ECONOMIC VALUES, UTILIZATION AND SPECIES COMPOSITION OF MEDICINAL PLANTS: A CASE STUDY OF PONDOK TANJUNG, PERAK

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by

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ABSTRACT

Malaysia is one of the world's 12 mega biodiversity, countries with the oldest rainforest. The most highly demanded non-timber forest products (NTFPs) are medicinal plants. The present case study was conducted in Pondok Tanjung Forest Reserve (PTFR), Perak on two ha plots using 100 subplots sized of 10m x 10m systematic strip line sampling and questionnaire-based methods. All trees with medicinal value were enumerated, measured and identified based on its major uses in traditional medicine practices. Results showed that there were 1862 individual plants with 102 species in 67 genera and 47 families. The most abundant species was *Thottea grandiflora* Rottb. (19.12%) and the largest family was *Aristolochiaceae* (19.12%). The traded medicinal plants were categorized into four groups of habits that are climbers (40%), trees (39%), shrubs (19%) and herbs (2%). Results show that 1862 traded medicinal plants were classified into economically first rating (365 individuals or 19.60%), second rating (1041individuals or 55.91%), third rating (384 individuals or 20.62%) and fourth rating (72 individuals or 3.87%). The first, second, third and fourth economic rating based on demand gave the estimated average potential value of RM 2292.73 ha^{-1}, RM 3571.74 ha^{-1}, RM 1760.38 ha^{-1} and RM 268.90 ha^{-1}, respectively. The largest family of first rating medicinal plants was Melastomataceae followed by Annonaceae. There was significant difference in community structure between Compartment 31 (Plot 1) and Compartment 11 (Plot 2), MRPP test, $p \leq 0.05$ with soil texture sandy and sandy-clay, respectively. The average estimated potential values of the traded medicinal plants calculated in both compartments per hectare-basis was RM 7893.75 ha^{-1}. Two species *Labisia pumila* (Blume) Fern.-Vill (Kacip

Fatimah) and *Thottea grandiflora* Rottb. (Gerham Badak) have the highest average potential value of RM 659.81 ha^{-1} (175 individual plants or 8.36.7%) and RM 447.41 ha^{-1} (356 individual plants or 5.67%), respectively. The average net revenue for active Traditional Medicinal Practitioners (TMPs) was RM 4501.56 yr^{-1} while the less active TMPs showed average net revenue of RM 1358.2 yr^{-1}. These two groups were classified based on their years of experience, expertise and broad knowledge especially in identifying the medicinal plants with their local names, utilization, market price and green price at local demand. The involvement, knowledge and reliability of the information obtained from the active TMPs helped very much in producing good estimated potential values of the traded medicinal plants in the study area as well as the net revenue of the TMPs.

KOMPOSISI SPESIES, PENGGUNAAN DAN NILAI EKONOMI TUMBUHAN UBATAN: SATU KAJIAN KES DI HUTAN SIMPAN PONDOK TANJUNG, PERAK

Malaysia adalah tergolong di dalam 12 mega kepelbagaian biologi, negara hutan hujan tropika yang tertua. Kajian ini dilaksanakan di Hutan Simpan Pondok Tanjung (HSPT), Perak di atas plot 2 ha yang terbahagi kepada 100 subplot dengan ukuran 10mx10m menurut sistem jalur garisan persampelan dan metodologi berasaskan soalselidik. Semua tumbuhan yang bernilai ubat-ubatan dikira, diukur dan dikenalpasti berdasarkan kegunaan umum di dalam amalan perubatan tradisional. Hasil penyelidikan menunjukkan bahawa terdapat 1862 individu tumbuh-tumbuhan ubatan yang terdiri daripada 102 spesies dalam 67 genera dan 47 famili. Spesies terbanyak adalah Thottea grandiflora Rottb. (19.12%) dan famili terbesar adalah Aristolochiaceae (19.12%). Tumbuh-tumbuhan ubatan ini dikategorikan kepada 4 kumpulan berdasarkan sifat pokok dengan peratus tertinggi iaitu pokok pepanjat (40%), pokok (39%), renik (19%) dan herba (2%). Hasil menunjukkan bahawa 1862 individu tumbuhan boleh dikelasifikasikan secara ekonomi kepada pemeringkatan satu (365 tumbuhan atau 19.60%), pemeringkatan dua (1041 tumbuhan atau 55.91%), pemeringkatan tiga (384 tumbuhan atau 20.62%) dan pemeringkatan empat (72 tumbuhan atau 3.87%). Anggaran purata nilai potensi untuk pemeringkatan satu adalah RM 2292.73 ha^{-1}, kedua RM 3571.74 ha^{-1}, ketiga RM 1760.38 ha^{-1}, dan keempat RM 268.90 ha^{-1}. Famili terbesar dalam pemeringkatan satu tumbuh-tumbuhan ubatan adalah Melastomataceae diikuti dengan Annonaceae. Terdapat perbezaan yang signifiken di dalam

