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Traditional Plant Use of the Raglay in Cãu Gãy Village, Núi Chúa National Park

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Abstract

Members of the Raglay community of Cãu Gãy Village were interviewed to determine the extent and nature of their traditional reliance on plants. This community, located in the buffer zone of Núi Chúa National Park, was found to utilize 64 plant species for a wide variety of uses. Botanical specimens and photographs were used to identify 42 plants to species level, 13 to genus level, and 6 to family level, while 3 remained unidentified. For each plant, the Raglay name, local Vietnamese name, use, specific application, and preparation were documented, as well as any details of ritual or commercial significance.

The plants were organized by use into the following distinct categories, presented by frequency of occurrence: medicine, food, fiber and rattan, poison, shampoo, dye, betel chew, and other uses. A total of 30 plants were used for medicinal purposes in order to treat 20 categories of illness or injury. Only 8 species were recorded which were regularly sold, although this number is clearly not representative of the whole range of local Non-Timber Forest Product commercialization. Of the documented species, those which were traditionally utilized as shampoo, dyes, or for fiber and rattan are most suitable for development as part of The Institute of Tropical Biology's ecotourism initiative, which seeks to provide alternative livelihoods for the Raglay.

Table of Contents

Acknowledgements

This project is not truly my project at all, because its form results from the efforts of many people, and its content stems from a collective knowledge beyond the scope of any individual experience. I am particularly indebted to my project advisor Mr. Vinh, on whose rapport with the Raglay I relied, not to mention his knowledge, experience, logistical support and interpretive skills. Mr. Vinh also introduced me to my primary contacts and accompanied every minute of my fieldwork. Without the botanical knowledge, resources and meticulous attention of Mr. Sam, many of the plant specimens would not have been identified, and so his contribution to the legitimacy of this report cannot be underestimated. During my time in Phan Rang and in the field, the logistical assistance of Tram, Trinh, and the many other staff members of the Institute of Tropical Biology and Nui Chua National Park helped to make my stay enjoyable and rewarding.

Most of all, I must thank my primary contacts Mr. Yen and Mr. Lech and all the other people of Cãu Gãy, whose knowledge compromises this study, and whose kindness and experience I greatly admire. Mr. Yen opened his home to us during our time in the village and also served as our guide during our treks into the forest. I hope that the results of this project bear fruit for the people of Cãu Gãy, and help them to preserve their cultural knowledge as they match the pace of change with their time-honored adaptability.

List of Tables and Figures

Introduction

Nui Chua National Park is located in Ninh Thuan Province, the driest, hottest, and poorest province in Vietnam. The park has an area of 24,353 ha comprised of a diverse set of ecological systems ranging from coastal coral reefs to evergreen montane forests located above 800m. The presence of extensive arid scrubland in the lower elevations of the park is ecologically significant, as this vegetation type is rare in the generally tropical climate of Vietnam. The park has a high terrestrial biodiversity, including a healthy population of Black-shanked Douc Langur (*Pygathrix nigripes*), one of the flagship species of the park. The offshore marine habitat is also highly biodiverse, including the unusually intact coral reefs and Vietnam's only known sea turtle nesting beaches (ITB 2008).

The park supports a total human population of over 50,000, roughly split between the buffer zone and the core zone. Of this population, 21% are members of the Raglay ethnic minority, a small number are from the Cham ethnic minority and the remainder are Kinh. Historically, the Kinh near the park have lived in coastal towns such as Vinh Hy and Vinh Hai, where they practice offshore fishing, lowland agriculture, and commerce. The Raglay have resided in the mountainous interior of the park practicing swidden agriculture and trading in forest products. However, beginning during the American War period and continuing to the present day, the Raglay have been relocated multiple times from their traditional villages in the interior of the park to lowland areas nearer the coastal road. Currently the Raglay reside in 10 villages around the buffer zone of the park, with 2 villages located on the coastal side and the rest distributed along the inland side of the park near national road 1A (ITB 2008).

As part of the government Land Allocation Program, the Raglay have been forbidden to practice their traditional form of agriculture and instead allocated individual households plots for farming. These plots include lowland irrigated wet rice in the river valleys and the more extensive steep slope gardens, which cultivate a mixture of cashew trees, bananas, oranges, papaya, and many other fruits and vegetables. However, the effects of climate change, including increased unpredictability of rainfall and a general increase in water shortage, have negatively impacted Raglay agriculture (ITB 2008). Just before

my research began, much of the Raglay's annual rice crop was destroyed by the disaster-level flooding which swept through central Vietnam. Because fixed-land agriculture is not the traditional practice of the Raglay, their production techniques are generally inefficient and contribute to their low crops yields. In addition, their practices of steep slope gardening are generally unsustainable and contribute to erosion, which in turn results in nutrient-leaching and is detrimental to crop yields (Vinh 2010).

To off-set the inefficiency of fixed-land agriculture, the majority of the Raglay have returned to their traditional practice of harvesting forest products. These products, which often provide more than half of the annual per capita income, include timber, firewood, charcoal, and a wide variety of Non-Timber Forest Products (NTFPs). These products are generally harvested by the Raglay illegally from within the core zone of the park and sold to Kinh traders living among the Raglay villages or in the villages along the coast. Because of the high demand for some species and the limited abundance of others, this practice has a negative impact on the park's 'protected' area. But because of the lack of livelihood alternatives, the park must turn a blind eye to this practice, or the marginal condition of the Raglay would become desperate (Vinh 2010).

To counter this unfortunate catch 22, the Institute of Tropical Biology has initiated a project to support the conservation of the park's natural resources by establishing livelihood alternatives for the Raglay. These alternatives include the small-scale production of *Cyclea peltata* and *Sterculia foetida*, both of which are used to produce refreshing medicinal beverages. They are in wide demand among local Kinh communities, with the purest form of *Sterculia* gum selling for 120,000 VND/kg (Yen 2010). The primary goal of the alternative livelihood project, which is funded by the McKnight Foundation, is the establishment of an ecotourism project within the national park (ITB 2008). This project will eventually connect international tourists with the Raglay, who will benefit economically as they provide home stays, guides and other services (East-West 2010). The project, which is still in the development phase, will also help the Raglay to develop sustainable NTFP products for sale in both ecotourism and domestic markets.

The first of these products, which is already in production, is a variety of handicraft jewelry produced from the attractive seeds of *Entada glandulosa*. Strings of these seeds, which are produced by a community group in the Raglay village of Cãu Gãy, have found a ready market in Ho Chi Minh City as Buddhist prayer beads. The seeds of *Abrus precatorius*, *Mucuna interrupta* and other species are currently under consideration for handicraft development (Vinh 2010). As part of the ITB ecotourism initiative, one of the aims of my project was to investigate the potential of traditional Raglay NTFPs for sustainable development, with particular emphasis on handicraft products and natural soaps and shampoos.

The Raglay population in Nui Chua National Park is very small, and it exists in isolation from the more substantial Raglay populations in the surrounding provinces. As a result of this isolation and the various stresses placed on the local communities over the last 50 years, the Raglay in Nui Chua have lost a substantial amount of their traditional culture. While retaining their language, they no longer have any knowledge of traditional dress, music or festivals, and their knowledge of folklore and handicrafts is quite limited. This situation obviously poses a problem for an ecotourism project, because traditional culture provides a strong draw for the ecotourist population and can make a site more viable for ecotourism development (East-West 2010). The aspects of Raglay culture which are still extant in Nui Chua, including Raglay cooking, traditional knowledge about NTFPs, and some limited storytelling and religious observance, should be utilized in the proposed ecotourism packages. But in order to be developed in such a context, they must first be adequately documented, a task which has not yet been fully undertaken by ITB.

My project was established in order to fill this gap in regards to the traditional Raglay use and knowledge of the floral NTFPs in Nui Chua National Park. Documenting the traditional ethnobotany sought to answer several different needs, all answering to the central goal of establishing sustainable alternative livelihoods for the Raglay. Because their culture is disappearing at such a fast rate, it seems imperative to the cultural integrity of the Raglay themselves to safeguard the knowledge they have retained in a concrete form, so that future generations can use it without relying on the instability of an

oral tradition. In addition, putting together an English-language source on Raglay plant use will provide material for the development of ecotourism resources such as pamphlets or short guidebooks.

Documenting this type of information will also assist in identifying aspects of Raglay culture which can be developed as part of the ecotourism project, such as using native edible plants to cook food for ecotourists or teaching them about traditional Raglay herbal medicine. It will also serve the purpose of identifying plants with historical Raglay usage which may have potential as marketable products for ecotourists, including shampoos, soaps, dyes, handicrafts, and edible fruit. The same could be said for products with potential for domestic marketing, such as edible and medicinal plants that can be harvested sustainably or cultivated in a household garden setting. Perhaps most importantly, information of this kind is central to the cultural heritage of forest peoples, and so learning about the Raglay's plant use can shed light on the Raglay themselves, and thus deepen the understanding of those who seek to work with them.

Literature Review

Vietnam is a fertile country for ethnobotanical study, providing as it does a long history of traditional herbal medicine, a high incidence of edible wild plant usage and a diverse group of ethnic minorities. These factors have resulted in the relative abundance of available English language resources, particularly on the subject of Traditional Vietnamese Medicine (TVM). TVM is an ancient system of herbal medicine developed along the lines of Traditional Chinese Medicine (TCM) but substituting the use of Chinese herbs with more than 700 native Vietnamese plants (Reddy 2005). This systematized approach is very popular and widespread throughout Vietnam, where it is commonly supplemented with plants used in TCM as well as locally known herbal remedies. In total, nearly 4,000 medicinal plants are known to be utilized in Vietnam, although not all of these are native or cultivated (Nguyen 2008). An illustrated English-language resource on the most widespread 200 of these plants is the result of a partnership between Vietnam's Institute of Materia Medica and the World Health Organization (Medicinal Plants 1990).

Beyond the well-known use of medicinal plants in TVM and TCM, much recent attention has focused on NTFPs, particularly among ethnic minorities. Ethnic minority groups are known to utilize a much wider range of wild plants for food (Tanaka 2007) and they tend to have a greater knowledge of local medicinal plants. In particular, many of these studies have focused on ethnic groups which, like the Raglay, reside in or near the boundaries of important national parks. National policy has often pushed these groups into a similar situation to that of the Raglay at Nui Chua National Park, so that many survive largely by harvesting local timber, charcoal, firewood and NTFPs. A study in Nghe An province found that household dependence on NTFP harvesting negatively correlated with poverty level and the distance to the nearest city and positively correlated with the rate of female labor (Dang 2006). The Vietnamese NTFPs with the highest demand and the corresponding highest levels of wild harvesting include medicinal plants, spices such as cinnamon and cardamom and fibers from bamboo and rattan species (Morris 2002).

