i> Raeusch.*	Mùng quân trắng	MM				NSBE
<i>Hydnocarpus anthelmintica</i> Pierre*	Khổng trắng	MM				
<i>Hydnocarpus hainanensis</i> (Merr.) Sleumer	Nang trứng hải nam	MM		V		NSBE
<i>Hydnocarpus kurzii</i> Warb.*	Nang trứng	MM				
<i>Hydnocarpus serrata</i> Warb.*	Nang trứng	MM				
<i>Hydnocarpus sp.</i>	Nang trứng	MM				
Gesneriaceae	Họ Thượng tiên					NFBE
<i>Beccarinda tonkinensis</i> (Pellegr.) B.L. Burtt*	Thượng tiên	Ch				NGBE
Hamamelidaceae	Họ Sau sau					
<i>Liquidambar formosana</i> Hance*	Sau Sau	MM				
<i>Mytilaria laosensis</i> Lecomte	Sau sau lão	MM				
<i>Symingtonia tonkinensis</i> (Lecomte) Steenis	Chấp tay	MM				DD
Hernandiaceae	Họ Liên đẳng					
<i>Illigera celebica</i> Miq.	Liên đẳng	Lp				
Hydrangeaceae	Họ Thường sơn					
<i>Dichroa febrifuga</i> Lour.*	Thường sơn	Na				
<i>Dichroa hirsuta</i> Gagnep.	Thường sơn lông	Na				
Icacinaceae	Họ Thụ đào					
<i>Gomphandra hainanensis</i> Merr.*	Bồ béo hải	Na				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
	nam					
<i>Gomphandra petelotii</i> Merr.*	Bồ bèo	Na				NSBE
<i>Gomphandra tonkinensis</i> Gagnep.*	Bồ bèo bắc bộ	Na				
<i>Nothapodytes</i> sp.	Gian thiều	Na				
Ixonanthaceae	Họ Hà nu					
<i>Ixonanthes cochinchinensis</i> Pierre*	Hà nu	MM				
<i>Ixonanthes reticulata</i> Jack	Hà nu	MM				NSBE
Juglandaceae	Họ Hồ đào					
<i>Annamocarya sinensis</i> (Dode) J.-F. Leroy*	Chò đai	MM	EN	EN	E	
<i>Engelhardtia chrysolepsis</i> Hance*	Chẹo tía	MM				
<i>Engelhardtia roxburghiana</i> Wall.	Chẹo trắng	MM				
<i>Engelhardtia</i> sp.*	Chẹo	MM				
<i>Pterocarya tonkinensis</i> Dode	Coi	MM				
Lamiaceae	Họ Hoa môi					
<i>Acrocephalus indicus</i> Kuntze	Nhân trần	Th				
<i>Anisomeles ovata</i> R.Br.	Cứt lợn	Ch				
<i>Elsholtzia blanda</i> H. Keng	Kinh giới dại	Th				
<i>Elsholtzia ciliata</i> (Thunb. ex Murray) Hyl.	Kinh giới	Th				
<i>Gomphostemma parviflorum</i> Wall.	Hoa môi	Ch				NSBE
<i>Hyptis rhomboidea</i> M.Martens & Galeotti	Ké	Hm				
<i>Hyptis suaveolens</i> (L.) Poit.	Tía tô dại	Hm				
<i>Leonurus sibiricus</i> L.	Ích mẫu	Ch				
<i>Leucas</i> sp.	Tổ ong	Hm				
<i>Mentha crispa</i> L.	Húng	Hm				
<i>Mosla cavaleriei</i> H. Lév.	Hương nhu	Th				
<i>Ocimum basilicum</i> L.	Húng quế	Th				
<i>Ocimum tenuiflorum</i> L.	Hương nhu tía	Th				
<i>Perilla frutescens</i> (L.) Britton	Tía tô	Th				
<i>Perilla ocymoides</i> L.	Tía tô dại	Th				
<i>Plectranthus amboinicus</i> (Lour.) Spreng.	Húng chanh	Th				
<i>Salvia miltiorhiza</i> Bunge	Kinh giới dại	Th				NGBE
Lauraceae	Họ Long					

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
não						
<i>Actinodaphne obovata</i> (Nees) Blume*	Song xanh	MM			T	NSBE
<i>Actinodaphne pedunculata</i> Meisn.*	Bạc tán	MM				NSBE
<i>Actinodaphne pilosa</i> (Lour.) Merr.	Đầu màu	MM				
<i>Beilschmiedia balansae</i> Lecomte*	Bạc tán xanh	MM				NSBE
<i>Beilschmiedia ferruginea</i> H. Liou*	Chấp xanh	MM				NSBE
<i>Beilschmiedia fordii</i> Dunn*	Chấp	MM				
<i>Beilschmiedia pergamentacea</i> C.K.Allen*	Chấp xanh	MM				
<i>Beilschmiedia poilanei</i> Liou*	Chấp	MM				
<i>Beilschmiedia</i> sp.	Bạc tán	MM				
<i>Caryodaphnopsis tonkinensis</i> (Lecomte) Airy Shaw	Cà lồ	MM				
<i>Cassytha filiformis</i> L.	Tơ xanh	Ep				
<i>Cinnamomum balansae</i> Lecomte	Vù hương	MM	V	EN	E	
<i>Cinnamomum bejolghota</i> (Buch.-Ham.) Sweet*	Quế lợn	MM				
<i>Cinnamomum camphora</i> (L.) Presl	Long não	MM				
<i>Cinnamomum cassia</i> Blume	Quế	MM				
<i>Cinnamomum ilicioides</i> A. Chev.*	Re gừng	MM				
<i>Cinnamomum impressineurium</i> Meissn.	Re gân lồm	MM				
<i>Cinnamomum iners</i> Reinw. ex Blume*	Re hương	MM				
<i>Cinnamomum ovatum</i> Lukman	Re rừng	MM				
<i>Cinnamomum</i> sp.	Re bắc bộ	MM				
<i>Cryptocarya annamensis</i> C.K. Allen*	Mò lông lá lớn	MM				NSBE
<i>Cryptocarya chinensis</i> Hemsl.*	Mò trung hoa	MM				NSBE
<i>Cryptocarya concinna</i> Hance	Mò quả vàng	MM				
<i>Cryptocarya ferrea</i> Blume*	Mò cứng	MM				
<i>Cryptocarya hainanensis</i> Merr.*	Mò hải nam	MM				NSBE
<i>Cryptocarya impressa</i> Miq.*	Mò quả lớn	MM				NSBE
<i>Cryptocarya lenticellata</i> Lecomte*	Nanh chuột	MM				
<i>Cryptocarya maclurei</i> Merr.*	Mò lá bạc	MM				NSBE
<i>Cryptocarya metcalfiana</i> C.K. Allen*	Mò hương	MM				NSBE
<i>Cryptocarya obtusiflora</i> Merr.	Mò lá tròn	MM				
<i>Cryptocarya</i> sp.*	Mò	MM				
<i>Endiandra hainanensis</i> Merr. & Metc.	Vừ	MM	EN		R	

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<i>Lindera aggregata</i> (Sims) Kosterm.*	Ô đước	MM				NSBE
<i>Lindera racemosa</i> Lecomte*	Lòng trứng	MM				
<i>Lindera tonkinensis</i> Lecomte*	Lòng trứng bắc bộ	MM				NSBE
<i>Litsea balansae</i> Lecomte*	Bời lời	MM				
<i>Litsea baviensis</i> Lecomte	Bời lời ba vì	MM				
<i>Litsea cubeba</i> Pers.*	Màng tang	MM				
<i>Litsea glutinosa</i> (Lour.) C.B. Rob.*	Bời lời nhót	MM				
<i>Litsea griffithii</i> Gamble	Bời lời	MM				
<i>Litsea impressa</i> Boerl.*	Bời lời	MM				NSBE
<i>Litsea lancifolia</i> Hook. f.	Bời lời lá mác	MM				
<i>Litsea mollifolia</i> Chun*	Bời lời lông	MM				NSBE
<i>Litsea monoptala</i> Pers.*	Bời bời lá tròn	MM				
<i>Litsea pierrei</i> Lecomte*	Bời lời lecom	MM				
<i>Litsea rotundifolia</i> Hemsl.*	Bời lời lá tròn	MM				
<i>Litsea sp.</i> *	Bời lời	MM				
<i>Litsea umbellata</i> Merr.*	Bời lời	MM				
<i>Litsea verticillata</i> Hance*	Bời bời lá vòng	MM				
<i>Litsea yunnanensis</i> Yang & P.H. Hoang	Bời lời vân nam	MM				NSBE
<i>Machilus bonii</i> Lecomte*	Kháo vàng	MM				
<i>Machilus chinensis</i> Hemsl.*	Kháo trung hoa	MM				
<i>Machilus grandifolia</i> S.K. Lee & F.N. Wei*	Kháo lá lớn	MM				NSBE
<i>Machilus hainanensis</i> Merr.	Kháo hải nam	MM				
<i>Machilus odoratissimus</i> Nees*	Kháo thơm	MM				
<i>Machilus platycarpa</i> Chun*	Kháo cuống dài	MM				NSBE
<i>Machilus sp.</i>	Kháo	MM				
<i>Machilus sp.1</i>	Kháo	MM				
<i>Machilus velutina</i> Champ. ex Benth.*	Kháo lông	MM				

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<i>Neocinnamomum lecomtei</i> H. Liou	Re mới	MM				NSBE
<i>Neolitsea angustifolia</i> A. Chev.	Re mới	MM				
<i>Neolitsea poilanei</i> H. Liou*	Re mới lá to	MM				
<i>Phoebe macrocarpa</i> C.Y. Wu*	Kháo quả to	MM	V		R	
<i>Phoebe paniculata</i> Nees*	Kháo nước	MM			T	NSBE
<i>Phoebe tavoyana</i> Hook.f.	Kháo lá to	MM				
<i>Phoebe</i> sp.	Kháo	MM				
Leeaceae	Họ Gối hạc					
<i>Leea indica</i> Merr.	Gối hạc đen	Na				
<i>Leea manillensis</i> Walp.	Gối hạc	Na				
<i>Leea rubra</i> Blume	Gối hạc	Na				
Lecythicaceae	Họ Lộc vùng					NFBE
<i>Barringtonia acutangula</i> (L.) Gaertn.	Lộc vùng	MM				NGBE
Loganiaceae	Họ Mã tiền					
<i>Gelsemium elegans</i> Benth.	Lá ngón	Lp				
<i>Strychnos angustifolia</i> Benth.*	Mã tiền	MM				
<i>Strychnos nitida</i> G. Don	Mã tiền	Lp	EN		DD	
<i>Strychnos umbellata</i> Merr.*	Mã tiền dây	Lp	V		DD	
Loranthaceae	Họ Tầm gửi					
<i>Dendrophthoe pentandra</i> (L.) Miq.*	Tầm gửi	Ep				
<i>Elytranthe albida</i> Blume	Tầm gửi	Ep	V			
<i>Scurrula ferruginea</i> Danser	Tầm gửi sét	Ep				
Lythraceae	Họ Bàng lẵng					
<i>Lagerstroemia calyculata</i> Kurz*	Bàng lẵng	MM			R	
<i>Lagerstroemia speciosa</i> Pers.	Bàng lẵng tím	MM				
<i>Lagerstroemia tomentosa</i> C. Presl	Săng lẻ	MM				
<i>Punica granatum</i> L.	Lựu	MM				NGBE
Magnoliaceae	Họ Mộc lan					
<i>Magnolia coco</i> DC.*	Hoa trứng gà	MM				
<i>Magnolia fistulosa</i> Dandy	Mộc lan rừng	MM				
<i>Manglietia conifera</i> Dandy	Mỡ	MM			R	
<i>Manglietia fordiana</i> Oliver*	Vàng tâm	MM	V		R	
<i>Manglietia insignis</i> Blume	Mỡ đá	MM				

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<i>Michelia alba</i> DC.	Ngọc lan	MM				NSBE
<i>Michelia balansae</i> Dandy*	Giỏi bà	MM	V			
<i>Michelia champaca</i> L.	Ngọc lan hoa vàng	MM				
<i>Michelia foveolata</i> Merr.	Giỏi nhung	MM				
<i>Michelia mediocris</i> Dandy*	Giỏi xanh	MM			R	
<i>Michelia tonkinensis</i> A. Chev.*	Giỏi bắc	MM			R	
Malvaceae	Họ Bông					
<i>Abelmoschus moschatus</i> Medik.	Bông vàng	Ch				
<i>Abutilon indicum</i> (L.) Sweet	Cối xay	Na				
<i>Hibiscus greviaefolius</i> Hassk.	Bụt cò ke	Na				
<i>Hibiscus rosa-sinensis</i> L.	Dâm bụt	Na				
<i>Hibiscus</i> sp.	Bông	MM				
<i>Kydia calycina</i> Roxb.*	Ong bù	MM				
<i>Sida acuta</i> Burm.	Ké	Na				
<i>Sida rhombifolia</i> L.	Ké hoa vàng	Na				
<i>Urena lobata</i> L.	Ké hoa đào	Na				
Melastomataceae	Họ Mua					
<i>Blastus cochinchinensis</i> Lour.*	Mua rừng	Na				
<i>Medinilla assamica</i> (C.B. Clarke) C. Chen	Mua chua	Na				
<i>Melastoma candidum</i> D. Don*	Mua bà	Na				
<i>Melastoma normale</i> D. Don	Mua	Na				
<i>Melastoma sanguineum</i> Sims	Mua máu	Na				
<i>Melastoma septemnerium</i> Merr.*	Mua đôi	Na				
<i>Melastoma</i> sp.	Mua đôi	Na				
<i>Memecylon edule</i> Roxb.*	Sầm si	Na				
<i>Memecylon fruticosum</i> King	Sầm	Na				
<i>Memecylon scutellatum</i> A.Chev.*	Sầm núi	Na			NSBE	
<i>Osbeckia truncata</i> D. Don ex Wight & Arn.	Mua tép	Na				
Meliaceae	Họ Xoan					
<i>Aglaia edulis</i> Gray*	Gội dụ	MM				
<i>Aglaia odorata</i> Lour.*	Ngâu	MM		LR		
<i>Aglaia perviridis</i> Hiern	Gội tè	MM		V		
<i>Aglaia roxburghiana</i> Miq.	Gội núi	MM			NSBE	
<i>Aglaia silvestris</i> Merr.	Gội	MM				

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<i>Aglaia spectabilis</i> (Miq.) S.S. Jain & Bennet*	Gội nếp	MM	V	LR	T	
<i>Aglaia sp.</i> *	Gội	MM				
<i>Aglaia tomentosa</i> Teijsm. & Binn.	Gội lông	MM		LR		NSBE
<i>Aphanamixis grandiflora</i> Blume*	Gội trắng	MM			T	
<i>Azadirachta indica</i> A. Juss.	Sầu đầu	MM				
<i>Chisocheton chinensis</i> Merr.*	Quếch tía	MM				
<i>Chisocheton sp.</i> *	Quếch	MM				
<i>Chisocheton thorelii</i> Pierre	Quếch	MM				
<i>Chukrasia tabularis</i> A. Juss.	Lát hoa	MM	V	LR		
<i>Cipadessa sp.</i> *	Cà muối	MM				
<i>Dysoxylum acutangulum</i> Miq.	Chua khét	MM				
<i>Dysoxylum cauliflorum</i> Hiern*	Đinh hương	MM	V		T	
<i>Dysoxylum tonkinensis</i> A. Chev.*	Chặt khế	MM				
<i>Khaya senegalensis</i> A. Juss.	Xà cừ	MM				
<i>Melia azedarach</i> L.	Xoan	MM				
<i>Toona sureni</i> Merr.*	Trương vân	MM			R	NGBE
Menispermaceae	Họ Tiết dê					
<i>Anamirta cocculus</i> Wight & Arn.	Nhai đắng	Lp				
<i>Cissampelos pareira</i> L.	Tiết dê	Lp			R	
<i>Coscinium fenestratum</i> Colebr.	Vàng đắng	Lp			E	NSBE
<i>Fibraurea recisa</i> Pierre*	Hoàng đằng	Lp			T	
<i>Fibraurea tinctoria</i> Lour.	Hoàng đằng	Lp				
<i>Pericampylus glaucus</i> Merr.*	Lỗi tiền	Lp				
<i>Pycnarrhena poilanei</i> (Gagnep.) Forman	Phi đằng	Lp				NSBE
<i>Stephania hernandiifolia</i> (Willd.) Walp.	Cam thảo	Lp				
<i>Stephania longa</i> Lour.	Lỗi tiền	Lp			R	
<i>Stephania rotunda</i> Lour.	Củ bình vôi	Lp			R	
<i>Tinospora sp.</i>	Dây cóc	Lp				
<i>Tinospora tomentosa</i> Miers	Dây đau xương	Lp				
Mimosaceae	Họ Trinh nữ					
<i>Acacia auriculaeformis</i> A. Cunn. ex Benth.	Keo lá tràm	MM				
<i>Acacia confusa</i> Merr.	Đài loan tương tự	MM				

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<i>Acacia farnesiana</i> (L.) Willd.	Keo ta	MM				
<i>Acacia mangium</i> Willd.	Keo tai tượng	MM				
<i>Acacia pennata</i> (L.) Willd.	Sống rắn	Lp				NSBE
<i>Adenanthra microsperma</i> Teijsm. & Binn.*	Muồng Ràng Ràng	MM				
<i>Albizia corniculata</i> (Lour.) Druce	Sống rắn	Na				
<i>Albizia lucida</i> Benth. *	Bản xe	MM			R	
<i>Archidendron balansae</i> (Oliver) I.C. Nielsen*	Phân mã lá lớn	MM				NSBE
<i>Archidendron chevalieri</i> (Kosterm.) I.C. Nielsen*	Phân mã	MM				
<i>Archidendron clypearia</i> (Jack) I.C. Nielsen*	Mán đĩa	MM				
<i>Archidendron kerrii</i> (Gagnep.) I.C. Nielsen	Mán đĩa	MM				NSBE
<i>Archidendron lucidum</i> (Benth.) I.C. Nielsen*	Mán đĩa trâu	MM				
<i>Entada phaseoloides</i> (L.) Merr.	Bầm bầm	Lp				
<i>Leucaena leucocephala</i> (Lam.) de Wit	Keo dậu	MM				
<i>Mimosa diplotricha</i> Wright	Trinh nữ	Lp				
<i>Mimosa pigra</i> L.	Mai Dương	Na				
<i>Mimosa pudica</i> L.	Trinh nữ thẹn	Ch				
Moraceae	Họ Dâu tằm					
<i>Antiaris toxicaria</i> Lesch.*	Sui	MM				
<i>Artocarpus heterophyllus</i> Lam.	Mít	MM				
<i>Artocarpus styracifolius</i> Pierre	Chay lá bò đề	MM				
<i>Artocarpus tonkinensis</i> A. Chev.	Chay	MM				
<i>Broussonetia papyrifera</i> Vent.*	Dướng	MM				
<i>Ficus annulata</i> Blume*	Đa quả xanh	MM				
<i>Ficus auriculata</i> Lour.*	Và	MM				
<i>Ficus benjamina</i> L.	Si	MM				
<i>Ficus capillipes</i> Gagnep.	Vú bò	Na				NSBE
<i>Ficus curtipes</i> Corner	Đa	MM				NSBE
<i>Ficus fistulosa</i> Reinw. ex Blume*	Ngoã	MM				
<i>Ficus fulva</i> Elmer	Ngoã lông	MM				
<i>Ficus glaberrima</i> Blume	Sung	MM				NSBE
<i>Ficus heterophylla</i> L. f.	Vú bò	Na				
<i>Ficus hirta</i> Vahl*	Ngái lông	MM				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Ficus hispida</i> L. f.*	Ngái	MM				
<i>Ficus lacor</i> Buch.-Ham.*	Đa	MM				
<i>Ficus laevis</i> Blume*	Sung lá bóng	MM				NSBE
<i>Ficus macrophylla</i> Roxb.*	Đa lá lớn	MM				
<i>Ficus nervosa</i> Roth*	Đa rừng	MM				
<i>Ficus pumila</i> L.*	Sộp	MM				
<i>Ficus racemosa</i> L.*	Sung	MM				
<i>Ficus retusa</i> L.	Đa	MM				NSBE
<i>Ficus sp.</i> *	Đa	MM				
<i>Ficus sp.1</i> *	Đa	MM				
<i>Ficus vasculosa</i> Wall.	Vỏ mần	MM				
<i>Maclura cochinchinensis</i> (Lour.) Corner	Mỏ quạ	Lp				
<i>Morus alba</i> L.	Đâu tằm	Na				
<i>Morus macroura</i> Miq.	Đâu quả dài	MM				
<i>Streblus asper</i> Lour.	Ruổi	MM				
<i>Streblus indicus</i> (Burm.) Corner*	Ruổi ô rô	MM				
<i>Streblus macrophylla</i> Blume*	Mạy tè	MM				
<i>Teonongia tonkinensis</i> Stapf*	Teo nông	MM				
Myristicaceae		Họ Máu chó				
<i>Horsfieldia amygdalina</i> (Wall.) Warb.*	Săng máu	MM				
<i>Knema conferta</i> Warb.*	Máu chó lá nhỏ	MM				
<i>Knema elegans</i> Warb.	Máu chó	MM				
<i>Knema pierrei</i> Warb.*	Máu chó lá to	MM	V		R	NSBE
<i>Knema tonkinensis</i> (Warb.) W.J. de Wilde	Máu chó bắc bộ	MM				
<i>Myristica fragrans</i> Houtt.	Đậu khấu	MM				NGBE
<i>Myristica yunnanensis</i> Y.H. Li*	Đậu khấu Bến En	MM			R	NSVN
Myrsinaceae		Họ Đơn nem				
<i>Ardisia crenata</i> Sims.	Trọng đũa	MM				
<i>Ardisia lecomtei</i> Pit.*	Trọng đũa gỗ	MM				
<i>Ardisia quinqueгона</i> Blume*	Trọng đũa	Na				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
	tuyền					
<i>Ardisia replicata</i> Walker*	Trọng đũa núi	MM				NSBE
<i>Ardisia rubescens</i> Pit.	Cơm nguội	Na				NSBE
<i>Ardisia silvestris</i> Pit.	Lá khô tím	Na	V		E	
<i>Ardisia sp.</i>	Trọng đũa	Na				
<i>Ardisia yunnanensis</i> Mez	Trọng đũa Vân Nam	Na				NSBE
<i>Embelia acuminata</i> Merr.	Chua ngút	Lp				
<i>Embelia laeta</i> Mez	Ngút trắng	Lp				
<i>Embelia oblongifolia</i> (Benth.) Hemsl.	Chua ngút lá dài	Lp				
<i>Embelia ribes</i> Burm.f.	Chua ngút	Lp				
<i>Maesa balansae</i> Mez	Đơn nem	Na				
<i>Maesa indica</i> Wall.	Đơn nem răng cưa	Na				
<i>Maesa perlarius</i> (Lour.) Merr.*	Đơn nem	Na				NSBE
<i>Maesa sinensis</i> A.DC.	Đơn nem	Na				
<i>Maesa sp.</i>	Đơn nem	Na				
Myrtaceae	Họ Sim					
<i>Baeckea frutescens</i> L.	Thanh hao	Na				NSBE
<i>Cleistocalyx operculatus</i> Merr. & L.M. Perry*	Trâm vối	MM				
<i>Eucalyptus camaldulensis</i> Dehnh.	Bạch đàn trắng	MM				
<i>Eucalyptus exserta</i> F. Müll.	Bạch đàn liễu	MM				
<i>Psidium guajava</i> L.	Ổi	MM				
<i>Rhodomyrtus tomentosa</i> Hassk.	Sim	Na				
<i>Syzygium attopeuense</i> (Gagnep.) Merr. & L.M. Perry	Rì rì	Na				
<i>Syzygium brachiatum</i> Miq.*	Trâm	MM				
<i>Syzygium chanlos</i> (Gagnep.) Merr. & L.M. Perry*	Trâm trắng	MM				
<i>Syzygium chloranthum</i> (Duthie) Merr. & L.M. Perry	Gioi đại	MM				
<i>Syzygium hancei</i> Merr. & L.M. Perry*	Trâm	MM				NSBE
<i>Syzygium jambos</i> (L.) Alston*	Gioi	MM				
<i>Syzygium levinei</i> (Merr.) Merr.*	Trâm núi	MM				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Syzygium polyanthum</i> Walp.*	Sắn thuyền	MM				
<i>Syzygium sp.</i> *	Trâm thơm	MM				
<i>Syzygium sp.1</i> *	Trâm	MM				
<i>Syzygium tonkinense</i> (Gagnep.) Merr. & L.M. Perry*	Trâm bắc bộ	MM				
<i>Syzygium wightianum</i> Wall.*	Trâm trắng	MM				
<i>Syzygium zeylanicum</i> (L.) DC.*	Trâm tía	MM				
Nyctaginaceae	Họ Hoa giấy					
<i>Bougainvillea spectabilis</i> Willd.	Hoa giấy	Lp				
Ochnaceae	Họ Mai vàng					
<i>Ochna integerrima</i> (Lour.) Merr.*	Mai vàng	MM				
Olacaceae	Họ Rau bủ khai					
<i>Erythralium scandens</i> Blume	Bủ khai	Lp				
Oleaceae	Họ Nhài					
<i>Jasminum longipetalum</i> King & Gamble	Nhài lá ngắn	Na				
<i>Jasminum nervosum</i> Lour.*	Chè vằng	Lp				
<i>Jasminum sambac</i> (L.) Ait.	Nhài	Na				
<i>Jasminum scandens</i> Vahl	Lài leo	Lp				
<i>Jasminum subtriplinerve</i> Blume	Vằng	Lp				
<i>Jasminum undulatum</i> Willd.	Vằng lông	Lp				
<i>Ligustrum indicum</i> (Lour.) Merr.	Râm	Na				
<i>Linociera sangda</i> Gagnep.	Vằng	Na				NSBE
<i>Osmanthus fragrans</i> Lour.*	Nhài	Na				
<i>Osmanthus matsumuranus</i> Hayata*	Vỏ sắn lá dài	MM				
<i>Osmanthus pendunculatus</i> Gagnep.*	Vỏ sắn	MM				
<i>Osmanthus sp.</i>	Nhài rừng	MM				
Onagraceae	Họ Rau mường					
<i>Ludwigia adscendens</i> (L.) H. Hara	Rau dừa nước	Cr				
<i>Ludwigia octovalvis</i> (Jacq.) P.H. Raven	Rau mường	Cr				
Opiliaceae	Họ Rau sáng					
<i>Cansjera rheedei</i> J.F. Gmel.	Sáng	MM				NGBE

SCIENTIFIC NAME	COMMON NAME	LF	RDBRD-IUCN	RDBE	NOTE
<i>Meliantha suavis</i> Pierre*	Rau sáng	MM	V		R
Oxalidaceae	Họ Chua me				
<i>Averrhoa carambola</i> L.*	Khế	MM			
<i>Biophytum sensitivum</i> (L.) DC.	Chua me đất	Ch			
<i>Oxalis corniculata</i> L.	Chua me	Ch			
Pandaceae	Họ Chấn				
<i>Microdesmis caseariaefolia</i> Planch. ex Hook.*	Chấn	MM			
Passifloraceae	Họ Lạc tiên				
<i>Passiflora foetida</i> L.	Lạc tiên	Lp			
Pentaphragmataceae	Họ Rau tai voi				
<i>Pentaphragma sinense</i> Hemsl. & E.H. Wilson	Rau tai voi	Hm			
Piperaceae	Họ Hồ tiêu				
<i>Peperomia pellucida</i> Kunth.	Rau càng cua	Th			
<i>Piper betle</i> L.	Trầu không	Lp			
<i>Piper bonii</i> C.DC.*	Tiêu lông	Lp			NSBE
<i>Piper lolot</i> C.DC.	Lá lốt	Hm			
<i>Piper nigrum</i> L.	Tiêu rừng	Ep			
<i>Piper sp.</i>	Tiêu rừng	Lp			
Plantaginaceae	Họ Mã đề				
<i>Plantago asiatica</i> L.	Mã đề	Hm			
<i>Plantago major</i> L.	Mã đề	Hm			
Polygalaceae	Họ Viễn chí				
<i>Polygala tonkinensis</i> Chodat	Viễn chí	Na			
<i>Xanthophyllum sp.</i>	Săng ốt	MM			
Polygonaceae	Họ Rau răm				
<i>Persicaria hydropiper</i> (L.) Spach	Nghê răm	Th			
<i>Polygonum barbatum</i> L.	Nghê râu	Hm			NSBE
<i>Polygonum chinense</i> L.	Mía giò	Lp			
<i>Polygonum multiflorum</i> Thunb.	Hà thủ ô	Lp	V		V
<i>Polygonum odoratum</i> Lour.	Rau răm	Hm			
<i>Polygonum orientale</i> L.	Nghê	Hm			
Portulacaceae	Họ Rau sam				

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<i>Portulaca grandiflora</i> Hook.	Hoa mười giờ	Th				
<i>Portulaca oleracea</i> L.	Rau sam	Th				
Proteaceae	Họ Quắn hoa					
<i>Helicia bullata</i> Sleumer*	Mạ sưa răng cưa	MM				NSBE
<i>Helicia cochinchinensis</i> Lour.*	Cơm vàng	MM				
<i>Helicia hainanensis</i> Hayata	Mạ sưa hải nam	MM				
<i>Helicia obovatifolia</i> Merr. & Chun*	Mạ sưa	MM				NSBE
<i>Helicia sp.</i> *	Mạ sưa	MM				
<i>Helicia tonkinensis</i> Lecomte*	Mạ sưa bắc bộ	MM				NSBE
<i>Heliciopsis lobata</i> (Merr.) Sleumer	Mạ sưa	MM				
<i>Heliciopsis sp.</i>	Mạ sưa rừng	MM				
Ranunculaceae	Họ Mao cần					
<i>Clematis buchaniana</i> DC.	Dây ông lão	Lp				
Rhamnaceae	Họ Táo ta					
<i>Berchemia lineata</i> (L.) DC.	Dây sâm	Lp				
<i>Gouania leptostachya</i> DC.	Dây đòn gánh	Lp				
<i>Ziziphus funiculosa</i> Buch.-Ham. ex Wall.	Táo dại	Na				
<i>Ziziphus mauritiana</i> Lam.	Táo nhà	MM				
<i>Ziziphus oenoplia</i> (L.) Mill.	Táo dại	Na				
Rhizophoraceae	Họ Đước					
<i>Carallia brachiata</i> (Lour.) Merr.*	Trúc tiết	MM				
<i>Carallia lucida</i> Roxb.	Răng cá	MM				
Rosaceae	Họ Hoa hồng					
<i>Duchesnea indica</i> (Andrews) Focke	Dâu núi	Na				NGBE
<i>Eriobotrya deflexa</i> Nakai*	Tì bà	Na				NSBE
<i>Eriobotrya japonica</i> (Thunb.) Lindl.*	Tì bà	Na				NSBE
<i>Persica vulgaris</i> Mill.	Đào	MM				NGBE
<i>Prunus arborea</i> (Blume) Kalkman*	Xoan đào	MM				
<i>Prunus armeniana</i> L.	Mơ	MM				
<i>Prunus fordiana</i> Dunn*	Vỏ hôi	MM				

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<i>Prunus salicina</i> Lindl.	Mận	MM				
<i>Prunus sp.</i>	Xoan đào rừng	MM				
<i>Prunus zippeliana</i> Miq.*	Da bò	MM				
<i>Rhaphiolepis indica</i> (L.) Lindl.	Bánh xe	MM				
<i>Rosa chinensis</i> Jacq.	Hoa hồng	Na				
<i>Rubus alcaefolius</i> Poir.	Mâm xôi	Lp				
<i>Rubus cochinchinensis</i> Tratt.	Ngấy	Lp				
<i>Rubus leucanthus</i> Hance	Mâm xôi	Lp				
Rubiaceae	Họ Cà phê					
<i>Aidia acuminatissima</i> (Merr.) Masam.*	Mãi táp lông	MM				NSBE
<i>Aidia cochinchinensis</i> Lour.*	Mãi táp	MM				NSBE
<i>Aidia oxyodonta</i> (Drake) Yamaz.*	Găng nhọn	MM				
<i>Aidia pycnantha</i> (Drake) Tirveng.*	Mãi táp	MM				
<i>Aidia sp.*</i>	Mãi táp	Na				
<i>Aidia spicata</i> (Valeton) Tirveng.*	Mãi táp	MM				
<i>Canthium dicoccum</i> Merr.*	Xương cá	MM	V			R
<i>Canthium horridum</i> Blume	Găng gai	Na				
<i>Canthium sp.*</i>	Găng côm	Na				
<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	Găng trâu	Na				
<i>Gardenia philastreii</i> Pierre ex Pit.	Dành dành	Na				NSBE
<i>Gardenia sp.*</i>	Dành dành	Na				
<i>Hedyotis capitellata</i> Wall.*	Dạ cầm	Lp				
<i>Hedyotis hispida</i> Retz.	Dạ cầm lông	Na				NSBE
<i>Ixora balansae</i> Pit.	Đơn núi	Na				NSBE
<i>Ixora chinensis</i> Lam.	Mẫu đơn	Na				
<i>Ixora coccinea</i> L.	Đơn đỏ	Na				
<i>Ixora sp.</i>	Mẫu đơn	Na				
<i>Ixora sp.1</i>	Mẫu đơn	Na				
<i>Lasianthus calycinus</i> Dunn	Chia vôi	Na				
<i>Lasianthus sp.*</i>	Chia vôi	Na				
<i>Morinda citrifolia</i> L.	Mặt qui	Lp				R
<i>Morinda officinalis</i> F.C. How	Ba kích	Lp				E
<i>Morinda tomentosa</i> Heyne	Nhàu lông	Lp				NSBE
<i>Morinda umbellata</i> L.	Mặt qui	Lp				
<i>Mussaenda cambodiana</i> Pierre ex Pit.	Bướm bạc	MM				

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<i>Mussaenda macrophylla</i> Wall.	Bướm bạc lá to	MM				
<i>Mussaenda pubescens</i> W.T. Aiton	Bướm bạc lông	MM				
<i>Mussaenda</i> sp.	Bướm bạc	Na				
<i>Neolamarckia cadamba</i> (Roxb.) J. Bosser	Gáo	MM				
<i>Neonauclea calycina</i> Merr.	Vàng kiêng	MM				
<i>Neonauclea purpurea</i> (Roxb.) Merr.	Vàng kiêng	MM				
<i>Neonauclea sessilifolia</i> Merr.	Gáo vàng	MM				
<i>Oldenlandia</i> sp.*	Dạ cẩm	Ch				
<i>Paederia foetida</i> L.	Mơ	Lp				
<i>Pavetta graciliflora</i> Wall.	Xương gà	MM				
<i>Psychotria fleuryi</i> Pit.	Lầu	Na				NSBE
<i>Psychotria montana</i> Blume*	Lầu núi	Na				NSBE
<i>Psychotria rubra</i> Poit.	Lầu	Na				
<i>Psychotria</i> sp.*	Lầu	Na				
<i>Psychotria</i> sp.1*	Lầu	Na				
<i>Randia acuminatissima</i> Merr.*	Mãi táp	MM				
<i>Randia eucodon</i> K. Schum.*	Mãi táp	MM				NSBE
<i>Randia macrophylla</i> Pit.*	Mãi táp lá to	MM				
<i>Randia oxyodonta</i> Drake*	Găng	Na				NSBE
<i>Randia pycnantha</i> Drake*	Mãi táp	Na				NSBE
<i>Randia</i> sp.*	Găng	Na				
<i>Randia spinosa</i> Loes.*	Mãi táp	MM				
<i>Tarennia latifolia</i> Pit.	Trên lá to	Na				NGBE
<i>Tarennia</i> sp.	Trên	Na				
<i>Timonius arborea</i> Elmer*	Găng Bến En	Na			R	NSVN
<i>Uncaria homomalla</i> Miq.	Vuốt đồng	Lp				
<i>Uncaria macrophylla</i> DC.	Câu đăng lá to	Lp				
<i>Uncaria scandens</i> Hutch.	Vuốt leo	Lp				
<i>Uncaria</i> sp.	Câu đăng	Lp				
<i>Urophyllum</i> sp.	Lá đuôi	MM				
<i>Urophyllum streptophodium</i> Wall.*	Lá đuôi	MM				
<i>Urophyllum villosum</i> Jack & Wall.	Lá đuôi lông	MM				NSBE