struktur komuniti tumbuhan di antara kedua kompartmen 31 (Plot1) dan Kompartmen 11 (Plot 2) melalui ujian Multi Response Permutation Procedure (MRPP), $p \leq 0.05$ dengan tekstur tanah berpasir dan berpasir-tanah liat. Anggaran purata nilai potensi tumbuh-tumbuhan ubatan yang diperolehi di dalam Kompartmen 31 dan Kompartmen 11 (Plot 2) hutan tersebut berdasarkan per ha adalah RM 7893.75 ha^{-1}. Spesies tumbuhan dari famili Myrsinaceae iaitu Labisia pumila (Blume) Fern.-Vill (Kacip Fatimah) mempunyai purata nilai potensi tertinggi sebanyak RM 659.81 ha^{-1} (175 pokok, 8.36%). Purata pendapatan sebenar untuk Pengamal Perubatan Tradisional (PPT) yang aktif adalah sebanyak RM 4501.56 thn^{-1}, sedangkan PPT yang kurang aktif menunjukkan purata pendapatan sebenar sebanyak RM 1358.20 thn^{-1}. Dua kumpulan ini dikelasifikasikan berdasarkan tempoh pengalaman, kepakaran dan ilmu pengetahuan yang luas terutama di dalam mengenalpasti tumbuh-tumbuhan ubatan dengan nama tempatan, kegunaan, harga pasaran segar pada permintaan tempatan. Kesahihan maklumat yang diperolehi daripada PPT aktif banyak membantu di dalam menentukan anggaran nilai potensi tumbuh-tumbuhan ubatan yang diperolehi untuk diproses dan diniagakan dari dalam kawasan kajian dan juga termasuk pendapatan bersih PPT.

CHAPTER 1

1.0 INTRODUCTION

1.1 General Introduction

The forest ecosystem is an important source of non-timber forest products (NTFPs) and usually forms the dominant natural ecosystem in tropical countries. The forest provides a main source of food to local people, a wide variety of materials used in medicine, a source of eco-tourism and recreation opportunities, and helps maintain favorable environmental conditions. According to Panayotou and Ashton (1992), NTFPs provide some subsistence needs for people living near a forest (rural people) and could generate employment, income and materials for industry.

According to the National Forestry Act (NFA), 1984, all the forest resources located in the forest reserve or in the state land are under the management of the state authority and nobody is allowed to collect or gain from any of the resources without permission from the state authority. In the past, the main emphasis of forest management in Malaysia has been for timber production and less attention was given to NTFPs. However, a recent approach under sustainable forest management has taken greater consideration of NTFPs. Ismail and Chin (1993) stressed that there is a need to draw up strategies to manage, develop and protect the NTFPs. These strategies should entail conservation of their genetic resources and natural heritage with the view that many NTFPs potentially have economic values both now and in the future.

Malaysian forests provide important sources of livelihood for the local communities living within or in the vicinity of the forests. The forest resources meet not only their household subsistence needs but also serve as an important source of income. Some of these forest products are traded while others are not. Valuation of forest goods used by the local community is essential in providing in-depth understanding on their importance to local socio-economic status. In 1993, the International Union for the Conservation of Nature (IUCN) estimated that 80% of the world's population is using plant materials for health purposes. In other words, despite the advances of modern medicine, the practice of traditional medicine persists. Basically, some medicinal plants are known for their medicinal value in their roots, leaves or other parts. Their effectiveness and popularity depend not only on new research findings but also the usage experience, ethnic beliefs and the availability of the plant materials. It is estimated that Malaysians spend about RM1 billion in the consumption of traditional medicines compared to only RM600 million on pharmaceutical medicines (Bishop, 1998). China and India are two countries where there are long traditions of medicinal plant users (Lambert *et al*., 1996). Over the last decade, the World Health Assembly has passed a number of resolutions in response to the resurgence of interest in the study and use of traditional medicine in health care, and in recognition of the importance of medicinal plants to the health system in many developing countries.