The local people of Ben En National Park utilize 230 species of medicinal plants, 18 of which are commonly commercialized. The commercialized plants contribute 11% of the average household income and the harvesters are 61% women (Hoang (B) 2008). The local people also unsustainably harvest 208 non-medicinal plants from the park and sell 38 of these species, which provides an additional 12% of the average household income. In contrast to medicinal plants, men more commonly collect non-medicinal plants, which are used for food, firewood, construction, household products, ornamentals, paper making and fish poison (Hoang (C) 2008). In Ba Vi National Park, the Dzao and Muong ethnic minority groups were reported to use a combined 257 species of medicinal plants, 74% of which were sourced from the national park. The vast majority of traditional Dzao healers and 67% of the total harvesters were female. These harvesters collected 51 plant species for sale to Hanoi and other neighboring cities, comprising 29% of the average household income (Hoang (A) 2010 and Sowerwine 1998).

The local ethnic minorities living in the buffer zone of Bach Ma National Park were found to illegally harvest around 432 local medicinal plant species, many of which were sold to pharmacists from Hue and Da Nang. Medicinal plant harvesting supported local traditional healers, supplemented household incomes, and played a significant role in the healthcare of local communities, although some species were becoming increasingly rare (Tran 2001). An ITB study at Ta Kou Nature Reserve in Binh Thuan province identified 49 species collected illegally within the reserve by local medicinal plant harvesters, 35 of which had a high frequency of use and were commonly traded to the nearby city. Around 30 households relied completely on the harvest of medicinal plants during the dry, non-agricultural season, as did many local non-professional healers. Many of the interviewed harvesters, who were mostly members of the Cham ethnic minority group, had noticed the scarcity of the local medicinal plants increasing (Luu 2006).

From these studies it is clear that the illegal harvest of plants from protected areas is a widespread trend in Vietnam, and that even according to the foragers, it may be impacting the local ecology. These harvesters are most likely to be poor ethnic groups collecting NTFPs in order to supplement their income, and the plants often make their way into mainstream markets in large cities. It seems likely that the

ubiquity of evidence about medicinal plant harvesting is due more to the interest and bias of the researchers themselves than to a true absence of non-medicinal NTFP use, because the only study that did investigate non-medicinal plants found 208 in utilization, quite comparable to the 230 medicinal plants being used.

Methodology

Given the limited time available for this study, it was decided to gather in-depth information on only one Raglay village as opposed to the somewhat superficial data that might be generated from a broader study area over such a short time period. The village of Cãu Gãy is one of the sites of the current ITB project, so the Raglay there are already used to hosting and talking with the occasional foreigner. This village is also the location of the current *Entada* handicraft production group. Data was collected through interviews with residents of Cãu Gãy and verified by collecting field specimens and, when possible, through participant observation.

A combination of semi-structured and unstructured interviews was applied, depending on the circumstances of the interview, including the age, memory and willingness of the participant, the time available, and the nature of the information already collected. Semi-structured interview questions were roughly based on the attached questionnaire (see Appendix A), although it quickly became clear which questions applied within the context of Cãu Gãy and which should be discarded. In retrospect, these sample questions and subjects could have been expanded, in particular by determining a more comprehensive list of illnesses likely to be encountered by the Raglay, for which specific herbal cures could be requested.

The snowballing technique was used for interviewee selection, beginning with the two primary contacts, Mr. Yen and Mr. Lech, who were identified beforehand by my project advisor, Mr. Vinh. Positive criteria used for identifying additional contacts included individuals of old age, forest knowledge and specialized experience. These criteria helped to identify the oldest couple in the village, the only traditional midwife still alive and the individual who represented the village during offerings to the local spirits. Although the snowballing technique helped to diversify the data and bring some interesting plants to light, it was obvious that the original two contacts were the most knowledgeable in the village. After this realization we returned to these contacts and conducted multiple in depth interviews with them as well as using them as guides to verify plants in the field. Whenever possible, information from one

informant was checked against the other, and at the very end of the fieldwork we managed to conduct a final interview with both primary participants simultaneously.

In general, interviews were conducted at the home of the interviewee, with myself, my advisor and translator Mr. Vinh, Alissa Morson, the other student conducting her ISP in Cãu Gãy, and Tram, Mr. Vinh's assistant, all present along with other members of the interviewee's family and sometimes curious neighbors. This large-group setting meant that answers were often the product of a group discussion rather than the knowledge or memory of one individual. I believe that this fact strengthened the responses, because knowledge was not only corrected and reinforced, but disseminated to less knowledgeable community members during the interview, one of the primary goals of the project.

In general, after identifying plants in any given category of interest, the following questions were asked: What is the specific application of the plant? What plant part is utilized and how is it prepared? Is this plant product sold? Are there any alternative uses? Is there any other interesting information about this plant or its products? When informants were reticent or have trouble remembering plants, they were often given books of edible or medicinal plants to peruse (Medicinal Plants 1990 and Tanaka 2007). This technique often resulted in them remembering some use of a plant they recognized and perhaps additional plants with a similar use. All interviews were unpaid, but a small gift of tea or snacks was taken to each household to be saved or served during the interview as a token of thanks.

Information was then compiled on a spreadsheet so that any gaps could be identified and filled in upon subsequent trips to the village. Two separate trips to Cãu Gãy of around 3 nights and 4 days each were conducted, with a home stay provided at the house of Mr. Yen. During the first trip, the focus was on conducting interviewing and identifying likely contacts. During the second trip, the focus changed to fieldwork, and involved one overnight trip and two day trips to the forest. The purpose of these trips was to have our local contacts indicate the exact plants that they had already named and provided information for, so that botanical samples could be collected. These trips also served to uncover complexities and inconsistencies in the data and to give an indication of harvesting techniques.

Botanical specimens were collected with a field plant press and, whenever possible, along the guidelines laid out for ethnobotanical field work (Alexiades 1996) and were supplemented with photographs taken using a digital camera. Notes on habit, habitat, usage and other interesting facts divulged by our guides in the field were recorded in a field journal, or, during the several days when it was too rainy to use a journal, on Mr. Vinh's voice recorder. The botanical specimens, many of which were collected with the aid of Trinh, an experienced Nui Chua National Park ranger, were then brought back to the ITB office in Phan Rang where a sizable herbarium is located. At the office these samples and their corresponding photographs were analyzed, checked against the herbarium, and located to the best of my ability in the seminal publication on Vietnamese botany: Cây cỏ Việt Nam: An Illustrated Flora of Vietnam (Phạm 1999).

Unfortunately, my limited knowledge of tropical botany and inability to read Vietnamese meant that assignment beyond genus level, or sometimes even to family level, was often impossible. To answer the pressing need for definite identification of my specimens, my advisor was able to arrange two meetings with a botanist on the ITB staff, Mr. Sam. Mr. Sam was able to go over the pictures and botanical specimens with me directly and by relying on his long botanical experience in Vietnam, reliable species and genus assignments were achieved for the vast majority of specimens. Voucher specimens for those collected in the field were left with the ITB staff in Phan Rang for possible inclusion, if their quality warrants it, in the herbarium located in the Nui Chua National Park office. Copies of all the digital photographs of plants were also left with the ITB staff. At all points during botanical identification, possible plant species were checked against those already listed in the most current botanical index of Nui Chua National Park (Luru 2009). However, this resource does not claim to be comprehensive, so some plants were identified as species not listed in this index.

Results

During the study, it was determined that the Raglay utilize at least 64 species of plants. Of these, and thanks to the botanical support of Mr. Sam, 42 were identified to species, 13 more identified to genus and 6 identified to family. For those plants which could only be identified to family, this was usually due to the lack of differentiating organs such as fruits or flowers on the specimens collected. The 3 species which remained wholly unidentified, as well as some of those identified to lower levels, were species which it was impossible to observe during the study period, either because of the remoteness of their habitat or the lack of adequate time for field expeditions. Only a few species, such as *Gleditsia australis* and some of those species which the Raglay recognized by their illustrations or pictures, were assigned to species level without being verified in the field. In these cases, identification was based on how closely the name and use provided by the Raglay matched those represented in the resources at my disposal (Medicinal Plants 1990, Phạm 1999 and Tanaka 2007).

The 64 utilized species are distributed throughout 39 families, only 12 of which are represented by multiple species. The family with the greatest number of species used is Fabaceae with 8 species, followed by Dioscoreaceae with 4 species. The distribution of those families with multiple species used can be seen in Table 1.

Table 1: Distribution of Frequently Used Families

Family	Number of species
Fabaceae	8
Dioscoreaceae	4
Moraceae	3
Mimosaceae	3
Piperaceae	2
Cactaceae	2
Sterculiaceae	2
Liliaceae	2
Rubiaceae	2
Apocynaceae	2
Palmeae	2
Asteraceae	2

The 64 plants were divided into those with multiple and single categories of use, and for those with only a single category of use, usage categories were established (See Figure 1). For those plants which only had one category of use, 19 species were used only as medicine, 10 species were used only as food, 6 species were used only for fiber or rattan, 5 species were used only as poison, 3 species were used only as shampoo, 3 species were used only as betel chew additives, 2 species were used only as dyes, and 1 species each for handicrafts, as ornamentals and for pest control. 13 species had multiple uses distributed throughout the other categories.

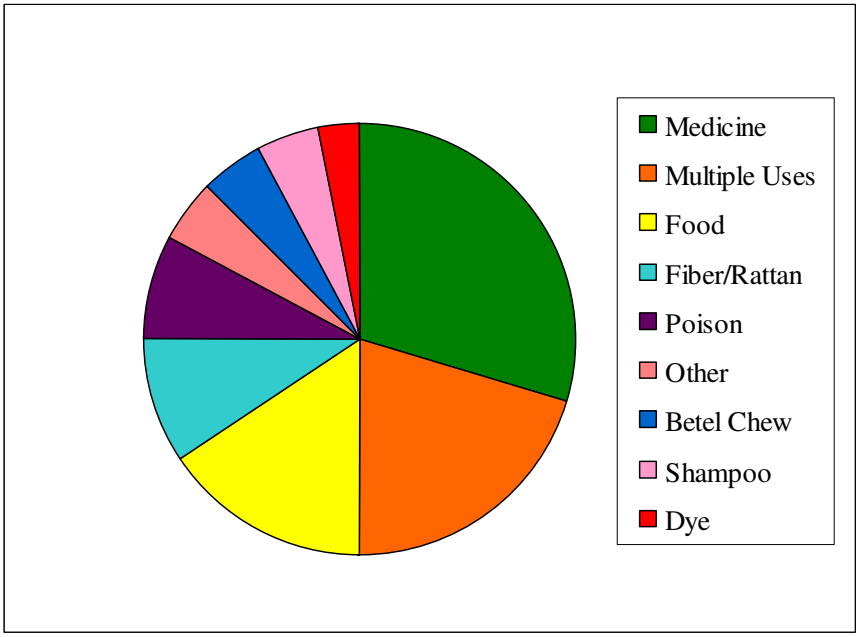

Figure 1: Distribution of Species by Category of Use

The extent of documented uses was surveyed to determine the total number of species used in each previously established usage category. The total number of species used for medicine is 30, for food is 16, for fiber and rattan, poison and shampoo is 6 each, for dye is 5, as betel chew additives is 3, for pest control is 2, and for alcohol production, handicrafts and as ornamentals is 1 each.