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<i>Wendlandia glabrata</i> DC.	Hoắc quang trắng	MM				NSBE
<i>Wendlandia paniculata</i> DC.*	Hoắc quang tía	MM				
<i>Xanthophytum polyanthum</i> Pit.	Hoàng cách	Na				
Rutaceae	Họ Cam					
<i>Acronychia pedunculata</i> Miq.*	Bưởi bung	MM				
<i>Atalantia citroides</i> Pierre ex Engl. & Prantl*	Chanh rừng	MM				NSBE
<i>Atalantia sessiliflora</i> Guillaumin	Tầm xoọng	Na				
<i>Citrus aurantifolia</i> Swingle	Chanh	Na				
<i>Citrus grandis</i> Osbeck	Bưởi	MM				
<i>Citrus reticulata</i> Blanco	Quýt	Na				
<i>Citrus sinensis</i> Osbeck	Cam	MM				
<i>Clausena dunniana</i> H. Lev.*	Hồng bì đại	MM				NSBE
<i>Clausena excavata</i> Burm.f.*	Hồng bì đại	MM				
<i>Clausena indica</i> Oliver*	Mắc mật	MM				
<i>Clausena lansium</i> Skeels*	Hồng bì	MM				
<i>Clausena laevis</i> Drake*	Hồng bì	MM				
<i>Euodia leptota</i> (Spreng) Merr.	Ba chạc	Na				
<i>Euodia meliaefolia</i> Benth.*	Thôi chanh	MM				
<i>Euodia</i> sp.	Ba chạc	Na				
<i>Glycosmis cochinchinensis</i> Pierre	Cơm rượu	Na				
<i>Glycosmis cyanocarpa</i> Spreng.	Cơm rượu	Na				NSBE
<i>Glycosmis parviflora</i> (Sims) Little	Cơm rượu	MM				NSBE
<i>Micromelum falcatum</i> Tanaka*	Mất trâu	MM				
<i>Micromelum hirsutum</i> Oliver*	Mất trâu	MM				
<i>Murraya alata</i> Drake	Nguyệt quất	Na				
<i>Murraya paniculata</i> (L.) Jack*	Nguyệt quất	Na				NSBE
<i>Zanthoxylum avicennae</i> DC.	Sén	Na				
<i>Zanthoxylum cucullatipetalum</i> Guillaumin	Hoàng mộc	MM				NSBE
<i>Zanthoxylum nitidum</i> (Roxb.) DC.	Xuyên tiêu	MM				
<i>Zanthoxylum rhesoides</i> Drake	Sén hôi	MM				
<i>Zanthoxylum</i> sp.	Sén	Na				
Sapindaceae	Họ Bồ hòn					
<i>Allophylus cobbe</i> (L.) Blume*	Ngoại mộc	MM				
<i>Amesiodendron chinense</i> (Merr.) Hu*	Trường sân	MM		LR	T	

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<i>Dimocarpus fumatus</i> (Blume) Leenh.*	Nhân rừng	MM				
<i>Dimocarpus longan</i> Lour.	Nhân	MM				
<i>Glennia philippinensis</i> (Radlk.) Leenh.	Chua khét	MM				
<i>Litchi chinensis</i> Sonn.	Vải	MM				
<i>Mischocarpus pentapetalus</i> Radlk.*	Trường kẹn	MM				
<i>Nephelium cuspidatum</i> Blume*	Vải guốc	MM				
<i>Paviesia annamensis</i> Pierre*	Trường mật	MM				T
<i>Pometia pinnata</i> Forst.*	Sâng	MM				R
<i>Sapindus saponaria</i> L.	Bồ hòn	MM				
<i>Xerospermum noronhianum</i> Blume*	Vải guốc	MM				
Sapotaceae	Họ Hồng xiêm					
<i>Achras sapota</i> L.	Hồng xiêm	MM				
<i>Chrysophyllum cainito</i> L.	Vú sữa	MM				
<i>Donella lanceolata</i> (Blume) Aubrév.	Sơn xâ	MM				NSBE
<i>Madhuca pasquieri</i> H.J. Lam*	Sến mật	MM	EN	V	E	
<i>Pouteria sapota</i> (Jacq.) H.E. Moore & Stearn.	Trứng gà	MM				
<i>Sinosideroxylon bonii</i> Aubrév.*	Sến xanh	MM				
<i>Sinosideroxylon racemosum</i> (Dubard) Aubrév.*	Sến đất	MM				
Saururaceae	Họ Diếp cá					
<i>Houttuynia cordata</i> Thunb.	Diếp cá	Hm				
Scrophulariaceae	Họ Hoa môm chó					
<i>Lindernia ciliata</i> Pennell	Mẫu thảo	Hm				
<i>Scoparia dulcis</i> L.	Cam thảo nam	Lp				
<i>Torenia violacea</i> (Azaola ex Blanco) Pennell	Tô liên	Hm				
Simaroubaceae	Họ Thanh thất					
<i>Ailanthus triphysa</i> (Dennst.) Alston*	Thanh thất	MM				
<i>Eurycoma longifolia</i> Jack*	Bách bệnh	MM				
Solanaceae	Họ Cà					
<i>Capsicum annuum</i> L.	Ớt	Na				
<i>Datura metel</i> L.	Cà độc dược	Na				
<i>Physalis angulata</i> L.	Tầm bót	Na				
<i>Solanum album</i> Lour.	Cà đại	Na				
<i>Solanum indicum</i> L.	Cà đại	Na				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
	hoa tím					
<i>Solanum torvum</i> Sw.	Cà gai	Na				
<i>Solanum undatum</i> Poir.	Cà nhà	Na				
Sonneratiaceae	Họ Bần					
<i>Duabanga grandiflora</i> Walp.*	Phay	MM				
Staphyleaceae	Họ Côi					
<i>Turpinia cochinchinensis</i> (Lour.) Merr.	Khớp	MM				
<i>Turpinia indochinensis</i> Merr.*	Khớp đơn	MM				NSBE
<i>Turpinia montana</i> Kurz*	Khớp núi	MM				
Sterculiaceae	Họ Trôm					
<i>Abroma angulosa</i> Poir.	Tai mèo	MM				
<i>Brownlowia tabularis</i> Pierre*	Lò bo	MM				
<i>Byttneria petiolata</i> Cristobal	Quả gai lông Lp					NSBE
<i>Commersonia bartramia</i> (L.) Merr.	Thung gai	MM				
<i>Firmiana simplex</i> W.F. Wight*	Ngô đồng	MM				
<i>Helicteres angustifolia</i> L.	Thâu kén đực	Na				
<i>Helicteres hirsuta</i> Lour.	Thâu kén bà	Na				
<i>Heritiera littoralis</i> Aiton	Vôi cui	MM				
<i>Heritiera macrophylla</i> Wall. ex Voigt*	Vôi cui lá lớn	MM				
<i>Pterospermum angustifolium</i> Tardieu*	Mang lá hẹp	MM				
<i>Pterospermum heterophyllum</i> Hance*	Mang xanh	MM				
<i>Pterospermum jackianum</i> Wall.*	Mang tía	MM				NSBE
<i>Pterospermum lancaefolium</i> Roxb.*	Mang lá mác	MM				NSBE
<i>Pterospermum truncatolobatum</i> Gagnep.*	Mang lá cụt	MM				
<i>Sterculia gracilipes</i> Pierre*	Sáng cuống nhỏ	MM				
<i>Sterculia lanceolata</i> Cav.*	Sáng nhung	MM				
<i>Sterculia lissophylla</i> Pierre	Sáng cuống dài	MM				
<i>Sterculia sp.*</i>	Sáng	MM				
Styracaceae	Họ Bồ đề					
<i>Alniphyllum fortunei</i> Makino*	Bồ đề xanh	MM				NSBE
<i>Styrax tonkinensis</i> Craib ex Hartwich*	Bồ đề	MM				
Symplocaceae	Họ Dung					

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
<i>Symplocos atriolivacea</i> Merr. & Chun ex H.L. Li	Dung đen	MM				NSBE
<i>Symplocos cochinchinensis</i> (Lour.) S. Moore.*	Dung nam	MM				
<i>Symplocos cochinchinensis</i> (Lour.) S. Moore. var. <i>cochinchinensis</i> *	Dung nam	MM				NSBE
<i>Symplocos glauca</i> Koidz.*	Dung mỡ	MM				NSBE
<i>Symplocos laurina</i> Wall.*	Dung giấy	MM				
<i>Symplocos racemosa</i> Roxb.	Dung lông	MM				
Theaceae	Họ Chè					
<i>Adinandra annamensis</i> Gagnep.	Súm	MM				
<i>Adinandra integerrima</i> T. Anderson ex Dyer	Súm	MM				NSBE
<i>Camellia amplexicaulis</i> Cohen-Stuart*	Hải đường	MM				
<i>Camellia caudata</i> Wall.	Chè đuôi	MM				
<i>Camellia chrysantha</i> (Hu) Tuyama*	Chè đôi	MM				NSBE
<i>Camellia sinensis</i> Kuntze	Chè	MM				
<i>Eurya acuminata</i> DC.*	Súm	Na				
<i>Eurya japonica</i> Thunb.	Súm	Na				
<i>Eurya tonkinensis</i> Gagnep.*	Súm bắc bộ	Na				
<i>Pyrenaria jonquieriana</i> Pierre ex Laness.	Súm	MM				
<i>Schima superba</i> Gardn. & Champ.*	Vối thuốc	MM				
<i>Schima wallichii</i> Choisy*	Vối thuốc	MM				
Thymelaeaceae	Họ Trâm					
<i>Aquilaria crassna</i> Pierre ex Lecomte	Trâm hương	MM	EN	CR	E	
<i>Wikstroemia indica</i> (L.) C.A. Mey.	Niết gió	Na				
Tiliaceae	Họ Đay					
<i>Colona thorelii</i> Burret	Bồ an	MM				
<i>Grewia eriocarpa</i> Juss.	Cò ke	MM				
<i>Grewia hirsuta</i> Vahl	Cò ke lông	MM				
<i>Grewia paniculata</i> Roxb.*	Cò ke	MM				
<i>Triumfetta pseudocana</i> Sprague & Craib	Ké lông	Na				
Ulmaceae	Họ Du					
<i>Celtis sinensis</i> Pers.*	Sấu	MM				
<i>Gironniera cuspidata</i> Kurz	Ngát	MM				
<i>Gironniera mollissima</i> Gagnep.	Ngát lông	MM				NSBE
<i>Gironniera subaequalis</i> Planch.*	Ngát vàng	MM				
<i>Trema angustifolia</i> Blume	Hu lá hẹp	Na				NSBE

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<i>Trema cannabina</i> Lour.	Hu đen	Na				
<i>Trema orientalis</i> (L.) Blume	Hu đay	MM				
<i>Trema politoria</i> Blume	Hu đay lông	Na				
Urticaceae	Họ Gai					
<i>Boehmeria clidemioides</i> Miq.	Gai núi	Na				NSBE
<i>Boehmeria nivea</i> (L.) Gaudich.	Gai	Na				
<i>Boehmeria tomentosa</i> Wedd.*	Gai lông	Na				NSBE
<i>Debregeasia squamata</i> King ex Hook*	Gai rừng	Na				NGBE
<i>Dendrocnide stimulans</i> (L.f.) Chew	Lá han	MM				
<i>Elatostema balansae</i> Gagnep.	Cao hùng	Na				
<i>Elatostema</i> sp.*	Cao hùng	Na				
<i>Gonostegia hirta</i> (Blume) Miq.	Bọ mắ lông	Na				
<i>Laportea violacea</i> Gagnep.	Han lá dài	MM				
<i>Oreocnide integrifolia</i> Miq.	Han lá nguyên	MM				
<i>Oreocnide tonkinensis</i> (Gagnep.) Merr. & Chun	Ná nang	Na				
<i>Pellionia repens</i> (Lour.) Merr.	Phu lệ bắc bộ	Th				
<i>Pouzolzia</i> sp.	Bọ mắ	Na				
<i>Pouzolzia zeylanica</i> (L.) Benn.	Bọ mắ	Na				
Verbenaceae	Họ Cỏ roi ngựa					
<i>Callicarpa albida</i> Blume	Tu hú	MM				
<i>Callicarpa arborea</i> Roxb.	Tu hú	MM				
<i>Callicarpa cana</i> L.	Nàng nàng	Na				
<i>Callicarpa dichotoma</i> Raeusch.*	Tu hú	Na				
<i>Callicarpa longifolia</i> Lam.	Tu hú lá dài	Na				NSBE
<i>Callicarpa macrophylla</i> Vahl*	Tu hú lá to	MM				NSBE
<i>Clerodendrum chinense</i> (Osborne) Mabb.	Mò trắng	Na				NSBE
<i>Clerodendrum colebrookianum</i> Walp.	Mò lông	Na				
<i>Clerodendrum cyrtophyllum</i> Turcz.	Mò núi	Na				
<i>Clerodendrum fortunatum</i> L.	Đắng cây	Na				
<i>Clerodendrum fragrans</i> Vent.	Mò thơm	Na				
<i>Clerodendrum japonicum</i> Sweet	Xích đồng nam	Na				
<i>Clerodendrum paniculatum</i> L.	Ngọc nữ	Na				

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<i>Clerodendrum sp.</i>	Mò	Na				
<i>Clerodendrum tonkinense</i> Dop	Mò trắng	Na				NSBE
<i>Gmelina annamensis</i> Dop	Lõi thọ trung bộ	MM				
<i>Gmelina arborea</i> Roxb.*	Lõi thọ	MM				
<i>Premna balansae</i> Dop	Vọng cách	Na				NSBE
<i>Premna cambodiana</i> Dop	Vọng cách lá to	Na				
<i>Premna chevalieri</i> Dop	Vọng cách hoa vàng	Na				
<i>Stachytarpheta jamaicensis</i> (L.) J.Vahl	Cây đuôi chuột	Th				
<i>Verbena officinalis</i> L.	Cỏ roi ngựa	Ch				
<i>Vitex leptobotrys</i> Hallier f.	Đền	MM				
<i>Vitex negundo</i> L.	Đền lông	MM				
<i>Vitex quinata</i> Druce*	Đền 5 lá	MM				
<i>Vitex trifolia</i> L.*	Đền 3 lá	MM				
Violaceae	Họ Hoa tím					
<i>Viola inconspicua</i> Blume*	Hoa tím	MM				
Vitaceae	Họ Nho					
<i>Ampelopsis heterophylla</i> Blume	Nho đại	Lp				
<i>Cayratia japonica</i> (Thunb.) Gagnep.	Nho rừng	Lp				
<i>Cayratia trifolia</i> (L.) Domin	Dây hời	Lp				
<i>Cissus modeccoides</i> Planch.	Chia vôi	Lp				
<i>Cissus trilobus</i> (Lour.) Merr.	Nho rừng	Lp				
<i>Parthenocissus heterophylla</i> Merr.	Dây chia vôi	Lp				
<i>Tetrastigma planicaule</i> Gagnep.	Dây thêm bếp	Lp				
<i>Tetrastigma sp.</i>	Thêm bếp	Lp				
<i>Tetrastigma strumarum</i> Gagnep.*	Dây quai bị	Lp				NSBE
<i>Vitis vinifera</i> L.	Nho	Lp				
Liliopsida	Lớp 1 lá mầm					
Acoraceae	Họ Thạch xương bồ					
<i>Acorus gramineus</i> Sol.	Thạch xương bồ	Cr				

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Agavaceae	Họ Huyết dụ					
<i>Cordyline terminalis</i> (L.) Kunth	Huyết dụ	Na				
Alliaceae	Họ Hành					
<i>Allium chinense</i> G. Don	Kiêu	Cr				
<i>Allium fistulosum</i> L.	Hành	Cr				
<i>Allium odorum</i> L.	Hẹ	Cr				
<i>Allium sativum</i> L.	Tỏi	Cr				
Araceae	Họ Ráy					
<i>Acorus gramineus</i> Aiton	Thạch xương bồ	Cr			R	
<i>Aglaonema modestum</i> Schott ex Engl.	Vạn niên thanh	Cr				
<i>Alocasia macrorrhizos</i> (L.) G. Don	Ráy	Cr				
<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicolson	Khoai nưa	Cr				
<i>Amorphophallus</i> sp.	Nưa	Cr				
<i>Colocasia esculenta</i> (L.) Schott	Khoai sọ	Cr				
<i>Colocasia gigantea</i> (Blume) Hook. f.	Dọc mùng	Cr				
<i>Colocasia macrorhiza</i> (L.) G. Don*	Ráy	Lp				
<i>Epipremnum giganteum</i> Schott	Ráy leo	Lp				
<i>Homalomena occulta</i> Schott	Thiên niên kiện	Cr				
<i>Pothos chinensis</i> (Raf.) Merr.	Cơ lênh	Lp				
<i>Pothos grandis</i> Buch.	Cơ lênh lá lớn	Lp				
<i>Pothos repens</i> Druce	Chân rết	Ep				
<i>Pothos</i> sp.	Ráy leo	Ep				
Areaceae	Họ Cau					
<i>Areca catechu</i> L.	Cau	MM				
<i>Arenga pinnata</i> Merr.*	Búng bóng	Na				
<i>Calamus balansaeanus</i> Becc.*	Mây nước	Lp				NSBE
<i>Calamus faberi</i> Becc.	Mây thủ công	Lp				
<i>Calamus platyacanthus</i> Warb. ex Becc.*	Song mật	Lp	V			R
<i>Calamus salicifolius</i> Becc.	Mây lá liễu	Lp				
<i>Calamus</i> sp.	Mây	Lp				

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<i>Calamus tenuis</i> Roxb.	Mây đàn	Lp				
<i>Calamus tetradactylus</i> Hance*	Mây mật	Lp			R	
<i>Caryota mitis</i> Lour.*	Đùng đình	Na				
<i>Caryota urens</i> L.*	Đùng đình	Na				
<i>Cocos nucifera</i> L.	Dừa	MM				
<i>Daemonorops longispathus</i> Becc.	Hèo	Na				
<i>Licuala fatua</i> Becc.*	Lụi	Na				
<i>Livistona chinensis</i> R.Br.	Cọ	MM				
<i>Livistona saribus</i> Merr. ex A. Chev.	Cọ	MM				
<i>Rhapis excelsa</i> Henry ex Rehder	Lụi cao	Na				
<i>Rhapis humilis</i> Blume	Lụi đỏ	Na				
<i>Rhapis sp.*</i>	Lụi	Na				
Asparagaceae	Họ Tóc Tiên					
<i>Asparagus cochinchinensis</i> Merr.	Tóc tiên	Hm				
Bromeliaceae	Họ Dứa					
<i>Ananas comosus</i> (L.) Merr.	Dứa	Hm				
Cannaceae	Họ Chuối hoa					
<i>Canna edulis</i> Ker Gawl.	Dong riềng	Cr				
Commelinaceae	Họ Thài lài					
<i>Commelina communis</i> L.	Thài lài	Hm				
<i>Commelina diffusa</i> Burm.f.	Rau trai	Hm				
<i>Commelina paludosa</i> Blume	Trai	Hm				
<i>Dictyospermum montanum</i> Wight	Trai núi	Na				
<i>Floscopa scandens</i> Lour.	Đầu riu	Cr				
<i>Pollia secundiflora</i> (Blume) Bakh.f.	Lài	Cr				
<i>Tradescantia zebrina</i> Bosse	Thài lài tía	Hm				
<i>Zebrina sp.</i>	Thài lài	Cr				
Convallariaceae	Họ Cao cẳng					
<i>Ophiopogon dracaenoides</i> Hook.	Cao cẳng	Hm				
<i>Ophiopogon latifolius</i> L. Rodr.	Cao cẳng lá rộng	Hm				
<i>Ophiopogon longifolius</i> Decne.	Cao cẳng lá dài	Hm				
<i>Ophiopogon reptans</i> Hook.	Cao cẳng	Hm				

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	lá hẹp					
<i>Ophiopogon sp.</i>	Cao cẳng	Hm				
Costaceae	Họ Mía dò					
<i>Costus speciosus</i> Sm.	Mía dò	Cr				
<i>Costus tonkinensis</i> Gagnep.	Mía dò bắc	Cr				NSBE
Cyperaceae	Họ cỏ					
<i>Carex indica</i> L.	Kiệt ần độ	Hm				
<i>Carex sp.</i>	Kiệt	Hm				
<i>Cyperus cephalotes</i> Vahl	Kiệt	Hm				
<i>Cyperus diffusus</i> Vahl	Lác	Hm				
<i>Cyperus distans</i> L.f.	Cói	Hm				
<i>Cyperus exaltatus</i> Retz	Cói cao	Hm				
<i>Cyperus iria</i> L.	Cú rận	Hm				
<i>Cyperus pilosus</i> Vahl	Cói lông	Hm				
<i>Cyperus rotundus</i> L.*	Cỏ gấu	Cr				
<i>Cyperus sp.</i>	Cói	Ch				
<i>Cyperus trialatus</i> (Boeckeler) J. Kern	Cói ba cánh	Ch				
<i>Fimbristylis complanata</i> (Retz.) Link	Năn	Hm				
<i>Kyllinga monocephala</i> Rottb.	Cỏ bạc đầu	Cr				
<i>Kyllinga nemoralis</i> (Forst.) Dandy ex Hutch. & Dalziel	Cỏ bạc đầu	Cr				
<i>Scleria biflora</i> Roxb.	Cỏ cuống	Hm				
Dioscoreaceae	Họ Củ nâu					
<i>Dioscorea alata</i> L.	Khoai ngot	Cr				
<i>Dioscorea arachidna</i> Prain & Burkill	Từ lông	Cr				
<i>Dioscorea bulbifera</i> L.	Củ đại	Cr				
<i>Dioscorea cirrhosa</i> Lour.	Củ nâu	Cr				
<i>Dioscorea depauperata</i> Prain & Burkill	Khoai mài	Lp				
<i>Dioscorea glabra</i> Roxb.	Củ từ	Lp				
<i>Dioscorea persimilis</i> Prain & Burkill	Củ mài	Cr				
Dracaenaceae	Họ Bồng bồng					
<i>Dracaena cambodiana</i> Pierre ex Gagnep.*	Huyết giác	Na				
<i>Dracaena cochinchinensis</i> Hort. ex Baker*	Huyết giác	Na				
<i>Sansevieria hyacinthoides</i> (L.) Druce	Lưỡi hổ	Na				
Hydrocharitaceae	Họ Thủy					

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	thảo					
<i>Hydrilla verticillata</i> (L.f.) Royle	Thuỷ thảo	Cr				
Hypoxidaceae	Họ Sâm cau					
<i>Curculigo gracilis</i> Wall.	Sâm cau	Cr				
<i>Curculigo latifolia</i> Dryand.	Sâm cau lá rộng	Cr				
<i>Curculigo orchiioides</i> Gaertn.	Sâm cau	Cr				
Liliaceae	Họ Loa ken					
<i>Dianella ensifolia</i> (L.) DC.	Hoa Loa ken	Hm				NGBE
<i>Lilium longiflorum</i> Thunb.	Hoa huệ	Hm				
Iridaceae	Họ Sâm đại hành					
<i>Belamcanda chinensis</i> DC.	Rê quạt	Cr				
<i>Eleutherine bulbosa</i> Urb.	Sâm đại hành	Cr				NGBE
Marantaceae	Họ Lá dong					
<i>Maranta arundinacea</i> L.	Khoai dong	Cr				
<i>Phrynium parviflorum</i> Roxb.	Dong	Cr				
<i>Phrynium placentarium</i> Merr.	Lá dong	Cr				
Musaceae	Họ Chuối					
<i>Musa acuminata</i> Colla	Chuối rừng	Cr				
<i>Musa balbisiana</i> Colla	Chuối hột	Cr				
<i>Musa basjoo</i> Siebold	Chuối ngự	Cr				
<i>Musa paradisiaca</i> L.	Chuối tiêu	Cr				
Orchidaceae	Họ Phong lan					
<i>Aerides falcata</i> Lindl. & Paxton	Giáng hương	Ep				
<i>Anoetochilus roxburghii</i> (Wall.) Lindl.	Kim tuyến	Cr	E			E
<i>Apotasia odorata</i> Blume	Lan lá hẹp	Ch				
<i>Appendicula</i> sp.	An lan	Ep				
<i>Bulbophyllum odoratissimum</i> Lindl.*	Cầu diệp thơm	Ep				
<i>Bulbophyllum</i> sp.	Lan	Ep				
<i>Calanthe herbacea</i> Lindl.*	Địa lan	Hm				
<i>Cymbidium lowianum</i> Reichb.f.	Phong Lan	Ep				
<i>Dendrobium aloideum</i> La Llave & Lex.	Hoàng thảo	Ep				
<i>Dendrobium</i> sp.*	Phong lan	Ep				

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<i>Eria pannea</i> Lindl.	Ni lan	Ep				NSBE
<i>Podochilus intermedius</i> Aver.*	Lan leo	Pp				
<i>Schoenorchis</i> sp.	Phong lan	Ep				
<i>Thrixspermum centipeda</i> Lour.	Lan xương cá	Ep				
<i>Thrixspermum</i> sp.	Lan	Ep				
Pandanaceae	Họ Dứa dại					
<i>Pandanus nanofrutex</i> B.S. Stone	Dứa bụi	Na				
<i>Pandanus tectorius</i> Parkinson	Dứa gỗ	Na				
<i>Pandanus tonkinensis</i> B.S. Stone	Dứa	Na				NSBE
Phormiaceae	Họ Hương bài					
<i>Dianella nemorosa</i> Lam.	Hương bài	Th				
Poaceae	Họ Lúa					
<i>Acroceras munroanum</i> (Balansa) Henrard	Cỏ lá tre	Ch				
<i>Arundinaria sat</i> Balansa	Sặt	Na				
<i>Axonopus compressus</i> (Sw.) P. Beauv.	Cỏ lá gừng	Hm				NGBE
<i>Bambusa blumeana</i> Schult.f.	Tre gai	MM				
<i>Bambusa flexuosa</i> Munro	Hóp gai	MM				
<i>Chloris barbata</i> Sw.	Cỏ mật	Th				NGBE
<i>Chrysopogon aciculatus</i> (Retz.) Trin.	Cỏ may	Hm				
<i>Coix lacryma-jobi</i> L.	Ý dĩ	Th				
<i>Cymbopogon caesius</i> (Hook. & Arn.) Stapf	Sả hôi	Hm				NGBE
<i>Cymbopogon citratus</i> Stapf	Sả	Ch				
<i>Cynodon dactylon</i> (L.) Pers.	Cỏ gà	Hm				
<i>Cyrtococcum patens</i> A. Camus	Cỏ lá tre	Hm				
<i>Dactyloctenium aegyptiacum</i> Willd.	Cỏ chân vịt	Th				
<i>Dendrocalamus asper</i> Backer ex K. Heyne	Bương	MM				
<i>Dendrocalamus barbatus</i> Hsueh & D.Z. Li	Luồng	MM				
<i>Dendrocalamus giganteus</i> Munro	Mai	MM				
<i>Digitaria adscendens</i> (Kunth) Henrard	Cỏ chỉ	Ch				
<i>Digitaria timorensis</i> (Kunth) Balansa	Cỏ chân nhện	Ch				
<i>Echinochloa crus-galli</i> (L.) P. Beauv.	Cỏ lồng vực	Ch				
<i>Eleusine indica</i> (L.) Gaertn.	Cỏ màn trâu	Th				

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<i>Eriachne pallescens</i> R.Br.	Cỏ chi	Hm			NGBE
<i>Eriochloa procera</i> (Retz.) C.E. Hubb.	Cỏ mật	Hm			
<i>Imperata cylindrica</i> L.P. Beauv.	Cỏ tranh	Cr			
<i>Indosasa angustata</i> McClure*	Vầu đắng	MM			
<i>Indosasa sinica</i> C.D. Chu & C.S. Chao*	Vầu ngọt	MM			
<i>Isachne miliacea</i> Roth.	Cỏ nghề	Ch			NGBE
<i>Microstegium ciliatum</i> A. Camus	Cỏ rác lông	Hm			
<i>Microstegium vagans</i> (Nees ex Steud.) A. Camus	Cỏ rác	Hm			
<i>Miscanthus floridulus</i> Warb. ex K. Schum. & Lauterb.	Lách	Hm			
<i>Neyraudia reynaudina</i> (Kunth) Keng ex Hitchcock	Sậy khô	Hm			
<i>Oplismenus compositus</i> (L.) P. Beauv.	Cỏ lá tre	Ch			
<i>Oryza sativa</i> L.	Lúa nước	Th			
<i>Panicum amoenum</i> Balansa	Cỏ gừng	Hm			
<i>Panicum miliaceum</i> L.	Kê	Th			
<i>Panicum sarmentosum</i> Roxb.	Cỏ giác	Ch			
<i>Paspalum conjugatum</i> Berg.	Cỏ giác	Ch			
<i>Paspalum scrobiculatum</i> L.	Cỏ đắng	Th			
<i>Paspalum</i> sp.	Cỏ giác	Ch			
<i>Pennisetum</i> sp.	Cỏ	Th			
<i>Phacelurus</i> sp.	Cỏ	Ch			
<i>Phragmites karka</i> (Retz.) Steud.	Sậy	Cr			
<i>Pogonatherum crinitum</i> Kunth	Cỏ lông lợn	Hm			
<i>Saccharum arundinaceum</i> Retz.	Lau	Ch			
<i>Saccharum officinarum</i> L.	Mía	Ch			
<i>Saccharum spontaneum</i> L.	Lách	Hm			
<i>Schizostachyum funghomii</i> McClure*	Nứa	MM			
<i>Setaria palmifolia</i> Stapf	Cỏ lá dứa	Cr			
<i>Sinarundinaria griffithiana</i> (Munro) C.S. Chao & Renvoize	Sặt gai	Ch			
<i>Themeda caudata</i> Hack.	Cỏ phao	Ch			
<i>Thysanolaena maxima</i> Kuntze	Chít	Hm			
<i>Vetiveria</i> sp.	Cỏ	Cr			
<i>Zea mays</i> L.	Ngô	Th			
Smilacaceae	Họ Kim				

SCIENTIFIC NAME	COMMON NAME	LF	RDB	RD-IUCN	RDBE	NOTE
	cang					
<i>Heterosmilax chinensis</i> Wang	Kim Cang	Cr				NSBE
<i>Heterosmilax gaudichaudiana</i> A.DC.	Thổ phục linh	Lp				
<i>Smilax bauhinioides</i> Kunth	Kim Cang lá tròn	Lp				
<i>Smilax china</i> L.	Khúc khắc trung hoa	Lp				
<i>Smilax corbularia</i> Kunth*	Kim Cang bạc	Cr				
<i>Smilax elegantissima</i> Gagnep.	Kim Cang	Cr	V			DD
<i>Smilax ferox</i> Wall. ex Kunth	Cầm Cang gai	Cr				
<i>Smilax glabra</i> Roxb.	Thổ phục linh	Cr				T
<i>Smilax lanceifolia</i> Roxb.*	Kim Cang lá thuôn	Cr				
<i>Smilax ovalifolia</i> Roxb.	Kim Cang lá to	Lp				
<i>Smilax perfoliata</i> Lour.*	Kim Cang	Cr				
<i>Smilax poilanei</i> Gagnep.	Kim Cang	Cr	CR			DD
<i>Smilax sp.*</i>	Kim Cang núi	Lp				
Stemonaceae	Họ Bách bộ					
<i>Stemona tuberosa</i> Lour.	Bách bộ	Cr				
Tacaceae	Họ Râu hùm					
<i>Tacca chantrieri</i> André	Râu hùm	Cr				
Zingiberaceae	Họ Gừng					
<i>Alpinia galanga</i> Willd.	Riềng nếp	Cr				
<i>Alpinia officinarum</i> Hance	Riềng dai	Cr				
<i>Alpinia sp.</i>	Riềng rừng	Cr				
<i>Alpinia zerumbet</i> (Pers.) B.L. Burtt & R.M. Sm.	Riềng	Cr				
<i>Amomum echinosphaera</i> K. Schum.	Sa nhân	Cr				
<i>Amomum villosum</i> Lour.	Sa nhân	Cr				
<i>Curcuma domestica</i> Valetton	Nghệ	Cr				
<i>Curcuma longa</i> L.	Nghệ	Cr				

<i>Curcuma zedoaria</i> Rosc.	Nghê đen	Cr
<i>Zingiber eberhardtii</i> Gagnep.	Gừng rừng	Cr
<i>Zingiber officinale</i> Rosc.	Gừng	Cr
<i>Zingiber zerumbet</i> (L.) Sm.	Gừng gió	Cr

Addendum: Species recorded for Ben En National Park by Anonymous (2000) and Tordoff et al. (2000), but not found in our 2005 - 2007 survey are listed below. Since no herbarium vouchers of the earlier surveys could be consulted, these additional species should be considered tentative. We have not checked the names for nomen-clatural precision or current taxonomic status.

LYCOPODIOPHYTA: Selaginellaceae (*Selaginella* sp., *S. sp1*).

POLYPODIOPHYTA: Adiantaceae (*Dryopteris concolor*, *Hemionitis arifolia*, *Onychium lucidum*, *Stenochlaena palustris*, *Syngamma alismifolia*, *Taenitis blechnoides*); Angiopteridaceae (*Angiopteris evecta*); Aspleniaceae (*Asplenium ensiforme*, *Diplazium christii*, *Diplazium esculentum*); Denstaedtiaceae (*Stenoloma chusanum*); Dryopteridaceae (*Tectaria polymorpha*, *T. subpedata*, *T. subtriphylla*); Gleicheniaceae (*Diplopterygium laevissimum*); Hymenophyllaceae (*Crepidomanes* sp.); Lindsaeaceae* (*Lindsaea ensifolia*, *L. orbiculata*); Marsileaceae (*Marsilea minuta*); Polypodiaceae (*Pyrrosia piloselloides*); Pteridaceae (*Pteris cadieri*, *Pteris deltodon*, *P. tripartita*); Salviniaceae (*Salvinia cucullata*); Schizaeaceae (*Lygodium microstachyum*, *L. polystachyum*); Sinopteridaceae (*Sinopteris* sp.); Vittariaceae (*Vittaria elongata*);

MAGNOLIOPHYTA - MAGNOLIOPSIDA: Acanthaceae (*Thunbergia grandiflora*); Annonaceae (*Uvaria purpurea*); Apocynaceae (*Rauvolfia cambodiana*, *R. indica*, *Winchia calophylla*, *Xylinabariopsis napeensis*); Asteraceae (*Centipeda minima*, *Gerbera jamesonii*, *Grangea maderaspatana*, *Tithonia diversifolia*, *Vernonia paludosa*); Begoniaceae (*Begonia balansaeana*, *B. rupicola*); Bignoniaceae (*Campsis grandifolia*, *Radermachera alata*); Boraginaceae (*Cordia myxa*); Cactaceae (*Opuntia ficus-indica*); Capparaceae (*Capparis grandis*); Caryophyllaceae* (*Drymaria cordata*; *Policarpon porostratum*); Celastraceae (*Euonymus aculeatus*, *E. mitratus*, *Salacia cochinchinensis*); Chenopodiaceae (*Chenopodium ambrosioides*); Chloranthaceae (*Chloranthus japonicus*); Clusiaceae (*Calophyllum dryobalanoides*); Connaraceae (*Agelaea trinervis*; *Connarus paniculatus*, *Rourea harmandiana*); Convolvulaceae (*Ipomoea bonii*, *I. heterifolia*, *I. involucre*, *I. triloba*, *Merremia hederacea*, *M. vitifolia*, *Neuropeltis racemosa*, *Operculina turpethum*); Cornaceae* (*Cornus tonkinensis*, *Mastixia arborea*); Cucurbitaceae (*Actinostemma tenerum*, *Cucurbita pepo*, *Trichosanthes tricuspidata*, *Zehneria maysorensis*); Dilleniaceae (*Tetracera loureiroi*); Ebenaceae (*Diospyros bangoiensis*, *Diospyros susarticulata*); Elaeocarpaceae (*Elaeocarpus stipularis*); Elatinaceae* (*Bergia ammannioides*, *Elatine ambigua*); Euphorbiaceae (*Acalypha siamensis*, *Cleistanthus myrianthus*, *Drypetes poilanei*, *Euphorbia ligularia*, *Glochidion zeylanicum*, *Macaranga tanarius*, *Mallotus mollissima*, *Pedilanthus tithymaloides*, *Phyllanthus clarkei*, *Sapium cochinchinensis*, *S. rotundifolium*, *S.*

sebiferum, *Sumbaviopsis albicans*, *Trewia nudiflora*, *Vernicia fordii*); Fabaceae (*Acacia megaladina*, *Aeschynomene indica*, *Arachis hypogaea*, *Butea monosperma*, *Cajanus cajan*, *Dalbergia, asamica*, *Desmodium styracifolium*, *D. zonatum*, *Mucuna bracteata*, *Neptunia oleracea*, *Saraca indica*); Fagaceae (*Lithocarpus finetii*); Flacourtiaceae (*Casearia menbranacea*, *Scolopia chinensis*); Hernandiaceae* (*Illigera parviflora*, *I. trifolia*); Gentianaceae* (*Crawfurdia sp.*); Lamiaceae (*Coleus scutellarioides*, *Pogostemon cablin*); Lardizabalaceae* (*Stautonia cavaleriana*); Lauraceae (*Beilschmiedia sphaerocarpa*, *Cinnamomum parthenoxylon*, *C. polyadelphum*, *Phoebe hainanensis*); Lythraceae (*Lagerstroemia floribunda*, *L. indica*); Malpighiaceae* (*Aspidopteryx henryi*, *A. tomentosa*, *Hiptage boniana*, *Malpighia coccigera*); Malvaceae (*Eriolaena candolei*); Melastomataceae (*Osbeckia thorelii*, *Phyllagathis setotheca*, *P. tonkinensis*, *Sonerilla rivularis*, *Vietsenia laxiflora*); Meliaceae (*Aglaia duperreana*, *Heynea trijuga*, *Swietenia macrophylla*); Menispermaceae (*Tinospora cripa*); Molluginaceae* (*Mollugo pentaphylla*); Moraceae (*Ficus altissima*, *F. elastica*, *F. retusa*, *Malaisia scandens*, *Morus australis*); Myristicaceae (*Horsfieldia prainii*, *Knema corticosa*); Myrsinaceae (*Ardisia gigantifolia*, *A. stenophylla*, *A. verbascifolia*); Myrtaceae (*Decaspermum parviflorum*, *Syzygium samarangense*, *S. tsoongii*); Nyctaginaceae (*Boerhavia diffusa*, *Mirabilis jalapa*); Oleaceae (*Jasminum lanceolarium*, *Ligustrum sinense*); Onagraceae (*Ludwigia hyssopyfolia*, *L. parennis*); Passifloraceae (*Adenia chevalieri*, *Passiflora quadrangularis*); Pedaliaceae* (*Sesamum orientale*); Piperaceae (*Piper pierrei*); Polygonaceae (*Rumex wallichii*); Primulaceae* (*Lysimachia decurrens*); Ranunculaceae (*Naravelia laurifolia*, *N. siamensis*, *N. zeylanica*); Rosaceae (*Eriobotrya bengalensis*, *Rubus pavifolius*); Rubiaceae (*Coffea arabica*, *Gardenia lucida*, *Lasianthus kamputensis*); Rutaceae (*Atalantia buxifolia*, *A. roxburghiana*, *Euodia triphylla*, *Micromelum minutum*); Sapindaceae (*Allophylus macrodontus*, *Arytera littoralis*, *Cardiospermum halicacabum*, *Nephelium melliferum*); Sapotaceae (*Planchonella annamensis*, *Sarcosperma kachinense*); Saururaceae (*Saururus sinensis*); Schisandraceae (*Kadsura coccinea*); Scrophulariaceae (*Angelonia goyazensis*, *A. aromatica*, *A. micrantha*, *Lindernia antipoda*, *L. pusilla*, *L. rueloides*, *L. tonkinensis*, *Microcarpaca minima*, *Torenia benthamiana*); Simaroubaceae (*Brucea javanica*); Solanaceae (*Solanum melongena*, *S. nigrum*, *S. virginianum*); Sterculiaceae (*Muntingia calabura*, *Sterculia lissophylla*, *S. tonkinensis*); Symplocaceae (*Symplocos adenophylla*); Theaceae (*Adinandra glischroloma*); Ulmaceae (*Gironniera yunnanensis*); Urticaceae (*Parietaria debilis*, *Procris frutescens*); Verbenaceae (*Premna chevalieri*, *P. serratifolia*, *Verbena hybrida*); Vitaceae (*Cissus javanica*, *C. quadrangulus*);

LILIOPSIDA: Acoraceae (*Acorus tatarinowii*, *A. verus*); Agavaceae* (*Agava americana*, *A. angustifolia*); Alismataceae* (*Alisma plantago*); Amaryllidaceae* (*Crinum asiaticum*, *C. giganteum*); Arecaceae (*Calamus poilanei*); Cannaceae (*Canna generalis*); Commelinaceae (*Zebrina pendula*); Cyperaceae (*Bulbostylis barbata*, *Cyperus compressus*); Dioscoreaceae (*Dioscorea esculenta*); Dracaenaceae (*Sansevieria cylindrica*, *S. trifasciata*); Eriocaulaceae* (*Eriocaulon bonii*, *E. miserum*); Flagellariaceae* (*Flagellaria indica*); Hemerocallidaceae (*Hemerocallis fulva*); Liliaceae (*Disporum calcaratum*); Orchidaceae (*Acriopsis javanica*, *Appendicula*

cornuta, *Bulbophyllum insulsum*, *Calanthe angusta*, *Ceratostylis tonkinensis*, *Cleisostoma paniculatum*, *C. rostratum*, *Corymborchis veratrifolia*, *Cymbidium aloifolium*, *Dendrobium anceps*, *D. fimbriatum*, *D. lindleyi*, *D. manii*, *D. podagraris*, *D. tortile*, *Habenaria ciliolaris*, *Paphiopedium gratrixianum*, *P. villosum*, *Schoenorchis rosea*, *Spiranthes sinensis*, *Thrixspermum arachnites*, *Zeuxine bonii*); Pontederiaceae (*Eichhornia crassipes*, *Monchoria elata*, *M. hastata*).