The Traditional Medicine Program of WHO is based on the reality that:

i) The majority of the world's population depends on traditional medicine for primary health care.

ii) The manpower represented by practitioners of traditional medicine is a potentially important resource for the delivery of health care.

iii) Medicinal plants are of great importance to the health of individuals and communities.

Martin (1995) defines ethnobotany as all studies concerning plants which describe local people's interaction with the natural environment. The monumental works of Henderson (1959) in South East Asia and Burkill (1935) in the Malay Peninsula and other contemporary accounts in the region are all testimonies to thorough knowledge in local plant taxonomy and conservation. The current resurgence of ethnobotany occurred because the local communities realized the importance of botany and plant taxonomy in their economies and on the parts of respective authorities, serious efforts must be taken to involve the local communities in ethnobotanical activities, biodiversity prospecting and other economic activities. The Forestry Department as the custodian of the forest resources in the country needs to be better informed on the role of medicinal plants. Speculative information on the growing importance of traditional medicine is not sufficient for the Forestry Department to act upon. There is a need for clear, consistent and empirical information on the growing importance of medicinal plant use and the associated industry. This, if it should be significant, would then form the basis for the formulation of strategic action plan for the consolidation of medicinal plants into the current forest management system.

1.2 Economic Significance of Medicinal Plants

In March 1988 an International Consultation on the Conservation of Medicinal Plants was convened in Chiang Mai, Thailand by WHO, in association with IUCN (International Union for the Conservation of Nature and Natural Resources) and WWF (World Wide Fund for Nature). There were two important outcomes of this Consultation: the first was the Chiang Mai Declaration entitled 'Saving Lives by Saving Plants', and second was the generation of a set of guidelines which describe the various tasks that should be carried out to ensure that medicinal plants are conserved effectively for the future and that where medicinal plants are taken from the wild, they are taken on a basis that is sustainable (IUCN *et al*., 1993). Even in China and India which have fairly well established industries, inadequate attention is currently paid to conservation and cultivation programmes that would protect and enhance genetic diversity of medicinal plants (Lambert *et al*., 1996). The main features of the Chiang Mai Declaration (IUCN *et al*., 1993) were the guide lines for the conservation and sustainable use of medicinal plants were listed below:

1. To ensure that any collecting from the wild is sustainable.
2. To improve techniques for harvesting, storage and production.
3. To study traditional knowledge on the use of plants in health care.
4. To conserve populations of medicinal plant species in natural habitats.
5. To conserve populations of medicinal plant species in commercial farms.
6. Wherever possible, to cultivate the medicinal plants as the source of supply.
7. To identify the medicinal plants, outline their distributions and assess their abundance.

8. To build public support for the conservation of medicinal plants through communication and cooperation.

It was equally emphasized in the guidelines that no single sector, private or public can undertake the conservation of medicinal plants alone. The job requires a team effort, involving a wide range of disciplines (including taxonomists, ethnobotanists, traditional healers and practitioners, and park managers) and institutions (medical centers, village cooperatives, medical authorities, universities and research institutions). For any successful conservation and utilization of medicinal plants, a holistic approach involving all these groups, together with the cooperation and support of the people at the ground level and public needs to be harnessed (Kumari *et al*., 1997).

Plant species are used for medicines in two ways. First, major commercial use, whether by prescription or over the counter sales, and secondly, as traditional medicines which may or may not attract a market price (Pearce & Moran, 1994). In the latter case two medicinal plant markets often co-exist as (a) formal – regulated to a limited degree by government, market crude and processed products with varying degrees of quality control; and (b) informal-unregulated without any apparent government control, provides basic healthcare, especially to rural populations.