Of the 30 plants with a known medicinal use, 28 were identified to family. These 28 species were distributed throughout 22 families in a frequency roughly parallel to the family distribution of the total plants used, as representing in Figure 1. There were only four families containing more than one medicinal species, of which Fabaceae contained 4 species and Dioscoreaceae, Apocynaceae and Piperaceae each contained 2 species. The most commonly used plant parts of medicinal plants are the roots, utilized for 13 species, the leaves, utilized for 9 species, and the trunk, stem or branches, utilized for 7 species. The whole plant, bark, seeds, sap and flowers were each utilized for 3 or less species (See Figure 2).

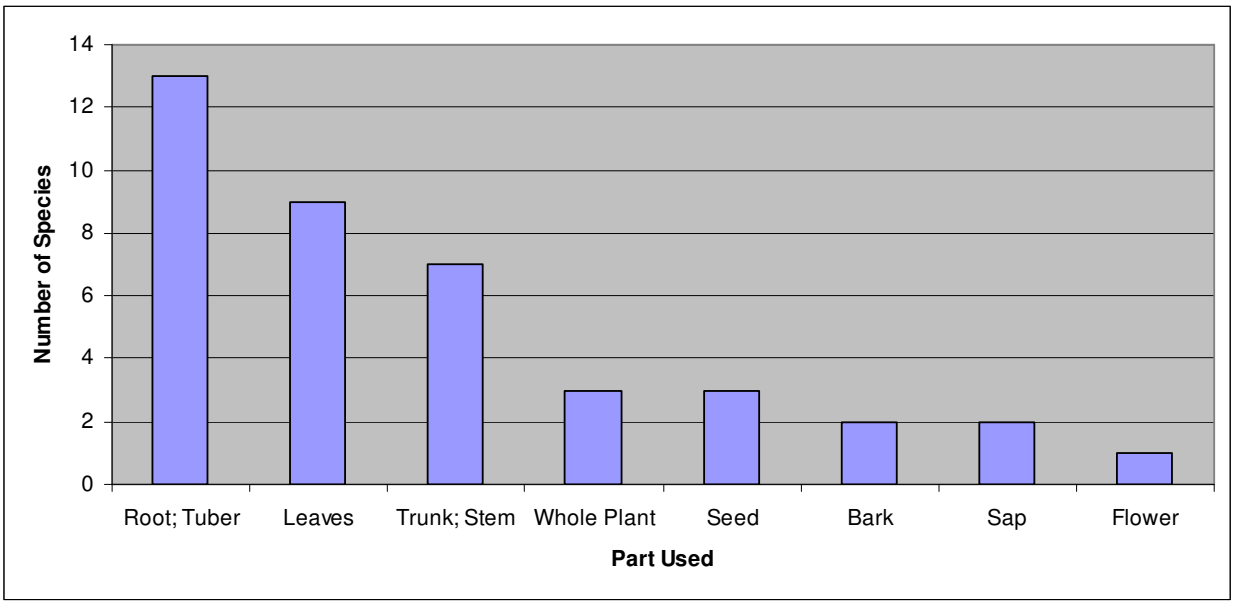

Figure 2: Distribution of medicinal plant parts used

The 30 medicinal plants were used in 37 reported applications (as well as one veterinary application) which could be categorized as treating 20 types of complaints, which are represented in Table 2. The ailments with the greatest number of plants used are snakebites, bruises and the common cold, which are each treated with 4 species. Other widely-used applications include the treatment of wounds and as tonics, for which 3 species each are used, and for post-partum care or to treat back pain, parasites

(parasitic worms and lice) and blood problems, for all of which 2 species are used. In addition to these, many complaints are only treated with one plant: arthritis, indigestion, chest pain, stomach ache, toothache, eyesore, skin irritation, appetite loss, liver disease, planar hyperhidrosis and dysentery.

Table 2: Distribution of ailments treated by medicinal plants

Medicinal Use	Number of Species	Medicinal Use	Number of Species
Snakebite	4	Indigestion	1
Bruises	4	Chest Pain	1
Common Cold	4	Stomach Ache	1
Wounds	3	Toothache	1
Tonic	3	Skin Irritation	1
Post-partum	2	Liver Disease	1
Back Pain	2	Eyesore	1
Parasites	2	Appetite Loss	1
Blood	2	Hyperhidrosis	1
Arthritis	1	Dysentery	1

The 4 plants used to treat snakebite each use a different plant part, but they are all applied directly to the wound. Perhaps the most effective is thought to be the seed of *Mucuna aff. interrupta*, which is halved and rubbed to roughen the surface before application to a snakebite, wasp sting or similar poisonous wound. The tuber of *Dioscorea hispida* and the sap of *Calotropis gigantea* are also used, as well as the less-effective trunk wood of *Cycas pectinata*.

Bruises, sprains and minor bone injuries are treated with a similar variety of plants, which are all externally applied. The most well-known of these plants is *Strychnos nux-vomica*, the seeds of which are crushed and soaked in alcohol before application. *S. nux-vomica* contains strychnine and brucine, which are well-known for their role in traditional medicine (Medicinal Plants 1990) and arrow poisons as well as historical poisoning attempts. Many *Strychnos* alkaloids have found application in modern Western medicine as well (Phillipe 2005). One of our informants told us that it causes bones to grow stronger but more brittle and must be used with caution, but that it has found wide application among martial artists in

Vietnam (Yen 2010). They also reported that if a small amount of the alcohol extract was consumed orally, it would cause sensations of weightlessness and the ability to lift incredibly heavy loads, which seems consistent with its reported antinociceptive qualities (Phillippe 2005).

The tuber of *Dioscorea membranacea*, soaked in an alcohol extract, the heated leaves of a *Crinum* species and the leaves of *Calotropis gigantea* are also applied to bruises. The heated pounded leaves of *Crinum asiaticum* are applied to bruises and sprains throughout Vietnam (Medicinal Plants 1990), and the leaves of *Calotropis gigantea* are used in India to treat testicular inflammation (Ramana 2008).

Coughing, fevers and other symptoms of the common cold are treated with 4 plants, all of which are extracted in water by varying methods, after which the liquid is drunk. The boiled whole plant of *Munronia robinsonii* and the ground whole plant of *Lepidagathis cambodiana* are both thought to be highly effective. The crushed leaves of *Catharanthus roseus* and the ground root and leaves of *Abrus precatorius* are also used, and both these plants are known for similar applications throughout Vietnam (Medicinal Plants 1990). The same use of *Abrus precatorius* is also recorded among the people of Ba Vi National Park, Ben En National Park and Ta Kou Nature Reserve (Luu 2006). *Catharanthus roseus* is used by the Dzao and Muong ethnic groups in Ba Vi and Ben En National Parks to treat high blood pressure and irregular menses (Hoang (A) 2010 and Hoang (B) 2008).

3 plants are used as vulneraries and are applied externally, although all have slightly differing applications. The crushed leaves of *Eupatorium odoratum* are applied to stop the bleeding of fresh wounds. If the wound is caused by metal, the root of *Lantana camara* is roughened on a rock and applied to the wound, probably in prevention of tetanus. The branch core of *Caesalpinia sappan* is boiled in water and applied to the wound as an antiseptic, a use which is supported by its known antibacterial properties (Medicinal Plants 1990).

General tonics are produced from 3 well known-species which are utilized widely in Kinh communities as well as by the Raglay. The crushed leaves of *Cyclea peltata* and the dried gum of *Sterculia foetida* are both soaked in water and used in popular refreshments. The gum of *Sterculia foetida*

is also thought to be effective against dysentery. Both of these species are known to Ayurvedic and folk medicine in India and are used to treat a wide variety of illnesses (Warrier 2002 and Kirana 2010). The propagation of both of these species has been encouraged and aided during the ITB project, because their products are in demand in local markets and can provide some supplemental income. In addition, the seedpods of *Amomum aff. villosum* are collected and soaked in multiple changes of wine. The first change of wine turns pink, the second turns red and the third turns green, and all are said to have various potencies as a general medicinal tonic. These seedpods are sold to the Kinh for the same purpose. *Amomum aff. villosum* is well-known as a medicinal NTFP with high demand in Vietnam (Nguyen 2008) and in the West as one species of cardamom.

Medicine for post-partum care is particularly well-known in Cau Gay, and the traditional application is a combination of 2 plants. The roots of both are prepared using a method common to TCM and TVM which involves slicing, then heating over a fire, covering and cooling in contact with the ground, and boiling in water, after which the resulting liquid is drunk. Soon after birth the new mother is given no more than 2 pots of the extract of *Zizyphus cambodiana* in order to facilitate the afterbirth and purge any 'dark blood'. After this, she is given the extract of Cây cổ đèn, a species in the family Rutaceae, to stop further bleeding and replenish the blood, which she should drink until she feels healthy. These treatments are combined with the practice of mother-roasting, and the umbilical cord was traditionally severed with a razor from the wood of *Caesalpinia sappan* and buried.

Caesalpinia sappan is also used to treat back pain (and arthritis), as is an alcohol extraction of the inner bark of *Cycas pectinata*, which is taken orally. Conditions of the blood are treated orally with the boiled root and trunk core of *Dracaena cambodiana* and an alcohol extraction of a number of plants including the trunk core of *Diospyros mun. D. cambodiana* is widely used as a blood tonic and is harvested from the wild and traded on a large scale in southern Vietnam (Medicinal Plants 1990 and Nguyen 2008).