TRADITIONAL MEDICINAL PLANTS IN BEN EN NATIONAL PARK, VIETNAM

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SUMMARY

This paper surveys the medicinal plants and their traditional use by local people in Ben En National Park, Vietnam. A total of 230 medicinal plant species (belonging to 200 genera and 84 families) is used by local people for treatment of 68 different diseases. These include species that are collected in the wild (65%) as well as species grown in home gardens. Leaves, stems and roots are most commonly used either fresh or dried or by decocting the dried parts in water. Women are mainly responsible for health care, they have a better knowledge of medicinal plants than men, and also collect them more than men at almost every age level. The indigenous knowledge of traditional medicinal plants may be rapidly lost because 43% of the young generation do not know or do not want to learn about medicinal plants, and the remainder knows little about them. Moreover, nowadays local people tend to use western medicine. Eighteen medicinal plant species are commercialized and contribute on average 11% to the income of the households. The majority of medicinal species are used by less than half of the households and 68% of the medicinal plant species have use indices lower than 0.25. Only 6 of the medicinal species of Ben En are listed in the Red data list of Vietnam, but locally 18 medicinal species are endangered because of over harvesting. A comparison of traditional uses of medicinal plants in Ben En National Park with traditional uses elsewhere in South-East Asia and the Indo-Pacific region shows that the same species may be used for widely different treatments by different ethnic groups. The conservation, sustainable use and economic potential of medicinal plants is discussed. We argue that their use, cultivation in home gardens, and marketing should be encouraged as an affordable alternative to expensive western medicine.

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Key words: Ben En National Park, traditional medicinal plants, disease treatment, conservation.

INTRODUCTION

Man is known to have utilized plants as a source of medicinal drugs for thousands of years. Medicinal plants are potential sources of new drugs and hold a great value for developing pharmaceutical products, phytomedicines, and dietary supplements (King et al. 1999).

An effective way to find new drugs is to follow the indigenous knowledge on medicinal plants (Spjut & Perdue 1976; Mendelsohn & Balick 1995; Swerdlow 2000). Using ethnobotany to identify promising plants could substantially reduce the costs for developing at least some pharmaceutical drugs (Mendelsohn 1997). About 80% of the world's population relies on traditional medicine (Farnsworth et al. 1985). Especially in remote areas in developing countries, medicinal plants may form the only available source of health care (Kasperek et al. 1996; Van Andel 2000).

Vietnam is no exception to this phenomenon. The better hospitals are all located in Hanoi, Ho Chi Minh City, and in other main cities. The health care situation in the research area of Ben En National Park is generally much less favourable. The few hospitals and health centres in the interior are often ill-equipped and suffer from lack of trained staff. Only few people can afford to travel to the hospital in the city when they need medical assistance, instead of seeking treatment in local health centres. Most local people do not have health insurance. The majority of the health problems of the local people in Ben En National Park are related to stomach ache, malaria, diarrhoea, wounds, and common colds.

Knowledge of medicinal plants, as once embedded in numerous indigenous cultures, is rapidly disappearing. Year by year, the total sum of human knowledge about the species, distribution, ecology, management, and extraction of medicinal plants is declining: the continuation of a process of loss of local cultural diversity that has been underway for centuries (Hamilton 2003). Although in many communities medicinal plants are the only available source for medical treatment, local indigenous remedies are less used now than before. In many tropical regions indigenous knowledge is at risk of extinction just as is biodiversity itself (Slikkerveer 1999, Van Andel 2000).

Ethnobotanical research can play a key role in the revitalization and revaluation of indigenous knowledge (Martin 1995). For Ben En National Park in particular very few ethnobotanical data exist. Some research has been conducted on biodiversity (Tordoff et al. 2000), and one study just listed plant or animal species, unfortunately without voucher specimens for scientific scrutiny (Anonymous 2000).

To analyse the role of medicinal plants in the indigenous communities in Ben En National Park, this study deals with the variety of medicinal plants and their uses recorded during a one year survey of non-timber forest products in that region.

The main research questions with regards to the use of medicinal plants were:

- Which plant species are being used for which disease?
- Which medicinal plant species are being commercialized in the research area?
- What is the present role of medicinal plants in the health care system of the indigenous communities?
- How does the situation in Ben En National Park compare with other local communities depending on natural forest resources in and beyond Vietnam?

We hope that the documentation of this medicinal plant knowledge contributes to the conservation of both cultural diversity and plant biodiversity in Vietnam in general and Ben En National Park in particular. By compiling and spreading this knowledge we hope to achieve those other ethnic groups in the region benefit from these local and cheap resources.

METHODOLOGY

Household surveys and interviews were carried out in 45 randomly selected households per village (out of a total of about 110-150 households per village). The standard interviews contained specific questions on age, gender, and ethnic background of the gatherers and main users of plant products. Additionally we used the 'walk-in-the-wood' method (Prance et al. 1987), to determine which products are harvested (and for what purpose) in the forests surrounding the villages. These trips were also used to collect voucher specimens for reliable identification of the harvested plants. Special collecting trips were organized with indigenous experts, e.g., traditional doctors, village elders and other local people who knew about medicinal plants. There are five traditional doctors (four females and one male) in the research area. Local names were also being noted during these surveys. Most information was confirmed by other informants. The information was also checked and compared with the 'Vietnam medicinal plants' (Loi 1995), 'Dictionary of medicinal plant of Vietnam' (Chi 1996), 'Plants of Vietnam' (Ho 2000), and the PROSEA (Plant Resources of South-East Asia) Handbooks on 'Medicinal and poisonous plants' (De Padua et al. 1999; Van Valkenburg & Bunyaphrathatsara 2001; Lemmens & Bunyaphrathatsara 2003).

Market inventories were used to determine the price of the forest products that are for sale. These surveys served as an independent way to determine which products are harvested from the surrounding forest, and to assess local uses of these forest products.

All plants that were considered by local people to have medicinal properties were collected and identified. These plants not only included wild species but also cultivated plants and wild plants that had been taken from the forest and planted in gardens or agricultural fields. Botanical specimens were collected of all useful plants. One voucher of each specimen was deposited at the herbarium of the

Vietnam Forestry University, additional vouchers were sent to the National Herbarium of the Netherlands and various specialists for identification.

The importance of medicinal plant species was identified using standard Participatory Rural Appraisal (PRA) techniques (PID & NES 1989; Ngai 2001) where local people were asked to rank a list of regularly used local medicinal plants. The importance of medicinal plants for health care was determined using two criteria: 1) proportion of local people using each listed species; and 2) frequency of use. The importance of medicinal plants species for income generation was determined by calculating the income from each listed species for the local population.

The database resulting from the ethnobotanical inventory was used to calculate a use index (UI) for each species by using the following equation:

$$UI = U_s/N$$

Where U_s is the number of households which mentioned a use for species s ; N is the total of households that were interviewed in the research area. This Use Index is a modification from the Use Value (UV) introduced by Phillips & Gentry (1993) and recently used by De Lucena et al. (2007), which is calculated from the relative number of times a species is mentioned by various informants in ethnobotanical inventories.

The market demand, intensity of collection, and abundance in the wild were classified as follows:

Market demand

- High: easy to sell in large amounts.
- Medium: difficult to sell in large amounts.
- Low: only in very small supply on the market and sometimes left unsold because the demand was not stable.

Collection intensity

- High: local people collect the plants in large amounts because of high demand of the market and/or for personal use.
- Medium: the collected amount is not big because the demand is not high, plants are not abundant, or it is difficult to collect them in large amounts.
- Low: the demand of the market is low or is non-existent. People mainly collect for home consumption, but in small amounts.

Abundance in the wild

- High: the species is easy to find and abundant.
- Medium: the species is neither abundant nor rare.

- Low: the species is rare, and although local people can find it with special effort, the species will be endangered if collection continues.

STUDY AREA

Field work was conducted in Ben En National Park 19° 30' to 19° 40' N by 105° 21' to 105° 35' E, situated in the Nhu Thanh and Nhu Xuan districts of Thanh Hoa province, Vietnam (Fig. 1.1). The highest peak is about 490 m. The core zone of the National Park covers 15,800 ha, while the buffer zone covers around 12,000 ha. About 18,000 people live in the buffer and core zones of the National Park (Tordoff et al. 2000). The majority of the people living in the national park belong to the Kinh, Thai, Muong, and Tay ethnic groups; although there are also a small number of Tho people. The interviews were carried out in three villages: Xuan Thai, Binh Luong, and Hoa Quy. Additional information on medicinal plants was collected in the markets of Ben Sung and Yen Cat. The vegetation of the core zone is dominated by disturbed tropical evergreen rain forest, which has been affected by human activities, especially logging, which was legal until the park was established in 1992, but has continued illegally up to now.

RESULTS

Diversity of medicinal plants

A total of 230 medicinal plant species were used by local people in Ben En National Park belonging to 200 genera and 84 families. These species were involved in 313 different treatments and recipes. For most species only one recipe was mentioned; some have multiple medicinal applications. A complete list of species and their local medicinal uses is given in Appendix 3.1. The total number of vascular plant species in the Park is about 1390 (Hoang et al. 2008 a).

Most of the medicinal plant species in Ben En National Park are angiosperms, only 2 species belong to the gymnosperms and 9 species are ferns. Sixteen percent of all plant species in the Park are used by local people for medicinal purposes. The number of medicinal plant species used by local people in Ben En National Park is 7.2% of the total medicinal plant species in Vietnam (Chi 1996). Diversity of taxa is shown in Table 3.1.

Table 3.1. Diversity of taxa

	Number of medicinal species	Total number of plant species in Ben En	Percent of medicinal species / total species in Ben En (%)
Ferns	9	86	10
Gymnosperms	2	9	22
Angiosperms	219	1294	17
Total	230	1389	16

Among the 84 families, the top 10 families with the highest number of medicinal species in the area are listed in Table 3.2.

Table 3.2. The 10 families with the highest numbers of medicinal species

Name of Family	Number of genera	Number of species
Euphorbiaceae	9	11
Asteraceae	8	9
Moraceae	5	9
Fabaceae	8	8
Rubiaceae	7	8
Menispermaceae	6	8
Verbenaceae	4	8
Rutaceae	5	7
Araceae	6	6
Apocynaceae	6	6

From the 230 species of medicinal plants recorded in Ben En National Park 65% of the species were collected from the wild. These were all plants naturally occurring in different vegetation types (primary, secondary and logged over forests, shrubbery, along roads, along streams, and in agricultural fields). Twenty percent of the species were cultivated in home gardens or in fields or even along the village road. This practice helps to develop the medicinal plant resources, and also makes them more widely available, especially when derived from rare and endangered species. Fifteen percent of the species were both taken from the forest, and also grown in the home gardens and agricultural fields. This semi-domestication reduces the need to cover long distances in the forest to search for plants.

Diversity of life forms of medicinal plants

The analysis of the life forms of medicinal plants used by local people in Ben En National Park is shown in Fig. 3.1. Herbaceous medicinal plants used by local people usually grow on the forest floor, along forest edges and roads, in fields and villages. They are mainly Amaranthaceae, Araceae, Asteraceae, and Zingiberaceae. Next in order of importance are forest trees mainly belonging to Euphorbiaceae, Moraceae, Rubiaceae, and Rutaceae. The smallest groups are formed by lianas and shrubs belonging to mainly Araceae, Asclepiadaceae, Cucurbitaceae, Menispermaceae, and Smilacaceae. Shrubs growing in the forest or along streams mainly are Myrtaceae and Solanaceae.

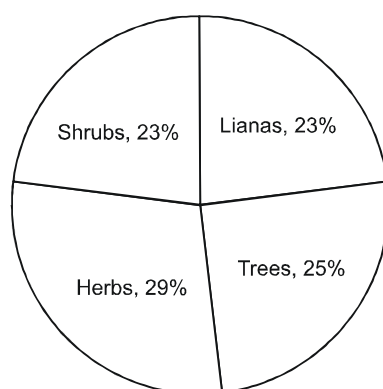


Fig. 3.1. Percentage of life forms of medicinal plants species used in Ben En National Park.

Diversity of plant parts used

In traditional medicine, different plant parts are used to treat different diseases: different components of one medicinal plant may have different effects. Some medicinal plant species have only one component that can be used, while for other species several components or the whole plant can be used. Of the identified medicinal plants in the research area, the whole plant is used of 14 species, whereas one species provides four useful components, 32 species provide three, 98 species provide two, and 85 species provide one component.

The diversity of parts used is indicated in Table 3.3. Leaves are most commonly used, either fresh or dried. Stems and roots are also common, either fresh or by decocting the dried root in water. Stems are usually chopped into small pieces and decocted in water. Often, different parts of the plants are combined to treat a disease.

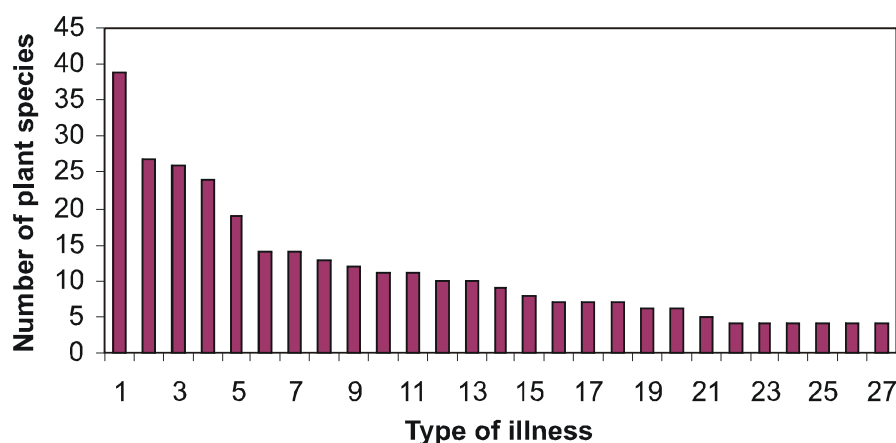
Table 3.3. Diverse parts of medicinal plants used by local people

Parts of plant	Number of species	Percent of total
Leaves	141	61
Root, rhizome	96	42
Stem	64	28
Bark	26	11
Fruit	19	8
Whole plant	14	6
Seed	9	4
Flower	9	4
Tuber	8	3
Bulb	3	1
Latex	2	1

Diseases treated with medicinal plants

The 230 medicinal plant species in Ben En National Park were used for treatment of 68 different diseases. For 20 of these diseases local people use only one medicinal plant for each disease. For example cancer was treated only with *Clausena lansium* (Rutaceae), mumps were exclusively treated with *Momordica cochinchinensis* (Cucurbitaceae), diabetes with *Aralia touranensis* (Araliaceae), aphasia with *Zanthoxylum avicennae* (Rutaceae), paralysis with *Alangium chinense* (Alangiaceae), and abscesses with *Hodgsonia macrocarpa* (Cucurbitaceae). For 12 of the 68 diseases local people used two plant species for treatment of each disease. For example, risk of miscarriage was treated with roots of *Boehmeria nivea* (Urticaceae) or with stems and leaves of *Artemisia vulgaris* (Asteraceae), and constipation was treated with leaves of *Cuscuta chinensis* (Cuscutaceae) or leaves of *Desmos cochinchinensis* (Annonaceae). For 5 diseases local people used three plant species for treatment of each disease. For example, impotence was treated with roots of *Morinda officinalis* (Rubiaceae), roots of *Morinda citrifolia* (Rubiaceae), or leaves and seeds of *Allium odorum* (Alliaceae).

The highest number of species was used to treat fairly common diseases, such as common colds, stomach ache, dysentery, weakness, itches, and diarrhoea (see Fig. 3.2).



1 Common colds, 2 Stomach ache, 3 Dysentery, 4 Weakness, 5 Itches, 6 Indigestion, 7 Diarrhoea, 8 Malaria, 9 Wounds, 10 Snake bite, 11 Fever, 12 Tooth ache, 13 Haemostatic, 14 Rheumatism, 15 Bone fractures, 16 Irregular menses, 17 High blood pressure, 18 Arthritis, 19 Sores, 20 Infection, 21 Urinating problems, 22 Sore throat, 23 Skin diseases, 24 Oedema, 25 Hemorrhage, 26 Detoxification, 27 Burns.

Fig. 3.2. Number of plant species used for different symptoms or illnesses in Ben En National Park.

Seven of the most common diseases in the research area are discussed below.

Wounds and cuts

Wounds and cuts can be caused by many agents, for instance spiny lianas, leaves of some grasses, and sharp limestone edges when people walk in the forest, and by knives, scissors, and other sharp utensils. Cuts soon become infected and may develop into deeper wounds and even skin sores. Common treatments include crushing or chewing leaves and covering cuts with them. Some plant species are commonly used for treatment of cuts and wounds, such as the leaves of *Piper betle* (Piperaceae) and leaves of *Microsorium superficiale* (Polypodiaceae), and leaves of *Eclipta prostrata* (Asteraceae).

Stomach ache

Stomach ache can be a symptom of many kinds of disease. Large numbers of medicinal plants are used against it, but only few species were said to cure the complaints completely. The Thai, Tho, and Muong ethnic groups are often quite knowledgeable on the collection and preparation of anti stomach ache plants and actively exchange recipes with other ethnic groups in the region to combat the symptoms. Medicinal plants which are used for the treatment of stomach ache are for example leaves of *Eupatorium odoratum* (Asteraceae), leaves of *Ardisia silvestris* (Myrsinaceae) or rhizomes of *Curcuma zedoaria* (Zingiberaceae).

Diarrhoea

Diarrhoea is associated with several diseases, mostly attributable to poor sanitary practices and infected drinking water. The local people in Ben En National Park prefer to drink rain water rather than boiled water. In the dry season, there is little choice, and water from Muc Lake (the lake inside the National Park) and streams is used. Many people get diarrhoea in this season. Barks, roots and leaves decoctions are specifically used to treat diarrhoea. *Celosia cristata* (Amaranthaceae) treatment was said to be effective against diarrhoea with blood, which indicates bacterial dysentery. Leaves of *Eupatorium odoratum* (Asteraceae), bark of *Melia azedarach* (Meliaceae), and bark of *Ficus auriculata* (Moraceae) are just three examples of plant species used against diarrhoea in general.

Snake bites

Naja naja, *Bugarus fasciatus*, and *Ptyas korros* are dangerous, poisonous snakes in Ben En National Park. When a person is bitten, the bite can be deadly within hours. The roots and leaves of *Gnetum montanum* (Gnetaceae), the leaves of *Phyllanthus urinaria* (Euphorbiaceae), and leaves and stems of *Gynura crepidioides* (Asteraceae) are considered to be the most effective medicinal plants to cure snake bites. The skin is sliced open, and some of the crushed or chewed plant parts are applied to the wound. This treatment must be applied as soon as possible after the bite.

Risk of miscarriage

Some medicinal plant species are used to prevent miscarriages. In the research area, pregnant women drink an extract from the leaves and stems of *Artemisia vulgaris* (Asteraceae), mixed with some salt or sugar. Another species said to be effective to prevent miscarriage is *Boehmeria nivea* (Urticaceae): boiled roots of this species are eaten during pregnancy. Muong and Tho ethnic groups claim that the older the roots, the better the effects.

Weakness

Weakness can be caused by insomnia, after giving birth or by excessive fatigue. A total of 24 plant species was used to treat weakness. Most remedies consist of a decoction of leaves and stems that is boiled and drunk as tea, such as a decoction of the stems of *Mucuna pruriens* (Fabaceae), decoction of leaves and stems of *Leonurus sibiricus* (Lamiaceae), or the whole plant of *Marsilea quadrifolia* (Marsileaceae) are used to treat insomnia. Some plants are specially used by women after childbirth, such as the leaves of *Artemisia vulgaris* (Asteraceae), roots and stems of *Jasminum subtripplinerve* (Oleaceae), or the roots of *Polygonum multiflorum* (Polygonaceae), and the stems of *Spatholobus suberectus* (Fabaceae). After sickness or exhaustion local people use the flowers of *Telosma cordata* (Asclepiadaceae), or a decoction of the roots and stems of *Fibraurea recisa* (Menispermaceae).

Common colds

A total of 39 plant species was used to treat common colds. Most remedies consisted of a decoction of leaves, which was boiled and drunk as tea, some plant species are drunk after grinding them together with sugar or salt and a little water. Some plants are specifically used to treat children's colds such as the leaves of *Allium odorum* (Alliaceae), and the leaves of *Ocimum tenuiflorum* (Lamiaceae). Some plant species could treat most kinds of colds, such as the leaves of *Blumea balsamifera* (Asteraceae), the bulbs of *Allium sativum* (Alliaceae), or leaves and roots of *Glycosmis pentaphylla* (Rutaceae). Pneumonia was clearly distinguished from the common colds and treated differently.

Collection and preparation of medicinal plants

Who is collecting medicinal plants?

From interviewing households and key informants, it emerged that women collect medicinal plants more than men at almost every age level, especially in the age classes of over 26 years old. This indicates that women are mainly responsible for health care. From the completed questionnaires it was also evident that women have a better knowledge of medicinal plants than men. Young people are rarely engaged in collecting medicinal plants (Table 3.4).

Knowledge of plants and preparation

Most of the people interviewed were familiar with the species used for the treatments of common ailments like cold/cough, fever, headache, indigestion, itches, and plant remedies were used on a regular basis. As in other rural communities (On 2003) common knowledge was learned from other community members, especially from elders and local healers who share knowledge of the mode of collection, and the preparation and administration of medicinal plants.

Table 3.4. Percentage of gender and age level of local people in Ben En National Park harvesting medicinal plants

Age	Gender	Percentage of individuals collecting medicinal plants (%)
> 50	Male	18
	Female	29
26 - 50	Male	17
	Female	27
16 - 25	Male	3
	Female	4
< 16	Male	1
	Female	1
<i>Average % of Males</i>		39
<i>Average % of Females</i>		61

Preparations of plants for medical use included decoction, paste, juice, chewing, and cooking or boiling (Table 3.5). The most common methods of the collection and preparation of medicinal plants are cutting the leaves, roots, stem or bark into small pieces and boiling them in water. For preparing a decoction, the plant parts are boiled until the liquid is reduced to about half or one third of the volume. Some decoctions are also used as steam baths. For pastes, plant parts are finely crushed or chewed, and then the resulting paste is applied to the affected part. For a juice, the plant part (mostly leaves and fruits) is extracted and drunk. For some remedies plant parts are chewed raw, then swallowed. Some plant materials can also be dried and stored for later use.

Administration of medicines

Medical administrations include oral intake, application to external body parts, rubbing/massage, and inhalation (Table 3.6). Most of the species were administered orally, mainly as a decoction or extracted from plant parts. A high number of species were externally applied mostly to treat wounds, snake bites, bleeding and itches. Rubbing applied to treat back pain, muscle pain, and in only three remedies local

people applied inhalation, for instance of steam from *Eucalyptus camaldulensis* (Myrtaceae) and bamboo leaves in boiling water, to treat fever or cold.

Table 3.5. Preparation of medicinal plants

Preparation	Medical remedies (%)
Decoction	50
Paste	24
Juice	14
Chewing	6
Cooking/boiling	4
Powder	2

Table 3.6. Mode of administration of medical remedies

Mode	No. of remedies
Oral intake	199
External application	71
Rubbing/massage	14
Inhalation	3

Commercialization of medicinal plants

A total of 18 medicinal plant species in Ben En National Park are commercialized (Appendix 3.2); of these *Zingiber officinale* (Zingiberaceae) and *Allium sativum* (Alliaceae) are cultivated species. *Curcuma zedoaria* (Zingiberaceae) is both cultivated and wild. Three wild species in high market demand are *Morinda officinalis* (Rubiaceae), *Amomum villosum* (Zingiberaceae) and *Spatholobus suberectus* (Fabaceae).

Most of the species are sold to traders or in the market of the Nhu Thanh and the Nhu Xuan districts. Traders usually sell roots of *Morinda officinalis*, roots of *Polygonum multiflorum*, roots and stems of *Smilax glabra*, roots of *Gynura japonica* and stems and barks of *Abrus precatorius* to traditional medicine shops in big cities in Vietnam. *Spatholobus suberectus* and *Amomum villosum* are exported to China.

The demand of the market and the collection intensity of *Morinda officinalis* used as aphrodisiac are especially high. From our botanical field surveys (Hoang et al. in prep.) it appeared that this species has become endangered by overcollecting of the entire plant, and will soon be extinct, at least locally, if no attempts are made to get the plant into cultivation.

Importance of medicinal plant species for the local people in Ben En National Park

Importance for health care

The eight most important species for health care by local communities are listed in Table 3.7. Most of them are used to treat common diseases such as fever, colds, flu, weakness, and for treating women after childbirth.

Five species of these important medicinal plant species are already grown in home gardens, but the number of households planting them is still low (Table 3.7).

Table 3.7. The most important medicinal plants for local people in Ben En National Park

Latin name	Common name	Origin	Percentage of households cultivating the species
Asteraceae	Họ Cúc		
<i>Artemisia vulgaris</i> L.	Ngải cứu	Temperate Europe and Asia, wild, cultivated	21
Fabaceae	Họ Đậu		
<i>Spatholobus suberectus</i> Dunn	Huyết rồng Lào	Native, wild	0
<i>Abrus precatorius</i> L.	Cam thảo	India, wild	0
Lamiaceae	Họ Hoa môi		
<i>Leonurus sibiricus</i> L.	Ích mẫu	Siberia, China, wild, cultivated	12
<i>Ocimum tenuiflorum</i> L.	Hương nhu tía	Old World Tropics, wild, cultivated	15
Plantaginaceae	Ho Mã đề		
<i>Plantago asiatica</i> L.	Mã đề	Asia, wild, cultivated	11
Zingiberaceae	Họ Gừng		
<i>Zingiber officinale</i> Blume	Gừng	China, Asia cultivated	25
<i>Amomum villosum</i> Lour.	Sa nhân	China, wild	0

The use index of the medicinal plant species varies widely (Table 3.8, Appendix 3.1), from 0.01 to 1, indicating that 2 species are only used by 1% of all households (*Lonicera japonica* (Caprifoliaceae) and *Xylopiá vielana* (Annonaceae)), while 4 species are used by all households, all of them are common and cultivated species (*Camellia sinensis* (Theaceae), *Allium fistulosum*, *Allium sativum* (Alliaceae), and *Zingiber officinale* (Zingiberaceae)). The majority of species are used by less than half of the households, and 68% of the species have use indices lower than 0.25

(Table 3.8). On average, households use 25 medicinal plant species for disease treatment (Table 3.8).

Table 3.8. Use index of medicinal plants

Use index	Number of medicinal plant species
> 0.75	18
0.51 – 0.75	16
0.25 – 0.50	39
< 0.25	157

Importance for income generation

The monetary income value for local people was calculated for each listed species. A total of 18 medicinal plant species are commercialized in Ben En National Park, but the most important species for local income are *Amomum villosum* (Zingiberaceae) and *Spatholobus suberectus* (Fabaceae). The average income from *Amomum villosum* is US\$ 11 per year per household; this is about 2.5% of the total income. *Spatholobus suberectus* yields about US\$ 18 per year per household (4.3% of the total income). The other species do not generate much income, though *Morinda officinalis* (Rubiaceae) has a high price but it is very rare in the field and the amount collected by local people is small. Income of local people per household in Ben En National Park is shown in Table 3.9.

Table 3.9. Income of local people per household in Ben En National Park

Resource	Income in US\$	Percentage (%)	Remark
Agriculture	150	36	Crops such as rice and corn
Livestock	100	24	Pigs, chickens, dogs, and cows
Non medicinal useful plants	50	12	Bamboo, rattan, resin, timber, firewood, etc.
Medicinal plants	45	11	See Appendix 3.2
Others	75	17	Employment, fishing, trading, etc.
Total	420	100	

Comparison with other regional studies on medicinal plants in Vietnam and in the region

To see whether medicinal plants in Ben En National Park had characteristics in common with those of other national parks in Vietnam, the results of this study were

compared with the medicinal plant uses recorded by other authors. Both wild and cultivated medicinal species were taken into account (Table 3.10).

The result of this study was also compared with the medicinal plant uses recorded in the PROSEA Handbooks on Medicinal and poisonous plants (De Padua et al. 1999; Van Valkenburg & Bunyapraphatsara 2001; Lemmens & Bunyapraphatsara 2003) and Van Reede tot Drakenstein's Hortus Malabaricus (1668–1692, Manilal 2003). Out of the total of 230 medicinal plant species in Ben En National Park 128 species are listed in the PROSEA Handbooks on Medicinal and poisonous plants and 41 species used by local people in Ben En National Park were also used in the 17th century in Southwest India according to Van Reede's Hortus Malabaricus (Manilal 2003). Differences and similarities in the medicinal use of these species will be considered in the discussion.

Table 3.10. Comparison of medicinal plants in Ben En National Park with other regions in Vietnam

Study	National Park	Ethnic groups	Size of population	Area (km ²)	No of Medicinal plant species
This study	Ben En	Kinh, Muong, Thai, Tay, Tho	18,000	15,800	230
Tran & Ziegler 2001	Banh Ma	Kinh, Ta ku, Van kieu, H Mong	65,000	22,031	432
On 2003	Ba Vi	Dao	46,547	6,768	503
Thin & Nhan 2003	Pu Mat	Kinh, Thai, Kho Mu, Dan Lai, Poong, H Mong, O Du, Tay	93,333	91,113	610
Chi 1996	Entire Vietnam	54 ethnic groups	85,000.000	330,000.000	3200

Public perception and awareness

In the research area many people are able to identify medicinal plants and give recipes, but the young members of the communities demonstrate little interest in learning the traditional ethnomedical lore. About 43% of young people in all households interviewed do not know about medicinal plants and 25% do not want to learn how to use traditional medicinal plants for disease treatment. Moreover, many local people tend to use synthetic medicine instead of medicinal plants. About 47% of the households interviewed prefer to use western medicine if they can afford it.

Most local people in Ben En National Park recognized that medicinal plants are important for the health care of communities, especially for poor people. They also agreed that medicinal plants in Ben En National Park would not be endangered if they are only harvested for local treatment of diseases and not for commercial purposes. About 82% are aware that such practices had caused a decline in the abundance of many species during the last few years, especially of the expensive, economically exploited species.

Conservation status

Three medicinal plant species from Ben En are listed in the Red data list of IUCN (2006). However, there are 6 medicinal plant species used by local communities in Ben En National Park that are listed in the Red Data Book of Vietnam Vol. 2 (Ban 2007) (Table 3.11). At the local level, 18 medicinal plant species appear to be endangered, rare, or threatened (Table 3.12).

Table 3.11. Medicinal plants in Ben En National Park listed in the red data book of Vietnam (Ban 2007), and Red list of threaten species of IUCN (2006).
E - Endangered; V - Vulnerable; T - Threatened; LR - Least concern; nl - not listed

Species	Family	Threat category in Red data book Vietnam	Threat category in Red list of IUCN 2006
<i>Alstonia scholaris</i> L.	Apocynaceae	nl	LR
<i>Anoectochilus roxburghii</i> (Wall.) Lindl.	Orchidaceae	E	nl
<i>Ardisia silvestris</i> Pit.	Myrsinaceae	V	nl
<i>Caesalpinia sappan</i> L.	Caesalpiniaceae	nl	LR
<i>Cycas pectinata</i> Buch.-Ham.	Cycadaceae	V	V
<i>Drynaria fortunei</i> (Mett.) J. Sm	Polypodiaceae	T	nl
<i>Polygonum multiflorum</i> Thunb.	Polygonaceae	V	nl
<i>Rauvolfia verticillata</i> (Lour.) Baill.	Apocynaceae	V	nl

DISCUSSION

The commercial potential of medicinal plants in Ben En National Park

The diversity of medicinal plants in Ben En National Park could have a much larger potential for the local people in the research area in particular and for Vietnam in general if the medicinal plants would be processed in a more sophisticated manner, e.g. in ready-to-use tonics and powders. On the other hand, the number of commercialized medicinal plant species in Ben En National Park (18 species) is lower than in other regions: for instance, 54 species in Ba Vi National Park (On 2003) are commercialized. Moreover, the prices of commercial medicinal plant species in Ben En are not stable. The two most important species to generate income

are *Amomum villosum* and especially *Spatholobus suberectus*. The revenues they generate still depend on the traders. It would be better if local communities organized the market system. Furthermore, local people should understand and establish sustainable harvesting methods, especially for the species of high value and importance for income generation. Last but not least, the commercially valuable medicinal plant species should be further studied and planted in home gardens.

Table 3.12. Medicinal plants considered as threatened species in
Ben En National Park
E - Endangered, R - Rare, T - Threatened

Species	Family	Threat category
<i>Acorus gramineus</i> Sol.	Araceae	R
<i>Anoectochilus roxburghii</i> (Wall.) Lindl.	Orchidaceae	E
<i>Ardisia silvestris</i> Pit.	Myrsinaceae	E
<i>Caesalpinia sappan</i> L.	Caesalpinaceae	R
<i>Catharanthus roseus</i> L.	Apocynaceae	T
<i>Cibotium barometz</i> (L.) J. Sm.	Dicksoniaceae	T
<i>Cissampelos pareira</i> L.	Menispermaceae	R
<i>Coscinium fenestratum</i> (Gaertn.) Colebr.	Menispermaceae	E
<i>Cycas pectinata</i> Buch.-Ham.	Cycadaceae	T
<i>Drynaria fortunei</i> (Mett.) J. Sm.	Polypodiaceae	R
<i>Fibraurea recisa</i> Pierre	Menispermaceae	T
<i>Morinda citrifolia</i> L.	Rubiaceae	R
<i>Morinda officinalis</i> Haw.	Rubiaceae	E
<i>Polygonum multiflorum</i> Thunb.	Polygonaceae	V
<i>Rauvolfia verticillata</i> (Lour.) Baill.	Apocynaceae	T
<i>Smilax glabra</i> Wall.	Smilacaceae	T
<i>Stephania longa</i> Lour.	Menispermaceae	R
<i>Stephania rotunda</i> Lour.	Menispermaceae	R

Loss of traditional knowledge

Traditional medicinal plant species are not only important for health care of local communities but also of some importance to generate income. However, the present knowledge on traditional healing practices is being lost rapidly. Only few of the local people younger than 25 year participate in collecting medicinal plants compared to those older than 50 (Table 3.4). Furthermore, many young members of the communities do not know about medicinal plants and show little interest in learning the traditional ethnomedical lore. Traditional knowledge of medicinal plants can get easily lost because many local people tend to use synthetic medicine

instead of medicinal plants. To protect and develop the valuable knowledge of traditional medicinal plants their use should be encouraged, especially among the younger generation.