The informal market is largely dependent on raw plant material. Although, the conservation, cultivation, collecting and processing of medicinal plant raw material constitute a large informal market, the exact size has never been objectively defined nor subjected to serious economic valuation (Lambert *et al.,*

1996). Clearly, both the commercial and less formal uses have an economic value but what little work there has been on valuation of medicinal plants tends to focus on the commercial and formal markets. Few studies of trade in medicinal plants have been carried out often because the networks for trade in medicinal plants are informal and characterizing such trade is often difficult. Recent attempts to value medicinal plants (Balich & Mendelsohn, 1992) have examined only the current local market value of these products and have not attempted any in-depth evaluation of the benefits to rural communities of traditional health strategies (Brown, 1992). In addition no studies have attempted to place a value on the health care provided by traditional healers and traditional plant medicines in terms of the costs of the modern equivalents. The paucity of studies available however, should not obscure the likelihood that local willingness to pay (WTP) for traditional medicines may be substantial.

The compelling argument for the identification and preservation of the world's most species rich ecosystems often comes from the potential pay-off from a 'block-buster' drug discovery. However, in reality the probability of a 'discovery' is often low, and the subsequent appropriation by the nation equally low or undefined (Pearce & Puroshotaman, 1992; Kumari, 1995). The role of plants in traditional medicine on the other hand provides more certain markets, and if systematically exploited could themselves be 'blockbuster' trades at the national level.

Although many scientists still regard folk remedies somewhat skeptically, one should not ignore the fact that many important modern drugs (example digitoxin, reserpine and ephedrine) were discovered by following leads from folk

medicine. It is reported that 74 per cent of the 121 biologically active plant-derived compounds presently in use worldwide, were discovered by researchers aimed at verifying the authenticity of information derived from folk ethnomedical uses of the plants (Farnsworth & Soejarto, 1985). The number of Malaysian rainforest plants that have been thoroughly evaluated for pharmacological potential remains small and the vast majority of them still have no identified market.

Preliminary evidence for the demand of medicinal plants in Selangor and Kuala Lumpur comes from consumer surveys undertaken by Institute of Medical Research (IMR). These surveys were aggregated for the different types of medicinal plants used by the main ethnic groups that are the Malay, Chinese and Indian (Haliza, 1989). Some estimates of revenue generated through the sale of Chinese herbal products are also forthcoming. For example, in Malaysia, based only on data obtained from 4,000 Chinese herbal stores, the annual sales of herbal products are estimated at RM 500 million in 1994. This value would be higher if sales from the Malay practitioners and Indian herbal stores are included (Ng & Azizol, 1995). As demand for these more popular species increases, their continuous harvest from the forests is likely to lead to their extinction. For example, two species *Rafflesia hasseltii* (Bunga Pakma), commonly used after childbirth by the Orang Asli and *Eurycoma longifolia* (Tongkat Ali), largely consumed for its aphrodisiac qualities have been heavily depleted in the natural forests. Although the harvest of these species is 'officially' banned, the regulation is difficult to enforce in practice.

Preliminary trade statistics on the import and export of medicinal plants, both of the finished products and the raw materials shed further light on the changing trends in the country. The statistics show the total import value of medicinal plant products to have increased from RM 54 million in 1990 to RM 64 million in 1992 (Kumari *et al*., 1998). There has been a corresponding decline in exports from RM 3.3 million to RM 1.4 million over the same two years period. The import of these medicinal plants comes largely from China while export on the other hand is largely to Singapore. The reason for this trend has been attributed to the increase in domestic demand for these medicinal plants. Import of raw plant materials for traditional medicine to Malaysia in the form of powder, pellets and plants is largely from Indonesia, China, Thailand, Taiwan and the US and is largely channeled through Singapore, Philippines, Australia and Hong Kong. The import of this raw material increased slightly from RM 9.6 to RM 9.8 million, whilst there was a corresponding decline in the export from RM 1.0 million to RM 0.80 million between the same two years. The suggestion again is that the increased domestic demand had resulted in the decline in exports, and increase in imports. These statistics are too preliminary to draw any major conclusions but the figures do suggest that there is substantial trade in medicinal products. These trends have to be confirmed with data over a longer time series, and supported with interviews with the relevant people.

The date for the formal standards came into effect in January 1998. It is hoped that given a reasonable time frame, technical guidance and support, a flourishing modern pharmaceutical industry of traditional medicine will emerge in Malaysia which can be promoted regionally and worldwide. In response to these legal and administrative overtures, the Perak Forestry Department has

set aside 40 ha in Reserved Forest Area in Kledang Saiong, Bt Tapah, Bubu, Bukit Larut and Pondok Tanjung for biodiversity projects. Nona Roguy from the private sector has also established 1,170 ha of herbal plantation in Gua Musang to provide for the establishment of 'stock' for herbal plants as well as a 'Good Manufacturing Practices' (GMP) factory which would allow for drug production to comply with the official and legal requirements (Kumari *et al*., 1998).