One of the species used for shampoo, *Pithecellobium vietnamense*, is also effective against lice. A species of *Maesa* which is used as a fish poison is also applied as a treatment for intestinal worms, for

which the leaves are ground and boiled and the resulting liquid drunk. Chest pain and difficulty breathing are treated with a liquid extract of the roots and trunk of *Mitrephora pallens*. A water extract of the roots and lower stem of *Cassia alata* is drunk to treat digestive problems, which is consistent with its traditional use in Vietnam (Medicinal Planta 1990). In addition to its use as a vulnerary, the whole plant of *Eupatorium odoratum* is used in the treatment of skin irritation (alcohol extract) and stomach ache (cold water infusion). This same preparation is used for the treatment of stomach ache by the people of Ben En National Park (Hoang (B) 2008). *Piper betle, Piper lolot* and *Passiflora foetida* are all used in ways consistent with their general applications (Medicinal Plants 1990). Additional unknown plants named Nhai and Cây bồng quân are used in the treatment of toothache and appetite loss respectively.

Of the 16 species used as food, 14 could be identified to family. These 14 species fell into 11 families, only two of which had more than 2 species per family: Dioscoreaceae with 3 species and Asteraceae with 2 species. For all the edible species recorded, only one plant part and one application are used for each. The most common plant part used is the fruit, of which 6 species are eaten, followed by roots and tubers, with 4 species eaten, leaves, with 3 species eaten, seeds with 2 species eaten and the nuts of one species (See Figure 3).

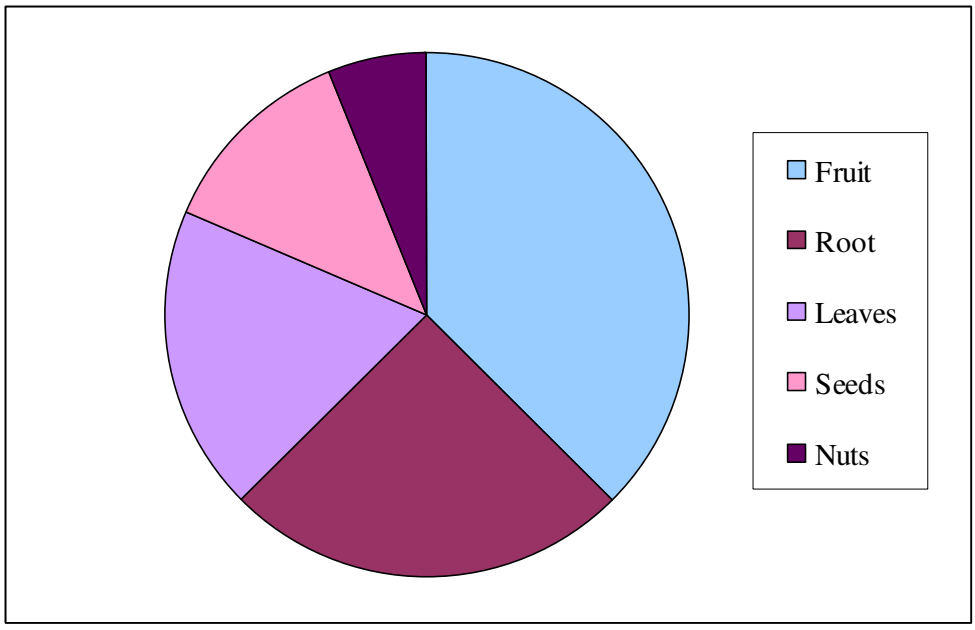

Figure 3: Distribution of edible plants by part used

All 6 fruits are eaten fresh and generally ripe when they are happened upon in the forest. Plants whose fruits are eaten are *Zizyphus cambodiana*, *Mitrephora pallens*, *Antidesma phanrangensis*, *Melastoma affine*, Cây bồng quân and Cây sim. The fruit of Cây sim is also used for the fermentation of wine. The ripe and unripe fruit of *Antidesma phanrangensis* is thought to have thirst-quenching properties and is used for this ability during long hikes in the forest. The fruits of other species in the genera *Zizyphus* and *Melastoma* are eaten by the people of Ben En National Park (Hoang (C) 2008). In Thailand, the fruits of *Zizyphus cambodiana* and other species of the genera *Mitrephora, Antidesma* and *Melastoma* are eaten (Suksri 2005).

Of the 4 different species of roots eaten, 3 are members of the genus *Dioscorea* whose tubers are common dietary supplements. The tubers of *Dioscorea aff. persimilis* and another *Dioscorea* species are washed, peeled, cubed and boiled in water. These species can be prepared in the same ways as the common potato. The tuber of *Dioscorea hispida* is similarly washed and peeled, but then it is dried in the sun, soaked in saltwater, and ground before cooking. *D. persimilis* and other *Dioscorea* species are widely used in Vietnam in the same way as other tubers (Tanaka 2007 and Hoang (C) 2008). The only species whose true root is eaten is *Asparagus acerosus*, which is dug, washed and consumed fresh to retain maximum sweetness.

The leaves of 3 species are prepared like other greens and can be eaten raw or cooked. These greens are *Moringa pterygosperma*, *Emilia sonchifolia* and *Gynura crepidioides*. The latter two are successionary weeds which are commonly eaten throughout Vietnam as well as in Thailand (Tanaka 2007 and Suksri 2005) and *G. crepidioides* is also eaten by the people of Ben En National Park (Hoang (C) 2008).

The two seeds are both eaten only as dietary supplements in times of hardship. The seeds of *Streblus ilicifolius* are roasted before consumption. The seeds of *Cycas pectinata* are harvested en masse from the heads of female plants and halved, dried in weak sunlight, ground, and stored until they are eventually boiled and mixed with rice. Only one nut is eaten, the acorn of *Castanopsis arietina*, which is

roasted in a fire, extracted from its shell and eaten piping hot. The same preparation of other *Castanopsis* species is eaten in Thailand (Suksri 2005).

Of the 6 species used for poison, 5 were applied as fish poisons, although only one of these plants could be identified to species level. The seeds of two plants known as Dây bồ hòn, *Antherosporum pierrei* and a *Derris* species, are both dried in the sun, ground and sold in order to be added to shrimp aquaculture ponds to kill the fish which compete with the shrimp for nutrients. The stems of *Derris elliptica* are used in Thailand as a fish poison (Suksri 2005). The ground leaves of a *Maesa* species (which is also used to treat intestinal worms) can be mixed with sand and added to a stream for fishing purposes. In addition, two species of the family Cactaceae, Cây xương rồng dây and San hô dây, are ground whole and used for the same purpose, although these species are highly toxic and used with care.

The only species utilized for hunting poison is the highly poisonous latex of *Antiaris toxicaria*, which is processed and used to tip crossbow bolts. This species is well-known for its role as a constituent of arrow poisons across Asia and contains a variety of highly active cardenolide glycosids (Phillipe 2005). This tree had ritual significance to the hunters who used it, who would only approach the tree for latex harvesting after a 2 day fast and one night of sexual abstinence. Beyond this precaution, a detailed set of specifications for its use were provided by our guide (Yen 2010).

The first time a hunter came to harvest latex, they should carve 3 eye shaped marks into its bark, thus signifying their pact with the tree. After this initial symbolic marking they could make any sort of cut in the tree; however, the guidelines for latex collection were very specific. A slice of the bark was cut from the trunk, the outermost bark removed and the remaining inner bark pulverized in order to increase absorbency. This was then held up to another cut in the tree in order to absorb as much latex as possible. In order to collect the thickest and most abundant sap, collection should take place after the leaves of the tree have fallen and between 9:00 and 10:00 in the morning (Yen 2010).

The latex was then squeezed out of the bark and boiled over a fire made from the wood of a specific tree whose name we did not learn. Once the liquid reduced and cooled, the crossbow bolts favored by the Raglay hunters could be dipped into the poison, although after their arrows had been

coated, the hunters were required to go out hunting three times, regardless of the result. If any of these ritual steps was ignored, the power of the tree could possibly rebound onto the hunter who disrespected it. Once game was shot, it was said to run in a pattern mirroring the ovate shape carved into the tree trunk, and to die upon returning to the point where it was shot (Yen 2010).

Whenever a hunter used this poison, he was cautioned to have two antidotes in his possession in the case of an accident. One was the dried and powdered 'mountain earthworm', which could be applied to the wound where the poison entered the blood in order to neutralize its activity. Another was the fatty substance located behind the eyes in the carapace of the 'mountain stream crab', a species of *Villopotamon* (newly described from Nui Chua National Park in 2003), which was also directly applied to the wound (Yen 2010).

A large number of species used for shampoo and soap were recorded, all of which have similar applications. The bark of *Pithecellobium vietnamense* and *Albizia aff. corniculata*, both of the family Mimosaceae, are crushed, briefly soaked in water and squeezed over the head. The same preparation of *P. vietnamense* is applied as a cure for lice. The bark of *Gleditsia australis* is also used as shampoo and a dark hair dye, but it is of inferior strength to the fruit, which is broken in pieces and boiled in water before use. The same application of the fruit is also known to the people living in Ben En National Park (Hoang (C) 2008). The fruit of two species known as Cây găng, *Randia spinosa* and *Randia dasycarpa*, are crushed and applied directly to the hair. The fruit of *Catunaregam tomentosa*, an alternate name for *Randia dasycarpa*, is used in Thailand as soap (Suksri 2005). The leaves of a *Crinum* species are also crushed and applied.

Fiber and Rattan are produced by a wide variety of plants, and this usage category was not delved into deeply enough to get a full account of local usage. Of the 6 species reported, only 1 was identified to species level. The stems of *Flagellaria indica* are used to make small string, and the vine of a species of *Bauhinia* is used to make a thicker fiber used for cattle ties. A *Calamus* species can be used to make rattan furniture such as tables and chairs, and the root core of a *Pandanus* species is used to make rattan mats and beds as well as rope and fishing nets. A species of bamboo in the family Poaceae is used to

make the string for crossbows, the binding for traditional roofs and carrying baskets. A different *Calamus* sp is used to make the carrying poles and bindings of traditional baskets. Many *Calamus* species are known for their use in rattan and similar handicrafts (Hoang (C) 2008).

In addition to the use of *Gleditsia australis* as a black hairdye, four additional species are used to dye various products. The bark of a *Syzygium* species is crushed and mixed with water, which is used to soak fishing nets for several days, thus dying them black. The bark of *Syzygium gratum* and *S. polyanthum* are used in Thailand to dye fishing nets in order to enhance their strength (Suksri 2005). The fruit of *Diospyros mun* is similarly cut in half and soaked in water, which is then used as a black fabric dye. The root of *Caesalpinia sappan* produces a red dye after it is cut in pieces and cooked in water for several hours. The root of a *Gymnosporia* species is prepared similarly but produces a yellow fabric dye.