Comparisons with other regional studies on medicinal plants in Vietnam and in the region

The general patterns of plant use recorded in Ben En National Park show overlap with other ethnomedicinal studies from other national parks. Many of the recipes and ideas about illnesses and healing in Ben En are similar to those in Ba Vi (On 2003) and Pu Mat (Thin & Nhan 2003). But the comparisons also show that the number of medicinal plant species used by local people in Ben En is smaller than in other national parks in Vietnam (Table 3.10). The reason may be that the population living in the core and buffer zone of Ben En is much smaller than in other parks. Moreover, this is the first study on medicinal plants in Ben En National Park, while the number of medicinal plants used by local people according to earlier research in other regions also was smaller than according to more recent results, e.g. 200 species found in Ba Vi National Park (On 2000) (now 503 species); 200 species found in Pu Mat National Park (On 2003) (now 610 species). So future research may show the number of medicinal plant species in Ben En to be higher than the 230 species recorded so far.

A total of 172 medicinal plant species in Ben En National Park (about 75%) are also used medicinally by local people in Pu Mat National Park (Thin & Nhan 2003). Out of these 172 species, 138 species show at least one disease treatment overlapping in use and application in the two parks. The ethnic minority groups in the two regions are quite similar; both regions have Kinh, Thai, and Tay groups, and this could account for similar traditional uses. In the remaining 34 species there are no similarities in the medicinal uses, for example *Glochidion velutinum* (Euphorbiaceae) is used in Pu Mat to treat oedema; in Ben En it is used to treat stomach ache and tooth ache.

The Dao ethnic group in Ba Vi National Park (On 2003) use 114 of the medicinal plant species (about 49%) recorded here as traditional medicinal plants in Ben En National Park. Out of these 114 medicinal species, 48 overlap in at least one disease treatment between the two parks. In the remaining 68 species there are no similarities in the medicinal uses. For example, *Rauvolfia verticillata* (Apocynaceae) is used in Ba Vi against diarrhoea; in Ben En it is used to treat sores and itches. *Gymnema inodorum* (Asclepiadaceae) in Ba Vi is used to treat rheumatism; in Ben En it is used to cure indigestion. This huge divergence in traditional use of medicinal plant species in two regions is hard to understand. It raises questions about the efficacy of traditional healing methods on the one hand and on the role of cultural divergence in health care, on the other.

In order to place these patterns in a broader perspective our results on the medicinal uses of plants in the Ben En National Park were also compared with two other detailed sources of information on traditional use of medicinal plants in Asia: Hortus Malabaricus and the three PROSEA handbook volumes on Medicinal and Poisonous Plants from South-East Asia.

The Hortus Malabaricus by Van Reede tot Drakenstein, consulted in the English translation (Manilal 2003), contains a detailed account of 690 species from the Malabar Coast in India (the modern state of Kerala) with information on their medicinal uses contributed and verified by local traditional healers and Brahmins (Heniger 1986). Although the floras of SW India and Vietnam are far apart and very different, 41 species out of the 230 medicinal species from Ben En National Park were also used medicinally in India in the 17th century and documented in the Hortus Malabaricus (the asterisked species in Appendix 3.1). A very precise comparison of the uses and (presumed) activity of the medicinal preparations is not possible because both Hortus Malabaricus and our own survey suffer from the fact that actual diseases are not properly identified in line with modern medical knowledge, but rather very general symptoms are listed that may be caused by many different diseases (such as stomach ache, head ache, fever, swellings, weakness, etc., cf. Appendix 3.1). Nevertheless, it is most striking that the same species were in most cases apparently used to treat entirely different symptoms by the 17th century inhabitants and doctors of Kerala when compared with the 21st century local healers in Ben En National Park. For instance, out of the 41 species only 9 show some overlap in their use and application between the two regions, usually concerning only general symptoms like headaches, fever or itches. In the remaining 32 species no similarities in the medicinal uses could be detected at all. To give just two examples: *Morinda citrifolia* (Rubiaceae) was used in India to treat gout; in Ben En National Park it is used as an aphrodisiac and to treat sores; *Phyllanthus reticulatus* was used in India as a mouth wash and to treat rheumatism and stomach ailments; in Ben En it is used to cure skin burns. This huge divergence in traditional use of these 41 species raises similar questions about the efficacy and reliability of traditional healing methods in general as signalled above. One might also question the reliability of the informants in both analyses.

A total of 128 medicinal species from Ben En (56% of the species) have also been reviewed in the PROSEA Handbooks on Medicinal and Poisonous Plants from South-East Asia (De Padua et al. 1999; Van Valkenburg & Bunyaphrathatsara 2001; Lemmens & Bunyaphrathatsara 2003). In the PROSEA Handbooks information on traditional and modern use of medicinal plants is comprehensively abstracted for the whole region from continental South-East Asia (including Vietnam and Thailand) to the Indo-Pacific (Malaysia, Indonesia, the Philippines, Papua New Guinea). Here the overlap with applications documented is much greater. This is not surprising because widespread medicinal species appear to have a very wide range of traditional uses, often highly divergent from country to country or region to region,

which increases the probability that a single traditional use communicated by the local people from Ben En is among the manifold uses documented for the whole of South-East Asia. PROSEA information thus also shows a fairly high overlap with ancient uses documented in Hortus Malabaricus. In over two thirds of the medicinal species from Ben En the local application agrees with one of the numerous applications recorded in the PROSEA Handbooks. Nevertheless, for 35 species the medicinal use reported by village elders, households and local doctors in Ben En appears to be 'new'. For instance *Achyranthes aspera* (Amaranthaceae) used to treat nervous debility in Ben En, is elsewhere used to treat wounds, abscesses and boils, rheumatism, stomach ache, menstruation pains, etc.; *Tetracera scandens* (Dilleniaceae) used to treat rheumatism in Ben En, has a very wide range of applications throughout South-East Asia, including the treatment of snake bites, coughs, burns and diarrhoea without any record for rheumatism (Van Valkenburg & Bunyapraphatsara 2001). These and other divergences between our results from the field survey and interviews in Ben En and information documented in the literature suggest that both broad and narrow inventories of medicinal plants may still be very incomplete and that further critical study is needed.

APPENDIX 3.1
Medicinal plant species used by local people

Key: * species also treated in Hortus Malabaricus; + species also treated in PROSEA

Life-form W = Wood; S = Shrub; H = Herb; C = Liana; **Wild/Cultivated:** W = Wild; C = Cultivated

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
POLYPODIOPHYTA – FERNS							
Adiantaceae							
<i>Adiantum caudatum</i> L.	Họ Tóc thần vệ nữ Tóc thần vệ nữ	H	0.10	W	Leaves, stem	Fever, coughs	Decoction of leaves and stems is drunk
Aspleniaceae							
<i>Asplenium nidus</i> L.	Họ Tổ chim Tổ chim	C	0.04	W	Leaves, tuber	Strained muscles	Plant parts are crushed and applied externally
Blechnaceae							
<i>Blechnum orientale</i> L.	Họ Ráng lá dừa Guột lá dừa	H	0.18	W	Leaves, stem	Wounds, snake bite	Plant parts are chewed raw or crushed, then paste applied on the affected part
Dicksoniaceae							
<i>Cibotium barometz</i> (L.) J. Sm.+	Họ Lóng cu li Lóng cu li	S	0.25	W	Root	Haemostatic	Hairs from stipe bases are taken and applied on the affected part
Marsileaceae							
<i>Marsilea quadrifolia</i> L.	Họ Rau bợ Rau bợ	H	0.23	W	Whole plant	Insomnia	Plant parts are cooked and eaten
Polypodiaceae							
<i>Drynaria fortunei</i> (Mett.) J. Sm.	Họ Dương xỉ Cốt toái bổ	H	0.17	W	Stem, leaves, root	Strained muscles, weakness	Decoction of plant parts is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Microsorium superficiale</i> (Bedd.) Ching	Ráng	H	0.06	W	Leaves	Wounds	Leaves are chewed and paste applied on affected part
Schizaceae	Họ Bòng bong						
<i>Lygodium conforme</i> C.Chr.	Bòng bong lá to	C	0.08	W	Leaves, stem	Indigestion	Plant parts are decocted and the decoction is drunk
<i>Lygodium scandens</i> (L.) Sw.	Bòng bong lá nhỏ	C	0.05	W	Leaves	Rheumatism	Juice extracted from leaves are rubbed externally on affected part
PINOPHYTA – GYMNOSPERMS	Ngành Thông						
Cycadaceae	Họ Tuế						
<i>Cycas pectinata</i> Buch.-Ham.	Tuế Lược	W	0.05	W, C	Root	Tuberculosis	Roots juice is taken with warm water
Gnetaceae	Họ Gấm						
<i>Gnetum montanum</i> Markgr.	Gấm núi	C	0.16	W	Seed	Malaria	Seeds pounded is drunk with warm water
					Root, leaves	Snakebite	leaves are chewed raw or leaves and roots are crushed and paste applied on affected part
					Seed	Detoxification	Seeds are chewed raw and swallowed
MAGNOLIOPHYTA – ANGIOSPERMS	Ngành Ngọc Lan						
MAGNOLIOPSIDA – DICOTS	Lớp 2 lá mầm						
Acanthaceae	Họ Ô rô						
<i>Rhinacanthus nasutus</i> (L.) Kurz*	Bạch hạc	S	0.12	W	Leaves, stem	Herpes, itches, wounds	Plant parts are crushes and paste applied on affected part

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Strobilanthes cystolithigera</i> Lind.	Chúy hoa	H	0.05	W	Leaves	Bone fractures	Leaves are crushed and paste applied on broken part
Alangiaceae	Họ Thối ba						
<i>Alangium chinense</i> Lour.	Thối ba	W	0.14	W	Leaves, root	Paralysis	Plant parts are crushed in water or root are soaked in wine and applied on, then rubbed by hand
Amaranthaceae	Họ Dền						
<i>Achyranthes aspera</i> L.* +	Cỏ xước	H	0.24	W	Flower	Nervous debility	Decoction of flowers is drunk
<i>Amaranthus viridis</i> L.	Đon đỏ	H	0.26	W	Leaves, root	Snakebite, bee stings	Leaves and roots are crushed and paste applied on affected part
					Leaves	Fever	Leaves are decocted, then the decoction is drunk
<i>Amaranthus spinosus</i> L.+	Dền cơm	H	0.26	C	Root	Fever	Roots juice is drunk
<i>Celosia cristata</i> L.	Mào gà	H	0.26	C	Stem, leaves, root	Diarrhea with blood	Plant parts are decocted, then the decoction is drunk
Anacardiaceae	Họ Điều						
<i>Spondias lakonensis</i> Pierre	Dầu da xoan	W	0.51	W,C	Root	Weakness after childbirth	Roots decoction is given to mother after birth
Annonaceae	Họ Na						
<i>Annona squamosa</i> L.+	Na	W	0.15	C	Leaves	Sores	Leaves are crushed, then applied externally
<i>Desmos cochinchinensis</i> Lour.+	Hoa giẻ	C	0.04	W	Stem	Constipation	Small pieces of stem are decocted and the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Fissistigma villosum</i> (Ast.) Merr.	Cánh hoa có lông	C	0.24	W	Leaves, stem	Stomach ache	Leaves and small pieces of stems are decocted then the decoction is drunk
<i>Xylopiá vielana</i> Pierre	Dền	W	0.01	W	Bark, root	Malaria	Small pieces of barks and roots are decocted, then the decoction is drunk
Apiaceae	Họ Hoa tán						
<i>Centella asiatica</i> (L.) Urb. +	Rau má	H	0.68	W	Whole plant	Detoxification, urinating problems	Plant parts are chewed raw and swallowed
Apocynaceae	Họ Trúc đào						
<i>Alstonia scholaris</i> L.*	Sữa	W	0.11	W,C	Bark	Irregular menses	Small pieces of bark are decocted, then the decoction is drunk
<i>Catharanthus roseus</i> (L) G.Don+	Dừa cạn	H	0.08	W	Root, stem	High blood pressure	Leaves and stems are decocted, then the decoction is drunk
					Leaves	Irregular menses	Leaves are decocted, then the decoction is drunk
					Root, leaves	Dysentery	Leaves and roots are decocted then the decoction is drunk
<i>Plumeria rubra</i> L.	Đại	W	0.26	C	Leaves, flower	Diarrhea	Flowers and leaves juice is drunk with warm water
					Bark	Dysentery	Small pieces of barks are decocted, then the decoction is drunk
<i>Rauvolfia verticillata</i> (Lour.) Baill. +	Ba gạc	S	0.23	W	Leaves	Sores, itches	Leaves are crushed and paste applied on affected part

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Strophanthus caudatus</i> (Burm. F.) Kurz +	Sừng Châu	C	0.04	W	Whole plant	High blood pressure	Plant parts are decocted, then the decoction is drunk
<i>Wrightia annamensis</i> Eberh. & Dub.	Mức trung bộ	S	0.06	W	Leaves	Dysentery	Leaves are decocted, then the decoction is drunk
Araliaceae	Họ Ngũ ra bì						
<i>Aralia armata</i> (Wall. ex G. Don) Seem.	Đơn châu châu	W	0.68	W	Root	Sore throat	Roots are chewed raw, then swallowed
<i>Aralia touranensis</i> Ha	Cuồng	C	0.32	W	Leaves	Rheumatism	Juice extracted from leaves are rubbed externally on affected part
					Root	Diabetes	Roots are decocted, then the decoction is drunk
<i>Polyscias fruticosa</i> Harms	Đinh lăng	H	0.82	C	Leaves, root	Weakness	Leaves are eaten as vegetable, roots are soaked in wine, then drunk
					Root	Indigestion	Roots are decocted, then the decoction is drunk
<i>Schefflera octophylla</i> (Lour.) Harms +	Chân chim 8 lá	W	0.84	W	Leaves, bark	Itches	Leaves and barks are crushed, then applied on the affected part
					Leaves	Urinating problems, weakness	Leaves are cooked, then eaten
Asclepiadaceae							
<i>Gynnuema inodorum</i> Decne +	Rau mợ	C	0.46	C	Root	Indigestion	Roots are chewed raw and swallowed

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Streptocaulon griffithii</i> Hook.f. +	Hà thủ ô	C	0.51	W	Root	Stomach ache	Roots are decocted, then the decoction is drunk
<i>Telosma cordata</i> (Burm.f.) Merr.	Hoa lý	C	0.19	C	Flower	Weakness	Flowers are cooked, then eaten
Asteraceae	Họ Cúc						
<i>Artemisia vulgaris</i> L.+	Ngải cứu	H	0.97	C	Leaves	Head ache	Juice extracted from leaves, then drunk
					Stem, leaves	Risk of miscarriage	Juice extracted from leaves and stems, mixed with salt or sugar then drunk
					Leaves	Weakness after childbirth	Leaves are cooked, then eaten
<i>Blumea balsamifera</i> (L.) DC.+	Đại bì	H	0.21	W	Leaves	Colds, flu, coughs	Leaves are decocted, then the decoction is drunk
					Stem	Stomach ache	Small pieces of stems are decocted, then the decoction is drunk
<i>Eclipta erecta</i> L.*+	Nhọ nôi	H	0.84	W	Root	Malaria	Roots are decocted, then the decoction is drunk
					Leaves	Haemostatic, wounds	Leaves are chewed raw or crushed, then paste applied on affected part
<i>Elephantopus scaber</i> L.*+	Cúc chi thiên	H	0.32	W	Root	Stomach ache	Roots are decocted, then the decoction is drunk
					Leaves	Dysentery	Leaves are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Emilia sonchifolia</i> (L.) DC.	Rau má lá rau muống	H	0.11	W	Leaves, root	Dysentery	Leaves and roots are decocted, then the decoction is drunk
					Leaves	Colds, flu	Leaves are decocted, then the decoction is drunk
					Leaves	Sores	Leaves are crushed, then applied on affected part
<i>Eupatorium odoratum</i> L.	Cỏ lào	H	0.40	W	Leaves	Stomach ache	Leaves are decocted, then the decoction is drunk
					Leaves	Diarrhea	Leaves are decocted, then the decoction is drunk
<i>Gynura crepidioides</i> Benth. +	Rau tàu bay	H	0.57	W	Leaves, stem	Snakebite	Leaves and stems are crushed, then paste applied on affected part
					Leaves	Haemostatic	Leaves are chewed raw or crushed, then paste applied on affected part
<i>Gynura japonica</i> (Thunb.) Juel+	Cúc Tam Thất	H	0.26	W	Leaves, root	Infection	Leaves and roots are crushed, then paste applied on affected part
					Leaves	Haemostatic	Leaves are chewed raw or crushed, then paste applied on affected part
<i>Xanthium strumarium</i> L.+	Ké đầu ngựa	H	0.51	W	Stem, leaves, root	Dysentery	Plant parts are decocted, then the decoction is drunk
					Leaves	Itches	Leaves are chewed raw then applied on affected part
Bignoniaceae	Họ Đinh						

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Oroxylum indicum</i> (L.) Vent.*+	Núc nác	W	0.09	W,C	Bark, fruit	Strained muscles	Barks and fruits are decocted, then the decoction is drunk
Bombacaceae							
Họ Bông Gao							
<i>Gossampinus malabarica</i> (DC.) Merr.	Gạo	W	0.08	W,C	Leaves, bark	Bone fractures	Leaves and barks are crushed, then paste applied on broken part
Caesalpinaceae							
Họ Vang							
<i>Bauhinia viridescens</i> Desv.	Móng bò	C	0.12	W	Root	Enteritis	Roots are decocted then the decoction is drunk
<i>Caesalpinia digyna</i> Rottler +	Móc mèo núi	S	0.35	W	Stem, seed	Fever, coughs	Small pieces of stems and seeds are decocted, then the decoction is drunk
<i>Caesalpinia sappan</i> L.*+							
Vang							
<i>Senna tora</i> L.+							
Thảo quyết minh							
S							
0.31							
W							
Flower							
Anodyne							
High blood pressure							
Decoction of seeds is drunk							

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Gleditsia australis</i> Hemsl. +	Bồ kết	W	0.28	W, C	Fruit	Tooth ache	Juice extracted from fresh fruit, then applied on affected teeth
<i>Tamarindus indica</i> L.+	Me	W	0.21	W, C	Fruit	Indigestion	Fruit is decocted, then the decoction is drunk
Caprifoliaceae	Họ Kim ngân				Fruit	Fever	Fruit is eaten
<i>Lonicera macrantha</i> (D. Don) Spreng.	Kim ngân hoa to	C	0.04	W	Leaves	Dysentery	Leaves are chewed raw, then swallowed
<i>Lonicera japonica</i> Thunb.+	Kim ngân	H	0.01	W	Leaves	Allergies	Leaves are decocted, then the decoction is drunk
<i>Sambucus hookeri</i> Rehder	Cơm cháy	W	0.02	W	Leaves, stem	Leprosy	Decoction of flower is drunk
Caricaceae	Họ Đu đủ						Juice extracted from leaves and stem are applied on affected part
<i>Carica papaya</i> L.*+	Đu đủ	W	0.36	C	Root, leaves	Coughs	Roots and leaves are decocted, then the decoction is drunk
Clusiaceae	Họ Bứa				Fruit	Urinating problems	Fruit are eaten
<i>Cratoxylum polyanthum</i> Korth.	Thành ngạnh	W	0.25	W	Root	Tooth ache	Roots are soaked in strong wine and applied on the hurting teeth
<i>Garcinia oblongifolia</i> Champ. ex Benth.	Bứa	W	0.12	W	Bark	Stomach ache	Small pieces of barks are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Combretaceae	Họ Bàng						
<i>Quisqualis indica</i> L.+	Dây giun	W	0.20	W	Leaves	Itches	Leaves are crushed, then applied on affected part
					Stem	Tooth ache	Small pieces of stems are soaked in strong wine and applied on the hurting teeth
Connaraceae	Họ Khế						
<i>Cnestis palala</i> Merr.+	Dây khế	C	0.29	W	Leaves, bark	Wounds	Leaves and bark are crushed, then paste applied on affected part
<i>Raurea minor</i> (Gaertn.) Leenh.* +	Khế rừng	W	0.07	W	Leaves, bark	Dysentery	Leaves and bark are decocted, then the decoction is drunk
Convolvulaceae	Họ Rau muống						
<i>Argyreia acuta</i> Lour.	Bạc thau	C	0.09	W	Stem, leaves, root	Menorrhagia	Plant parts are decocted, then the decoction is drunk
<i>Merremia boissiana</i> (Gagnep.) Ooststr.	Bìm bịp	C	0.16	W	Leaves	Indigestion	Leaves are chewed raw, then swallowed
Crassulaceae	Họ Thuốc bỏng						
<i>Kalanchoe pinnata</i> (Lam.) Pers. +	Thuốc bỏng	H	0.87	W,C	Stem, leaves, root	Detoxification	Juice extracted from plant part, then drunk
					Leaves	Burns	Leaves are crushed, then paste applied on affected part
Cucurbitaceae	Họ Bầu bí						
<i>Cucurbita maxima</i> Lam.	Bí đỏ	C	0.23	C	Leaves, fruit	Head ache	Leaves and fruits are cooked, then eaten

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Hodgsonia macrocarpa</i> (Blume) Cogn.+	Đại hái	C	0.05	W	Leaves	Abscesses	Leaves are crushed then paste applied on externally affected part
<i>Momordica cochinchinensis</i> (Lour.) Spreng.+	Gấc	C	0.34	C	Seed	Mumps	Seeds pounded mixed with honey, then paste applied on externally affected part
					Seed	Food poisoning	Seeds pounded is given with warm water
<i>Trichosanthes cucumeroides</i> (Ser.) Maxim.* +	Dưa núi	C	0.04	W	Leaves, stem	Fever	Plant parts are decocted, then the decoction is drunk
Cuscutaceae	Họ Tơ hồng						
<i>Cuscuta chinensis</i> Lam. +	Tơ hồng	C	0.04	W	Whole plant	Back pain	Plant parts are heated, then applied on the back
					Whole plant	Constipation	Plant parts are decocted, then the decoction is drunk
Dilleniaceae	Họ Sổ						
<i>Tetracera scandens</i> (L.) Merr.+	Chặt chiu	C	0.15	W	Root	Rheumatism	Juice extracted from roots is drunk
					Root, stem	Stomach ache	Small pieces of roots and stems are decocted, then the decoction is drunk
Ebenaceae	Họ Thị						
<i>Diospyros decandra</i> Lour.	Thị	W	0.07	C	Leaves, fruit	High blood pressure	Decoction of leaves and fruits is drunk
Elaeagnaceae	Họ Nhót						
<i>Elaeagnus bonii</i> Lecomte	Nhót	S	0.08	C	Stem	Dysentery	Decoction of small pieces of stems is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Euphorbiaceae							
Họ Thầu dầu							
<i>Baccaurea ramiflora</i> Lour.	Dầu da dặt	W	0.25	W, C	Leaves	Itches	Leaves are crushed, then applied on affected part
<i>Bischofia javanica</i> Blume	Nhội	W	0.11	W	Leaves, fruit Bark, leaves	Indigestion Burns	Fresh leaves and ripen fruits are eaten Plant parts are crushed, then paste applied on affected part
<i>Breynia fleuryi</i> Beille	Bồ cu vẽ	S	0.05	W	Root	Malaria	Roots are decocted, then the decoction is drunk
<i>Euphorbia antiquorum</i> L.*+	Xương rồng	H	0.29	W, C	Stem	Tooth ache	Juice extracted from stems, then applied on affected teeth
<i>Euphorbia hirta</i> L.+	Cỏ sữa	H	0.12	W	Whole plant	Malaria	Plants parts are decocted, then the decoction is drunk
<i>Glochidion velutinum</i> Wight+	Bọt ếch	S	0.48	W	Whole plant Leaves, stem	Dysentery Stomach ache	Plant parts are decocted, then the decoction is drunk
<i>Jatropha curcas</i> L.+	Dầu mè	W	0.04	W	Root Seed Leaves	Tooth ache Head ache Kidney failure	Roots is soaked in wine, then applied on hurting teeth Seeds oil is applied on forehead Leaves are decocted, then the decoction is drunk
<i>Mallotus barbatus</i> (Wall.) Muell. Arg.+	Bùm bụp	S	0.12	W	Leaves, root	Dysentery	Leaves and roots are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Phyllanthus reticulatus</i> Poir.*+	Phèn đen	S	0.27	W	Leaves	Haemostatic	Leaves are crushed, then paste applied on affected part
<i>Phyllanthus urinaria</i> L.	Chó đẻ	S	0.52	W	Whole plant	Sores, itches	Leaves are crushed, then paste applied on affected part
<i>Ricinus communis</i> L.*	Thầu dầu	S	0.14	C	Leaves	Snakebite	Plant parts are crushed, then applied on affected part
Fabaceae							Leaves are crushed, then paste applied on affected part
<i>Abrus precatorius</i> L.*+	Cam thảo	S	0.86	W	Whole plant	Weakness	Small pieces of stems and barks are decocted, then the decoction is drunk
<i>Bowringia callicarpa</i> Champ. ex Benth.	Dây bánh nem	S	0.09	W	Bark, stem	Coughs	Plant parts are decocted, then the decoction is drunk
<i>Derris elliptica</i> Benth.+	Dây mật	C	0.03	W	Leaves	Throat sores	Barks and stems are chewed raw, then swallowed
<i>Desmodium caudatum</i> (Murray) DC.	Thóc lép	H	0.04	W	Root	Rheumatism	Leaves are crushed in water, then rubbed externally
<i>Erythrina fusca</i> Lour.+	Vông đồng	W	0.27	W,C	Root	Nervous debility	Roots are decocted, then the decoction is drunk
						Oedema	Roots are decocted, then the decoction is drunk
						Hemorrhage	Small pieces of stems and barks are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Mucuna pruriens</i> (L.) DC.+	Mắc mề	C	0.48	W	Stem	Tooth ache	Barks are soaked in wine, then use that wine applied on affected teeth
<i>Pueraria phaseoloides</i> (Roxb.) Benth.	Sắn dây	C	0.76	C	Tuber	Weakness	Small pieces of stems are decocted, then the decoction is drunk
<i>Sophora japonica</i> L. f.	Hoa hòe	W	0.27	W,C	Seed, flower	Weakness	Powder made from tubers is drunk with water, or cooked, then eaten
<i>Spatholobus suberectus</i> Dum.	Huyết rồng lão	C	0.95	W	Stem	High blood pressure	Seeds and flowers are boiled, then drunk like tea
Hydrangeaceae	Họ Thuồng Sơn					Weakness after childbirth	Small pieces of stems are boiled in water, then drunk
<i>Dichroa febrifuga</i> Lour.	Thuồng sơn	S	0.07	W	Leaves, root, stem	Weakness after childbirth	Plant parts are decocted, then the decoction is drunk
Lamiaceae	Họ Hoa môi						
<i>Hyptis suaveolens</i> (L.) Poit.	Tía tô đại	H	0.17	W	Root	High blood pressure	Roots are decocted, then the decoction is drunk
<i>Leonurus sibiricus</i> L.+	ích mẫu	H	0.87	W,C	Leaves, stem	Weakness	Leaves and stems are decocted, then the decoction is drunk
<i>Ocimum tenuiflorum</i> L.	Hương nhu tía	H	0.78	W,C	Leaves	Hemorrhage	Leaves are crushed in warm water and mixed with some salt, then drunk
					Leaves	Head ache	Leaves are crushed, then applied on forehead

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Lauraceae							
Họ Long não							
<i>Cassytha filiformis</i> L.*+	Tơ xanh	C	0.04	W	Stem	Malaria	Leaves are decocted, then the decoction is drunk
<i>Cinnamomum iners</i> Reinw. ex Blume+	Re hương	W	0.21	W	Bark	Indigestion	Leaves are decocted, then the decoction is drunk (special to treat children's cold)
<i>Cinnamomum cassia</i> Blume+	Quế	W	0.82	C	Bark	Indigestion	Decoction of small pieces of stems is drunk
<i>Litsea cubeba</i> (Lour.) Pers.+	Mãng tang	W	0.12	W	Leaves, stem	Nervous debility	Barks is chewed raw, then swallowed
<i>Litsea glutinosa</i> (Lour.) C.B. Rob.	Bồ lõi nhót	W	0.04	W	Bark, root	Dysentery	Barks pounded and mixed with honey is given with cold water
Leeaceae							
Họ Gối hạc							
<i>Leea rubra</i> Blume +	Gối hạc	S	0.07	W	Root	Arthritis	Plant parts are decocted, then the decoction is drunk
					Root	Enteritis	Small roots and barks are decocted, then the decoction is drunk
					Root	Enteritis	Roots are decocted, then the decoction is drunk
					Root	Arthritis	Small pieces of roots are soaked in wine, then wine is applied on affected part

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Lythraceae	Họ Bàng lạng				Root	Stomach ache	Roots are decocted, then the decoction is drunk
<i>Punica granatum</i> L.+	Lựu	W	0.15	C	Leaves	Dysentery	Young leaves are chewed raw and swallowed
Malvaceae	Họ Bông						
<i>Abutilon indicum</i> (L.) Sweet *+	Cối xay	S	0.51	W	Leaves, fruit	Fever, flu	Plant parts are decocted, then the decoction is drunk
<i>Hibiscus rosa-sinensis</i> L.*+	Dâm bụt	S	0.15	W,C	Leaves, stem	Sores	Plant parts are decocted, then the decoction is drunk
<i>Sida rhombifolia</i> L.+	Ké hoa vàng	S	0.07	W	Root, stem	Malaria	Small pieces of roots and stems are decocted, then the decoction is drunk
<i>Urena lobata</i> L.*	Ké hoa đào	S	0.09	W	Root, stem	Malaria	Small pieces of roots and stem are decocted, then the decoction is drunk
Melastomataceae	Họ Mua						
<i>Melastoma normale</i> D. Don	Mua	S	0.19	W	Leaves, stem	Infection	Plant parts are crushed, then paste applied on affected part
<i>Melastoma sanguineum</i> Sims.	Mua bả	S	0.15	W	Young leaves	Fever	Young leaves are decocted, then the decoction is drunk
Meliaceae	Họ Xoan						
<i>Melia azedarach</i> L.+	Xoan	W	0.21	C	Leaves, root	Sore throat	Young leaves are chewed raw, then swallowed
						Stomach ache	Plant parts are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Menispermaceae	Họ Tiết dê				Inner bark	Diarrhea	Inner barks are decocted, then the decoction is drunk
<i>Cissampelos pareira</i> L.+	Tiết dê	C	0.11	W	Leaves, stem, root	Rheumatism	Leaves, stems and roots are crushed, then paste applied on externally
<i>Coccoloba fenestratum</i> (Gaertn.) Colebr. +	Vàng đắng	C	0.04	W	Root, stem	Fever	Decoction of roots and stems is drunk
					Root	Dysentery	Roots are decocted, then the decoction is drunk
					Leaves	Wounds	Plant parts are crushed, then paste applied on affected part
<i>Fibraurea recisa</i> Pierre	Hoàng đằng	C	0.12	W	Stem	Wounds	Plant parts are crushed, then paste applied on affected part
					Stem, root	Weakness	Small pieces of roots and stems are decocted, then the decoction is drunk
<i>Pericampylus glaucus</i> (Lam.) Merr. Lôi tiên		C	0.12	W	Leaves, stem	Snakebite	Plant parts are crushed, then paste applied on affected part
<i>Pycnanthemum poilanei</i> (Gagnep.) Foran	Phi đằng	C	0.08	W	Leaves, root	Eye sores	Plant parts are decocted, then the decoction is drunk
<i>Stephania japonica</i> (Thunb.) Miers+	Cam thảo	C	0.35	W	Stem, root	Diarrhea	Plant parts are decocted, then the decoction is drunk
<i>Stephania longa</i> Lour.	Lôi tiên	C	0.16	W	Root	Stomach ache	Plant parts are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Stephania rotunda</i> Lour.	Củ bình vôi	C	0.51	W	Tuber	Stomach ache	Tuber decocted, then the decoction is drunk
Mimosaceae							
Họ Trinh nữ							
<i>Acacia farnesiana</i> (L.) Willd. +	Keo ta	W	0.03	C	Bark, stem	Wounds	Plant parts are crushed, then paste applied on affected part
<i>Entada phaseoloides</i> (L.) Merr. +	Bầm Bầm	C	0.05	W	Bark, flower, leaves	Itches	Plant parts are crushed, then applied on affected part
<i>Leucaena leucocephala</i> (Lam.) De Wit	Keo dậu	W	0.02	W, C	Bark	Malaria	Decoction of barks is drunk
Moraceae							
Họ Dầu tằm							
<i>Artocarpus tonkinensis</i> A. Chev. ex Gagnep.	Chay	W	0.12	W, C	Bark	Tooth ache	Juice extracted from barks is dipped on affected teeth, or bark are soaked in wine, then use that wine to applied on affected teeth
<i>Broussonetia papyrifera</i> L.	Dướng	W	0.15	W	Leaves, root	Haemostatic	Plant parts are crushed, then paste applied on affected part
<i>Ficus auriculata</i> Lour.	Vả	W	0.18	W	Bark	Diarrhea	Barks are decocted, then the decoction is drunk
<i>Ficus benjamina</i> L. +	Sĩ	W	0.14	W, C	Latex	Itches	Latex is paste applied on affected part

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Ficus heterophylla</i> L.f.*	Vú bò	S	0.15	W	Root, stem	Weakness, icterus	Small pieces of roots and stems are decocted, then the decoction is drunk
<i>Ficus hispida</i> L.f.*+	Ngái	S	0.15	W	Latex Bark, leaves	Itches Diarrhea	Latex is paste applied on affected part Plant parts are decocted, then the decoction is drunk
<i>Ficus racemosa</i> L.*	Sung	W	0.22	W,C	Leaves, bark	Stomach ache, dysentery	Plant parts are decocted, then the decoction is drunk
<i>Morus alba</i> L.+	Dâu	W	0.26	W,C	Fruit	Weakness	Fruits are soaked in water with sugar, then eaten and drunk
<i>Streblus asper</i> Lour.*+	Duối	W	0.19	W,C	Root, leaves	Sunburn	Juice extracted from leaves and roots is applied on affected part
Myrsinaceae	Họ Đon nem				Leaves	Flu	Leaves are boiled, then inhaled
<i>Ardisia silvestris</i> Pit.	Lá khôì	H	0.37	W	Fruit, leaves	Stomach ache	Plant parts are decocted, then the decoction is drunk
<i>Embelia ribes</i> Burm.f.*+	Chua ngút	C	0.19	W	Leaves, fruit	Hookworm	Leaves and fruits are chewed and swallowed
<i>Maesa balansae</i> Mez	Đon nem nùi	S	0.10	W	Leaves	Snakebite Hiccups	Plant parts are crushed, then paste applied on affected part Leaves are chewed raw and swallowed
					Leaves	Hookworm	Juice from leaves mixed with sugar is drunk with warm water

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Maesa sinensis</i> A. DC.	Đon nem	S	0.12	W	Leaves, stem	Oedema	Plant parts are decocted, then the decoction is drunk
Myrtaceae	Họ Sim						
<i>Baeckea frutescens</i> L.	Thanh hao	S	0.14	W,C	Leaves	Infection	Leaves crushed then paste applied on affected part
<i>Eucalyptus camaldulensis</i> Dehnh.+ Bành dàn trắng		W	0.51	C	Leaves	Irregular menses	Plant parts are decocted, then the decoction is drunk
<i>Eucalyptus exserta</i> F.Muell.	Bành dàn	W	0.52	C	Leaves	Colds, flu	Leaves are boiled with leaves of bamboo, then steam is inhaled
						Colds, flu, head ache	Leaves are boiled with leaves of bamboo, then steam is inhaled
					Root	Rheumatism	Roots are crushed in water, then applied on affected part
<i>Psidium guajava</i> L.*+	ổi	W	0.27	C	Leaves	Diarrhea, dysentery	Young leaves are chewed raw, then swallowed
<i>Rhodomyrtus tomentosa</i> (Aiton) Hassk.+	Sim	S	0.11	W	Stem, root	Diarrhea	Decoction of stems and roots is drunk
Oleaceae	Họ Hoa nhài						
<i>Jasminum scandens</i> Vahl	Lài leo	C	0.04	W	Root, stem, leaves	Back pain	Plant parts are steamed, then paste applied on the back
<i>Jasminum subtriplinerve</i> A.DC.+	Vằng	C	0.11	W	Leaves, root	Itches	Leaves and roots crushed, then applied on affected part

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Oxalidaceae	Họ Chua me						
<i>Oxalis corniculata</i> L.+	Chua me đất	H	0.10	W	Stem, leaves, root	Weakness after childbirth	Plant parts are decocted, then the decoction is drunk
Passifloraceae	Họ Lạc tiên						
<i>Passiflora foetida</i> L.	Lạc tiên	C	0.07	W	Root, leaves, stem	Heart weakness, anodyne	Plant parts are decocted, then the decoction is drunk
Piperaceae	Họ Tiêu						
<i>Piper betle</i> L.*+	Trầu không	C	0.53	C	Leaves	Wounds, itches	Leaves are crushed, then paste applied on affected part
<i>Piper lolot</i> C.DC.+	Lá lốt	H	0.32	C	Leaves	Tooth ache	Juice from leaves, then applied on the hurting teeth
Plantaginaceae	Họ Mã đề						
<i>Plantago asiatica</i> L.+	Mã đề	H	0.79	W,C	Leaves, stem	Kidney failure	Plant parts are decocted, then the decoction is drunk
					Leaves	Urinating problems, cough	Leaves are decocted then the decoction is drunk
Polygonaceae	Họ Rau răm						
<i>Polygonum chinensis</i> L.* +	Mía giò	H	0.16	W	Leaves, stem	Dysentery	Leaves and stems are chewed raw and swallowed
					Leaves	Snakebite	Leaves are crushed, then paste applied on affected part