The economic activities are increasing in the field of medicinal plants in Malaysia. The general complaint appears to be that the various groups (botanists, ethnobotanists, chemists, pharmacists) and agencies (public and private) tend to work in isolation, and that much could be gained if the issues and problems facing the medicinal plant industry were tackled in a concerted and coordinated fashion.

1.3 Recent Developments in the Field of Traditional Medicine in Malaysia

There has been a surge of public interest in traditional medicine in Malaysia. The National Committee on Medicinal Plants was set up in January 1995 as an Act of Parliament, following Cabinet approval. The Forest Research Institute Malaysia (FRIM) as the Secretariat of the Committee hosts the Traditional Medicine Section and has the task of charting out a strategic vision on the future of medicinal plants in the country in terms of the short, medium and long-term approaches.

The Minister of Health made a statement that the Medical Act will be amended to give traditional medicine a greater role in health care. Acknowledging that

plants hold the key to many remedies yet untapped, the Cabinet made a decision recently instructing the Institute of Medical Research (IMR) and Forest Research Institute Malaysia (FRIM) to study plants and document their curative properties (Anonymous, 1998). In recent years several seminars, conferences and forum have been organized which address specifically the topic of medicinal plants (Soepadmo *et al.*, 1989; Khozirah *et al*., 1991; Chan *et al*., 1993; MNPS, 1994 & FRIM, 1995). In addition, the Botany Departments of Universiti Malaya (UM), Universiti Kebangsaan Malaysia (UKM) and Universiti Putra Malaysia (UPM) have been actively involved in the botanical compilation of useful medicinal plants, whilst the ethnobotanical use of these species is of interest at FRIM, the Forestry Department and Institute of Medical Research (IMR). The School of Pharmacy Sciences, Universiti Sains Malaysia (USM), and the medical faculties of UKM and UM have made considerable progress on the pharmacological and phyotochemical aspects of specific medicinal plants (Kumari, 1996).

This official endorsement of the Government comes as a culmination of years of effort by several individuals and agencies, including private practitioners, universities, FRIM and IMR. Ong (1997), stated that the Rimba Ilmu at Universiti Malaya (UM), with a collection of over 600 rare plant species represents one of the pioneering efforts towards in-situ conservation of medicinal plants in the country. Suhair (2003), has documented the medicinal properties of a hundred and sixteen species conserved in the herbal garden in Universiti Sains Malaysia (USM) and has been used as a reference for this study.

The recent developments in the medicinal plant field in Malaysia, taken isolated or collectively, suggest intuitively that the inherent economic value of medicinal plants must be quite significant. The current study, if carefully structured, could provide the necessary justification for the consolidation of the variety of activities currently underway in the medicinal plant programme in Malaysia.

1.4 Objectives

The objectives of the study were to:

1. Identify and quantify traded medicinal plants resources available in the forest concession in order to document the biodiversity of the Lowland Inland Dipterocarp Forest in Pondok Tanjung Forest Reserve (PTFR), Larut Matang and Selama, Perak.
2. Assessing the utilization of traded medicinal plants by interviewing the traditional medicinal practitioners (TMPs) as collectors and processors.
3. Determine the estimated potential values of traded medicinal plants resources in the study sites.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Overview of the State of Medicinal Plants

Medicinal plants constitute an important group among all of mankind's natural resources. Healing herbs have been traded and used since ancient times, but for all that they are neglected by mainstream development (Lambert *et al*., 1996). It is estimated that about 250,000 plant species are found in the world, 150,000 are distributed in the tropics, about 35,000 in Southeast Asia (Henderson, 1959) and not less than 6,000 species reported to have medicinal properties. Nonetheless, the conservation, cultivation, collecting and processing of medicinal plant raw materials constitutes a large formal market. Millions of people in developing countries use herbal medicines. In view of the growing momentum in traditional medicine worldwide, the current study is very timely. The international interest in medicinal plants is also reflected in the Malaysian scene where there has been a mushrooming activity of trade in medicinal plants (Kumari, 1996).