Betel chewing, a widespread habit among the older generations in Vietnam and particularly among older women, is supplemented with a variety of barks used to enhance various characteristics of the chew. The Raglay reported 3 species commonly added to the basic chew, composed of betel leaf, areca nut, lime, and chewing tobacco. The branches of *Terminalia triptera* are pounded to remove the bark, which is dried, cut in the pieces and added to provide a hot taste. The branches of a *Pterospermum* species are prepared similarly. The root bark of Cây rế lúa, a species in the Moraceae family, is removed, dried and added to enhance the red color and soften the texture of the chew.

Several species are used for other uses such as pest control, handicrafts, as ornamentals and for alcohol. The sap of *Calotropis gigantea* is applied to all four corners of the chicken coop to prevent chicken parasites. The leaves of *Nicotiana* species are mixed with hot peppers and soaked in water, which is then sprinkled onto the fields in order to drive away pests. The seeds of *Entada glandulosa* were historically collected when dry and sold to the Kinh communities for handicraft production. Now, however, they are collected and handicrafts are produced in the village, including necklaces, bracelets and prayer bead strings. A species in the Orchidaceae family is collected from the forest and sold to Kinh communities as an ornamental.

Only 8 documented species were mentioned which were regularly sold to the nearby Kinh town of Vinh Hy or to traveling traders. Of these, 4 species were sold for their use as medicine, 2 for use as fish poison, 1 for use in handicrafts and another for use as an ornamental. *Munronia robinsonii* was in high demand for its use against the common cold, and orders would come into the village for a set number of plants, which would be harvested whole and hung to dry with air circulation before sale. The alcohol produced by soaking the seeds of *Strychnos nux-vomica* was also in demand from Kinh traders, and could sell for 10,000 VND/wet kg. The seedpods of cardamom, *Amomum villosum*, are to the Kinh on the other side of the mountain for their use in alcoholic tonics. The highest quality 'pure white gum' produced by tapping the *Sterculia foetida* tree was worth 120,000 VND/kg.

Both species of Dây bồ hòn, *Antherosporum pierrei* and a *Derris* species, were in high demand from the nearby village of Vinh Hy for application as fish poisons in shrimp aquaculture ponds. In previous times, the seeds of *Entada glandulosa* were often harvested for sale to Kinh traders, although this no longer occurs, since now they can be more profitably processed by the village itself. The orchid species is often collected from the forest and grown around the house until its sale is specifically requested by a friend or relative in a nearby town.

Discussion

The usage categories established as part of this study are similar to those used in many similar ethnobotanical surveys, but they also differ in several ways. Most studies cover the use of construction materials more deeply, while this study only touches on them briefly in the fiber and rattan category (Hoang (C) 2008 and Suksri 2005). I felt that real knowledge of construction materials would require learning about timber, and since the focus of this study was Non-timber Forest Products, I decided to steer away from these uses in my interview. The large scale on which many construction materials are harvested makes their use generally unsustainable, with the probable exception of some species of bamboo, and so they were unlikely to be supported by a conservation-minded National Park. Beyond rattan-type handicrafts, these materials also have limited application for ecotourism. The final reason is that the present village of Cau Gay is a relocation village of concrete houses built by the government, so the Raglay there have much less use for their knowledge of traditional construction than in some other areas.

The prominence of medicinal plants and then food plants is consistent with other studies, although the relative frequency of these categories will vary with the ethnicity, environment and common livelihood of the people. Most of the other categories established here would generally fall into the 'household products' or 'other'categories in a more large-scale study. The small scale of this project and the relatively small number of species covered allowed me to establish categories with a greater level of specificity. Categories of particular interest which are usually passed over in larger-scale studies are the shampoos, dyes and poisons, as well as the betel chew additives.

When the number of species used exclusively for a given usage category is compared to the total number of species used for each usage category, an indication is given of the distribution of plants with multiple uses (See Figure 4).

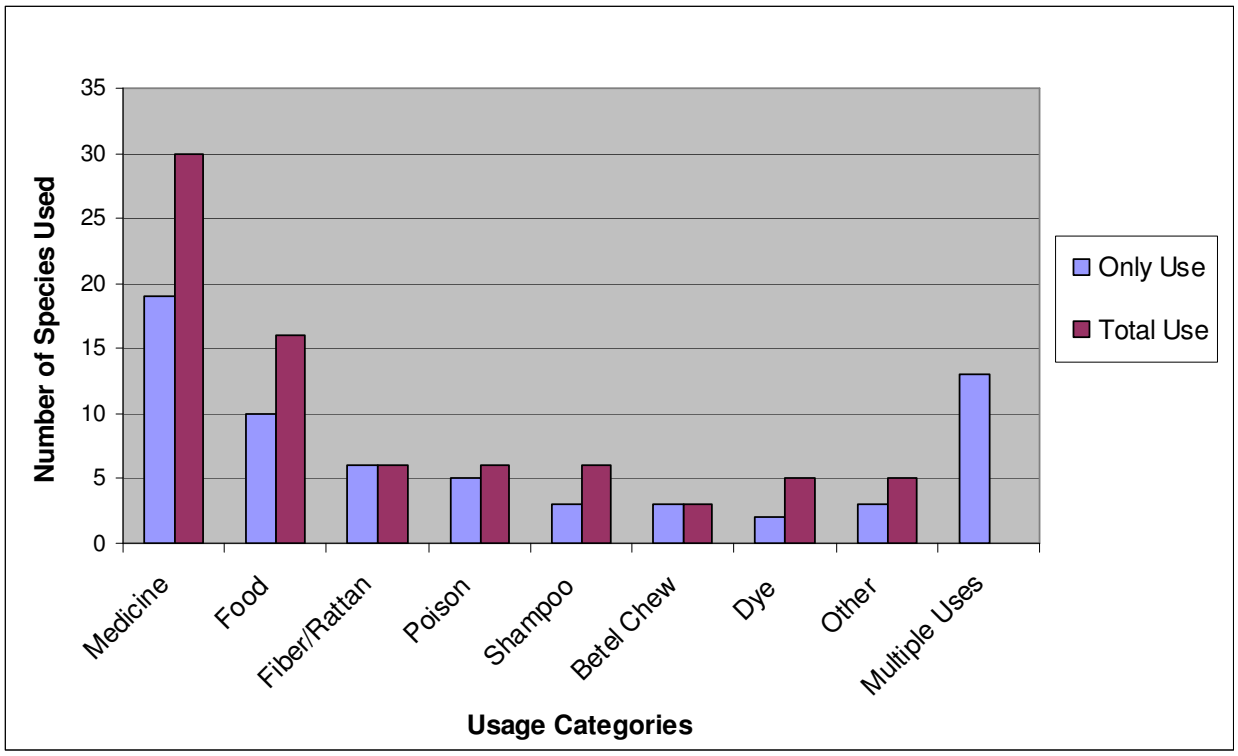

Figure 4: Number of species used only for a given category (light blue) compared to the total number of species used in each category (purple)

From this comparison it is clear that for the fiber and rattan, poison, and betel chew categories, the vast majority of plants used for that purpose are used *only* for that purpose. Species in these categories have virtually no multiple uses, with the notable exception of the *Maesa* species which is used as a fish poison and a treatment for intestinal worms, which is in reality also a use as a poison. In contrast to these categories, plants used as medicine, food, shampoo and dye often have nearly half their species with a documented use in another category. With this high degree of multiple use, it is clear that these categories contain the species with the greatest flexibility and widest range of use. These species also tend to have the greatest number of plant parts used. The 5 species of the dye category, for example, also contain species used as medicine and shampoo, and altogether the roots, trunk and branches, bark and fruit of these species can be utilized.

The medicinal species have the highest diversity of plant parts used (although this is also the largest category), with some plants using multiple parts for the same application, some using different parts for different applications and some using the same part for multiple applications. Although other studies have documented the use of a higher number of leaves than roots, multiple studies agree that the three most frequently used parts of medicinal plants are the roots, leaves and stems (Hoang (A) 2010 and Hoang (B) 2008).

The type of illnesses most commonly treated is a clear reflection of the environment and livelihoods of the people who utilize medicinal plants. In the case of the Raglay, there are at least 8 species of poisonous snakes that reside in the mountains they frequently travel through, so having a high number of plants effective against snakebite is a matter of dire practicality. In addition, the high frequency of treatments for the common injuries of any working people, such as contusions and cuts, reflects the Raglay's livelihoods as farmers, foragers and laborers. Like any people, they are often beset by the common cold, so it is no surprise to find a relatively high number of treatments for this ailment. The use of tonics, which are believed to be medicinal but often not in any specifiable way, is widespread among forest peoples and ethnic minorities in general. The 3 tonics used by the Raglay are not, however, unique to their culture but are in fact widely used by local Kinh and to some extent, throughout Vietnam.

Beyond these categories, the ailments with cures reported to us may be more a product of the memory or experience of our informants than an actual indicator of frequency of use. In many cases, the ethnobotanist must ask the right questions to receive answers, and if a disease is not specifically mentioned or the plant happened upon in the field, knowledge about a given treatment may never come to light. This is the case with, for example, malaria and diarrhea, both of which almost certainly have herbal remedies known to the Raglay, but which were unfortunately overlooked by the researcher.

The incidence of actual use of the medicinal plants mentioned was hard to determine, particularly because the focus of the project was on documentation of traditional uses rather than present uses. Sensing this, our contacts clearly provided us with much information which can be considered obsolete in the modern Cau Gay context of concrete houses, motorbike access to clinics and the occasional TV. The

only medicinal product that was shown to us was a bottle of the alcoholic extract of *Strychnos nux-vomica*, which was prepared from a nearby tree and kept in readiness for bone bruises and similar injuries. It was clear that this product at least was widespread in the village, because our hosts told us amusing anecdotes about several village members who had recreationally consumed small amounts of *Strychnos* alcohol, which clearly has a powerful effect on the mind as well as the body.

Other than this plant, the 3 tonic species are also known and used in the village; at one point a *Sterculia foetida* beverage was prepared for us using the leaf petioles. We also took part in the collection of *Amomum villosum* seedpods, some of which would be used in a bottle of wine for our host, because, as he explained, his wife had finished the previous bottle. Given this evidence, it is probable that any species sold to the Kinh is also used by the Raglay, but unfortunately the full extent of medicinal plants sold to the Kinh remains undetermined.

In general, the herbal medicine of the Raglay appears to be small amount of local knowledge mixed with a wide variety of Traditional Vietnamese and Traditional Chinese Medicine. This is clear not only from the plants used, the use of many of which is widespread and well-known in Vietnam, but also from the preparations. Some preparations, such as heating a plant part on the fire and cooling it while covered and in contact with the ground, are borrowed from these systems and based on the concepts of yin and yang which inform TVM and TCM.