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Polygonum multiflorum</i> Thunb. +	Hà thủ ô đỏ	H	0.21	W	Root	Weakness after childbirth	Small pieces of roots are decocted, then the decoction is drunk
<i>Polygonum odoratum</i> Lour.	Rau răm	H	0.08	C	Leaves	Malaria	Leaves are decocted, then the decoction is drunk
Portulacaceae	Họ Rau sam						
<i>Portulaca oleracea</i> L.*+	Rau sam	H	0.68	W	Stem, leaves	Weakness	Plant parts are cooked, then eaten
Rhamnaceae	Họ Táo						
<i>Ziziphus mauritiana</i> Lam.*+	Táo nhà	W	0.46	C	Leaves, root	Rheumatism	Juice extracted from leaves and roots is applied externally
					Leaves	Stomach ache	Leaves are decocted, then the decoction is drunk
					Leaves	Swellings	Leaves are crushed with salt, then paste applied on affected part
<i>Ziziphus oenoplia</i> (L.) Mill.+	Táo dại	W	0.04	W	Leaves, root, stem	Menorrhagia	Plant parts are decocted, then the decoction is drunk
Rosaceae	Họ Hoa Hồng						
<i>Duchesnea indica</i> (Andr.) Focke	Dâu núi	H	0.05	W	Leaves, root, stem	Stomach ache	Plant parts are decocted, then the decoction is drunk
<i>Persica vulgaris</i> Mill.	Đào	S	0.09	W,C	Flower, stem	Irregular menses	Plant parts are decocted, then the decoction is drunk
<i>Rosa chinensis</i> Jacq.	Hoa hồng	S	0.18	C	Flower, stem	Hemorrhage	Small pieces of stems and flowers are decocted, then the decoction is drunk
<i>Rubus cochinchinensis</i> Tratt.	Ngây	S	0.15	W	Leaves, fruit	Oedema, icterus	Fruits are eaten, or juice from leaves and fruit is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Rubiaceae	Họ Cà Phê				Leaves	Indigestion	Leaves are decocted, then the decoction is drunk
<i>Canthium horridum</i> Blume+	Găng gai	S	0.25	W	Root	Dyspnea	Decoction of roots is drunk
<i>Hedyotis capitellata</i> Wall. ex G.Don+	Dạ cẩm	S	0.13	W	Leaves, root, stem	Wounds	Leaves are crushed, then paste applied on affected part
<i>Morinda citrifolia</i> L.*+	Mật qui	S	0.08	W	Whole plant	Bone fractures	Plant parts are crushed, then paste applied on affected part
						Sores	Plant parts are decocted, then the decoction is drunk
<i>Morinda officinalis</i> Haw.+	Ba Kích	C	0.24	W	Root	Aphrodisiacs	Roots are soaked in wine, then drunk, the longer the better
						High blood pressure	Plant parts are decocted, then the decoction is drunk
<i>Mussaenda cambodiana</i> Pierre ex Pit.	Bướm bạc	C	0.04	W	Root	Aphrodisiacs	Roots are soaked in wine, then drunk, the longer soaking the better.
<i>Neolamarckia cadamba</i> (Roxb.) Bosser*	Gáo	W	0.12	W,C	Leaves, root	Arthritis	Decoction of roots and leaves is drunk
<i>Paederia foetida</i> L.+	Mơ	C	0.81	C	Leaves	Itches	Leaves are crushed, then applied on affected part
<i>Psychotria rubra</i> (Lour.) Poit.	Lầu	S	0.56	W	Leaves, root	Dysentery, diarrhea	Leaves are chewed raw and swallowed, or cooked with chicken egg, then eaten
						Kidney failure	Decoction of roots and leaves is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Rutaceae							
Họ Cam							
<i>Clausena excavate</i> Burm.f.+	Hồng bì đại	W	0.09	W	Leaves	Stomach ache	Leaves are decocted, then the decoction is drunk
<i>Clausena lansium</i> (Lour.) Skeels+	Quất hồng bì	W	0.10	W,C	Leaves, fruit	Cancer	Plant parts are decocted, then the decoction is drunk
<i>Euodia lepta</i> (Spreng.) Merr. +	Ba gạc	S	0.21	W	Leaves	Measles	Leaves are heated, then paste applied on affected part
					Leaves	Itches	Leaves are crushed, then applied on affected part
<i>Glycosmis pentaphylla</i> Spreng.	Cơm rượu	S	0.17	W	Leaves, root	Colds, flu, coughs	Juice extracted from leaves and roots is drunk with warm water
					Leaves	Stomach ache	Leaves are decocted, then the decoction is drunk
<i>Micromelum hirsutum</i> Oliv.	Mát trâu	W	0.09	W	Leaves	Itches, skin diseases	Leaves are crushed, then applied on affected part
<i>Zanthoxylum avicennae</i> (Lamk) DC. +	Xén	W	0.06	W	Root, leaves	Aphasia	Decoction of roots and leaves is drunk
<i>Zanthoxylum nitidum</i> (Lamk.) DC.	Xuyên tiêu	W	0.10	W	Leaves, bark	Itches	Leaves and barks are crushed, then applied on affected part
Simaroubaceae							
Họ Thanh Thất							
<i>Eurycoma longifolia</i> W. Jack	Bách bệnh	S	0.19	W	Leaves, bark, root	Diarrhea	Plant parts are decocted, then the decoction is drunk
					Leaves	Infection	Leaves are crushed, then paste applied on affected part

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Solanaceae	Họ Cà						
<i>Capsicum annuum</i> L.*	ớt	S	0.08	C	Root, fruit	Malaria	Plant parts are decocted, then the decoction is drunk
<i>Datura metel</i> L.*+	Cà độc dược	S	0.12	W	Leaves	Swellings	Leaves are crushed, then paste applied on affected part
<i>Solanum indicum</i> L.	Cà đại hoa tím	S	0.22	W	Leaves, root	Tooth ache	Juice extracted from roots and leaves, then paste applied on affected teeth
					Root	Vomiting	Juice extracted from roots is drunk with warm water
<i>Solanum torvum</i> Sw.+	Cà dại	S	0.13	W	Root	Tooth ache	Juice extracted from roots, then paste on affected teeth
Sterculiaceae	Họ Chôm						
<i>Helicteres angustifolia</i> L.	Thầu kén dục	S	0.20	W	Leaves	Snakebite	Leaves are crushed, then paste applied on affected part
<i>Sterculia lanceolata</i> Cav.	Sáng nhung	W	0.12	W	Leaves, bark	Snakebite	Leaves and barks are crushed, then paste applied on affected part
Styracaceae	Họ Bồ Đề						
<i>Styrax tonkinensis</i> (Pierre) Craib+	Bồ đề	W	0.02	W	Leaves	Pneumonia	Decoction of leaves is drunk
Theaceae	Họ Chè						
<i>Camellia sinensis</i> (L.) Kuntze+	Chè	S	1	C	Leaves	Indigestion	Tea make from fresh leaves is drunk
Ulmaceae	Họ Du						
<i>Trema orientalis</i> (L.) Blume*	Hu Day	W	0.12	W	Leaves	Vomiting	Leaves are chewed raw with salt and swallowed

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Urticaceae	Họ Gai				Leaves, bark	Diarrhea	Decoction of leaves and barks is drunk
<i>Boehmeria nivea</i> (L.) Gaudich.+	Gai	S	0.48	C	Root	Risk of miscarriage	Roots are boiled, then eaten
<i>Pouzolzia zeylanica</i> (L.) Benn. *+	Bọ mần	S	0.15	W	Leaves	Infection	Leaves are crushed, then paste applied on affected part
Verbenaceae	Họ Téch						
<i>Clerodendrum cyrtophyllum</i> Turcz. Đẳng cây		S	0.08	W	Leaves	Itches	Leaves are crushed, then applied on affected part
<i>Clerodendrum fragrans</i> Vent.+	Ngọc nữ	S	0.29	W	Root, Leaves	Haemostatic	Roots and leaves are decocted, then the decoction is drunk
					Root	Rheumatism	Juice extracted from roots is rubbed externally
					Root	Irregular menses	Roots are decocted, then the decoction is drunk
<i>Clerodendrum japonicum</i> (Thunb.) Sweet+	Xích đồng nam	S	0.34	W	Root	Metritis, leucorrhoea, Irregular menses	Roots are decocted, then the decoction is drunk
					Root	Irregular menses	Decoction of roots is drunk
<i>Clerodendrum paniculatum</i> L.+	Mồ trắng	S	0.10	W	Leaves, root	Haemostatic	Roots and leaves are decocted, then the decoction is drunk
<i>Stachytarpheta jamaicensis</i> (L.) Vahl +	Cây đuôi chuột	H	0.06	W	Whole plant	Arthritis	Plants parts are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Verbena officinalis</i> L.+	Cỏ roi ngựa	H	0.24	W	Leaves	Cold	Decoction of leaves is drunk
					Leaves	Skin diseases	Leaves are crushed, then applied on affected part
					Leaves	Itches	Leaves are crushed, then applied on affected part
<i>Vitex quinata</i> (Lour.) F. N. Williams +	Đền	W	0.09	W	Root, stem	Dysentery	Roots and stems are decocted, then the decoction is drunk
					Fruit, leaves	Fever	Decoction of fruits and leaves is drunk
<i>Vitex trifolia</i> L.*+	Đền 3 lá	W	0.07	W	Fruit	Indigestion	Fruits are eaten
Vitaceae					Leaves	Arthritis	Decoction of leaves is drunk
<i>Cayratia japonica</i> (Thunb.) Gagnep.	Nho rừng	C	0.12	C	Leaves	Bone fractures	Leaves are crushed, then paste applied on affected part
<i>Cissus modeccoides</i> Planch.	Chia vôi	C	0.07	W	Root, stem	Arthritis	Decoction of leaves and stems is drunk
<i>Tetrastigma strumarium</i> Gagnep.	Dây quai bị	C	0.08	W	Leaves	Bone fractures	Leaves are crushed, then paste applied on affected part
					Leaves, root	Arthritis	Decoction of leaves and roots is drunk
LILIOPSIDA – MONOCOTS							
Agavaceae							
<i>Cordyline terminalis</i> Kunth	Huyết dụ	H	0.45	W,C	Root, leaves	Haemostatic	Roots and leaves are decocted, then the decoction is drunk
Alliaceae	Họ Hành						

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Allium fistulosum</i> L.+	Hành	H	1	C	Leaves, stem, Bulb	Flu, cold	Plant parts are cooked with rice, then eaten (onion soup)
<i>Allium odorum</i> L.+	Hẹ	H	0.61	C	Leaves	Cold	Juice extracted from leaves, then mixed with sugar is drunk (special to treat children's colds)
<i>Allium sativum</i> L.+	Tỏi	H	1	C	Bulb	Dysentery, coughs, flu	Juice extracted from leaves is drunk or seed soaked in wine is drunk (the longer soaked the better effect)
Araceae							
<i>Acorus gramineus</i> Aiton et Soland	Họ Ráy Thạch xương bồ	H	0.24	W	Leaves, stem	Stomach ache	Fresh bulbs are eaten
<i>Aglaonema modestum</i> Schott	Vạn niên thanh	H	0.17	W,C	Leaves, tuber	Bone fractures	Leaves and stems are decocted, then the decoction is drunk
<i>Alocasia macrorrhizos</i> (L.) G. Don+	Ráy	H	0.14	W,C	Stem, leaves	Wounds, burns	Leaves and tubers are crushed, then paste applied on affected part
<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicol.*+	Khoai nua	H	0.09	W,C	Leaves	Detoxification	Leaves and stems are crushed, then paste applied on affected part
<i>Homalomena occulta</i> (Lour.) Schott	Thiên niên kiện	H	0.22	W,C	Tuber	Weakness, oughs	Leaves are cooked, then eaten
<i>Pothos repens</i> (Lour.) Druce	Chân rết	H	0.09	W	Whole plant	Food poisoning	Decoction from tubers is drunk
Areaceae	Họ Cau dừa						Plant parts are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Areca catechu</i> L.+	Cau	W	0.09	C	Root, fruit	Dysentery, diarrhea	Plant parts are decocted, then the decoction is drunk
<i>Caryota mitis</i> Lour.	Đùng đình	W	0.12	W	Root	Stomach ache	Small pieces of roots are decocted, then the decoction is drunk
Asparagaceae	Họ Túc Tiên						
<i>Asparagus cochinchinensis</i> (Lour.) Merr.+	Túc tiên	H	0.16	W,C	Root	Tuberculosis	Decoction of roots is drunk
Commelinaceae	Họ Thái Lài						
<i>Commelina communis</i> L. +	Thài lài	H	0.21	W,C	Stem, leaves	Dysentery	Plant parts are decocted, then the decoction is drunk
Cyperaceae	Họ Cói						
<i>Cyperus rotundus</i> L.+	Cỏ gấu	H	0.09	W	Tuber	Diarrhea	Tubers are decocted, then the decoction is drunk
<i>Kyllinga monocephala</i> Rottb.*+	Cỏ bạc đầu	H	0.21	W	Stem, leaves, stem	Flu, fever Skin diseases	Plant parts are steamed, then paste applied on forehead Plant parts are crushed, then applied externally on affected part
Dioscoreaceae	Họ Củ mài						
<i>Dioscorea glabra</i> Roxb.	Củ từ	C	0.06	W,C	Tuber	Dysentery	Decoction from tubers is drunk
<i>Dioscorea pycnostachya</i> Prain & Burkill+	Củ mài	C	0.13	W	Tuber	Fever	Tubers are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
Hypoxidaceae	Họ Sâm Cau						
<i>Curculigo orchioides</i> Gaertn.*+	Sâm cau	H	0.15	W	Leaves, root, stem	Rheumatism	Decoction of plant parts is drunk
Iridaceae	Họ Sâm Đại Hành						
<i>Eleutherine bulbosa</i> (Mill.) Gagnep.	Sâm đại hành	H	0.16	W	Bulb	Weakness, Indigestion	Bulbs are decocted, then the decoction is drunk
Orchidaceae	Họ Phong Lan						
<i>Anoectochilus roxburghii</i> (Wall.) Lindl.	Kim Tuyền	H	0.03	W	Whole plant	Weakness	Plant parts are decocted, then the decoction is drunk
Pandanaceae	Họ Dứa						
<i>Pandanus tectorius</i> Parkinson+	Dứa gỗ	S	0.06	W	Leaves, root, stem	Hemorrhage	Plant parts are decocted, then the decoction is drunk
<i>Pandanus tonkinensis</i> Mart. ex Stone	Dứa	S	0.05	W	Fruit	Sunburn	Juice extracted from fruits is rubbed externally
					Root	Oedema	Roots are decocted, then the decoction is drunk
Phormiaceae	Họ Hương bài						
<i>Dianella ensifolia</i> (L.) DC.+	Hương bài	H	0.30	W	Root	Wounds, infection	Roots are crushed, then paste applied on affected part
Poaceae	Họ Cỏ						
<i>Chrysopogon aciculatus</i> (Retz.) Trin.*	Cỏ may	H	0.09	W	Leaves, root, stem	Stomach ache	Plant parts are decocted, then the decoction is drunk

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Cymbopogon citratus</i> (DC.) Stapf. + Să		H	0.08	C	Whole plant	Bone fractures	Plant parts are crushed, then paste applied on affected part
<i>Eleusine indica</i> (L.) Gaertn.	Cỏ Mần trầu	H	0.15	W	Leaves	Flu	Leaves are decocted, then the decoction is drunk
					Root	Urinating problems	Fresh roots are chewed and swallowed
Smilacaceae							
	Họ Cẩm Cang						
<i>Smilax corbularia</i> Kunth+	Kim cang bạc	C	0.09	W	Leaves, root, stem	Indigestion	Plant parts are decocted, then the decoction is drunk
<i>Smilax glabra</i> Wall. +	Thổ phục linh	C	0.12	W	Root, stem	Arthritis	Plant parts are decocted, then the decoction is drunk
					Root, stem	Skin diseases	Juice are extracted from roots and stems is rubbed externally
					Root, stem	Bone fractures	Plant parts are crushed, then paste applied on affected part
Zingiberaceae							
	Họ Gừng						
<i>Annonum villosum</i> Lour. +	Sa nhân	H	0.36	W	Seed	Stomach ache	Seeds pounded is mixed with honey, then drunk with cold water
					Seed	Malaria	Seeds pounded is given with warm water
<i>Curcuma domestica</i> Valetton = C. longa L. +	Nghệ	H	0.77	C	Rhizome	Throat sores	Fresh pieces of rhizomes are chewed and swallowed
					Rhizome	Stomach ache	Small pieces of rhizomes are cooked with honey, then eaten

Scientific name	Common name	Life form	Use index	W/C	Part utilized	Medicinal application	Preparation and administration
<i>Zingiber officinale</i> Blume*+	Gừng	H	1	C	Rhizome	Weakness	Small pieces of rhizomes are soaked in wine, then drunk
<i>Curcuma zedoaria</i> (Berg.) Roscoe+	Nghệ đen	H	0.48	C	Rhizome	Indigestion, flu	Juice extracted from rhizomes is given with warm water
					Rhizome	Stomach ache	Small pieces of rhizomes are cooked with honey, then eaten

APPENDIX 3.2
Commercial medicinal plant species

Scientific name	Common name	Abundance in the wild	Intensity of collection	The price in US\$ (1\$ = 16,000 Vietnamese dong)	Market demand
POLYPODIOPHYTA-FERNS	Ngành Dương xỉ				
Dicksoniaceae	Họ Long cu li				
<i>Cibotium barometz</i> (L.) J. Sm.	Long cu li	Low	Medium	0.32/dried kg root	Medium
MAGNOLIOPHYTA-ANGIOSPERMS	Ngành Ngọc Lan				
MAGNOLIOPSIDA-DICOTS	Lớp 2 lá mầm				
Araliaceae	Họ Ngũ ra bi				
<i>Schefflera octophylla</i> (Lour.) Harms	Chân chim 8 lá	High	Medium	0.07/kg fresh leaves	Medium
Asclepiadaceae	Họ Hà thủ ô				
<i>Streptocaulon griffithii</i> Hook.f.	Hà thủ ô	Medium	Medium	Not stable	Medium
Asteraceae	Họ Cúc				
<i>Gynura japonica</i> (Thunb.) Juel.	Cúc Tam Thất	Medium	Medium	Not stable	Medium
Fabaceae	Họ Đậu				
<i>Abrus precatorius</i> L.	Cam thảo	Medium	Medium	Not stable	Medium
<i>Spatholobus suberectus</i> Dum.	Huyết rồng lão	High	High	0.06/kg dried stem	High
Lauraceae	Họ Long não				
<i>Cinnamomum cassia</i> Blume	Quế	Low	Low	0.7/ kg dried bark	Medium
Myrsinaceae	Họ Đơn nem				
<i>Ardisia silvestris</i> Pit.	Lá khô	Low	Low	0.1/kg fresh leaves	Medium

Scientific name	Common name	Abundance in the wild	Intensity of collection	The price in US\$ (1\$ = 16,000 Vietnamese dong)	Market demand
Polygonaceae	Họ Rau răm				
<i>Polygonum multiflorum</i> Thunb.	Hà thủ ô đỏ	Low	Medium	0.6/kg fresh tuber	Medium
Rubiaceae	Họ Cà Phê				
<i>Morinda officinalis</i> Haw.	Ba Kích	Low	High	2.5/kg fresh tuber	High
<i>Mussaenda cambodiana</i> Pierre ex Pit.	Bướm bạc	Medium	Medium	Not stable	Low
LILIOPSIDA-MONOCOTS	Lớp 1 lá mầm				
Alliaceae	Họ Hành				
<i>Allium sativum</i> L.	Tỏi	Cultivated		0.07/4 tubers	High
Araceae	Họ Ráy				
<i>Acorus gramineus</i> Soland	Thạch xương bồ	Medium	Medium	1.9/kg dried stem	Low
<i>Homalomena occulta</i> (Lour.) Schott	Thiên niên kiện	Medium	Medium	0.32/kg dried stem	Medium
Smilacaceae	Họ Cầm Càng				
<i>Smilax glabra</i> Wall. ex Roxb.	Thỏ phục linh	Medium	Medium	Not stable	Medium
Zingiberaceae	Họ Gừng				
<i>Amomum villosum</i> Lour.	Sa nhân	High	High	0.6/kg dried seed	High
<i>Curcuma zedoaria</i> (Berg.) Roscoe	Nghệ đen	Low in wild, but cultivated	Medium	0.95/kg fresh rhizome	High
<i>Zingiber officinale</i> Blume	Gừng	Cultivated		0.7/kg fresh rhizome	High

**USES AND CONSERVATION OF PLANT SPECIES
IN A NATIONAL PARK
A CASE STUDY OF BEN EN, VIETNAM**

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ABSTRACT

This paper surveys the use of wild and cultivated plants by local people in Ben En National Park, Vietnam, and analyzes its impact on the conservation status of some of the utilized species. A total of 208 species used for a range of non-medicinal purposes are listed (see Hoang et al. 2008 b) for 230 medicinal plants used in the Park. Most species are used for food. The use of plants contributes very significantly to the livelihood of local people in the Park, but the current use patterns are not sustainable and would lead to local extinction of rare and endangered species if no additional conservation measures are introduced. Men are collecting non-medicinal plants more often than women. A total of 38 useful plant species are commercialized, and contribute 12% of the average income of individual households. Bamboo shoots of *Schizostachyum funghomii* (Poaceae) are the most important for income generation. The monetary equivalent of non-commercialized useful plants probably far exceeds the value of the traded plant products. Plant use is independent of the ethnicity of the different populations living in the Park. Larger households make use of a greater variety of useful plant species than small families. Abundant species in the forest have a higher use index (UI) than less common species. Out of the 208 useful species, as many as 27 were found to be endangered locally, many more than the 11 or 8 endangered species included in national or global red lists. Currently, useful plants, especially important timber trees are more abundant in the less disturbed parts of the Park, far away from the villages,

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indicating the pressures of illegal logging and harvesting near villages on the ecosystems.

Key words: Useful plants, Ben En National Park, food plants, construction, firewood, household tools, conservation, Use Index.

INTRODUCTION

Ben En National Park is one of 30 National Parks in Vietnam, established in 1992 to conserve the rich, but seriously threatened biodiversity of the country. The Ben En area was designated for the protection of fauna in 1979, and as a nature reserve in 1986, although commercial logging operations continued until 1992. The Park is inhabited by 4000 local people belonging to five ethnic groups. Although initially all uses of wild natural resources were forbidden in the National Parks, current policies in Vietnam seek to find an optimal and realistic balance between conservation and sustainable use of natural resources, also within the boundaries of the National Parks. Apart from very preliminary species surveys (Anonymous 2000; Todoff et al. 2000), very little is known of both the plant biodiversity and ethnobotany of Ben En. The current study of native and cultivated plant use in the Park forms part of a larger study including traditional medicinal plant use (Hoang et al. 2008 b) and detailed botanical plot studies analysing the effect of selective harvesting of NTFP and of illegal logging on the plant species diversity within the Park (Hoang et al. 2008 c; Hoang et al. 2008 in prep.). This knowledge is crucial for the development of a sound management policy that is both aimed at nature conservation and improving the livelihood of the local communities within the Park.

The commercial extraction of useful plants as a conservation strategy is based on the argument that forest conservation must be able to offer economic incentives to local rural people in order to counter the threat of destructive land uses such as logging, shifting cultivation, and cattle ranching (Amacher 2002; Nepstad & Schwartzman 1992; Panayotou & Ashton 1992). However, the growing commercial trade of natural products, in particular medicinal plants and woodcrafts, has resulted in increasing exploitation of wild plant populations (Lange 1998) and this has generated concern about threats for local extinction (Cunningham 2001; Clay 1997; Tiwari 2000).

Specific research questions of the present study are: 1) which plant species are used for which purpose; 2) which species are commercialized; 3) what is their relative importance for the local communities based on a use index and on monetary revenues from commercialised species; 4) what is the impact of local people on these useful plants in the wild; and 5) how do factors such as ethnicity, size of each household, and species density in the park affect plant use?

The answers to these questions can hopefully serve to model management strategies in other National Parks in Vietnam and elsewhere and contribute to the conservation of both cultural and plant diversity.

METHODOLOGY

Ethnobotanical inventory

Household surveys and interviews were carried out in 45 randomly-selected households per village (out of a total of about 110 – 150 households per village) during a 6 months field survey held from October 2005 to March 2006 by the senior author and 4 students. The standard interviews contained specific questions on age, gender and ethnic background of the gatherers and main users of plant products. Additionally we used the ‘walk-in-the-wood’ method (Prance et al. 1987), to determine which products are harvested (and for what purpose) in the forests surrounding the villages. These trips were also used to collect voucher specimens for reliable identification of the harvested plants. Special collecting trips were organized with local experts, for instance people usually collecting useful plants, or locals with a detailed knowledge of plants. Furthermore several companies making furniture in and around the research area were visited to determine which timber species were used and from which sources they came. Local names were noted during these surveys as recommended by Martin (1995). Most information was double-checked with different informants and with manuals such as the Flora of Vietnam (Ho 2000), the manual on Non timber forest products in Vietnam (Hung 2007), and the PROSEA Handbooks (1989 – 2003). Market inventories were used to determine the price of the forest products. These served as an independent way to determine which products are harvested from the surrounding forest. We also assessed local uses of these forest products.

All plants that were considered by local people to have useful properties were collected and identified. These plants not only included wild species, but also cultivated plants and wild plants that had been taken from the forest and planted in gardens or agricultural fields. One herbarium voucher of each specimen was deposited in the herbarium of the Vietnam Forestry University, additional vouchers were sent to the National Herbarium of the Netherlands (L) and specialists elsewhere for identification.

The importance of useful plant species was identified using standard Participatory Rural Appraisal (PRA) techniques (PID & NES 1989; Ngai 2001), where local people were asked to rank a list of regularly used plants. We also quantified the relative use of species by calculating a Use Index (UI) based on the proportion of households utilizing a given species (see below).

The relative importance of timber species was assessed using three criteria: (1) ranking of species from a given list by forest rangers of Ben En National Park, who were asked how often certain illegally harvested species were confiscated from local people both inside and outside the Park, (2) proportion of listed species harvested by local people, and (3) frequency of tree stumps found during the field inventory. Stumps were identified by leaves, and fruits or flowers left in the forest when the timber trees had been felled very recently or from sucker shoots when the trees had been felled a long time ago. Bark characters were also used to identify the stumps. Additionally, local informants with expertise in tree (and stump) identification assisted us.

The market demand, intensity of collection and abundance in the wild were classified as low, medium or high (based on the interviews with local people, and by using PRA techniques).

Plants were divided into five end-use categories, largely following Prance et al. (1987):

- a. Food: Any plant or plant part (fruits, seeds, leaves, bark, flowers, or latex) used for human consumption.
- b. Construction: All roundwood and sawn boards used for house frames, furniture, canoes and bridges.
- c. Household tools and related products: All plants or plant parts used for house equipment, handicrafts, tools, poisons, shampoo, candles.
- d. Medicine (see Hoang et al. 2008 b).
- e. Firewood: All plants that are used for firewood, including charcoal.
- f. Others: Plants used as ornamentals, wrapping material, or pulp and paper.

Plants with multiple uses fall in more than one category.

Plot inventory

For a detailed analysis of plant biodiversity patterns in the Park (Hoang et al. 2008 a), and to study the impact of local people on collecting useful plants in the wild (this study) we established 41 transects, 200 m long, at 250 m intervals at right angles to and along the old logging road from Song Chang forest ranger station to Cong troi. The total length of these transects combined is ca. 7.4 km. We also established four 10 x 10 m plots at 50 m from the logging road and at 40 m forward intervals on each transect, resulting in ca. 147 plots for all transects combined (in some transects we were not able to establish four plots, because of steep, inaccessible limestone slopes). In each plot of 10 x 10 m, all trees with a dbh $\geq$ 5 cm were identified. In this study we combined four plots in each transect into one larger plot (we use the word 0.04 ha plot for these combined plots). We also established six transects to cover the rest part of the Park, with a total length of about 26 km. In each transect we noted all species and collected specimens of plants which could not be identified in the field. In all six transects we established 30 random plots of 10 x 10 m, and identified all species in the plots. Furthermore we also collected many plants outside the plots and transects, to make sure that our inventory was as representative as possible of the entire species richness of the local flora.

Data analysis

The database resulting from the ethnobotanical inventory was used to calculate a use index (UI) for each species by using the following equation:

$$UI = U_s/N$$

Where U_s is the number of households which mentioned a use for species s ; N is the total of households that were interviewed in the research area. This Use Index is a modification from the Use Value (UV) introduced by Phillips & Gentry (1993) and recently used by De Lucena et al. (2007), which is calculated from the relative number of times a species is mentioned by various informants in ethnobotanical inventories.

Simple regression analysis (SPSS 16.0) was used to examine whether the number of stumps, and distances from villages to plots relate to number of useful plants and number of important timber trees; the relation between Use Index and number of useful plant species and number of important timber trees in plots; and the number of people in each household and number of useful plant species used by their households. Additionally, we used One Way ANOVA analysis to test if the number of useful plant species used is different among ethnic groups.

RESEARCH AREA

Field work was conducted in Ben En National Park, situated in Nhu Thanh and Nhu Xuan districts of the Thanh Hoa province in Vietnam, $19^{\circ} 40' N$ by $105^{\circ} 21'$ to $105^{\circ} 35' E$ (Fig. 1.1). Before its establishment in 1986, the Park was a logging enterprise, resulting in the fact that big trees with a diameter at breast height of over one meter were rarely observed during our field work. Ben En National Park was established as a protected area in 1986 and as a National Park in 1992. Since then all logging activities are illegal. The core zone of the National Park covers 15,800 ha, while the buffer zone covers around 12,000 ha. About 18,000 people live in the buffer and core zones of the National Park (Tordoff et al. 2000). The majority of the people living in the National Park belong to the Kinh, Thai, Muong and Tay ethnic groups; although there are also a small number of Tho people. All ethnic groups have their own languages, but all can communicate in the national King (Viet) language. Most households in the research area have their own home garden, varying in size from 100 to 2,000 sq.m implying that 26% of the total land in the buffer zone is thus managed by local people. This includes 2620 ha (8.4%) of secondary forest and poor forest lands, 2256 ha (7.3%) of bare land or land with some small trees and shrubs, 443 ha (1.4%), of plantation forest and 2554 ha (8.2%) of agricultural land. There are plans to allocate more land to local households in the future. In some areas, land is being planted with sugar cane, cassava, in other areas reforestation is taking place with *Eucalyptus camaldulensis*, (Myrtaceae), *Acacia mangium*, *A. auriculiformis* (Mimosaceae), *Hevea brasiliensis* (Euphorbiaceae), and fruit trees.

The interviews were carried out in three villages: Xuan Thai, Binh Luong and Hoa Quy. Additional information on useful plants was collected in the Ben Sung, Yen Cat, and Xuan Thai markets and from several companies making furniture in and around the Park. There are nine vegetation types in Ben En National Park (Hoang et al. 2008 a): the vegetation of the core zone is dominated by tropical evergreen forest, which has been disturbed by human activities, principally by logging.

RESULTS

Diversity of useful plant species

A total of 208 plant species were found to be used by local people in Ben En National Park (excluding medicinal plant species which are surveyed elsewhere, see Hoang et al. 2008 b). These species belong to 130 genera and 64 families. A complete list of useful, non-medicinal plant species is given in Appendix 4.1.

From the 208 useful species, 59% are collected exclusively from the wild (primary, secondary and logged-over forest); 31% of the species are cultivated in home gardens or in fields and mostly used as vegetables or for their fruits, e.g. *Mangifera indica* (Anacardiaceae), *Artemisia vulgaris* (Asteraceae), *Diospyros kaki* (Ebenaceae); another 10% of the species are taken from the forest and planted in home gardens, e.g., *Garcinia cowa*, *Garcinia multiflora* (Clusiaceae), and *Dracontomelon dao* (Anacardiaceae).

Plant parts used

In Appendix 4.1 the different plant parts used of each species are indicated. Stems of trees, shrubs and lianas are most commonly used, for construction, firewood or handicrafts. Fruits and leaves are also commonly used; mostly for food. 22 species are used by local people as whole plants, mostly for ornamental purposes, e.g. *Euphorbia pulcherrima* (Euphorbiaceae), *Acanthopanax trifoliatum* (Araliaceae); some small plants are used as vegetables such as *Centella asiatica* (Apiaceae). Local people use seeds, resin, branches or bark. For instance, seeds of *Michelia tonkinensis*, *Michelia mediocris* (Magnoliaceae) are used as spice for food; resin of *Canarium album* and *Canarium tramdenum* (Burseraceae) is used for making candles. Bark of *Artocarpus tonkinensis* (Moraceae) is chewed together with leaves of *Piper betle* (Piperaceae) and fruits of *Areca catechu* (Arecaceae) - this is a traditional custom in Vietnam.

Diversity of commodity groups

Table 4.1 shows the distribution of useful plants in the five end-use categories. The different commodity groups are discussed below.

Table 4.1. Commodity groups of useful plants in Ben En National Park

Commodity group	Number of plant species	Percent/total (%)
Food	142	68
Construction	40	19
Firewood	25	12
Household tools and related products	18	9
Other	16	8

Food

Food (fruits and vegetables) is the most important end-use category. Sixty wild species are collected from the forest, e.g. leaves of *Meliantha suavis* (Opiliaceae), *Maesa balansae* (Myrsinaceae), *Vernonia solaniflora* (Asteraceae), *Callipteris esculenta* (Athyriaceae), *Erythrophalum scandens* (Olacaceae), *Schefflera octophylla* (Araliaceae), fruits of *Baccaurea ramiflora* (Euphorbiaceae), and tubers of *Dioscorea persimilis* (Dioscoreaceae). A total of 64 wild species have already been introduced in home gardens or agricultural fields such as *Polyscias fruticosa* (Araliaceae), *Telosma cordatum* (Asclepiadaceae), *Dracontomelon dao*, *Spondias lakoensis* (Anacardiaceae). All households interviewed collect bamboo shoots of *Schizostachyum funghomii* (Poaceae) for food; 32% of the households collect these shoots also for trading, both fresh and dried in local markets, and sell them to traders from Yen Cat, Ben Sung and Bai Tranh, three neighboring towns at 8–20 km distance from Ben En.

Construction

Although Ben En was established as a National Park in 1992, illegal logging is still taking place by people inside and outside the Park. A total of 40 species are used by local people for construction and furniture, e.g. *Erythrophleum fordii* (Caesalpiniaceae), *Paviesia annamensis* (Sapindaceae), *Vatica odorata* (Dipterocarpaceae), *Actinodaphne obovata* (Lauraceae), *Dysoxylum cauliflorum* (Meliaceae). Some rattan and bamboo species such as *Dendrocalamus barbatus* and *Bambusa blumeana* (Poaceae) are used for construction of animal cages (pigs, cows, buffaloes, chickens), and some households still use leaves of the palm *Livistona chinensis* for thatching. The 15 most important local timber species, according to the interviews with forest rangers and local people, and according to their stump frequency in the research plots (Hoang et al. 2008 a; Hoang et al. in prep.) are listed in Table 4.2.

Firewood

All households in the research area still depend on firewood for their cooking, also for heating and other energy sources; 25 species were recorded for firewood use; most of them are collected from the forest, and the forest land that belongs to the individual families. Small trees or branches are used that can easily be chopped into small pieces and quickly lit, from species such as *Xylopiia pierrei* (Annonaceae), *Cratoxylum polyanthum* (Clusiaceae), *Melastoma normale*, or *Melastoma septemnerium* (Melastomataceae). Some cultivated species are also used such as *Acacia auriculaeformis*, *Acacia mangium* (Mimosaceae), *Eucalyptus camaldulensis* (Myrtaceae), *Pinus massoniana*, and *Pinus merkusii* (Pinaceae). Local people also make charcoal by burning the stumps and branches of *Erythrophleum fordii* (Caesalpiniaceae) that have already been cut for their timber.

Table 4.2. Important timber trees in Ben En National Park and their use index (UI)

Scientific name	Family	Use Index (UI)
<i>Actinodaphne obovata</i> Blume	Lauraceae	0.65
<i>Aglaia spectabilis</i> (Miq.) S.S. Jain & Bennet	Meliaceae	0.56
<i>Amesiodendron chinense</i> (Merr.) Hu	Sapindaceae	0.56
<i>Aphanamixis grandifolia</i> Blume	Meliaceae	0.53
<i>Dysoxylum cauliflorum</i> Hiern	Meliaceae	0.78
<i>Erythrophleum fordii</i> Oliv.	Caesalpiniaceae	0.99
<i>Garcinia fagraeoides</i> A. Chev.	Clusiaceae	0.52
<i>Lagerstroemia calyculata</i> Kurz	Lythraceae	0.81
<i>Michelia mediocris</i> Dandy	Magnoliaceae	0.84
<i>Parashorea chinensis</i> Wang Hsie	Dipterocarpaceae	0.81
<i>Pavieasia annamensis</i> Pierre	Sapindaceae	0.85
<i>Peltophorum tonkinensis</i> Pierre	Caesalpiniaceae	0.54
<i>Phoebe paniculata</i> Nees	Lauraceae	0.66
<i>Vatica harmandiana</i> Pierre	Dipterocarpaceae	0.54
<i>Vatica odorata</i> (Griff.) Symington	Dipterocarpaceae	0.50

Household tools and related products

A total of 18 species are used for household tools and related products, e.g. *Dendrocalamus barbatus*, *Bambusa blumeana*, and *Schizostachyum funghomii* (Poaceae) to make baskets; *Calamus balansaeanus*, *Calamus faberi*, and *Calamus tetradactylus* (Arecaceae) for handicrafts, e.g. cane chairs and tables, pillows, boxes; and *Baeckea frutescens* (Myrtaceae) for making brooms.