The flora and fauna of tropical forests hold an astonishing cornucopia of medicines for traditional and industrial uses. Up to a quarter of the prescribed drugs used in the United States are derived from tropical rainforest plants. Nearly three-quarters of the 3,000 plants identified by the US National Cancer Institute as having anti-cancer properties comes from the rainforest. Quinine derived from the cinchona tree is used to treat malaria. Rainforest plants also

offer much promise of new treatments, particularly as cures for cancer and AIDS (Kumari, 1996).

According to Li Chaojin (1987), traditional medicine is an integral part of the formal Health system and is utilized in about 40% of cases at the primary care level in China. Therefore, special encouragement has been given for the cultivation of medicinal plants since most of the crude drugs were formally collected in the wild and would be depleted if there were no measures taken. Agricultural departments in China at all levels take part in formulating policy and establishing plantations, which covered about 330,000 hectares in 1987. The escalating cost of sophisticated medical care and its dangers of over-medication of modern medicines also act as a factor why traditional medicines are known as the best alternative remedy to human being.

Several African and Asian nations have just begun to encourage traditional medicine as an integral component of their public health care programs. The indigenous medicines are generally inexpensive, locally available and readily accepted by the local population (Prescott-Allen, 1982). India officially recognizes over 2500 plants as having medicinal value, and it is estimated that over 6000 plants are used in traditional, folk, and herbal medicine, representing about 75% of the medical needs of the Third World (Huxley, 1984). The focus on plants uses in traditional medicine by the World Health Organization (WHO) led to the initial identification of 20,000 species of which 200 have been selected for more detailed studies (Levingston & Zamora, 1983).

In United States of America where synthetics dominate the drug market scene, plant products still represent an important source of prescriptions dispensed from community pharmacies, and was valued at $US 8 billion in 1980 (Farnsworth & Morris, 1976). In 1981, about 400 species of plants were reported in products marketed by the herbal industry in health-food stores throughout United States, and valued at $US 360 million (Wong & Taylor, 1987). This number increased to $US 36 billion in 1994 (Hassler, 1995). In China and Japan, the market value was $US 2.5 billion and $US 5 billion (Kojima, 1995), respectively. The estimated global value of plant based drugs is $US 43 billion a year (FAO, 1997). In Malaysia, the health food market is growing steadily at about 15 per cent per year. The market was valued at RM 38 million in 1994 and is estimated to be RM 45 million by the end of 1995 (Anonymous, 1994). Recent estimates of the domestic market for pharmaceutical and herbal care products is RM 1 billion and RM 3 billion, respectively; and traditional medicine record annual sales of RM 2 billion (Anonymous, 1998) .

2.2 Malaysian Forests as a Source of Medicinal Plants

The Malaysian rain forests are endowed with high biological diversity. There are over 20,000 medicinal plant species (accounting for over 10% of the world's total number of plant species) some of which are unique only to Malaysia (Soepadmo, 1992). Malaysia is rich in natural resources which are the basic requirement for traditional medicine. Traditional medicine is an integral part of Malaysian culture and has been practiced by various ethnic groups long before the introduction of the modern medicine system into the country. Much of the

knowledge is still dominant in the culture of the various ethnic groups in an unrecorded form. They are assumed to be passed from one generation to another in the traditional, oral manner. In Malaysia, the classical works of Burkill & Hanniff (1930); Gimlette & Burkill (1930) and Burkill (1935) represent the monuments of our knowledge on traditional medicine.

According to Bidin & Latiff (1995), the flora of Malaysia is rich and a conservative estimate of the seed plants was about 12,500 species. Soepadmo *et al.,* (2002) stated that about 1,200 species of higher plants in Peninsular Malaysia and 2,000 species in Sabah and Sarawak are reported to have medicinal values and have been used for generations in various traditional health care systems. These useful plants grow wild in the lowland and hill dipterocarp forest, which are under serious threat of being extinct.