The lack of a high degree of true local knowledge is probably partly due to the lack of any holistic transmission of traditional knowledge. Cau Gay currently lacks a traditional medicine practitioner and it was unclear whether the village had ever had one, so the knowledge that our primary contacts do have is assembled from bits and pieces of their own experience, and is likely to be cobbled together from multiple traditions. From our interview with the traditional midwife, we learned that while in more traditional times there were several operative midwives in the village, any medicine that was administered before, during or after the birth was prepared by the mother or husband of the pregnant woman, not the midwife, a healer or any other trained individual.

It is also possible that the Raglay have never had a very strong tradition of herbal medicine. Robert Voeks has proposed that the development of an herbal medicine tradition is associated with the social processes which clump human populations together, since infectious disease only becomes a problem with large clumped communities. He argues that scattered forest peoples are only afflicted by a very few natural illnesses such as fungal infections, snakebites, parasites, dental problems and a limited number of viral and bacterial illnesses, so that they have little need for advanced medicinal knowledge. Thus the Raglay, who have practiced hunting, gathering and low-density shifting agriculture for millennia, would never have established a significant pool of herbal medicinal knowledge (Voeks 2004). In contrast, the closely related Cham ethnic minority, who established an agricultural and maritime trading society more than a thousand years ago, are widely regarded as skilled herbal healers (Center for Advance Study 2009 and Vinh 2010).

The type of plant parts consumed is fairly consistent with other studies, although there were some gaps (Hoang (C) 2008 and Suksri 2005). No edible flowers were recorded in this study, nor was a single species of bamboo. Although bamboo is not widespread in Nui Chua National Park, it is certainly present, and given the range and frequency of bamboo shoot consumption in Vietnam (Tanaka 2007), it is unlikely that the Raglay know of no edible species. Again, this gap is probably due to the failure of my methodology, since I did not specifically ask what species of bamboo shoots are eaten.

The fact that fruits are the most frequently eaten plant part is corroborated by a study in Thailand (Suksri 2005). However, without exception these fruits do not make up a large part of the diet of foragers, but are instead eaten only on a supplemental and random basis as they were chanced upon in the forest. The nut of *Castanopsis arietina* is used in the same way. Instead, the next most frequent category of use, the roots and tubers, provides by far the most important plants to the Raglay diet.

During the several wars which the older generations of Cau Gay have lived through, people were banned from living in the forest in order to prevent them from aiding the Viet Cong. Regardless, the people of Cau Gay refused to leave their home and instead fled farther up into the mountains, where they lived in scattered groups. During this period they could not farm even their upland gardens because of the

possibility of detection by surveillance planes, so they existed largely off of the products offered by the forest.

Of these, *Dioscorea persimilis* and *Dioscorea hispida* were the principle providers, since they offered highly nutritious food that could be harvested in bulk and stored for long periods, and because they grow well in higher elevation, sheltered areas. *Dioscorea persimilis* contains 63% starch and 6.7% protein, so it is a good choice for the base of a wild-sourced diet (Tanaka 2007). In addition to the *Dioscorea* species, the third plant product of dietary importance during the wartime was the seeds of *Cycas pectinata*, which can also be harvested in bulk from the heads of female plants. The roasted seeds of *Streblus ilicifolius* were also mentioned as a rice substitute and famine food.

Compared to the medicinal plants, it is much more likely that the Raglay still utilize the vast majority of the edible plants which were recorded. During our time in the field, the fruits of *Z. cambodiana*, *A. phanrangensis, M. pallens* and *M.affine* as well as the nut of *C. arietina* and the root of *A. acerosus* were all casually consumed. During other excursions, the leaves of all three edible greens were collected and brought back to the homestay house to be prepared in that evening's meal. At one of the upland garden work houses, we observed several *Dioscorea* plants and tubers which had been bought or harvested for planting and eventual consumption.

The use of plants for poison was clearly an important application in the past, although very few vestiges of this use still continue. That fact that 5 separate plants are known for the identical purpose, even more than is recorded to treat any single ailment, shows how prevalent the practice of fish poisoning once was. Although it was not mentioned by any informants, it is possible that the use of plants for fish poisoning was one of the ways that the Raglay supplemented their wartime diet of roots, seeds and hunting. These species also have an unusual range of habitats; while 3 grow in the mountain foothills near the village, 2 of the species mentioned were cacti known only from the sandy coastal area. Today, the only common application of this knowledge is the use of the Dây bồ hòn species, *Antherosporum pierrei* and a *Derris* species, for their use as a commercial NTFP. During our excursions we observed

huge mounds of the seedpods of *A. pierrei* and during our stay in the village there were usually many trays of *A. pierrei* seeds laid out in the sun to dry.

Easily the most charismatic and awe-inspiring of the plants we recorded is the 'Spirit Tree', *Antiaris toxicaria*. Although it is doubtful that many in the village even know how to locate the two individuals our guide knew of, he made it clear that previous generations relied heavily on this tree for its perceived and demonstrated power. The trunk of the individual we observed was scarred for tens of feet above the ground from what had obviously been many decades of latex harvesting. Given the great scope and details of the usage rituals, this plant was probably seen as sacred by the traditional Raglay, who even today practice a diluted form of animism. It was viewed as a provider of game but also as a powerful ally which must be approached with caution and reverence. *Antiaris toxicaria* was the only plant documented which could be said to have religious significant to the Raglay.

There is no obvious explanation for the high number of reported species used as shampoo. One possibility is that this function became important during the war when the Raglay of Cau Gay lived completely cut off from the supply lines they had previously relied on for amenities like shampoo. Although all 6 species were described as shampoo, shampoo is essentially one application of soap, and so these species may have been used more widely for food preparation, hygiene, clothing and other uses during a time when all processed soap was unavailable. Indeed, 3 of the 6 species, *Gleditsia australis, Albizia aff. corniculata* and a *Crinum* species, were reportedly used during the war period. The *Crinum* species is used specifically to make the hair silky and is used particularly by women after pregnancy. *A. corniculata, G. australis* and *Pithecellobium vietnamense* all grow on the banks of the small streams which feed off of the mountains and so are easily accessible to the present-day Cau Gay Village. The two *Randia* species grow most commonly as pioneer species in the cleared saddles of more upland areas, so they are less accessible and thus less likely to be used.

The limited information we recorded about fibers and rattan made it clear that most of the truly traditional knowledge about this subject was already lost. We were told that only two of the oldest people in the village still remembered how to make handicrafts using the *Pandanus* and *Calamus* species.

Within the living memory of most village inhabitants, the only reason these species had been harvested at all was for sale to the coastal Kinh communities where basketry and rattan weaving is more widespread. All of the flat baskets, carrying baskets or woven doors which I spotted in the village and inquired about were bought from Vinh Hy. In contrast, it was made clear that the fiber made from the inner liana core of the *Bauhinia* species was still locally produced and used as a cattle tie.

The fact that the shampoo preparation of *Gleditsia australis* is also effective as a dark hairdye is incidental and essentially meaningless to the Raglay themselves, who all have very dark hair. Most would probably not even notice this effect; its only true application might have been by some of those of great age who preferred it as a shampoo source in order to reverse their slow greying. During the study it was not made clear to me why the *Syzygium* species was used to dye fishing nets, since they seemed equally effective if they were white or black. If the evidence of similar use from Thailand is applicable here, however, their real function is the coat the fiber of the fishing nets in order to strengthen them and make them more durable (Suksri 2005).

The 3 fabric dyes, each for a different color, all had historical applications. They were also used during the wartime when access to cheap processed dyes was nonexistent. The fruit of *Diospyros mun* was used to dye clothes black when local guerrillas and messengers had to move stealthily at night. The cost of detection by the French, American or South Vietnamese Armies was high, so being able to effectively blend into the forest was crucial for any of the Raglay involved in revolutionary activities. The red and yellow dyes produced by *Caesalpinia sappan* and a species of *Gymnosporia*, on the other hand, were used to produce fabrics for festive occasions. When I asked my contact to clarify this use, he explained that the main festive activity in those days would have been courtship. However, it is possible that in the days when the Raglay still remembered their festivals, fabrics dyed with these plants had other occasions of use.

Betel chewing is still common among some members of the older generation and was observed among a few interviewees. These habituated users usually have a preference for specific aspects of the chew, and the various bark additives give them the ability to highlight whichever quality they prefer. The

only additive which was actually observed was the bark of Cây rế lúa, a plant which could only be identified to the family Moraceae and was chewed to help soften and texturize the mixture. The Cham park ranger who came along with us on some excursions harvested all the bark of a root that was cut by our guide, explaining that otherwise it would go to waste and he knew an old woman in his village who would be happy to buy it. He claimed that the roughly 5 kilograms he harvested and dried would yield around 100,000 VND at a rate of 20,000 VND/kg.

It is surprising that of the 64 species of NTFPs for which information was recorded, only 8, roughly 12%, were reportedly sold. The vast majority of these are no surprise, as they are commonly used or cultivated specifically for sale. The three species which are only harvested from the wild and may have more localized use are *Munronia robinsonii, Antherosporum pierrei* and the species of *Derris.* The obvious reason may be that information was not specifically requested for most of the plants; for those which were recorded as commercial, the information was volunteered or in response to broad question of NTFP sale. If I had had the time to sit down with one of our primary participants and go over the entire usage list, the result may have been significantly broader. Unfortunately, information about the sale of plants was not one of the original project goals; instead, our time was focused on documenting all remembered traditional uses.

An alternative reason may be that this study was conducted during the wet season. According to the evidence of other studies on NTFP collection, the true commercial season for NTFPs is during the dry season when agriculture is no longer possible and funds begin to run thin (Luru 2006 and Morris 2002). The only NTFP actively harvested during our time in the village was *Antherosporum pierrei*, and it is possible that if we had come at a time when a wider range of plants was being collected, information about commercial NTFPs would have been more readily available.

According to the Disturbance Pharmacopoeia theory, humans tend to learn the most about, and thus utilize, those plants which they encounter most frequently. This means that in the context of any agricultural people and particularly for those who practice shifting agriculture, the vast majority of utilized plants will be drawn from the variety of human-influenced successional habitats which surround

their farms and settlements (Voeks 2004). My experience with the Raglay resoundingly supports this: of the 43 species I directly observed, I estimated that 6 were in human landscapes, 7 were in lowland riparian habitats, 24 were in primary successional habitats, 3 were in secondary successional habitats, and 3 were in what appeared to be relatively untouched forest. This evidence is neither professional nor conclusive, but it does at least indicate that there is a preference among the Raglay of Cau Gay for using plants in easy-to-access, human-impacted landscapes.