Other uses

Only 11 species are used as ornamental plants in the research area: e.g. *Camellia amplexicaulis* (Theaceae), *Acanthopanax trifoliatum* (Araliaceae), *Cycas revoluta* (Cycadaceae), *Barringtonia acutangula* (Lecythidaceae) and several orchid species.

Leaves of *Phrynium placentarium* (Marantaceae) are used for wrapping rice cake. Twelve species are collected for paper making, e.g. *Acacia auriculaeformis*, *Acacia mangium* (Mimosaceae), and *Schizostachyum funghomii* (Poaceae), and sold to a pulp mill in Lam Son, 15 km away from the Park. *Pterocarya tonkinensis* (Juglandaceae) is used to stupefy fish: leaves are crushed and immersed in streams and ponds as a mild fish poison that immobilises the fishes but does not affect their edibility after the fish is caught in this way.

Commercialization of useful plants

A total of 38 of the 208 useful species in the Park are commercialized. Most of these species are sold to traders or in the local markets. The commercial plant species are listed in Appendix 4.2. Of these, 14 are cultivated in home gardens, mostly as fruit trees and vegetables, e.g. *Musa paradisiaca* (Musaceae), *Citrus maxima*, *Citrus sinensis* (Rutaceae), *Psidium guajava* (Myrtaceae), *Ocimum basilicum* (Lamiaceae), *Luffa cylindrica* and *Lagenaria siceraria* (Cucurbitaceae). The remaining 24 commercial species are collected from the forest for a variety of end-uses such as resin for candle manufacturing from *Canarium album* and *Canarium tramdenum* (Burseraceae) or leaves and shoots as vegetables, e.g., from *Melianta suavis* (Opiliaceae) and *Schizostachyum funghomii* (Poaceae). Illegal logging of 15 timber species (Table 4.2) for domestic use and trade is still ongoing. The most important species is *Erythrophleum fordii* (Caesalpiniaceae). The timber is sold to traders or furniture manufacturers.

Only 24 families collect firewood for trade, but the income from it is low. Eight families produce charcoal for trading at a price of about 6 US\$ /100 kg.

The income of each commercialized plant species is shown in Appendix 4.2.

Income of local people per household in Ben En National Park is shown in Table 4.3.

Table 4.3. Annual income per household in Ben En National Park

Resource	Income in US\$	Percentage (%)	Remarks
Agriculture	150	36	Crops such as rice and corn
Livestock	100	24	Pigs, chickens, dogs, and cows
Non-medicinal useful plants	50	12	See Appendix 4.2
Medicinal plants	45	11	See Hoang et al. 2008 a
Others	75	17	Employment, fishing, trading, etc.
Total	420	100	

Who is collecting useful plants?

From interviewing households and key informants, it emerged that men collect useful plants more often than women at almost every age level, especially in the age classes from 20 to 50 (Table 4.4). This is in contrast to medicinal plants which are chiefly collected by women (Hoang et al. 2008 b). Moreover, activities such as cutting timber, harvesting firewood, collecting honey and making charcoal are almost all carried out by men. Young people participate more actively in collecting non-medicinal useful plants than medicinal ones (Hoang et al. 2008 b). However, people younger than 25 years are less active in collecting both non-medicinal useful and medicinal plants than older people. The older people in the research area have a better knowledge of useful plants, and many young people in the research area are employed outside the Park (Hoang et al. 2008 b).

Table 4.4. Gender and age classes of local people harvesting useful plants in Ben En National Park

Age	Gender	Percentage of individuals harvesting useful plants (%)
> 50	Male	15
	Female	8
26 - 50	Male	34
	Female	23
16 - 25	Male	8
	Female	7
< 16	Male	3
	Female	2
Average % of Males		60
Average % of Females		40

Importance of useful plants for the local communities

Firewood is considered to be the most important by local people, irrespective of which species is used. All households in the study area use firewood as the main fuel to cook food for people and pigs (pigs are also an important source of income – see Table 4.3), and for heating. In fact, the prices of the alternative fuels like electricity, gas and kerosene are too high and cannot be afforded by the local people while firewood is freely available. Additional to firewood, the bamboo shoots of *Schizostachyum funghomii* (Poaceae) are also very important because they are not only collected for local consumption, but also for generating cash. The average income from this species was 13 US\$ / per year / per household in 2005. *Erythrophleum fordii* (Caesalpiniaceae) is the most important timber species, not only for timber, but also for charcoal.

The use index of species varies widely (Appendix 4.1), from 0.01 to 1, indicating that some species are only used by 1% of all households (e.g. the orchid *Dendrobium aloideum* used by only two households for ornamental purposes), while others are used by virtually all households (e.g. onion, ginger, garlic, and sweet potato). Most species with an UI higher than 0.75 are cultivated food plants, but some timber trees also have a high use value such as *Erythrophleum fordii* (Caesalpiniaceae) (0.99), *Pavieasia annamensis* (Sapindaceae) (0.85), *Michelia mediocris* (Magnoliaceae) (0.84), and *Parashorea chinensis* (Dipterocarpaceae) (0.81). The vast majority of species are however used by less than half of the households, and 37% of the useful species have use indices lower than 0.25.

Conservation status

A total of 8 plant species used by local people from Ben En National Park are listed in the Red Data List of IUCN (2006), and 11 species are listed in the Red Data Book of Vietnam (Ban 2007) (Table 4.5).

Table 4.5. Useful plants in Ben En National Park listed in the Red list of IUCN 2006, the Red Data Book of Vietnam (Ban 2007), and considered as threatened species in Ben En National Park on the basis of this study.

E - endangered, CR - critically endangered, V - vulnerable, R - rare,
T - threatened, K - insufficiently known, LR - least concern, nl - not listed.

Species	Family	Threat category in Red book of Vietnam	Threat category in Red list of IUCN 2006	Threat category in Ben En (this study)
<i>Actinodaphne obovata</i> Blume	Lauraceae	nl	nl	T
<i>Aglaia spectabilis</i> (Miq.) S.S. Jain & Bennet	Meliaceae	V	nl	T
<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	nl	LR	nl
<i>Amesiodendron chinense</i> (Merr.) Hu	Sapindaceae	nl	LR	T
<i>Aphanamixis grandifolia</i> Blume	Meliaceae	nl	nl	T
<i>Caesalpinia sappan</i> L.	Caesalpiniaceae	nl	nl	R
<i>Calamus platyacanthus</i> Warb. ex Becc	Arecaceae	V	nl	R
<i>Calamus tetradactylus</i> Hance	Arecaceae	nl	nl	R
<i>Canarium tramdenum</i> Chan Dinh Dai & Yakovlev	Burseraceae	V	nl	R
<i>Chukrasia tabularis</i> A. Juss.	Meliaceae	V	LR	nl
<i>Cycas chevalieri</i> Leandri	Cycadaceae	LR	CR	R
<i>Cycas revoluta</i> Thunb.	Cycadaceae	nl	nl	R
<i>Dysoxylum cauliflorum</i> Hiern	Meliaceae	V	nl	T
<i>Erythrophloeum fordii</i> Oliv.	Caesalpiniaceae	nl	E	T
<i>Garcinia fagraeoides</i> A. Chev.	Clusiaceae	V	nl	E
<i>Hopea odorata</i> Roxb.	Dipterocarpaceae	nl	nl	R
<i>Hopea chinensis</i> (Merr.) Hand.-Mazz.	Dipterocarpaceae	nl	CR	R
<i>Lagerstroemia calyculata</i> Kurz	Lythraceae	nl	nl	R
<i>Manglietia fordiana</i> Oliv.	Magnoliaceae	V	nl	R
<i>Markhamia stipulata</i> (Wall.) Seem. ex Schum.	Bignoniaceae	V	nl	E
<i>Meliantha suavis</i> Pierre	Opiliaceae	V	nl	R
<i>Michelia mediocris</i> Dandy	Magnoliaceae	nl	nl	R
<i>Parashorea chinensis</i> (Wang Hsie) H. Zhu	Dipterocarpaceae	nl	E	T
<i>Pavieasia anamensis</i> Pierre	Sapindaceae	nl	nl	T

Species	Family	Threat category in Red book of Vietnam	Threat category in Red list of IUCN 2006	Threat category in Ben En (this study)
<i>Peltophorum tonkinensis</i> Pierre	Caesalpiniaceae	nl	nl	V
<i>Phoebe paniculata</i> Nees	Lauraceae	nl	nl	T
<i>Vatica odorata</i> (Griff.) Symington	Dipterocarpaceae	nl	nl	R
<i>Vatica harmandiana</i> Pierre	Dipterocarpaceae	nl	E	R
<i>Vatica subglabra</i> Merr.	Dipterocarpaceae	E	nl	E

Based on our plot inventories (density of living trees and stumps) and interviews with forest rangers and local people a total of 27 species appears to be endangered, vulnerable, rare, or threatened in the Park (Table 4.5). For instance, *Cycas revoluta*, and *Cycas chevalieri* (Cycadaceae) are rare in Ben En and local people also collect these species for ornamental purposes, although the pressure of collecting is low and the market demand is not high. All the used timber tree species are illegally exploited by local people in Ben En, and trespassers are often caught by the forest ranger of the Park. *Actinodaphne obovata*, *Phoebe paniculata* (Lauraceae), and *Erythrophleum fordii* (Caesalpiniaceae), are not difficult to find in the forest, but the intensity of harvesting these species by local people is high, and recent stumps were often seen during the field inventory. Additional species that are often confiscated by the forest ranger are *Garcinia fagraeoides* (Clusiaceae) and *Markhamia stipulata* (Bignoniaceae). These species are in high demand but rare in the forest, and thus locally endangered.

Impact of local people on useful plants

Of all useful species in the Park, 54 were recorded in the plot inventories (see Appendix 4.1). These species were further analysed for impact of local use on their occurrence and density in the plots. Most of these species are used for construction and firewood. Useful plants in general and important timber trees in particular are more abundant in remote (and less disturbed) plots than close to the villages (data not shown). Not surprisingly the density of useful plant species, especially of important timber trees is negatively correlated with the number of stumps found in each plot (Figs. 4.1 and 4.2).

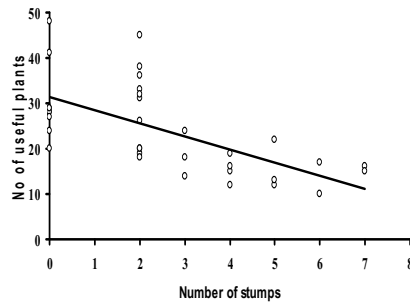


Fig. 4.1. Relation between the number of useful plants and number of stumps per 0.04 ha plot;
 $y = 30.72 - 2.84 x$; $R^2 = 0.45$

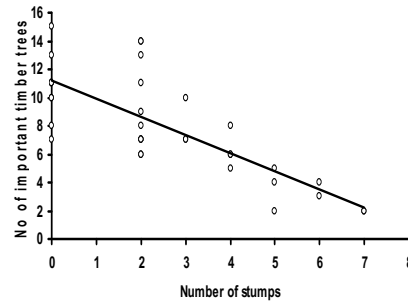


Fig. 4.2. Relation between the number of important timber trees and number of stumps per 0.04 ha plot;
 $y = 11.34 - 1.29 x$; $R^2 = 0.60$

Relation of use index, tree density, and number of people in each household

There is a strong correlation between number of people in each household and number of useful plant species used by each household in the Park (Fig. 4.3). There are also weak but significant correlations between use index and the density of useful plants (Fig. 4.4).

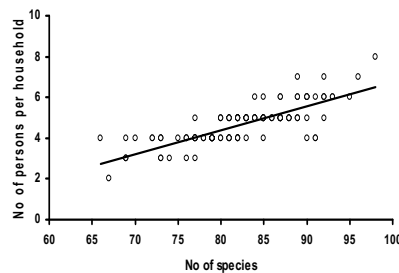


Fig. 4.3. Relation between number of persons in each household and number of useful plant species used;
 $y = 0.12 x - 5.02$; $R^2 = 0.64$

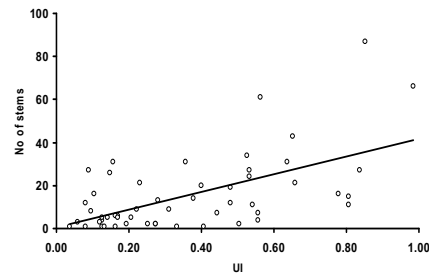


Fig. 4.4. Relation between number of stems per 0.04 ha plot and UI of 54 useful plant species;
 $y = 42.22 x + 0.56$; $R^2 = 0.34$

DISCUSSION

Conservation of useful plant species in Ben En National Park

Local people, living in and around the Park, still depend on natural resources. Dependence on these resources is highest in those communities living inside the core zone of the National Park. The remoteness of these communities makes it difficult for people to bring building materials or other plant commodities from outside the Park to their village. As a result 27 useful plant species in Ben En National

Park appear in danger of being lost locally; 16 of these are not recorded in the Red Book of Vietnam (Ban 2007). They are perhaps not only threatened in Ben En, but also in other parts of Vietnam, because the information on endangered species was - and still is - very incomplete. *Chukrasia tabularis* is listed both in the Red List of IUCN 2006, and the Red Book of Vietnam (Ban 2007); this species is endangered in nature, and it is rare in the natural forest. However, *Chukrasia tabularis* is planted widely in plantation forests in Vietnam, especially in and around Ben En National Park. Therefore we did not list this species in the list of threatened species in Ben En. Another species, *Alstonia scholaris* (Apocynaceae), listed by IUCN list (2006) is very common in plantations throughout the whole country. In contrast, *Garcinia fagraeoides* (Clusiaceae) is not on the IUCN list, but locally this species is endangered, because of the high intensity of illegal logging and its rarity in the field inventories. *Markhamia stipulata* (Bignoniaceae) was an important timber tree for local people 5 - 10 years ago. However, this species has become endangered in Ben En; only a single tree with a diameter over 5 cm was found during the field inventory.

Recently illegal logging has decreased because of the strict protection by forest rangers (Hien 2006; 2007). Local people also obtain land to plant trees. However, some illegal logging is still carried out in the Dong Tho, Song Chang, Duc Luong and Bai Tranh areas. In order to reduce the impact of local people on forest resources and to improve their living conditions, the Vietnamese Government issued Decree 02/CP in 1994, making it possible to allocate forest land to individual households for protection and re-plantation, and that policy still applies in the whole country. In some buffer zones of national parks, land is being planted with sugar cane, cassava, in others reforestation is taking place with *Eucalyptus camaldulensis*, *Acacia mangium*, *Acacia auriculiformis* and various fruit trees. This could reduce the pressure from local people on the Park in general, and in the core zone in particular. Additionally local people should be encouraged to cultivate plant species in home gardens, using modern techniques that would increase the yield of commonly used and commercialized species.

Impact of local people on useful plants

Our analysis of the occurrence and densities of useful plants in the plots (only 54 species out of the 208) has shown a significant and negative impact of harvesting and illegal logging near villages. It must be feared that – without appropriate measures - plant resources will in future also become depleted in more remote areas. A more detailed assessment of the impact of local people on plant species diversity and species densities throughout the Park is currently in preparation (Hoang et al. in prep.).

Some factors affecting plant use

We found no differences between the different ethnic groups and plant use (data not shown), but instead a significant relationship between the size of households and the number of species used per household. According to Phillips & Gentry (1993); Johns et al. (1990) and De Lucena et al. (2007) traditional plant use is strongly influenced

by factors such as abundance in the forest, and plant size and conspicuousness of individual species. Our analysis of the Use Index (UI) and other indicators of plant uses such as species ranking by informants and commercial value to some extent confirm this: in the plots species with a high UI are indeed more common than species with a low UI (Fig. 4.4), and all very useful commercial timber trees (both by species ranking and high UI, Table 4.1) are indeed big and conspicuous. There are however major exceptions to these trends: several important timber tree species with high UI are of very infrequent occurrence in all plots, e.g. *Vatica odorata* (UI = 0.50), *Parashorea chinensis* (0.81), *Amesiodendron chinense* (0.56), and *Garcinia fagraeoides* (0.52) (Hoang et al. in prep.). Also, several species with very high UI are inconspicuous and small plants in the forest, e.g. *Artemisia vulgaris* (0.52), *Hydrocotyle sibthorpioides* (0.67), *Bauhinia coccinea* (0.69), and *Perilla frutescens* (0.57) (cf. Appendix 4.1). For many cultivated plant species there is an interesting discrepancy between the calculated UI and the relatively low ranking given in the PRA questionnaires (results not shown), suggesting that local people take many cultivated species “for granted” in their response to our interviews using PRA techniques.

The Use Index spectrum for non-medicinal useful plants is quite different from that of medicinal plants (Hoang et al. 2008 b): for medicinal plant species the vast majority (68%) has low UI values (< 0.25), and only 8% have high values > 0.75 (for the non-medicinal plants these values are 32% and 16% respectively). This indicates that traditional medicinal use of wild plant species is less common than the use of non-medicinal plants, perhaps because in many households the knowledge of or confidence in the therapeutic efficacy of a certain species is low, while non-medicinal uses are much more straightforward.

Valuation of traditional plant use

The contribution of non-medicinal and medicinal plants collected in the wild or grown in home gardens to income generation was calculated to amount to 23% or 95 US\$ per household per annum (Table 4.3). These figures are only rough approximations since they are based on interviews of local people and market inventories, each with their own sources of error and imprecision. Nevertheless the total economic value of traditional plant use far exceeds this monetary component for the people of Ben En National Park, since it offers important commodities such as vegetables, fruits, condiments, fuel, construction materials, medicines, etc., “free of monetary charge”, but in return for fairly light collecting and plant cultivation efforts. It would be interesting to calculate the monetary equivalents for all these free commodities, but our data unfortunately do not allow this. Conversely, the costs of overexploitation and ecological degradation should also be modeled: an even more difficult exercise, beyond the scope of this study.

APPENDIX 4.1
Plant species used by local people in Ben En National Park

Key: Wild/Cultivated: W; Wild; C; Cultivated

+: Species are also used for medicinal plant purposes (Hoang et al. 2008 b)

+: Species recorded in plots

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
Ferns					
Gleicheniaceae					
<i>Dicranopteris linearis</i> (Burm.) Underw.	Họ Guột Guột	0.28	W	Whole plant	Firewood
Marsileaceae					
<i>Marsilea quadrifolia</i> L.*	Họ Rau Bọ Rau bọ	0.14	W	Leaves	Food
Woodsiaceae					
<i>Diplazium esculentum</i> (Retz.) Sw.	Ráng gỗ nhỏ Rau rón	0.30	W	Leaves	Food
Gymnosperms					
Cycadaceae					
<i>Cycas chevalieri</i> Leandri	Họ Tuế Nghèn	0.12	W	Whole plant	Ornamental
<i>Cycas revoluta</i> Thunb.	Vạn tuế	0.08	W	Whole plant	Ornamental
Gnetaceae					
<i>Gnetum gnemon</i> L.	Họ Dây gắm Gắm	0.29	W	Fruit	Food
Pinaceae					
<i>Pinus massoniana</i> D. Don	Họ Thông Thông đuôi ngựa	0.33	W,C	Branch, stem	Construction, firewood
<i>Pinus merkusii</i> Jungh. & de Vriese	Thông nhựa	0.36	W,C	Branch, stem	Construction, firewood

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
Angiosperms	Ngành Ngọc Lan				
Dicotyledons	Lop Ngọc Lan				
Amaranthaceae	Họ Rau Dền				
<i>Alternanthera sessilis</i> (L.) A. DC.	Rau diếp đại	0.24	W	Leaves	Food
<i>Amaranthus spinosus</i> L.	Dền cơm	0.26	C	Leaves	Food
<i>Amaranthus tricolor</i> L.	Dền tía	0.08	C	Leaves	Food
Anacardiaceae	Họ Xoài				
<i>Dracontomelon dao</i> (Blanco) Merr. & Rolfe	Sấu	0.19	W,C	Fruit, leaves, stem	Food, construction
<i>Mangifera indica</i> L.	Xoài	0.43	C	Fruit	Food
<i>Mangifera reba</i> Pierre	Quáo	0.06	W,C	Fruit	Food
<i>Spondias axillaris</i> Roxb.	Xoan nhừ	0.08	W	Fruit	Food
<i>Spondias lakoensis</i> Pierre * +	Dầu da xoan	0.25	W,C	Fruit	Food
Annonaceae	Họ Na				
<i>Annona squamosa</i> L. *	Na	0.16	C	Fruit	Food
<i>Xylopia vielana</i> Hance * +	Dền	0.91	W	Stem	Firewood
Apiaceae	Họ Hoa Tán				
<i>Anethum graveolens</i> L.	Thì là	0.27	C	Leaves, stem	Food
<i>Centella asiatica</i> (L.) Urb. *	Rau má	0.30	W	Whole plant	Food
<i>Coriandrum sativum</i> L.	Rau mùi	0.32	C	Leaves, stem	Food
<i>Eryngium foetidum</i> Thunb.	Mùi tàu	0.31	C	Leaves, stem	Food
<i>Hydrocotyle sibthorpioides</i> Lamk.	Rau má	0.67	W	Whole plant	Food

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
Apocynaceae	Họ Trúc Đào				
<i>Alstonia scholaris</i> (L.) R. Br. *	Sữa	0.04	W	Whole plant	Ornamental
<i>Holarrhena antidysenterica</i> Wall.	Mộc hoa trắng	0.04	W	Whole plant	Ornamental
Aquifoliaceae	Họ Nhựa ruồi				
<i>Ilex macrocarpa</i> Oliv.	Bùi quả to	0.07	W	Leaves	Drink
<i>Ilex rotunda</i> Thunb. +	Nhựa ruồi	0.08	W	Leaves	Drink
Araliaceae	Họ Ngũ ra bì				
<i>Acanthopanax aculeatum</i> Seem.	Ngũ ra bì	0.07	W	Whole plant	Ornamental
<i>Polyscias fruticosa</i> Harms	Đinh lăng	0.42	C	Leaves	Food
<i>Schefflera alpina</i> Grushv. & Skvorts.	Chân chim	0.30	W	Leaves	Food
<i>Schefflera octophylla</i> Harms *+	Chân chim 8 lá	0.48	W	Leaves	Food
Asclepiadaceae	Họ Thiên lý				
<i>Telosma cordata</i> Merr.*	Thiên lý	0.26	C	Flower	Food
Asteraceae	Họ Cúc				
<i>Artemisia japonica</i> Thunb.	Ngải cứu rừng	0.16	W	Leaves	Food
<i>Artemisia vulgaris</i> L. *	Ngải cứu	0.52	C	Leaves	Food
<i>Gynura crepidioides</i> Benth *	Rau tàu bay	0.21	W	Leaves	Food
<i>Lactuca indica</i> L.	Bồ công anh	0.36	W	Leaves	Food
<i>Vernonia andersonii</i> C. B. Clarke	Dây rau rầu	0.22	W	Leaves	Food
Basellaceae	Họ Mồng tơi				
<i>Basella alba</i> L.	Mồng tơi	0.70	C	Leaves	Food

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
Bignoniaceae	Họ Đỉnh				
<i>Markhamia stipulata</i> Seem. ex Schum. +	Đỉnh	0.41	W	Stem	Construction
<i>Oroxylum indicum</i> (L.) Benth. ex Kurz* +	Núc nác	0.13	W	Fruit	Food
Brassicaceae	Họ Cải				
<i>Brassica chinensis</i> L.	Cải bẹ trắng	0.91	C	Leaves	Food
<i>Brassica integrifolia</i> West.	Cải ngọt	0.73	C	Leaves	Food
<i>Brassica juncea</i> (L.) Czern.	Cải canh	0.74	C	Leaves	Food
<i>Raphanus sativus</i> L.	Cải củ	0.70	C	Leaves, tuber	Food
Burseraceae	Họ Trám				
<i>Canarium album</i> Rauesch.+	Trám trắng	0.53	W	Resin, fruit	Candles, food
<i>Canarium tonkinensis</i> L.+	Trám chim	0.27	W	Resin, fruit	Candles, food
<i>Canarium trandenum</i> Chan Dinh Dai & Yakovlev+	Trám đen	0.53	W	Resin	Candles
Caesalpiniaceae	Họ Vang				
<i>Bauhinia coccinea</i> DC.	Quạch	0.69	W	Stem	Drink
<i>Bauhinia variegata</i> L.	Ban	0.04	W.C	Whole plant	Ornamental
<i>Caesalpinia sappan</i> L. *	Vang	0.07	W	Stem, branch	Drink
<i>Erythraploeum fordii</i> Oliv.+	Lim xanh	0.99	W	Stem	Construction
<i>Gleditsia australis</i> Hemsl. ex Forb. & Hemsl.+	Bồ kết	0.25	W	Fruit	Shampoo
<i>Peltophorum tonkinensis</i> Pierret+	Lim xẹt	0.54	W	Stem	Construction
<i>Tamarindus indica</i> L.	Me	0.20	W	Fruit	Food
Caricaceae	Họ Đu đủ				

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
<i>Carica papaya</i> L. *	Đu đủ	0.40	C	Fruit	Food
Clusiaceae	Họ Mãng cụt				
<i>Cratoxylum polyanthum</i> Korth. *	Thành ngạnh	0.18	W	Whole plant	Firewood
<i>Garcinia cowa</i> Roxb.	Tai chua	0.16	W,C	Fruit, leaves	Food
<i>Garcinia fagraeoides</i> A. Chev. +	Trai lý	0.52	W	Stem	Construction
<i>Garcinia multiflora</i> Champ. ex Benth.	Độc	0.22	W,C	Fruit, leaves	Food
<i>Garcinia oblongifolia</i> Champ. ex Benth. *+	Bứa	0.23	W	Fruit, leaves	Food
Convolvulaceae	Họ Bìm bịp				
<i>Ipomoea aquatica</i> Foir.	Rau muống	0.99	C	Leaves, stem	Food
<i>Ipomoea batatas</i> (L.) Lam	Khoai lang	0.99	C	Tuber, leaves	Food
Cucurbitaceae	Họ Bầu bí				
<i>Benincasa hispida</i> (Thunb.) Cogn.	Bí xanh	0.27	C	Fruit	Food
<i>Cucurbita maxima</i> Lam. *	Bí đỏ	0.30	C	Fruit	Food
<i>Lagenaria siceraria</i> (Molina) Standley	Bầu	0.26	C	Fruit, leaves	Food
<i>Luffa aegyptiaca</i> M. Roem.	Mướp	0.88	C	Fruit	Food
<i>Momordica charantia</i> L.	Mướp đắng	0.20	C	Fruit	Food
<i>Momordica cochinchinensis</i> (Lour.) Spreng. *	Gấc	0.42	C	Fruit	Food
Dilleniaceae	Họ Sổ				
<i>Dillenia heterosepala</i> Finet & Gagnep.	Lọng bàng	0.10	W	Fruit, stem	Food, firewood
<i>Dillenia indica</i> L. +	Sổ	0.10	W	Fruit, stem	Food, firewood
Dipterocarpaceae	Họ Dầu				

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
<i>Hopea odorata</i> Roxb.	Sao đen	0.56	W	Stem	Construction
<i>Hopea chinensis</i> (Merr.) Hand.-Mazz.+	Sao	0.39	W	Stem	Construction
<i>Parashorea chinensis</i> Wang Hsie +	Chò chỉ	0.81	W	Stem	Construction
<i>Vatica harmandiana</i> Pierre+	Tầu nước	0.54	W	Stem	Construction
<i>Vatica odorata</i> (Griff.) Symington+	Tầu mặt	0.50	W	Stem	Construction
<i>Vatica subglabra</i> Merr.	Tầu xanh	0.20	W	Stem	Construction
Ebenaceae					
<i>Diospyros decandra</i> Lour. *	Họ Thị	0.42	C	Fruit	Food
<i>Diospyros kaki</i> L.f.	Thị	0.33	C	Fruit	Food
Elaeagnaceae					
<i>Elaeagnus bonii</i> Lecomte *	Hồng				
<i>Elaeagnus tonkinensis</i> Serv.	Họ Nhót				
	Nhót	0.18	W	Fruit	Food
	Nhót nhà	0.33	C	Fruit	Food
Euphorbiaceae					
<i>Baccaurea ramiflora</i> Lour. *+	Họ Thầu Dấu				
<i>Bischofia javanica</i> Blume *+	Dầu da đất	0.44	W	Fruit	Food
<i>Breynia fleuryi</i> Beille *	Nhội	0.21	W	Leaves	Food
<i>Euphorbia hirta</i> L. *	Bồ cu vẽ	0.05	W	Leaves	Food
<i>Euphorbia pulcherrima</i> Willd ex Klotzsch	Cỏ sữa	0.10	W	Whole plant	Drink
<i>Macaranga denticulata</i> Mull. Arg.+	Trang nguyên	0.06	W,C	Whole plant	Ornamental
<i>Mallotus paniculatus</i> (Lam.) Mull. Arg.+	Lá nén	0.10	W	Stem	Firewood
<i>Manihot esculenta</i> Crantz	Ba soi	0.38	W	Stem	Firewood
	Sắn	0.80	C	Tuber	Food

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
<i>Phyllanthus emblica</i> L.	Me rừng	0.19	W	Fruit	Food
<i>Sauropus androgynus</i> Merr.	Rau ngót	0.39	C	Stem	Food
<i>Vernicia montana</i> Lour.+	Trầu	0.17	W,C	Fruit	Oil, firewood
Fabaceae	Họ Đậu				
<i>Lablab purpureus</i> (L.) Sweet	Đậu ván	0.29	C	Fruit	Food
<i>Pachyrhizus erosus</i> (Lour.) Merr.	Củ đậu	0.19	C	Tuber	Food
<i>Pueraria phaseoloides</i> Benth.*	Sắn dây	0.33	C	Tuber	Food
<i>Sophora japonica</i> L. *	Hoè	0.21	W,C	Flower, fruit	Drink
<i>Tephrosia candida</i> DC.	Cốt khí	0.16	W,C	Whole plant	Firewood
<i>Vigna radiata</i> (L.) Wilczek.	Đậu xanh	0.42	C	Fruit	Food
<i>Vigna unguiculata</i> (L.) Walp.	Đậu đen	0.45	C	Fruit	Food
Fagaceae	Họ Dẻ				
<i>Castanopsis boisii</i> Hickel & Camus+	Dẻ ăn quả	0.14	W	Fruit, stem	Food, construction
<i>Castanopsis indica</i> A. DC.+	Cà ối	0.13	W	Stem	Firewood, construction
<i>Lithocarpus pseudosundaicus</i> (Hick. & A. Camus) A. Camus+	Sỏi xanh	0.17	W	Stem	Construction
<i>Quercus platycalyx</i> Hick. & A. Camus+	Dẻ cau	0.12	W	Stem	Construction
Flacourtiaceae	Họ Móng quân				
<i>Flacourtia balansae</i> Gagnep.+	Móng quân	0.09	W	Fruit	Food
Hamamelidaceae	Họ Sau sau				
<i>Liquidambar formosana</i> Hance	Sau sau	0.26	W	Leaves, resin	Food, candle

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
Juglandaceae	Họ Hồ đào				
<i>Engelhardtia chrysolepis</i> Hance+	Chẹo tía	0.22	W	Stem	Firewood
<i>Pterocarya tonkinensis</i> Dode	Cối	0.13	W	Leaves	Fishing
Lamiaceae	Họ Hoa môi				
<i>Acrocephalus indicus</i> Kuntze	Nhân trần	0.41	W	Stem, leaves	Drink
<i>Mentha crispa</i> L.	Húng	0.53	C	Leaves	Food
<i>Ocimum basilicum</i> L.	Húng quế	0.42	C	Leaves	Food
<i>Perilla frutescens</i> Britton	Tía tô	0.57	C	Leaves	Food
Lauraceae	Họ Long não				
<i>Actinodaphne obovata</i> Blume+	Song xanh	0.65	W	Stem	Construction
<i>Beilschmiedia poilanei</i> H. Liou+	Cháp	0.04	W	Stem	Construction
<i>Beilschmiedia ferruginea</i> H. Liou+	Cháp xanh	0.16	W	Stem	Construction
<i>Cinnamomum cassia</i> Blume *	Quế	0.50	W, C	Bark	Spice
<i>Lisea cubeba</i> Pers. *	Mãng tang	0.38	W	Leaves, fruit	Spice
<i>Machilus bonii</i> Lecomte+	Kháo vàng	0.40	W	Stem	Construction
<i>Phoebe paniculata</i> Nees+	Kháo nước	0.66	W	Stem	Construction
Lecythidaceae	Lộc vừng				
<i>Barringtonia acutangula</i> (L.) Gaertn.	Lộc vừng	0.04	W, C	Whole plant	Ornamental
Lythraceae	Họ Sang lẻ				
<i>Lagerstroemia calyculata</i> Kurz+	Sang lẻ	0.81	W	Stem	Construction
Magnoliaceae	Họ Ngọc Lan				

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
<i>Manglietia confiera</i> Dandy	Mỡ	0.32	W,C	Stem	Construction
<i>Manglietia fordiana</i> Oliver+	Vàng tâm	0.29	W,C	Stem	Construction
<i>Michelia mediocris</i> Dandy+	Giối xanh	0.84	W	Seed, stem	Spice, construction
<i>Michelia tonkinensis</i> A. Chev.+	Giối bắc bộ	0.24	W	Seed, stem	Spice, construction
Melastomataceae					
<i>Melastoma normale</i> D. Don *	Mua	0.12	W	Stem, fruit	Firewood, Food
<i>Melastoma septemnerium</i> Merr.	Mua đôi	0.28	W	Stem, fruit	Firewood, Food
Meliaceae					
<i>Aglaia spectabilis</i> (Miq.) S.S. Jain & Bennet+	Gội nếp	0.56	W	Stem	Construction
<i>Aphanamixis grandifolia</i> Blume+	Gội trắng	0.53	W	Stem	Construction
<i>Chukrasia tabularis</i> A. Juss.	Lát hoa	0.52	W,C	Stem	Construction
<i>Dysoxylum cauliflorum</i> Hiern+	Đinh hương	0.78	W	Stem	Construction
<i>Melia azedarach</i> L. *	Xoan ta	0.61	C	Stem	Construction
Mimosaceae					
<i>Acacia auriculaeformis</i> A. Cunn. ex Benth.	Họ Trinh nữ				
	Keo lá trăm	0.90	C	Stem	Construction, paper, firewood
<i>Acacia mangium</i> Willd.	Keo Tai tượng	0.87	C	Stem	Construction, paper, firewood
Moraceae					
<i>Anitarius toxicaria</i> Lesch.+	Họ Dầu tằm				
	Sui	0.31	W	Bark, stem	Twine, firewood
<i>Artocarpus heterophyllus</i> Lam.	Mít	0.65	C	Fruit, stem	Food, Firewood
<i>Artocarpus tonkinensis</i> A. Chev. *	Chay	0.16	W,C	Fruit, bark	Food, chewing betel
<i>Broussonetia papyrifera</i> Vent. *	Dướng	0.07	W	Leaves, stem	Firewood, twine

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
<i>Ficus auriculata</i> Lour. *+	Vả	0.23	W	Fruit, stem	Food, firewood
<i>Morus alba</i> L.	Dâu tằm	0.22	C	Fruit	Food
Myrsinaceae	Họ Đon nem				
<i>Embelia laeta</i> Mez	Ngút trắng	0.19	W	Leaves	Food
<i>Embelia oblongifolia</i> (Benth.) Hemsl.	Chua ngút lá dài	0.10	W	Leaves	Food
<i>Maesa balansae</i> Mez	Đon nem	0.11	W	Leaves	Food
Myrtaceae	Họ Sim				
<i>Baeckea frutescens</i> L.	Thanh Hao	0.09	W	Whole plant	Brooms, firewood
<i>Cleistocalyx operculatus</i> Merr. & L.M. Perry	Trám với	0.19	W	Leaves	Drink
<i>Eucalyptus camaldulensis</i> Dehnh. *	Bạch đàn trắng	0.58	C	Stem	Construction, firewood, paper
<i>Psidium guajava</i> L. *	Ổi	0.68	C	Fruit	Food
<i>Rhodomyrtus tomentosa</i> Hassk. *	Sim	0.38	W	Fruit	Food
<i>Syzygium polyanthum</i> Walp. +	Sắn thuyền	0.28	W	Leaves	Food
Oleaceae	Họ Bù Khai				
<i>Erythralium scandens</i> Blume	Bù Khai	0.37	W	Leaves	Food
Opiliaceae	Họ Rau sáng				
<i>Melanthia suavis</i> Pierre+	Rau sáng	0.58	W	Leaves	Food
Oxalidaceae	Họ Chua me				
<i>Oxalis corniculata</i> L. *	Chua me	0.25	W	Whole plant	Food
Piperaceae	Hồ tiêu				
<i>Piper betle</i> L. *	Trầu không	0.53	C	Leaves	Chewing betel

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
<i>Piper lolot</i> C. DC. *	Lá lốt	0.96	W, C	Leaves	Food
Rhamnaceae	Họ Táo				
<i>Ziziphus mauritiana</i> Lam. *	Táo nhà	0.92	C	Fruit	Food
<i>Ziziphus oenoplia</i> (L.) Mill.	Táo rừng	0.42	W	Fruit	Food
Rosaceae	Họ Hoa Hồng				
<i>Rubus alcaefolius</i> Poir.	Mán xôi	0.60	W	Fruit	Food
<i>Rubus cochinchinensis</i> Tratt. *	Ngây	0.36	W	Fruit	Food
Rutaceae	Họ Cam				
<i>Acronychia pedunculata</i> Miq.	Bưởi bung	0.53	W	Fruit	Food
<i>Clausena dunniana</i> H.Lev. +	Hồng bì rừng	0.36	W	Fruit	Food
<i>Clausena indica</i> Oliver+	Mắc mật	0.33	W	Fruit	Food
<i>Clausena lansium</i> Skeels *+	Hồng bì	0.19	C	Fruit	Food
<i>Citrus aurantifolia</i> Swingle	Chanh	0.95	C	Fruit, leaves	Food
<i>Citrus maxima</i> Osbeck	Bưởi	0.81	C	Fruit	Food
<i>Citrus sinensis</i> Osbeck	Cam	0.79	C	Fruit	Food
Sapindaceae	Họ Bồ hòn				
<i>Amesiodendron chinense</i> (Merr.) Hu+	Trường Sàng	0.56	W	Stem	Construction
<i>Dimocarpus longan</i> Lour.	Nhãn	0.96	C	Fruit	Food
<i>Litchi chinensis</i> Sonn.	Vải	0.95	C	Fruit	Food
<i>Mischocarpus pentapetalus</i> Radlk.+	Trường ken	0.15	W	Stem	Construction
<i>Paviesia annamensis</i> Pierre+	Trường mật	0.85	W	Stem	Construction

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
Sapotaceae	Họ Hồng xiêm				
<i>Achras sapota</i> L.	Hồng xiêm	0.19	C	Fruit	Food
<i>Chrysophyllum cainito</i> L.	Vú sữa	0.20	C	Fruit	Food
<i>Pouteria sapota</i> (Jacq.) H. E. Moore & Stearn	Trứng gà	0.50	C	Fruit	Food
Theaceae	Họ Chè				
<i>Camellia amplexicaulis</i> Cohen-Stuart+	Hải đường	0.23	W	Whole plant	Ornamental
<i>Camellia sinensis</i> Kuntze *	Chè	0.94	C	Leaves	Drink
Tiliaceae	Họ Đay				
<i>Microcos paniculata</i> L.+	Cò ke	0.16	W	Stem	Firewood
Ulmaceae	Họ Du				
<i>Trema orientalis</i> (L.) Blume *	Hu đay	0.22	W	Stem	Firewood
Monocotyledons	Lớp Hành				
Alliaceae	Họ Hành				
<i>Allium fistulosum</i> L. *	Hành	0.99	C	Whole plant	Spice, food
<i>Allium sativum</i> L. *	Tỏi	1.00	C	Whole plant	Spice, food
Arecaceae	Họ Cau Dừa				
<i>Areca catechu</i> L. *	Cau	0.56	C	Fruit, stem	Chewing betel, firewood
<i>Calamus balansaeanus</i> Becc.	Mây nước	0.36	W	Stem	Handicrafts
<i>Calamus fabri</i> Becc.	Mây thủ công	0.19	W	Stem	Handicrafts
<i>Calamus platyacanthus</i> Warb. ex Becc.	Song mật	0.36	W	Stem	Handicrafts
<i>Calamus tetractylus</i> Hance	Mây mật	0.79	W	Stem	Handicrafts

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
<i>Caryota mitis</i> Lour. *	Đùng đình	0.21	W	Stem	Handicrafts, food
<i>Cocos nucifera</i> L.	Dừa	0.67	C	Fruit, stem	Food, firewood
<i>Daemonorops longispatus</i> Becc.	Hèo	0.38	W	Stem	Handicrafts
<i>Livistona chinensis</i> (Jacq.) R. Br. & Mart.	Cọ	0.35	C	Leaves, fruit	Oil, roofs
Costaceae	Họ Mía dò				
<i>Costus speciosus</i> (Koenig) Smith	Mía dò	0.36	W	Stem	Food
Dioscoreaceae	Họ Củ nâu				
<i>Dioscorea cirrhosa</i> Lour. *	Củ nâu	0.34	W	Tuber	Food
<i>Dioscorea persimilis</i> Prain & Burk. *	Củ mài	0.19	W	Tuber	Food, to plaster board
Marantaceae	Họ Lá Dong				
<i>Phrynium placentarium</i> (Lour.) Merr.	Lá dong	0.95	W	Leaves	Wrapping cakes
Musaceae	Họ Chuối				
<i>Musa acuminata</i> Colla	Chuối rừng	0.21	W	Fruit, flower bud, stem	Food
<i>Musa balbisiana</i> Colla	Chuối hột	0.39	C	Fruit, flower bud, stem	Food
<i>Musa basjoo</i> Sieb.	Chuối ngự	0.97	C	Fruit, flower bud, stem	Food
<i>Musa paradisiaca</i> L.	Chuối tiêu	0.94	C	Fruit, flower bud, stem	Food
Orchidaceae	Họ Phong lan				

Scientific name	Common name	Use index	Wild/ Cultivated	Part utilized	Use
<i>Cymbidium lowianum</i> Reichb.f.	Phong lan	0.06	W	Whole plant	Ornamental
<i>Dendrobium aloideum</i> La Llave & Lex.	Hoàng thảo	0.01	W	Whole plant	Ornamental
Phormiaceae	Họ Hương bài				
<i>Dianella nemorosa</i> Lam. *	Hương bài	0.04	W	Whole plant	Incense
Poaceae	Họ Cỏ				
<i>Arundinaria sat</i> Balansa	Sắt	0.50	W	Stem	Firewood
<i>Bambusa blumeana</i> Schult. f.	Tre gai	0.41	C	Stem, shoot	Construction, food, tools
<i>Cymbopogon citratus</i> Stapf*	Sả	0.51	C	Tuber	Food
<i>Dendrocalamus barbatulus</i> Hsueh & D.Z.Li	Luồng	0.78	C	Stem, shoot	Paper, construction, food, tools
<i>Indosasa angustata</i> McClure	Vầu dăng	0.37	W	Stem, shoot	Food, construction
<i>Indosasa sinica</i> C.D. Chu & C.S.Chao	Vầu ngọt	0.33	W	Stem, shoot	Food, construction
<i>Panicum miliaceum</i> L.	Kê	0.36	C	Seed	Food
<i>Saccharum officinarum</i> L.	Mía	0.96	C	Stem	Food
<i>Schizostachyum funghomii</i> McClure	Nứa	0.99	W	Stem, shoot	Making paper, food, tools
Zingiberaceae	Họ gừng				
<i>Curcuma longa</i> L. *	Nghệ	0.97	C	Tuber, leaves	Spice, food
<i>Curcuma zedoaria</i> Rosc.*	Nghệ đen	0.39	W,C	Tuber	Spice, food
<i>Zingiber officinale</i> Rosc. *	Gừng	0.99	C	Tuber	Spice, food

APPENDIX 4.2
Commercial useful plant species in Ben En National Park

Scientific name	Abundance in the wild or cultivated	Intensity of collection	Price in US\$	Income/ household/ year in US\$	Market demand
Anacardiaceae					
<i>Dracontomelon dao</i> (Blanco) Merr. & Rolfe	Cultivated		Not stable	0.5	Medium
<i>Mangifera indica</i> L.	Cultivated		0.07/2fruits	0.6	Medium
<i>Spondias lakoensis</i> Pierre	Cultivated		Not stable	0.1	Medium
Annonaceae					
<i>Annona squamosa</i> L.	Cultivated		0.07/3 fruits	0.6	Medium
Araliaceae					
<i>Schefflera alpina</i> Grushv. & Skvorts.	High	Medium	Not stable	0.2	Medium
<i>Schefflera octophylla</i> Harms	High	Medium	0.28/kg	1	Medium
Burseraceae					
<i>Canarium album</i> Ruesch.	Medium	High	0.07/kg fruit 1.3/kg resin	2.9	Medium High
<i>Canarium tonkinensis</i> L.	Medium	High	1.3/kg resin	1.2	High
<i>Canarium trandenum</i> Chan Dinh Dai & Yakovlev	Medium	High	1.3/kg resin	1.1	High
Caesalpiniaceae					
<i>Gleditsia australis</i> Hemsl. ex Forb. & Hemsl.	Low	Medium	0.07/4 fruits	0.2	Medium
<i>Tamarindus indica</i> L.	Low	High	0.07/6 fruits	0.2	Medium
Clusiaceae					
<i>Garcinia cowa</i> Roxb.	Low	Medium	0.07/5 fruits	0.5	Medium

Scientific name	Abundance in the wild or cultivated	Intensity of collection	Price in US\$	Income/ household/ year in US\$	Market demand
<i>Garcinia multiflora</i> Champ. ex Benth.	Medium	Medium	0.07/4 fruits	0.8	Medium
Ebenaceae					
<i>Diospyros decandra</i> Lour.	Cultivated		0.07/6 fruits	0.8	Medium
<i>Diospyros kaki</i> L.f.	Cultivated		0.07/6 fruits	1.0	Medium
Euphorbiaceae					
<i>Vernicia montana</i> Lour.	Medium	High	0.17/kg fruit	0.2	Medium
Lamiaceae					
<i>Acrocephalus indicus</i> Kuntze	Medium	Medium	Not stable	0.2	Medium
Moraceae					
<i>Artocarpus tonkinensis</i> A. Chev.	Medium	High	Not stable	0.2	Medium
<i>Artocarpus heterophyllus</i> Lam.	Cultivated		0.28/fruit	0.6	Medium
Myrtaceae					
<i>Baeckea frutescens</i> L.	Medium	Medium	Not stable	0.3	Medium
<i>Psidium guajava</i> L.	Cultivated		0.07/4 fruits	1.0	Medium
Olacaceae					
<i>Erythralum scandens</i> Blume	High	Medium	Not stable	0.2	Low
Opiliaceae					
<i>Melanthia suavis</i> Pierre	High	Medium	0.14/kg	0.5	Medium
Rutaceae					
<i>Citrus aurantifolia</i> Swingle	Cultivated		0.07/5 fruits	0.5	Medium

Scientific name	Abundance in the wild or cultivated	Intensity of collection	Price in US\$	Income/ household/ year in US\$	Market demand
<i>Citrus maxima</i> Osbeck	Cultivated		0.14/ fruits	0.6	Medium
<i>Citrus sinensis</i> Osbeck	Cultivated		0.07/3 fruits	0.8	Medium
Sapotaceae					
<i>Achras sapota</i> L.	Cultivated		0.07/5 fruits	0.5	Medium
<i>Chrysophyllum cainito</i> L.	Cultivated		0.07/5 fruits	0.7	Medium
<i>Pouteria sapota</i> (Jacq.) H. E. Moore & Stearn.	Cultivated		0.07/5 fruits	0.8	Medium
Liliopsida					
Arecaceae					
<i>Calamus balansaeanus</i> Becc.	Low	Medium	0.17/kg	1.0	Medium
<i>Calamus faberi</i> Becc.	Low	Medium	0.17/kg	1.2	Medium
<i>Calamus tetradactylus</i> Hance	Low	Medium	0.17/kg	2.6	Medium
Dioscoreaceae					
<i>Dioscorea cirrhosa</i> Lour.	High	Low	Not stable	0.3	Low
<i>Dioscorea perstimilis</i> Prain & Burk.	High	Low	Not stable	0.4	Low
Marantaceae					
<i>Phrynium placetarium</i> (Lour.) Merr.	High	Medium	0.28/100 leaves	2.7	Medium
Poaceae					
<i>Indosasa sibata</i> C.D.Chu & C.S.Chao	Medium	High	0.2/fresh kg (Bamboo shoot)	2.0	High
<i>Indosasa sibataeoides</i> McClure	Medium	High	0.2/fresh kg (Bamboo shoot)	1.8	High
<i>Schizostachyum funghomii</i> McClure	High	High	1.1/dried, 0.17 fresh kg (Bamboo shoot) 0.0014/trees	13	High

HUMAN AND ENVIRONMENTAL INFLUENCE ON PLANT DIVERSITY IN BEN EN NATIONAL PARK, VIETNAM

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ABSTRACT

In order to understand the influence of human disturbance and the physical environment on plant biodiversity in Ben En National Park, Vietnam, we analyzed species composition and density in forest plots with diverse soils and varying degrees of human disturbance. Soil factors significantly influenced tree species composition, although they only explained 5.7% of the observed data variance. Human factors (disturbance) were second most important in explaining species composition and density, accounting for 4.4% of variance. Changes in species composition related to human disturbance varied mostly independently of soils. The species composition of slightly and heavily disturbed forest differed significantly, with species of low conservation value being most common in heavily disturbed forest, while endangered species and important timber trees were most common in least disturbed forest. Density of treelets was higher in limestone forest than in non limestone forest. Timber trees and useful plants were more abundant in the less disturbed plots, which were located far away from villages and roads. Basal area in less disturbed forest was also larger than in heavily disturbed forest, indicating that the pressures of illegal logging and harvesting are closely connected to travel distances to nearest villages. Limiting the accessibility to forest resources should therefore be a priority in forest conservation as a first step to safeguard the park's rich biodiversity and stocks of useful plants.

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Key words: Biodiversity conservation, disturbance, human impact, plant diversity, soils.

INTRODUCTION

Human disturbance affects plant populations and can modify interactions among species within communities (Huston 1994; Acharya 1999). Habitat loss, fragmentation, and degradation are currently the most important threats to biodiversity (Primack 1993). However, human activities are highly variable in their influence on biodiversity (Putz et al. 2000). For example, numerous studies have shown that logged-over forests retain much of their original biodiversity despite the severe damage that logging can inflict on the forest ecosystem (Whitmore & Sayer 1992; Cannon et al. 1998; Meijaard et al. 2005).

Several interactions between human disturbance, environmental factors and plant diversity have been reported. For example, in logged or burnt forests, light levels are increased, while tree density is reduced (Cannon et al. 1998; Utterra et al. 2000; Eichhorn & Slik 2006). The increased light levels usually result in the occurrence of many woody pioneers and herbaceous species, which in some cases, i.e. logged forests, positively influence diversity indices although the “quality” of the biodiversity is negatively affected (Fredericksen & Mostacedo 2000; Pinard et al. 2000; Eichhorn & Slik 2006). Therefore, identification of factors related to human disturbance that affect biodiversity and forest vegetation structure is important because it might enable us to change to less destructive forest management types (Pickett 1995).

Within diverse tropical forests there is also evidence that variation in environmental factors, such as soil nutrients, canopy openness, slope, and herb cover affect the distribution of tree species and forest composition (Duivenvoorden 1995; Potts et al. 2002). However, environmental factors can have a differential effect on plant diversity and forest composition (Potts et al. 2002). For example, soil factors and mean annual rainfall are more strongly related with floristic composition when compared with topography in lowland forests (Baillie et al. 1987; Potts et al. 2002; Slik et al. 2003; Eichhorn & Slik 2006).

Ben En National Park is one of 30 National Parks in Vietnam. It was established in 1992 to conserve the rich, but seriously threatened biodiversity of the country. The Park is inhabited by 18,000 local people belonging to five ethnic groups: Kinh, Muong, Thai, Tay, and Tho, who continue to exert a strong influence on the natural environment. Illegal logging and harvesting of Non Timber Forest Products (NTFP) by both local people and people from outside the National Park continues (Tordoff et al. 2000; Hoang et al. 2008 a). The park has strongly contrasting soil types and one of the challenges is therefore to disentangle effects of soils and human disturbance on species composition.

In this study we focus on the following questions: Can human influences on species composition be separated from environmental factors, and if so, how do both affect

plant diversity and composition in Ben En National Park? Answers to these questions will be relevant for developing a sustainable management plan for Ben En and other National Parks in Vietnam.

RESEARCH AREA

Ben En National Park is situated in the Nhu Thanh and Nhu Xuan districts of the Thanh Hoa province in Vietnam ($19^{\circ} 30' - 19^{\circ} 40' \text{ N}$; $105^{\circ} 21' - 105^{\circ} 35' \text{ E}$ (Fig. 5.1)). The Park is situated in a region of low hills surrounding an artificial lake. Altitude ranges from 20 to 497 m, with most areas being below 200 m. The lake is 50 m above sea level and covers 2,281 ha. Small areas of limestone are also present (Tordoff et al. 2000). Soils in Ben En National Park are mainly ferralitic, while a small area around Lake Muc has alluvial soils (Anonymous 2000).

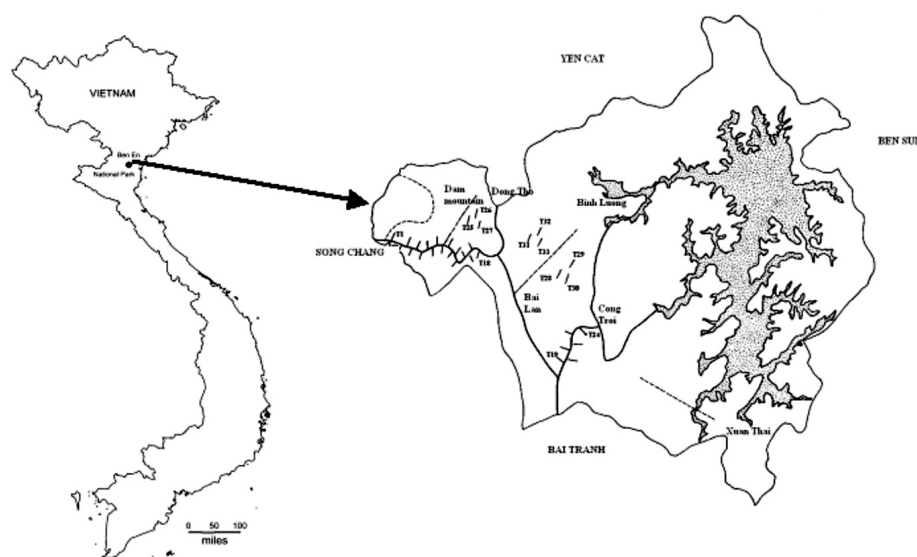


Fig. 5.1. Map of Ben En National Park in Vietnam (inset – lakes are in grey; line transects are drawn in).

The core zone of the National Park covers 15,800 ha, while the buffer zone covers ca. 12,000 ha. The Ben En area was designated for the protection of fauna in 1979, changed to a Nature Reserve status in 1986, and to National Park status in 1992. Major parts of the forest in Ben En National Park have been impacted by man (Khoi 1996; Hoang et al. 2008 a). The forests were commercially logged as late as 1992, and small-scale, illegal logging continues to this date (Tordoff et al. 2000; Hoang et al. 2008 a & c). Ben En National Park is estimated to have a total species number of vascular plants of ca. 1600 (Hoang et al. 2008 a). In a previous study 1389 vascular plant species were recorded, belonging to 650 genera and 173 families (Hoang et al. 2008 a).

METHODOLOGY

Plot inventory

For this study we established transects and plots in forest areas along the old logging road as well as in the forest interior (Fig. 5.1). No agricultural lands and shrublands were included. In total we established 33 transects, each 200 m long. Twenty-four of these transects were placed at 250 m intervals at right angles along the old logging road from the Song Chang forest ranger station to Cong Troi, while nine transects were established in the slightly disturbed forest interior (Fig. 5.1). The total length of these transects combined was ca. 7.4 km. Along each transect we established four 10 x 10 m plots at 40 m intervals, starting 50 m from the old logging road. This resulted in 132 plots for all 33 transects combined. In the 132 plots (10 x 10 m) all trees with a dbh ≥ 5 cm were identified and their diameter measured. All treelets with a dbh < 5 cm, and $h \geq 1$ m high were identified and their diameter measured in 5 x 5 m subplots within each 10 x 10 m plot. The data collected in each transect (four plots) were combined to so-called 0.04 ha plots to get a large enough sample size for subsequent statistical analyses.

In each 10 x 10 plot, we measured the percentage herb cover, canopy openness, slope, GPS-coordinates, noted the number of stumps, number of footpaths, and presence of limestone (Hoang et al. 2008 a). The distances used in this paper represent the shortest average distance (measured along the logging road and forest trails) to the four nearest villages. Inhabitants from 4 of these villages (Binh Luong, Xuan Binh, Hoa Quy, Xuan Quy) (Fig. 5.1) illegally log timber and harvest non timber forest products in the research area.

Light availability in the 10 x 10 m plots was determined with the use of hemispherical photographs taken at 1.5 m height in a north-south direction in the centre of each plot. Canopy openness was then calculated using WINPHOT (Ter Steege 1996). Plot slopes were measured with a clinometer (Brunton Clino Master). Percentage herb cover was estimated in each 10 x 10 m plot. Canopy openness, slope and herb cover values of the plots were calculated by averaging the values of the four plots.

Soil samples were collected between 0 and 30 cm depth from a single location in the centre of each plot by using an auger with a diameter of 3 cm. Soils were analyzed at the Vietnam Forestry University, Vietnam following the Chin methods (Chin 2000; Le 2001). Total Ca, Mg, N, C, pH and exchangeable NH_4 were determined. To analyze the relation between soil factors and plant diversity, soil data of the four plots in each transect were averaged.

Vouchers were collected of all plant species in the plots. One voucher of each specimen was deposited in the herbarium of the Vietnam Forestry University (VFU),

additional vouchers were sent to the National Herbarium of the Netherlands (L) and to various specialists for identification.

Data analysis

A total of 245 tree species ($\text{dbh} \geq 5 \text{ cm}$), and 251 species of treelets ($\text{dbh} < 5 \text{ cm}$, and $h \geq 1 \text{ m}$ high, including juvenile stages of 146 of the 245 tree species) were recorded in the plots. For each plot the density of trees, treelets, tree basal area, and Fisher's-Alpha were calculated (Fisher et al. 1943; Taylor et al. 1976). The usefulness of the plant species and importance of timber trees in Ben En National Park was determined by using standard Participatory Rural Appraisal (PRA) techniques (PID & NES 1989; Ngai 2001), and Use Index (UI) (Hoang et al. b & c). A total of 54 useful plant species and 15 important timber trees were found within the plots (Hoang et al. 2008 c).

The Red list species in Ben En National Park were identified based on the Red Data Book of Vietnam (Ban 2007), IUCN (2006), and frequency of trees and stumps found during the field inventory (Hoang et al. 2008 a, b & c).

A Canonical Correspondence Analysis (CCA) was used to see which variables best explained the differences in species composition, be it environmental or human (Ter Braak 1986; McCune & Mefford 1999). CCA is a constrained ordination technique, where the ordination axes represent a relationship between species and environmental data (Press & Wilson 1978). This analysis was done with PCORD 5, using the abundance matrix of tree species in the plots, in order to determine how environmental and human variables were related to differences in tree species composition between the plots. If certain CCA axes are significantly related to human or environmental factors, they can be used as proxy for disturbance or environmental gradients.

The CCA analysis was also used to determine species that were significantly affected by human impact and environmental variables (indicator species). Simple regression analysis (SPSS 16) was used to determine whether a species was significantly correlated with a CCA axis. Only species with more than 5 stems were used in the correlation analysis. Simple regression analysis was also used to examine whether and how the human and environmental variables were related to plot data for trees, treelets, useful plants and important timber trees. One way ANOVA analysis was used to test whether the density of trees, useful plants, important timber trees, and endangered species were different between slightly and heavily disturbed forest. The slightly and heavily disturbed forests were distinguished by their physiognomy (number of vegetation layers, presence of big trees) and the frequency of stumps and foot paths found in the plots (Hoang et al. 2008 a). In the slightly disturbed forest there were no or very few stumps and foot paths. In heavily disturbed forest stumps and foot paths were common (2 to 5 stumps and more than 1 foot path in each 0.04 ha plot) (Hoang et al. 2008 a).

RESULTS

Influence of human and environmental variables on tree composition in Ben En National Park

The first CCA axis explained 5.7% of data variance and was mainly determined by soil variables (Fig. 5.2). The second CCA axis explained 4.4% of data variance and was mainly determined by human impact variables. Tree species composition in the plots was therefore more strongly correlated with soil factors than with human disturbance. Especially Ca, Mg, pH and NH₄ were important correlates. Human impact variables were almost exclusively correlated with CCA axis 2; these were mostly independent of soil variables. Since the distance to villages, number of stumps, and number of footpaths were strongly correlated with CCA axis 2, we used this axis as our human impact proxy for the remainder of our forest disturbance analyses. The slightly disturbed and heavily disturbed forest types are clearly recognizable along this axis in Fig. 5.2.

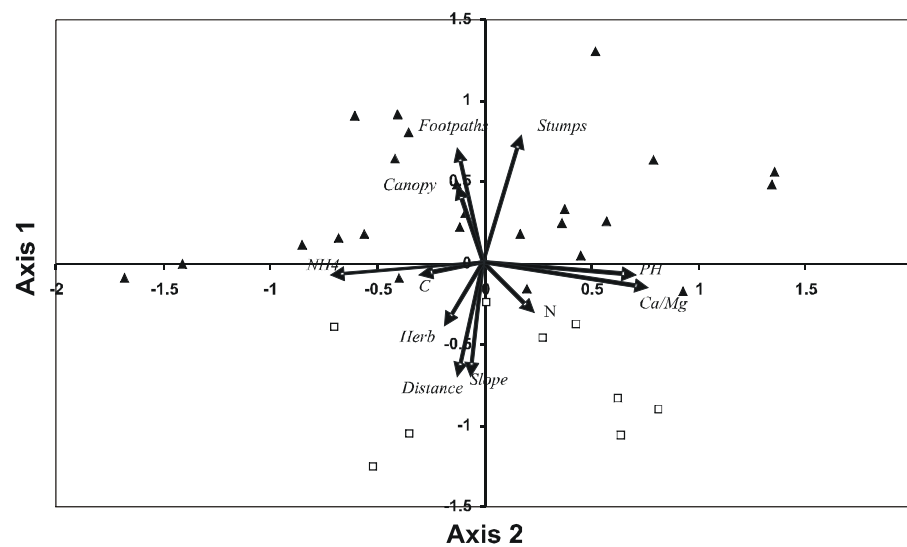


Fig. 5.2. Canonical Correspondence Analysis (CCA) showing the plots and environmental variables. The first axis explains 5.7% of the variance present in the data; the second axis explains 4.4% of the data variance. The slightly disturbed (white squares) and heavily disturbed (black triangles) forest types are well separated along axis 2.

Since soil factors, especially Ca, Mg, pH and NH₄ were strongly correlated with species composition along CCA axis 1 in the Park we used this axis as environmental axis. There were nine species with a strong and significant correlation with axis 1 (Table 5.1); of these, four species were positive indicators for limestone forest, while five species were indicators for forest on acidic, and non limestone soils (Table 5.1).

Table 5.1. Soil type indicator species in Ben En National Park

Name of species	Axis 1	Number of stems per 0.04 ha	Correlation coefficient (r)	P Value
Limestone indicators				
<i>Callicarpa macrophylla</i> (Verb)	1.894	6	0.95	0.025
<i>Garcinia fagraeoides</i> (Clus)	1.369	5	0.98	0.026
<i>Vatica odorata</i> (Dipt)	1.079	5	0.93	0.012
<i>Callicarpa dichotoma</i> (Verb)	1.032	8	0.87	0.027
Acidic soil and non limestone indicators				
<i>Schefflera octophylla</i> (Aral)	-2.374	10	-0.85	0.034
<i>Syzygium wightianum</i> (Myrt)	-1.755	23	-0.74	0.002
<i>Canarium tramdenum</i> (Burs)	-1.571	30	-0.75	0.001
<i>Erythrophleum fordii</i> (Caes)	-1.292	59	-0.55	0.005
<i>Randia pycnantha</i> (Rub)	-1.239	8	-0.92	0.015

Six species had a strong and significant correlation with CCA disturbance axis 2; two of these indicated heavily disturbed forest, while four species were indicators of slightly disturbed forest (Table 5.2).

Table 5.2. Indicator species for forest disturbance in Ben En National Park

Name of species	Axis 2	Number of stems per 0.04 ha	Correlation coefficient (r)	P Value
Disturbance indicators				
<i>Claoxylon indicum</i> (Euph)	1.523	6	0.97	0.026
<i>Microcos paniculata</i> (Til)	1.259	16	0.89	0.012
Indicators of low disturbance forest				
<i>Diospyros montana</i> (Eben)	-2.235	5	-0.98	0.046
<i>Melientha suavis</i> (Opil)	-1.364	11	-0.74	0.029
<i>Heritiera macrophylla</i> (Stere)	-1.253	7	-0.88	0.023
<i>Actinodaphne obovata</i> (Laur)	-1.190	43	-0.59	0.007

Human impact on plant diversity in Ben En National Park

The density of trees, useful plants, and tree basal area were negatively correlated with human impact (Fig. 5.3 a-d). However, there were no significant correlations between disturbance factors and Fisher's alpha diversity indices of trees and treelets,

density of treelets, and number of treelet species in our plots (data not shown). The number of stumps found in each plot abruptly declined over 6 km away from the villages (Fig. 5.4). Although Fig. 5.4 shows total absence of stumps in these distant plots, we did find occasional stumps outside the plots in these remote areas.

The CCA analysis showed that soil factors had a strong correlation with plant composition in Ben En National Park (Fig. 5.2). Our analysis also showed that there was no significant correlation between soil factors, density of trees (including important timber tree species), useful plants and tree basal area in the 0.04 ha plots. However, soil factors had a strong correlation with treelet stem density, with highest treelet density in limestone forests (Fig. 5.5).

Soil variables also showed a very weak but significant correlation with Fisher's alpha index for tree species.

Canopy openness was not significantly correlated with treelet density. However, there was a weak but significant correlation with basal area, and tree density (Fig. 5.6 & 5.7).

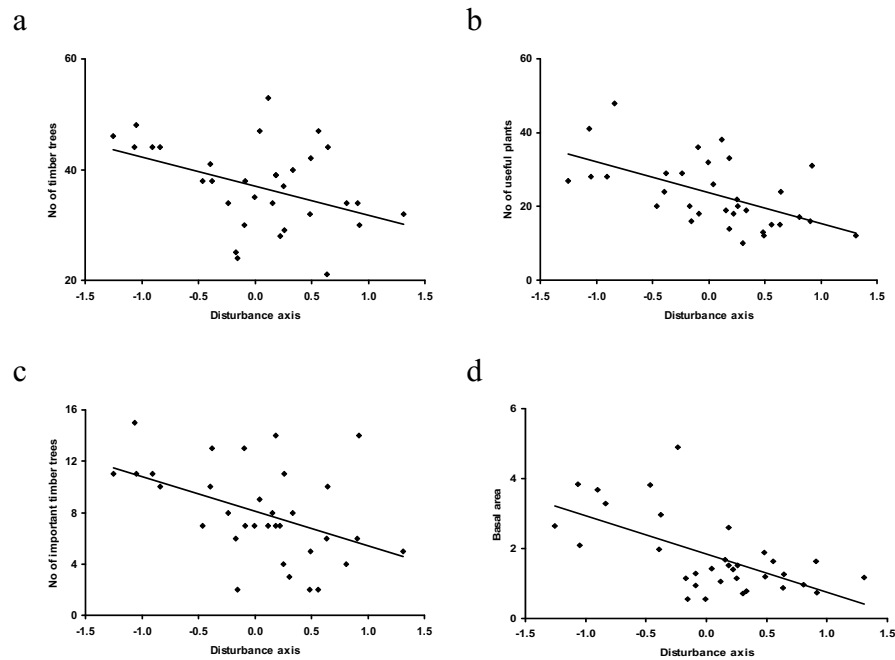


Fig. 5.3. Relation between disturbance CCA axis II and (a) tree density in the 0.04 ha plots; $R^2 = 0.16$; $P < 0.05$; (b) density of useful plants in the 0.04 ha plots; $R^2 = 0.31$; $P < 0.001$; (c) density of important timber trees in the 0.04 ha plots; $R^2 = 0.21$; $P < 0.01$; (d) tree basal area in the 0.04 ha plots; $R^2 = 0.38$; $P < 0.001$ (disturbance increases from left to right).

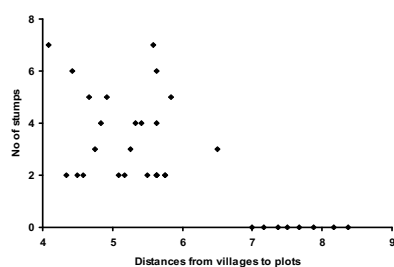


Fig. 5.4. Relation between the number of stumps per 0.04 ha plot and distance from villages to plots.

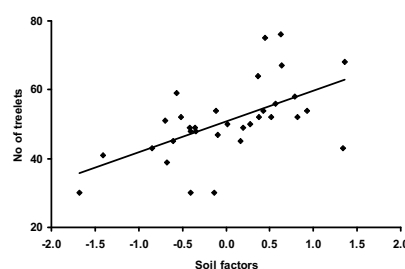


Fig. 5.5. Relation between soil CCA axis 1 and treelet density in the 0.04 ha plots: $R^2 = 0.33$; $P < 0.001$ (left to right indicates decreasing soil acidity and increasing occurrence of limestone).

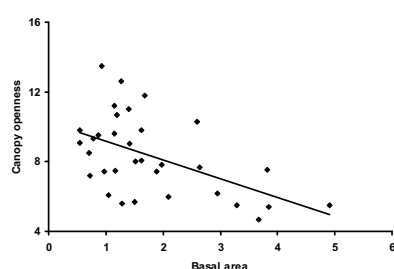


Fig. 5.6. Relation between canopy openness and tree basal area in the 0.04 ha plots: $R^2 = 0.27$; $P < 0.001$.

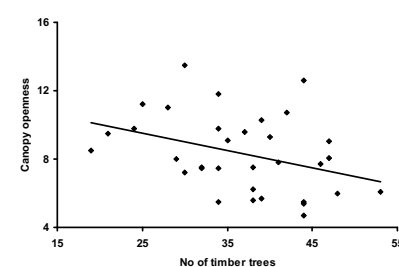


Fig. 5.7. Relation between canopy openness and tree density in the 0.04 ha plots: $R^2 = 0.13$; $P < 0.001$.

DISCUSSION

Human and environmental impact on plant diversity and composition in Ben En National Park

Our CCA analyses showed that soil is the most important factor for forest composition in Ben En National Park, even more important than the influence of human disturbance (Fig. 5.2). This is doubtlessly because Ben En National Park has strongly contrasting soil types: limestone on the one hand and ferrallitic/alluvial soils of varying acidity on the other. The special characteristics of limestone floras in terms of species composition and forest structure have been well documented for several regions in Southeast Asia (Whitmore 1984; Vidal 2000; Lan et al. 2006). Soil factors, especially Ca and Mg are also important factors for forest composition

in Ben En National Park, which corresponds to findings in forests of North Borneo (Davies et al. 2005; Potts et al. 2002).

The two axes in the CCA only explain 10.1% of data variance. The low percentage of explanation of human and environmental factors on forest composition in Ben En National Park might be due to the fact that the inventory did not include very heavily disturbed shrublands, and bamboo forest. When those areas would have been included the explanatory power of the disturbance CCA axis would doubtlessly have been much higher. Low percentages of explanation of forest composition gradients by environmental parameters are not uncommon in tropical forests. For instance in an Amazonian forest, environmental factors (drainage, flooding, humus forms, and soil nutrient status) only explained 6.2 % of data variance by the first two canonical axes (Duivenvoorden 1995). In addition, plots that we surveyed were relatively small (0.04 ha) and, since many tropical tree species are rare, most species were only represented by a few individuals. This means that our analysis includes much random statistical noise since it is impossible to determine habitat preference for species with four or fewer individuals.

While the impact of human disturbance on the species composition in the forest appears to be limited (Fig. 5.2), its impact on tree density and basal area is considerable (Fig. 5.3). We observed a 13.4% decline in density of all trees (both timber trees and treelets), 16.7% in timber trees, 30% in useful plants, 30.8% in endangered species, and 36.4% in important timber trees. This is comparable to selectively logged forests elsewhere in the tropics, where basal area and density of trees are much reduced (Kao & Iida 2006). It must therefore be feared that without appropriate measures plant resources will become depleted in the future, also in the areas further away from villages, if illegal harvesting continues. Despite the large impact of disturbance on tree densities and basal area, human disturbance had no significant correlation with Fisher's alpha for tree species. This is an indication that the human disturbance seems not to affect relative species abundances much in the forests of Ben En National Park. Comparable findings were reported by Slik et al. (2002) in forests of Kalimantan where Fisher's alpha index in selectively logged forest did not differ significantly from undisturbed forest and even increased over time, even though tree density was strongly reduced by logging.

Two out of the four indicator species for low disturbance forest are listed in the Red List of Ben En National Park: *Actinodaphne obovata* (Lauraceae) and *Melientha suavis* (Opiliaceae) (Table 5.2; Hoang et al. 2008 a). In addition to that, *Actinodaphne obovata* (Lauraceae) is an important timber tree species. In contrast, none of the species indicating disturbance is listed in the Red Data Book of Vietnam and the Red List species in Ben En National Park, and none of them are important timber trees. Indeed, the number of Red List species in the Park has a significant negative correlation with the disturbance CCA axis (Fig. 5.8), emphasizing the conservation value of slightly disturbed forests in the area.

Soil factors were not significantly correlated with tree density, number of species and Fisher's alpha index in Ben En National Park. However, the density of treelets is higher on limestone soils than on other soil types (Fig. 5.5). This conforms to results from tropical forests in Sarawak and New Guinea, where the number of shrubs and treelets was also found to be higher on limestone (Whitmore 1984; Chapman & Wang 2002). This is apparently caused by a deficiency in certain plant nutrients, and poor water retention of limestone substrates (Whitmore 1984).