On Names

All plants were first reported by our participants using their vernacular Vietnamese names, although for a few species which were recognized out of books, various park and ITB staff provided the common Vietnamese names. Of the names provided by the Raglay, many are purely local creations, and may only be applicable within Cãu Gãy village or even within the household of the specific informant. Other names, such as Trái mun (*Diospyros mun*) or Sa Nhân (*Amomum villosum*), are the common vernacular Vietnamese names known throughout the country. In these cases, the reason may be that the products are sold to Kinh communities, as is the case with *Diospyros mun* and *Amomum villosum*, so that the Raglay must know the popular name in order to communicate and trade. However, many other popular Vietnamese names were applied to different species from their usual usage. Examples of this kind include Vú bò, which is usually applied to *Ficus heterophylla* but is applied by the Raglay to *Mitrephora pallens*, or Thần linh, which is commonly applied to *Kibatalia anceps* but is here applied to *Antiaris toxicaria*.

In some cases, the provided Vietnamese name referred not to the specific plant but to a group of related plants such as a genus or a family, even though only one species within this group was utilized in a specific way. This may have been because the informant did not know the specific Vietnamese name, and it is possible that the equivalent Raglay name contained a higher level of specificity. Occasionally, one name was used for several different species with the same use, which were designated as male or female. This was the case with Bồ hòn (*Antherosporum pierrei* and a *Derris* sp), which refers to two related species whose seeds are used in an identical way but have different habits, fruits, and flowering periods. These types of occurrences made it clear that relying on the provided Vietnamese names alone would be highly misleading, and reinforced the need to observe the plants in the field. Vietnamese names were often supplied with specific floral modifiers, which included: cây (tree), dây (vine), mây (rattan), trái (fruit), lan (orchid), khoai (tuber) or nấm (mushroom). These modifiers referred either to the plant habit or the part utilized.

Raglay plant names were all recorded in one session, during which we went through the list of all known utilized plants with several of the key informants. The names were vocalized to a Cham park ranger, whose familiarity with the similar Cham language, which is linguistically very similar to Raglay, allowed him to suggest a Vietnamese transliteration. The Vietnamese transliterations were tested and refined by Vietnamese speakers until they could be read to the satisfaction of the Raglay informants. These names almost entirely lack translations, which may be because all of our Raglay contacts are bilingual, and so they have no need to, and are thus unfamiliar with, translation between the two languages. Raglay names follow a similar system of modifiers as those applied to Vietnamese names, of which the most common are: ca dâu (tree), hu réh (vine), ha wai (rattan), ha pùi (tuber) and pù mao (mushroom).

Conclusion

The Raglay of Cau Gay Village possess a significant heritage of traditional plant usage. In only a few weeks they revealed the uses of over 60 plants, and I am confident that any more thorough research in this subject will find evidence of many more. As might be expected given the rapid pace of change in Vietnam and the many hardships and relocations the Raglay have endured, the majority of this knowledge is no longer utilized and so is quickly disappearing. The eldest people of the village, who probably lived during times when this knowledge was much more widely utilized, are unfortunately uncommunicative; what memory they have left is usually dominated by the hardships of the war period.

The true repositories of knowledge about traditional plant use are among the children of this oldest generation, especially the handful of surviving guerrillas who relied almost exclusively on edible plants and herbal medicines, shampoos and construction products during the wars. Of this traditional forest knowledge, today only a few subjects are widely known in the village, mainly concerning edible plants and those which can be sold to the Kinh, for the Raglay still lead tenuous lives and face periods of hunger.

In terms of the future, many aspects of this documented knowledge will be of use to the development of ecotourism. A wonderful network of underdeveloped trails exists in Nui Chua National Park which is only used by the Raglay to access their steep slope gardens, other villages, or deeper areas of the forest which are of historical or economic interest. These trails are perfect for rustic day hikes or camping trips, and nearly any Raglay is fit to serve as a guide. As the trail winds through successional vegetation, the upland gardens, across small streams and into the thicker forest, an ever-changing array of useful plants is encountered.

With very little effort the Raglay could identify wild plants of particular interest and explain their uses to ecotourists, at the same time showing them how to gather edible species for those who are interested in the local flavor of farm-to-table food preparation. Combined with the fresh fruit of the upland gardens and the possibility of langur observation, this type of outing would be perfect for an

ecotourism tour. Longer hikes into the forest could be catered to the interests of particular groups and easily combined with trips to key spots like the location of the *Antiaris toxicaria* individual.

In addition, some of the plants documented could eventually find their way into ecotourism products. The wealth of plants used for shampoo, many of which are easily accessible from the village, could be used in small-scale productions of local, natural shampoo. Combined with the fragrance of local flowers, such products have the potential to be very popular among ecologically-minded tourists. *Gleditsia australis* is already used in a variety of natural shampoos. However, sustainable harvesting of tree bark, the main plant part used for several species, might be difficult, so I would recommend trying to develop soaps and shampoos from the fruit of *Gledisia australis* and the *Randia* species.

Another possible product might be developed from the natural yellow and red fabric dyes which were once utilized by the Raglay. Unmarked white T-shirts can often be purchased in bulk for very cheap and printed with simple logos about the park or the village with minimal labor. Such T-shirts could then be dyed with *Caesalpinia sappan* or the *Gymnosporia* species to provide a variety of colors and sold at an easy profit. The natural dye and local labor would make these products appealing to ecotourists. However, since the roots of these two species are used, only very small batches should be produced to reduce over-exploitation of these useful species.

Beyond marketable products, it should be easy to use the information documented in this study to create basic English-language resources to provide free to ecotourists. These resources should indicate the scientific name of the plant, the Raglay name of the plant, and the local Vietnamese name of the plant along with identifying marks, local uses and interesting details of preparation. Particular focus should be placed on species of multiple uses such as *Caesalpinia sappan* , species of economic importance such as *Antherosporum pierrei* or *Sterculia foetida*, species of cultural importance, including the 3 edible species relied on during the wartime and the 2 species for post-partum care, and species for which interesting information exists such as *Strychnos nux-vomica* and *Antiaris toxicaria.* All necessary information is provided in Appendix B.

Any future work on the ethnobotany of the Raglay in Nui Chua National Park should deeply investigate the plants mentioned above, trying to ascertain if any other plants are used for the same purposes, determining their relative abundance in the park, and if possible, directly observing their preparation. In order to determine the feasibility of rattan-type handicrafts, more information should be gathered about the species used, their preparation and specific application, particularly from those elder villagers who still remember the methods of traditional rattan making.

More detailed information about the species of commercialized NTFPs, their collection methods and markets will be useful for the ecotourism project and the understanding of the economic role of NTFP harvesting among Vietnamese ethnic minority groups in general. This type of information can help to give a realistic estimation of the impact of the Raglay villages living in the buffer and core zones of the park on the existing park's ecology, and thus provide better grounds on which to design effective management strategies. It is recommended that any study on NTFPs be conducted during the dry season, when NTFP collection is more widespread and information about it easier to access and observe.

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Appendix A: Sample Questions for Semi-Structured Interviews

1. What medicinal NTFPs are used to treat _____ and how are they prepared?
2. What fruits/vegetables/roots are collected from the forest and how are they prepared?
3. What types of seaweed are harvested and how are they used?
4. What NTFPs are used as flavoring agents or condiments?
5. What NTFPs are used as tonics to increase longevity and general health and how are they prepared?
6. What plants are used in the production of wine and alcohol?
7. What causes disease? How do medicinal plants counter these causes?
8. What NTFPs are used for birth control?
9. What NTFPs are used during pregnancy and postpartum? Who would traditionally oversee pregnancy? What plants are used for infant care?
10. What NTFPs are used as poisons for hunting, aquaculture, or pest control?
11. What plants were traditionally used to produce soaps and shampoos?
12. What NTFPs are used as natural dyes?
13. What plants were traditionally used as fibers and how were these fibers prepared?
14. What plants were traditionally used to make handicrafts such as baskets, mats, and ornaments?
15. What plants are known for their spiritual or religious significance? Why? How are they utilized?

Appendix B: Selected Information About All Recorded Species. F=Food, M=Medicine, S=Shampoo, D=Dye, P=Poison, B=Betel Chew, Fb=Fiber, R=Rattan, PC=Pest Control, H=Handicrafts, O=Ornamental, A=Alcohol Production and VM=Veterinary Medicine

Vietnamese Name	Raglay Name	Family	Scientific Name	Use	Application	Part	Preparation
Củ mài	Ha pùi Clài	Dioscoreaceae	Dioscorea aff. persimilis Prain & Burkill	F	Rice substitute	Tuber	Peel skin, wash, boil and prepare like potato
Dây khai	Ra kai	Dioscoreaceae	Dioscorea sp	F		Tuber	Peel, cube and cook in soup
Khoai nừng	Ha pùi di minh	Dioscoreaceae	Dioscorea hispida Dennst.	F		Tuber	Slice, dry in the sun, soak in saltwater, grind and cook
				M	Snakebite	Tuber	slice and apply to bite (do not contact water for 1 week)
Nừng đực	Ha pùi di minh	Dioscoreaceae	Dioscorea membranacea Pierre ex Craib	M	Bruises & Bone injuries	Tuber	Soak in wine with other plants and apply externally to injuries
Cây khai	Ca dâu kai	Mimosaceae	Pithecellobium vietnamense I.C. Nielsen	S		Inner bark	Peel outer bark, harvest inner bark, submerge in water and squeeze over hair
				M	Lice	Inner bark	Peel outer bark, harvest inner bark, submerge in water and squeeze over hair
Đại tướng quân	Ca dâu pa cô	Liliaceae	Crinum sp	S		Leaves	Crush and apply to hair
				M	Bruises	Leaves	Heat over a fire and apply 3 times/day
Cây sống rắn	Ca dâu vi nea	Mimosaceae	Albizia aff. corniculata Druce	S		Outer bark	Crush, soak in water and apply to hair