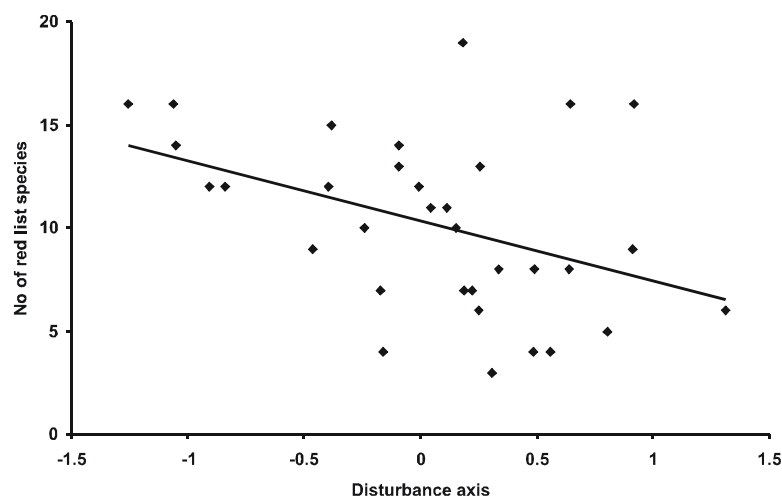


Fig. 5.8. Relation between disturbance CCA axis and density of Red list species in the 0.04 ha plots; $R^2 = 0.18$; $P < 0.05$.

CONCLUSION

Soil types and human disturbance have a significant effect on forest composition in Ben En National Park. Human disturbance had a strong negative impact on forest structure, leading to lowered densities of timber trees, useful plants, especially important timber trees, and Red list species. Disturbance levels decreased with distance to villages, indicating that the pressures of illegal logging and harvesting are closely connected to accessibility and transport costs. Prevention of forest conversion is urgently needed, by strict law enforcement within the Park to protect the important timber trees and endangered species before they become locally extinct. Reforestation and ecosystem restoration in the heavily disturbed forests and shrublands should be the next steps.

SUMMARY AND RECOMMENDATIONS

This study concerns the plant species diversity of Ben En National Park in Vietnam - its history and current status, the uses of many local plant species still being made by the indigenous population, and the impact thereof on the conservation status of the flora. Ben En National Park was established in 1992 in a former timber concession. With a core zone covering 15,800 ha and a buffer zone of 12,000 ha, it constitutes one of the 30 National Parks in Vietnam.

The botanical inventory was carried out from 2005 - 2007 and consisted of general collecting throughout the core zone of the park and complete inventories of all woody plants in 147 10 x 10 m plots in slightly and heavily disturbed forests along transects that would allow to study the effects of accessibility by local people and of contrasting soil types on species composition and forest structure. Soil samples from all the plots were chemically analyzed. Information on plant use was obtained by completing extensive questionnaires for 135 households in three villages in the park, from village elders and forest rangers, and from recording all traces of plant collecting (such as stumps resulting from illegal logging) in the 147 plots.

Floristic diversity (Chapter 2) - Based on our own and earlier inventories in Ben En National Park, the total species number of vascular plant species is about 1600. In our survey 1389 vascular plant species were recorded, belonging to 650 genera and 173 families. Three species are new to the flora of Vietnam: *Myristica yunnanensis* Y.H. Li (Myristicaceae), *Glyptopetalum sclerocarpum* (Kurz) M.A Lawson, (Celastraceae), and *Timonius arborea* Elmer (Rubiaceae). Seven families, 43 genera and 252 species are new records for the flora of Ben En National Park. Euphorbiaceae constitute the most diverse family with 113 species, while 47 families are represented with one species only. As for the life form of plant species in Ben En, phanerophytes are the dominant component (76% of all species), with chamaephytes (6%), hemicryptophytes (8.5%), cryptophytes (6%) and therophytes (4%) constituting minor proportions of the local flora.

Vegetation types (Chapter 2) - Major parts of the forest in Ben En National Park have been impacted by man. The forests were commercially logged as late as 1992, and small-scale, illegal logging continues to this date. Three man-made ecosystems are present on 29% of the surface area of the core zone: 1) agricultural fields, about 650 ha; 2) plantation forests, about 110 ha; 3) mixed bamboo and timber tree stands, about 3800 ha. Two main natural vegetation types are recognized with heavily and slightly disturbed subtypes, depending on the intensity of plant use and illegal

logging by the local population (truly undisturbed, virgin forest is limited to a small inaccessible limestone area in the Park, and could not be included in this study).

1) Tropical evergreen limestone forest (subtypes: slightly disturbed, heavily disturbed, and shrubland on limestone). 2) Tropical evergreen lowland forest on other soils (mainly ferrallitic, and in a small area on alluvial soil). Subtypes: slightly disturbed forest on ferrallitic or alluvial soil, heavily disturbed forest on ferrallitic soil, and shrubland vegetation outside the limestone hills.

Conservation status (Chapter 2) - A total of 29 plant species occurring in Ben En National Park are listed in the red data list of IUCN (2006), and 42 species are listed in the Red Data Book of Vietnam (2007), which recognizes a total of 448 endangered species. However, on the basis of our plot inventories and interviews with local people and forest rangers, 89 species (including 45 useful plants) were found to be endangered locally.

Useful plant species (Chapters 3 and 4) - A total of 386 plant species are used by local people in Ben En National Park, 52 of these species have more than one application. Medicinal plant species predominate among these useful plants with 230 species, belonging to 200 genera and 84 families, altogether used for the treatment of 68 different diseases (Chapter 3). These include species that are collected in the wild (65%) as well as species grown in home gardens. Leaves, stems and roots are most commonly used either fresh or dried or by decocting the dried parts in water. Women are mainly responsible for health care; they have better knowledge of medicinal plants than men, and also collect them more than men at almost every age level. The indigenous knowledge of traditional medicinal plants may be rapidly lost because 43% of the young generation do not know or do not want to learn about medicinal plants, and the remainder knows little about them. Moreover, local people increasingly tend to use western medicine. The majority of medicinal species are used by less than half of the households, and 68 % of the medicinal plant species are used by less than 25% of the households. A comparison of traditional uses of medicinal plants in Ben En National Park with traditional uses elsewhere in Southeast Asia and the Indo-Pacific region shows that the same species may be used for widely different treatments by different ethnic groups.

A total of 208 plant species are used for non-medicinal purposes (Chapter 4). Most species are used for food. In contrast with medicinal plants, men are collecting non-medicinal plants more often than women. A total of 56 useful plant species are commercialized and contribute 23% of the average income of individual households. Bamboo shoots of *Schizostachyum funghomii* (Poaceae), chipped stems of *Spatholobus suberectus* (Fabaceae), and seeds of *Amomum villosum* (Zingiberaceae) are the most important for income generation. The monetary equivalent of non-commercialized useful plants probably far exceeds the value of the traded plant products. Plant use is independent of the ethnicity of the different populations living in the Park. Larger households make use of a greater variety of useful plant species than small families. Abundant species in the forest have a higher use index (UI) than less common species ($UI = U_s/N$. Where U_s is the number of households which mentioned a use for species s ; N is the total of households that were interviewed in

the research area). The current use patterns are not sustainable and would lead to local extinction of rare and endangered species if no additional conservation measures are introduced.

Human and environmental influences on plant diversity (Chapter 5) - Human disturbance had a strong negative impact on forest structure, leading to lowered densities of trees (especially important timber tree species) and useful plants, even though species diversity was not greatly altered. Soil factors significantly influence tree species composition although mineral composition of the soil only explains 5.7% of the observed data variance. Human factors (disturbance factors) are the second most important in explaining forest structure and species composition, accounting for 4.4% of data variance. Changes in species composition related to human disturbance varied independently of soils. The species composition of slightly and heavily disturbed forest differed significantly. Density of small trees was higher in limestone forest than in non limestone forest.

Timber trees and useful plant species, especially important timber trees, are more abundant in the less disturbed plots which were located far away from villages and roads. The number of endangered species is also more abundant in the less disturbed forest plots compared to heavily disturbed forest. Basal area in less disturbed forest was larger than in heavily disturbed forest. The pressures of illegal logging and harvesting are closely connected to travel distances to the nearest villages.

Recommendations and future outlook

Despite the fact that many forest areas in Ben En National Park have been and still are disturbed by local people, the plant diversity is still very high and worth conserving. Special measures are urgently needed to reverse the effects of disturbance by stopping illegal harvesting. In order to reduce the human pressures on the forest resources, and to conserve both plant biodiversity and traditional knowledge of local people on sustainable plant uses, more support is needed for local people living in the core zone of the Park, both financially and in teaching plant cultivation skills. More research is needed on the conservation status of endangered and utilised species in relation to the collecting activities of the inhabitants of the Park. Special research on the impact of local people on each individual endangered species is also needed, in order to prepare action plans for conservation and recovery of those species. Local people, especially of the young generation, should be encouraged to learn and use traditional medicinal plants for disease treatment to prevent that traditional knowledge of medicinal plants in the research area will disappear soon. Additionally, a forest restoration program is needed to counteract the heavy anthropogenic disturbance in large parts of the Park. Both the typical tree species and endangered herbaceous plants in the Park should be used for enrichment planting in the heavily disturbed forests and shrublands. Additionally, human pressure on the (semi-) natural forest ecosystem should be alleviated by allowing the plantation of valuable indigenous timber tree species in mixed stands with an undergrowth of multipurpose species in homegardens and shrublands near the villages, for future sustainable harvesting.

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SAMENVATTING EN AANBEVELINGEN

Dit proefschrift handelt over de diversiteit aan plantensoorten in het Ben En National Park in Vietnam. De volgende thema's komen aan bod: de voorgeschiedenis van het park, de huidige stand van zaken, het traditioneel gebruik van tal van inheemse en geïntroduceerde plantensoorten door de plaatselijke bevolking, de invloed daarvan op de zeldzaamheid, en de mogelijke bedreiging van de lokale flora. Voordat het Ben En National Park in 1992 tot beschermd gebied werd uitgeroepen, was het nog een kapconcessie. Met een zogenaamde "kernzone" van 15,800 ha, omgeven door een "bufferzone" van 12,000 ha vormt het één van de 30 nationale parken van Vietnam.

In het kader van dit onderzoek werd tussen 2005 en 2007 de botanische soortenrijkdom geïntroduceerd. In de gehele kernzone werden zoveel mogelijk soorten verzameld. Daarnaast werden in 147 proefvlakken van 10 x 10 m alle houtige planten geregistreerd. Deze "plots" werden zodanig langs transecten aangelegd dat ze een vergelijking mogelijk maakten tussen de soortenrijkdom en vegetatiestructuur in sterk en weinig door de lokale bevolking verstoorde bossen op verschillende bodemtypes. In alle plots werden bodemon monsters genomen voor chemische analyse. Informatie over het gebruik van planten werd ingewonnen door van 135 huishoudens uit de drie dorpen in het park uitgebreide enquêtes af te nemen en vragenlijsten in te vullen. Daarnaast werden dorpsoudsten en boswachters uitgebreid geïnterviewd, en werden sporen van het inzamelen van nuttige planten (zoals voorkomen en frequentie van boomstronken en voetpaden) in de 147 plots geregistreerd.

Diversiteit van de flora (Hoofdstuk 2) - Op grond van onze eigen inventarisatie en die van eerdere studies in Ben En National Park komen er in totaal ongeveer 1600 soorten vaatplanten voor. Daarmee is de soortenrijkdom van dit betrekkelijk kleine park vrijwel gelijk aan die van heel Nederland! Onze eigen verzamelingen brachten 1389 soorten aan het licht, behorend tot 650 geslachten en 173 families. Drie soorten bleken nieuw te zijn voor de flora van Vietnam: *Myristica yunnanensis* Y.H. Li (Myristicaceae), *Glyptopetalum sclerocarpum* (Kurz) M.A. Lawson, (Celastraceae) en *Timonius arborea* Elmer (Rubiaceae). Zeven plantenfamilies, 43 geslachten en 252 soorten bleken tot nu toe nog niet bekend in het park. De wolfsmelkachtigen (Euphorbiaceae) vormen de meest diverse familie met 113 soorten. Daartegenover staan 47 plantenfamilies die slechts door één soort vertegenwoordigd zijn. Fanerofyten vormen de meest dominante component van de flora (76% van alle soorten). Chamaefyten (6%), hemicryptofyten (8.5%), cryptofyten (6%) en therofyten (4%) zijn elk veel minder prominent aanwezig in de lokale flora.

Vegetatietypes (Hoofdstuk 2) - Overgrote delen van het bos zijn door de mens aangetast. Commerciële houtkap vond plaats tot 1992. Illegale houtkap, zei het op kleinere schaal, vindt nog steeds plaats. Drie door de mens gecreëerde ecosystemen beslaan niet minder dan 29% van het oppervlak van de kernzone: 1) akkerbouw-

velden, ca. 650 ha; 2) aangeplant bos, ca. 110 ha; 3) gemengde bamboe en houtopstanden (ca. 3800 ha). Twee natuurlijke hoofdtypen kunnen worden onderscheiden in de vegetatie, elk met drie (zeer) zwaar of slechts gering door de mens aangetaste varianten, afhankelijk van de intensiteit van het verzamelen van wilde planten en illegale houtkap door de lokale bevolking. Geheel onaangetast, zogenaamd maagdelijk bos, komt in het hele park slechts in een klein ontoegankelijk kalkrotsgebied voor en kon helaas niet in ons onderzoek worden betrokken. De wel onderzochte vegetatietypen zijn: 1) Tropisch immergroen laagland bos op kalkformaties (met drie subtypes: licht aangetast bos, zwaar aangetast bos, en struikvegetaties op kalksteen); 2) Tropisch immergroen laagland bos op andersoortige bodems (veelal ferralitisch, op een klein gebied alluviaal) met als subtypes: licht aangetast bos, zwaar aangetast bos en struikvegetaties buiten de kalksteenheuvels.

Natuurbeschermingsaspecten (Hoofdstuk 2) - De IUCN Rode Lijst van bedreigde plantensoorten (2006) telt 29 soorten die ook in Ben En National Park voorkomen; de Rode Lijst van Vietnam (2007) telt er niet minder dan 42 (op een totaal van 448 bedreigde soorten in Vietnam). Op grond van onze plotgegevens en interviews met de lokale bevolking en parkwachters zijn niet minder dan 89 soorten met lokale uitsterving bedreigd. Hiervan worden wel 45 soorten door de lokale bevolking voor diverse doeleinden gebruikt, wat hun bedreigde status verder verslechtert.

Nuttige planten (Hoofdstukken 3 & 4) - In totaal worden 386 plantensoorten gebruikt door de lokale bevolking van Ben En National Park. Hiervan hebben 52 soorten meer dan één soort toepassing. Medicinaal gebruik kon worden vastgesteld voor 230 soorten behorend tot 200 geslachten en 84 families. Deze soorten worden gebruikt bij de behandeling van 64 verschillende klachten of ziektebeelden (hoofdstuk 3). Van de medicinale planten wordt 65% der soorten verzameld in het wild; de rest wordt in zg. home gardens in en rond de dorpen gekweekt. Bladeren, stengels & takken en wortels worden zowel vers als gedroogd (of, na droging, met water verwerkt tot een infuus) gebruikt. De gezondheidszorg berust voornamelijk bij de vrouwen: zij hebben een betere kennis van de medicinale planten dan mannen, en zijn binnen alle leeftijdsklassen meer betrokken bij het verzamelen ervan in het wild. De lokale kennis van traditionele geneeskrachtige planten dreigt snel verloren te gaan, want 43% van de jongere generatie bleek geen kennis over medicinale planten te hebben en/of wenst zich die kennis ook niet eigen te maken. Ook bij de overige 57% van de jonge geïnterviewden was deze kennis gering. Daarnaast neemt de plaatselijke bevolking in toenemende mate haar toevlucht tot moderne westerse geneesmiddelen. Het overgrote deel van de 230 medicinale planten wordt door minder dan de helft van de huishoudens gebruikt, en 145 soorten worden zelfs door minder dan een kwart van de gezinnen gebruikt. Uit een vergelijking van het traditioneel gebruik van medicinale planten in Ben En met het gebruik elders in Zuidoost-Azië en het Indo-Pacifische gebied bleek dat dezelfde plantensoorten vaak voor totaal verschillende behandelingen en ziektes werden aangewend door de verschillende bevolkingsgroepen.

Een totaal van 208 plantensoorten vindt in het park toepassing voor niet-medicinale doeleinden (hoofdstuk 4). Het gaat hierbij vooral om voedselplanten, maar ook toepassingen in constructie, brandhout, en diverse huishoudelijke artikelen spelen een belangrijke rol. In tegenstelling tot wat bij de medicinale planten het geval was, zijn het vooral mannen die zich bezighouden met het verzamelen van deze niet-medicinale planten(delen). Niet minder dan 56 nuttige plantensoorten in het park worden verhandeld en dragen ca. 23% bij van het gemiddelde inkomen van de individuele huishoudens. Bamboescheuten van *Schizostachyum funghomii* (Poaceae), stamfragmenten van *Spatholobus suberectus* (Fabaceae), en zaden van *Amomum villosum* (Zingiberaceae) zijn de drie belangrijkste producten voor aanvulling van de inkomsten van de lokale bevolking. Het monetaire equivalent van de niet-verhandelde maar direct door de huishoudens gebruikte nuttige planten is waarschijnlijk veel hoger dan de waarde van de verhandelde planten, maar kon in ons onderzoek niet berekend worden. De benutting van planten bleek onafhankelijk van de etniciteit van de verschillende bevolkingsgroepen die in het park wonen. Grotere gezinnen bleken wel gebruik te maken van een grotere diversiteit aan plantensoorten dan kleinere gezinnen. Zeer algemeen voorkomende soorten in het bos hadden ook een grotere gebruiksindex (UI) dan zeldzamere soorten ($UI = Us/N$; waarbij Us = het aantal huishoudens dat het gebruik van een bepaalde soort s noemde; N = het totaal aantal geïnterviewde huishoudens). Het huidige gebruikspatroon van wilde planten is niet duurzaam en kan leiden tot plaatselijk uitsterven van enkele zeldzame en bedreigde soorten. Om dit te voorkomen zijn aanvullende beschermingsmaatregelen noodzakelijk.

De invloed van de mens en omgevingsfactoren op de floristische diversiteit (Hoofdstuk 5) - Menselijke verstoring heeft een grote negatieve invloed op de structuur van het bos, vooral op de frequentie van voorkomen van bepaalde boomsoorten, in het bijzonder de belangrijke houtleveranciers, en andere nuttige plantensoorten. De soortenrijkdom zelf is nog niet sterk aangetast. Bodemfactoren zijn van grote invloed op de soortensamenstelling van het bos, hoewel de minerale samenstelling van de bodem in de plots slechts 5.7% van de variatie in de floristische diversiteit verklaart. Menselijke verstoringfactoren verklaren op hun beurt 4.4% van de variatie in soortensamenstelling. Veranderingen in de soortensamenstelling door menselijke verstoring bleken onafhankelijk van bodemfactoren. De soortensamenstelling van licht verstoord en zwaar verstoord bos was significant verschillend. De frequentie van kleine bomen was hoger op de kalkrijke bodems dan op de ferralitische en alluviale bodems. Grote bomen en nuttige plantensoorten, vooral de commerciële houtsoorten, komen in hogere frequentie voor in de slechts licht verstoorde bosplots, die op grotere afstand van de dorpen en de wegen (hoofdweg door het park) lagen dan de sterk verstoorde plots. Het aantal bedreigde plantensoorten was ook hoger in de slechts licht verstoorde plots. Het basale stamoppervlak van de bomen was het grootst in de minst verstoorde plots. De schade door illegale houtkap vertoont een negatieve correlatie tot de afstand van de dorpen.

Aanbevelingen en vooruitblik

Ondanks het feit dat een groot deel van het bosareaal van het Ben En National Park in het verleden sterk beïnvloed is door commerciële houtkap en nog steeds te lijden heeft van illegale houtkap door de lokale bevolking, is de diversiteit aan plantensoorten nog steeds erg hoog en zéér de moeite van het beschermen waard. Er is een urgente behoefte aan extra maatregelen om de gevolgen van verstoring van de natuurlijke ecosystemen door de mens een halt toe te roepen en natuurlijk herstel een kans te geven. Het stoppen van de illegale houtkap is hierbij een eerste prioriteit. De menselijke druk op de natuurlijke hulpbronnen uit het bos kan ook verkleind worden door meer steun te bieden aan de lokale bewoners van de kernzone van het park, zowel financieel als in de vorm van educatie op het gebied van het zelf kweken van nuttige, met name medicinale planten. Hierdoor zou een bijdrage worden geleverd aan behoud van plantendiversiteit en zg. bioculturele diversiteit (nl. de kennis van de traditionele geneeskunde). Er is verder onderzoek nodig naar de verbanden tussen het verzamelen van nuttige planten door de lokale bevolking in het park en hun zeldzaamheid en bedreiging. Hierbij zou voor iedere met lokaal uitsterven bedreigde soort een actieplan moeten worden opgesteld voor het herstel ervan in het park. De plaatselijke bevolking, vooral de jonge generatie, zou ook gestimuleerd moeten worden om hun kennis over traditionele geneeskrachtige planten in ere te herstellen, ter voorkoming van verlies van dit biocultureel erfgoed in de regio. Daarnaast wordt gepleit voor een programma ter herstel van de verstoorde bosccosystemen in een groot deel van het park. Zowel de voor het gebied kenmerkende boomsoorten als de bedreigde kruidachtige plantensoorten zouden gebruikt moeten worden voor zg. verrijkingsaanplantingen in verstoord bos en in de anthropogene struikvegetaties. Bovendien zou de menselijke druk op het natuurlijke boscossysteem verlaagd moeten worden door toe te staan de lokale bevolking op een beperkt areaal rond de dorpen gemengd bos te laten aanplanten met waardevolle inheemse boomsoorten, met een ondergroei van nuttige soorten van struiken en kruidachtige planten, voor toekomstig duurzaam (deels traditioneel) gebruik.

TÓM TẮT

Luận án này là kết quả nghiên cứu về sử dụng và bảo tồn đa dạng Thực vật ở Vườn quốc gia Bến En, Việt Nam - một trong 30 vườn quốc gia của Việt Nam. Trong đó tập trung vào nghiên cứu đa dạng loài, thảm thực vật, giá trị sử dụng, tình trạng bảo tồn, vai trò của tài nguyên Thực vật tới cuộc sống người dân, cũng như những tác động của người dân và một số nhân tố môi trường đến hệ Thực vật. Dựa vào những kết quả nghiên cứu, chúng tôi đưa ra những kiến nghị nhằm quản lý tốt hơn vườn quốc gia Bến En nói riêng cũng như các vườn quốc gia và khu bảo tồn thiên nhiên khác tại Việt Nam hay trong khu vực và trên thế giới.

Đa dạng sinh học Thực vật tại Việt Nam (Chương 2)

Việt Nam là nước giàu về đa dạng sinh học (Thिन 1997). Đa dạng sinh học của Việt Nam đứng thứ 16 trên thế giới (WCMC 1992). Tuy nhiên diện tích rừng ở Việt Nam đã bị suy giảm nhiều trong 6 thập kỷ qua (Chien 2006). Hệ Thực vật Việt Nam rất đa dạng và phong phú, với ghi nhận lên tới 11.373 loài, thuộc 224 chi, 378 họ và 7 ngành, trong đó khoảng 28% số loài đặc hữu (Thिन 1997). Nhằm bảo vệ nguồn tài nguyên rừng giàu tính đa dạng nhưng đang bị đe dọa, Chính phủ Việt Nam đã thành lập hệ thống rừng đặc dụng trên cả nước (Tai 1995; Chien 2006). Đến nay 126 khu rừng đặc dụng trên cả nước đã được thành lập, với tổng diện tích 2.54 triệu ha, chiếm 7.7% diện tích của cả nước.

Đa dạng sinh học Thực vật tại Vườn quốc gia Bến En (Chương 2)

Hệ Thực vật vườn quốc gia Bến En bao gồm 6 ngành với tổng số 1389 loài Thực vật có mạch thuộc 650 chi, 173 họ. Cùng với những nghiên cứu trước đây tại Vườn Bến En thì tổng số loài Thực vật có mạch có thể lên tới khoảng 1600 loài.

Nghiên cứu này đã bổ sung 3 loài mới cho hệ Thực vật Việt Nam đó là: Đậu khấu Bến En - *Myristica yunnanensis* Y.H.Li (Myristicaceae) (Hoang 2008 a), Xâm cánh Bến En - *Glyptopetalum sclerocarpum* (Kurz) M.A. Lawson, (Celastraceae) (Hoang 2008 b), và Găng Bến En *Timonius arborea* Elmer (Rubiaceae). Nghiên cứu cũng bổ sung 7 họ Thực vật, 43 chi và 252 loài Thực vật mới cho hệ Thực vật vườn quốc gia Bến En (Chương 2). Họ đa dạng nhất là họ Thầu dầu (Euphorbiaceae) với 113 loài. Bên cạnh đó có tới 47 họ Thực vật chỉ có duy nhất 1 loài đại diện. Dạng sống của hệ Thực vật vườn Quốc gia Bến En với ưu thế thuộc về cây có chồi trên mặt đất (Phanerophytes) với 76% tổng số loài, tiếp đến là cây có chồi nửa ản (hemicryptophytes) 8.5 %, cây có chồi sát mặt đất (chamaephytes) 6%, cây có chồi ản (cryptophytes) 6% và cuối cùng là cây có chồi một năm (therophytes) 4%.

Thảm Thực vật vườn quốc gia Bến En (Chương 2)

Trước khi được thành lập năm 1992 thì vườn Quốc gia Bến En thuộc Lâm trường Như Xuân, nên nhiều diện tích rừng ở đây đã bị tác động bởi con người (Khoi 1996;

Tordoff et al. 2000). Hiện nay, tình trạng khai thác gỗ trái phép vẫn còn xảy ra (Tordoff et al. 2000).

Thảm thực vật tại Vườn quốc gia Bến En được chia làm 2 kiểu rừng chính là: Rừng nhiệt đới thường xanh trên núi đá vôi và rừng nhiệt đới thường xanh trên núi đất. Mỗi trạng thái rừng được chia ra 3 loại phụ tùy theo mức độ tác động của người dân địa phương đó là: Rừng ít bị tác động, rừng bị tác động nhiều và trảng cây bụi. Bên cạnh đó tại vườn quốc gia Bến En còn có một số diện tích nhỏ rừng nguyên sinh chưa bị tác động ở những địa điểm nguy hiểm khó tiếp cận. Ngoài ra còn có khoảng 650 ha đất nông nghiệp, 110 ha rừng trồng và 3.800 ha rừng tre nứa hỗn giao với cây gỗ.

Giá trị bảo tồn tài nguyên Thực vật (Chương 2)

Tài nguyên Thực vật vườn quốc gia Bến En không chỉ đa dạng về thành phần loài, dạng sống và thảm thực vật mà còn có giá trị bảo tồn cao. Nghiên cứu đã đưa ra tổng số 29 loài tại vườn quốc gia Bến En có tên trong danh lục đỏ IUCN năm 2006, 42 loài có tên trong sách đỏ Việt Nam năm 2007. Bên cạnh đó, dựa vào kết quả điều tra thực địa, kết quả phỏng vấn người dân địa phương và kiểm lâm trong vườn, chúng tôi đưa ra 89 loài đang bị đe dọa trong phạm vi của vườn (chúng tôi gọi những loài này là Danh lục đỏ Bến En).

Đa dạng về giá trị sử dụng Thực vật Vườn quốc gia Bến En (Chương 3 & 4)

Qua điều tra và phỏng vấn 135 hộ gia đình trong khu vực nghiên cứu, chúng tôi xác định được 386 loài Thực vật được sử dụng bởi người dân địa phương, trong đó có 52 loài là cây đa tác dụng.

Nhóm thực vật có giá trị làm thuốc chiếm ưu thế với 230 loài thuộc 200 chi, 84 họ và được sử dụng để điều trị 68 bệnh khác nhau cho người dân địa phương khu vực vườn quốc gia Bến En (Chương 3). Với 56% tổng số loài được người dân sử dụng làm thuốc thu hái từ rừng tự nhiên. Lá, thân và rễ là các bộ phận chính của cây được người dân sử dụng để chữa bệnh. Về giới tính, phụ nữ có kiến thức tốt về cây thuốc hơn là nam giới và họ cũng tham gia thu hái cây thuốc từ rừng nhiều hơn nam ở mọi lứa tuổi. Qua điều tra chúng tôi cũng nhận ra rằng kiến thức bản địa của người dân về sử dụng thực vật làm thuốc đang bị suy giảm và có thể mất đi trong tương lai, bởi 43% số người trẻ được phỏng vấn không biết, hoặc không muốn học hỏi về chuyên môn này. Hơn nữa người dân nơi đây đang có xu hướng thích sử dụng thuốc tây để chữa bệnh (chương 3).

Số hộ gia đình sử dụng nhiều loài cây thuốc trong khu vực nghiên cứu để chữa bệnh không nhiều, trung bình một hộ gia đình sử dụng 25 loài cây thuốc. Trong khi đó khoảng 68% số loài được sử dụng bởi dưới 25% hộ gia đình. Khi so sánh giá trị sử dụng cây thuốc ở Bến En với một số nước khu vực Đông Nam Á và châu Á, chúng tôi nhận thấy rằng cùng một loài cây nhưng ở những địa điểm khác nhau, truyền

thống văn hóa và dân tộc khác nhau thì người dân có thể sử dụng để chữa các bệnh khác nhau (chương 3).

Bên cạnh 230 loài được người dân sử dụng làm thuốc, 208 loài được người dân sử dụng vào các mục đích khác (ngoài giá trị làm thuốc) (Chương 4), trong đó có 52 loài là cây đa tác dụng (Chương 3 & 4). Phần lớn các loài được sử dụng làm thức ăn. Trái ngược với nhóm thực vật có giá trị làm thuốc, trong nhóm này đàn ông tham gia thu hái nhiều hơn phụ nữ ở hầu hết mọi lứa tuổi.

Tài nguyên Thực vật không chỉ quan trọng đối với cuộc sống sinh hoạt hàng ngày của người dân địa phương mà nó còn góp phần quan trọng nâng cao thu nhập của các hộ gia đình. Qua điều tra, chúng tôi thống kê được tổng số 56 loài với giá trị thương mại trong khu vực nghiên cứu và đóng góp 23% tổng thu nhập trung bình của các hộ gia đình. *Schizostachyum funghomii* (Poaceae), *Spatholobus suberectus* (Fabaceae), và *Amomum villosum* (Zingiberaceae) là những loài quan trọng đối với thu nhập cho người dân. Giá trị kinh tế của tài nguyên Thực vật có thể còn cao hơn nhiều so với thu nhập mà người dân có được do bán các sản phẩm này, bởi những đóng góp hàng ngày vào cuộc sống của người dân chưa được tính tới.

Kiến thức bản địa trong việc sử dụng tài nguyên Thực vật giữa các dân tộc trong khu vực nghiên cứu là cơ bản giống nhau, bởi các dân tộc sống cùng nhau trong bản/thôn. Tuy nhiên những hộ có đông thành viên thì sử dụng nhiều loài hơn những gia đình có ít người. Qua nghiên cứu chúng tôi phát hiện ra những loài còn phong phú trong tự nhiên thì có chỉ số sử dụng (UI) cao hơn những loài có ít số lượng cá thể. Rất tiếc việc sử dụng tài nguyên Thực vật tại vườn Quốc gia Bến En hiện nay là không bền vững. Những loài quý hiếm, bị đe dọa và có giá trị kinh tế cao có nguy cơ bị tuyệt chủng nếu không có những biện pháp bảo tồn kịp thời.

Tác động của con người và môi trường tới đa dạng thực vật (Chương 5)

Con người và môi trường có ảnh hưởng không lớn tới thành phần loài tại vườn Quốc gia Bến En. Tuy nhiên, ảnh hưởng của người dân địa phương có tác động tiêu cực tới mật độ cây trong rừng, đặc biệt là các loài cây gỗ quan trọng, cây có giá trị sử dụng và những loài trong Danh lục đỏ, cho dù chỉ số đa dạng sinh học không thay đổi. Sự tác động của con người và các nhân tố môi trường (chủ yếu là đất) lên cấu trúc rừng và thành phần loài thực vật là độc lập nhau. Các nhân tố môi trường phản ánh 5.7% cấu trúc và thành phần loài thực vật, trong khi những tác động của con người phản ánh 4.4%.

Nghiên cứu kết luận rằng thành phần loài và cấu trúc rừng ở khu vực ít bị tác động có sự khác biệt rõ rệt với những nơi bị tác động nhiều. Ngoài ra nghiên cứu còn chỉ ra rằng mật độ cây gỗ nhỏ ở rừng núi đá vôi cao hơn trên núi đất.

Mật độ cây gỗ, cây có giá trị sử dụng, đặc biệt là cây gỗ quan trọng càng cao hơn ở những khu vực càng xa khu dân cư và đường khai thác cũ. Bên cạnh đó số loài trong

Danh lục đồ và trữ lượng gỗ cũng cao hơn ở rừng ít bị tác động so với rừng bị tác động mạnh. Đồng thời nghiên cứu cũng khẳng định rằng áp lực của người dân địa phương lên tài nguyên thực vật càng lớn ở những diện tích gần khu vực dân cư.

Kiến nghị

Mặc dù nhiều diện tích rừng ở vườn Quốc gia Bến En bị tác động bởi con người. Tuy nhiên tài nguyên Thực vật ở đây còn rất phong phú và đáng được quan tâm bảo tồn. Vì vậy việc cần thiết phải làm để bảo tồn tài nguyên thực vật là hạn chế tối đa việc khai thác gỗ trái phép.

Để giảm áp lực của người dân địa phương lên tài nguyên rừng và bảo tồn đa dạng sinh học cũng như kiến thức bản địa của người dân địa phương, đồng thời sử dụng bền vững tài nguyên thực vật thì cần thiết phải hỗ trợ người dân địa phương cả về tài chính cũng như hướng dẫn họ về kỹ thuật để gây trồng những loài cây hữu ích, đặc biệt là có giá trị kinh tế cao trong đất vườn và đất được giao sử dụng lâu năm của họ.

Bên cạnh đó cũng cần có những nghiên cứu sâu hơn về mối tương quan giữa người dân địa phương tới những loài bị đe dọa và những loài hữu ích trong khu vực vườn Quốc gia Bến En. Đồng thời người dân địa phương, đặc biệt là những người trẻ tuổi cần được khuyến khích sử dụng cây thuốc để chữa bệnh, nếu không kiến thức bản địa quý giá đó sẽ bị mai một và mất hẳn trong thời gian tới (chương 3).

Cuối cùng một chương trình làm giàu rừng là cần thiết cho những khu vực bị tác động mạnh, trồng cây bụi và khu vực vùng đệm. Trong chương trình này nên trồng những loài cây gỗ đặc trưng của vườn Bến En, những loài cây đa tác dụng và những loài đang bị đe dọa.

CURRICULUM VITAE

Hoang Van Sam was born on November 4th 1977 in Thanh Hoa province, Vietnam. In 1995 he enrolled at the Vietnam Forestry University, Hanoi. During this study he specialized in forest resources management. He graduated from the university with a BSc in 1999. In the same year, he started to work in the Forest Plant Department of the Faculty of Forest Resources and Environmental Management of this university as an assistant lecturer, and became a lecturer one year later. He teaches both theory and practice of taxonomy and Vietnamese plant families for students of Silviculture and Forest Resources and Environmental Management. He has carried out field work in many National Parks and Nature reserves in Vietnam. In 2002 he attended a training course on Plant taxonomy for young scientists from ASEAN countries in Bogor, Indonesia. Following this course, he was selected to follow an MSc program on Plant Biodiversity and Natural Products at the National Herbarium of the Netherlands, Leiden University. One of his MSc research projects on timber trees of Vietnam was carried out at the Musée Nationale d'Histoire Naturelle in Paris, France. He obtained his MSc at Leiden University in August 2004. After graduation he resumed his work at the Vietnam Forestry University. In May 2005 he was admitted as a PhD student at the National Herbarium of the Netherlands, Leiden University and embarked on the project of this thesis: "Uses and Conservation of Plant Biodiversity in Ben En National Park, Vietnam" under the supervision of Prof. Pieter Baas and Dr. Paul J.A. Keßler.

Hoang Van Sam has participated in and gave presentations at several international conferences related to his subject, such as the meetings on "Important Plant Areas and Standardization of Habitat Classification for ASEAN", in Kota Kinabalu, Malaysia in 2004; "Managing forests for poverty reduction" in Ho Chi Minh City, Vietnam in 2006; the "14th International conference of parties CITES", in Den Haag, the Netherlands in 2007; "Important timber trees and international trade" in Kuala Lumpur, Malaysia in 2007; the "VIIth Flora Malesiana Symposium" in Leiden, the Netherlands in 2007; "Biodiversity and Climate Change" in Aarhus, Denmark in 2008, and the first Symposium of the Flora of Laos, Cambodia and Vietnam in Phnom Penh, Cambodia in 2008.

During his study in Leiden University he gave lectures for MSc students in the courses on Ethnobotanical Knowledge Systems and Tropical Plant Families of South East Asia.

He published the following papers, some of which form part of this PhD thesis:

Hoang, S.V. & P.C. van Welzen. 2004. Revision of *Annesijoa*, *Elateriospermum* and the introduced species of *Hevea* in Malesia (Euphorbiaceae), Blumea 49: 425 - 440.

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