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Bồ kết	Ca dâu ka mak	Fabaceae	Gleditsia australis Hemsl. ex Forb. & Hemsl.	S		Fruit; Bark	Break fruit in pieces, boil, filter, and apply liquid; or rub bark on a rock, soak in water and squeeze over hair
				D	Black hairdye	Fruit; Bark	Break fruit in pieces, boil, filter, and apply liquid; or rub bark on a rock, soak in water and squeeze over hair
Táo rừng	Ca dâu ka ru lai	Rhamnaceae	Zizyphus cambodiana Pierre.	F		Fruit	Eat fresh
				M	Primary Post-partum (placenta purge)	Root	Slice, roast, cool on the ground (covered), then boil and drink until healthy
Cây cổ đèn	Ca dâu có đèn			M	Secondary Post-partum (stop bleeding)	Root	Slice, roast, cool on the ground (covered), then boil and drink until healthy
Trái mun	Ca dâu ha tăc	Ebenaceae	Diospyros mun A.Chev. & Lecomte	D	Black	Fruit	Halve, soak for 1 day and submerge fabric in the water
				M	Bone strength & Blood ailments	Inner trunk	soak in wine with other plants for 1 month, then drink daily after meals
Cây giang	Ca dâu ha pa	Fabaceae	Caesalpinia sappan L.	D	Red	Root	Cut in pieces, cook in water for 3 hours, then submerge fabric for 20-30 minutes

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				M	Vulnerary	Branch Core	Cut, roast, dry and boil
				M	Arthritis/Rheumatism	Root & Branches	Boil until reduced, dry into a hardened jelly, then dissolve in water and drink
					Post-partum	Trunk	A razor of its wood is used to sever the umbilical cord
				M	Back pain		Soak in wine and drink
Găng gai dây	Ca dâu cù dran	Celastraceae	Gymnosporia sp	D	Yellow	Root	Cut in pieces, cook in water for 3 hours, then submerge fabric for 20-30 minutes
Cây găng nhung		Rubiaceae	Randia dasycarpa (Kurz) Bakh.f.	S		Fruit	Crush the inside and apply to hair
Cây găng gai đuc		Rubiaceae	Randia spinosa Loes.	S		Fruit	Crush the inside and apply to hair
Dây mắt mèo	Hu réh ha man neng	Fabaceae	Mucuna aff. interrupta Gagnep.	M	Snakebite & Wasp sting	Seed	Halve, rub on a rock until rough and apply to bite with pressure for a few minutes
Cây chiêu liêu	Ca dâu tà té	Combretaceae	Terminalia triptera Stapf	B	Texture; Hot Taste	Bark	Pound branches to remove bark, dry and use
Cây rế lúa	Ca dâu rẽ lúa	Moraceae		B	Softener	Root bark	Remove bark, dry and use
Cây dứa rừng	Tu khék	Pandanaceae	Pandanus sp	Fb & R	Rope; Fishing nets; Bed covers; Mats	Root core	
Mây đắng	Ha wai plú	Palmeae	Calamus sp	Fb	Carrying poles; Basket bindings		
Song mây	Ha wai cha po	Palmeae	Calamus sp	R	Tables; Chairs		

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Giang dây	Ka tạ	Poaceae		Fb & R	Carrying baskets; Roof bindings; Crossbow string		
Mây nước	Ha wai ea craw	Flagellariaceae	Flagellaria indica L.	Fb	String		
Cây sùot cá	Ca dâu y ka	Myrsinaceae	Maesa sp	P	Fishing	Leaves & Branches	Grind, mix with sand and use
				M	Intestinal worms	Leaves	Grind, boil, strain and drink
San hô dây	Ca dâu gu ga	Cactaceae		P	Fishing	Whole plant	Grind and use
Cây xương rồng dây	Ca dâu xương rông	Cactaceae		P	Fishing	Whole plant	Grind and use
Dây bồ hòn	Hu réh ra đáh	Fabaceae	Antherosporum aff. pierrei Gagnep.	P	Fishing; Aquaculture	Seeds	Dry in the sun, grind, and add to shrimp aquaculture ponds
Dây bồ hòn		Fabaceae	Derris sp	P	Fishing; Aquaculture	Seeds	Dry in the sun, grind, and add to shrimp aquaculture ponds
Cây quýt gai	Ca dâu tàr nrá	Moraceae	Streblus ilicifolius (Vidal) Corner	F	Rice substitute (famine)	Seeds	Roast and use
Dây cổ rùa	Hu réh para lít	Fabaceae	Bauhinia sp	Fb	Cattle tie	Liana core	
Cây cộng sản	Ca dâu nho ta no	Compositae	Eupatorium odoratum L.	M	Vulnerary	Leaves	Crush and apply to wound
				M	Stomach ache	Whole plant	Cold water extract
				M	Skin irritation	Whole plant	Steep in wine and drink
Cây vú bò	Ca dâu pô tai kra	Annonaceae	Mitrephora pallens Ast	F		Fruit	Eat fresh
				M	Chest pain/ Difficulty breathing	Trunk & Roots	Water extract

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Cây sắc máu	Ca dâu cha nách	Avagaceae	Dracaena cambodiana Pierre ex Gagnep.	M	Blood-purifying	Trunk core & Roots	Boil and drink
Cây cán dù	Ca dâu cán dù	Meliaceae	Munronia robinsonii Pellegr.	M	Flu; Cough (especially post-partum)	Whole plant	Boil, reduce until viscous and drink
Thiên tuế; Trái săn té đục	Ca dâu trúc	Cycadaceae	Cycas pectinata Buch.-Ham.	M	Snakebite	Trunk	Slice off a piece of trunk, remove outer bark and apply to bite
				M	Back pain from heavy work	Inner bark	heat, grind, soak in wine and drink
				F		Seed	Halve, dry in weak sunlight, grind, boil and eat
Cây lá trầu		Piperaceae	Piper betle L.	M	Eyesore	Leaves	Crush, dip in hot water and apply
Cây móng chó	Ca dâu ta kai a sâu	Acanthaceae	Lepidagathis cambodiana Benoist	M	Flu; Cough	Whole plant	Grind, squeeze out the juice and drink 3 servings
Dây cườm thảo	Hu réh cré	Fabaceae	Abrus precatorius L.	M	Flu; Cough	Leaves & Roots	Grind, squeeze out the juice and drink
Cây lá lốt	Ca dâu cha lóa	Piperaceae	Piper lolot C.DC.	M	Planar Hyperhidrosis	Leaves	Boil and dip feet in the water
Lạc tiên		Passifloraceae	Passiflora foetida L.	M	Liver disease	Roots & Vine	Slice, dry, cook in water, reduce to half volume and drink
Cây bông giấy	Ca dâu và nguôn ea	Apocynaceae	Catharanthus roseus (L.) G.Don.	M	Fever; Cough	Flower & Leaves	Crush with water and drink
Cây bồn bồn	Ca dâu ráh	Apocynaceae	Calotropis gigantea (L.) W.T.Aiton	M	Snakebite	Sap	Apply directly to bite
				M	Bruises	Leaves	Bruise leaves and apply
				PC	Chicken lice	Sap	Put in four corners of chicken coop

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Cây thuốc lá		Solanaceae	Nicotiana sp.	PC		Leaves	Mix with chili, soak in water and sprinkle water on the fields
Cây thần linh	Ca dâu u cấp	Moraceae	Antiaris aff. toxicaria (Pers.) Lesch.	P	Hunting	Latex	Boil latex
Ngũ sắc	Nho rừng; Ca dâu cà chủ	Verbenaceae	Lantana camara L.	M	Vulnerary	Roots	Roughen on rock and apply to wounds caused by rusty metal
Cây trôm	Ca dâu plô	Sterculiaceae	Sterculia foetida L.	VM	Cow fever	Leaves	Crush, grind with salt, soak in cold water and give to cow to drink
				M	Dysentery	Gum	Roast until it turns into powder, then mix in water and drink
				M	General tonic	Gum	Tap the trunk, collect and dry, then dissolve in water
Cây bố đề	Ca dâu vớh	Mimosaceae	Entada glandulosa Pierre ex Gagnep.	H	Jewelry	Seeds	Collect when dry, polish and use
Dây sâm nam	Hu réh sâm nam	Menispermaceae	Cyclea peltata Diels	M	General tonic; refreshing	Leaves	Crush with water until it thickens, then add sugar and drink
Cây bồng quân	Ca dâu ca cớh			M	Lack of appetite (pregnant women)	Root	Cut, roast, cover and cool on the ground, then boil until reduced and drink
				F		Fruit	Eat fresh
Lan hồ/ Lan đá	Lan pa tâu	Orchidaceae		O		Whole plant	
Cây hồng mang	Ca dâu a rơt	Sterculiaceae	Pterospermum sp	B		Bark	Remove, dry and use

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Cây chòi mòi	Ca dâu ka chil	Euphorbiaceae	Antidesma aff. phanrangense Gagnep.	F	Thirst-quenching	Fruit	Eat fresh (ripe & unripe)
Cây sim	Ca dâu ti túc			F		Fruit	Eat fresh
				A		Fruit	Use to ferment wine
Mua		Melastomataceae	Melastoma affine D.Don.	F		Fruit	Eat fresh
Cây sa nhân	Ca dâu ha mró	Zingiberaceae	Amomum aff. villosum Lour.	M	Medicinal Alcohol	Seedpod	Soak in wine
Cây gỏ đen	Ca dâu kúh	Myrtaceae	Syzygium sp	D	Black (fishing nets)	Bark	Crush, put in a little water, and soak the net for 2 days
Cây mã tiền	Ca dâu u cầp	Loganiaceae	Strychnos nux-vomica L.	M	Sprains; Bruises	Seed	Break with a hammer, soak in wine and apply externally while lightly massaging
Cây muồng gai		Fabaceae	Cassia alata L.	M	Indigestion	Root & Lower stem	Slice, heat over a fire, then boil in water until reduced and drink
Plụp tai		Liliaceae	Asparagus acerosus Roxb.	F		Root	Eat fresh
Nhai				M	Toothache	Root	Grind and apply to tooth and gums
Chùm ngay		Moringaceae	Moringa pterygosperma Gaertn.	F		Leaves	Eat fresh or cook
Rau		Asteraceae	Emilia sonchifolia (L.) DC.	F		Leaves	Eat fresh or cook
Rau tàu bay		Asteraceae	Gynura crepidioides Benth.	F		Leaves	Eat fresh or cook
		Fagaceae	Castanopsis arietina Hickel & A.Camus	F		Acorn	Roast whole fruit in a fire, then extract the nut and eat

Appendix B: Selected Information About All Recorded Species. F=Food, M=Medicine, S=Shampoo, D=Dye, P=Poison, B=Betel Chew, Fb=Fiber, R=Rattan, PC=Pest Control, H=Handicrafts, O=Ornamental, A=Alcohol Production and VM=Veterinary Medicine

Nấm mỡ	Pù mao gia	F	Whole	Wash, then cook with other vegetables
Nấm mèo	Pù mao chyu	F	Whole	Cook fresh or hang on a string to dry and rehydrate to cook