Of the more than 7,000 species of angiosperms and 600 species of ferns in Malaysia, about 1,082 species (about 15%) and 76 species (about 13%) respectively, are reported to have medicinal value were replaced by mono-specific tree crops (rubber and oil palm), intensive logging to non–forestry land such as hydroelectric dams and rural settlements (Latiff *et al.,* 1984). Various plant families such as those of the *Euphorbiaceae, Leguminosae, Gramineae, Verbenaceae* and others are commonly used to treat various ailments and diseases including diarrhea, skin problems and headache (Kumari, 1996). In Malaysia, the practice of traditional medicine is encouraged among various ethnic groups such as Malays, Chinese, Indian and aborigines where the knowledge has been passed down through generations. There are products derived from medicinal plants, which have economic value and have been

traded for years in Malaysia. These are *Eurycoma longifolia, Areca catechu*, *Oldenlandia diffusa, Myristica fragrans, Piper nigrum and Melastoma decemfidum* (Latiff, 1988). Although it is known that the products are in favorable demand locally, information related to the price and availability of those plants is scarce. In Malaysia, the use of plant materials as traditional medicines either formally or informally is widespread among the local rural communities, especially the Malays, aborigines and others. Latiff (1988a) stated that there are four sources of Malaysian traditional medicine namely; Malay village medicine (including Orang Asli medicine), Chinese medicine (introduced from China), Indian medicine (introduced from India) and other traditional medicine (including those introduced by Javanese, Sumatrans, Arabs, Persians and Europeans).

Burkill (1935) reported that more than 1300 plants have been used in traditional Malay medicine, although the system is not as well organized as the Indian and Chinese systems. The actual number of medicinal plants commonly used in the country was, however, indicated to be between 12 to 18 per cent of the claims (Sabariah, 1989), which approximates to 174 species. This figure is close to other estimates, which cited that the forests support more than 200 potentially important medicinal plants (Hurst, 1990). While some species are more popular than others, many form the minor ingredients of a decoction, or components of a wider curative concept. Given that thousands of plants in Malaysia have at one time or another been used for medicinal purposes, knowledge of such folk or ethnomedical uses could lead us to cut short the time required to discover modern therapeutic drugs from plants. Every tribe and race has its own methods or ways of curing the affliction of diseases. It depends very much on

the practice, belief and knowledge each one possesses. Malaysia as a melting pot of the key ethnic cultures of Asia i.e. Malay, Chinese and Indian have a wide range of medicinal plant products available in the market. In addition, there are the medicinal plant products used by the indigenous tribes (Orang Asli) who live close to the forests or within them. The Orang Asli is renowned for their skills in combining herbal remedies from forest products. Their close relationship with the jungle is the basis for their survival despite the modern conveniences of Twentieth Century Malaysia. Those deep in the jungle still rely on traditional cures handed down through the generations. They use these plants in one form or another to cure or alleviate a variety of ills from bruises, bee or snake bites, tooth or stomach ache, rashes, kidney pains to healing hemorrhoids, tongue or mouth ulcers, bone fractures and malaria (Kumari, 1996). There are also preparations and infusions for diabetes, diarrhea, rheumatism, coughs, anemia and smallpox. Sometimes the same plants are used by the rural people for multi-purposes. For example, tubers of the black lily or 'keladi murai' (*Tacca cristata*) are used to treat rashes by Malay villagers, but the Orang Asli use the leaves as a hot poultice for rheumatism and aching limbs. Malays use the roots of *Forrestia griffithi* to treat fevers but the Orang Asli tribes use them for snake or centipede bites (Kress, 1995).

For the Orang Asli, medicinal plants represented the only form of treatment available to them since modern medicine was not available. In the case of the Malays, there is often a preference for the traditional forms of medicine, especially in the very remote areas. Traditional herbal medicinal practices have persisted despite access to modern medicine. In many ways these are socially acceptable and have a wide cultural acceptance. The local Malay traditional

medicine is actually based on old Indonesian traditional medicine, which has been modified to suit the local and current needs (Muhamad & Mustafa, 1994).

The increasing number of traditional medicine industries in Malaysia and the new approach of the production and marketing of the traditional medicine products also attracted people's interest in using the products. With the modern approach (that is from the raw form which is now converted into capsule), the uses of the traditional medicine became more convenient and provided more confidence to users on the efficaciousness of the drugs. Furthermore, the medicinal plants product is believed to give no negative side effect to human body since there were no additional chemical drugs contents. The number of medicinal plant companies registered was increasing throughout the years and it is found that about 1,546 traditional medicine industries could be found in Peninsular Malaysia and Labuan since 1989 (Mohd. Azmi & Ahmad Fauzi, 1998)

In Malaysia, the proper statistics on the production of NTFPs are still lacking and difficult, as it was not properly formulated at the initial project. The same situation also occurs in the development of NTFPs resources. Most of the information with regard to the development of NTFPs only confined to rattan and bamboo. Rattan and bamboo were two of the main NTFPs that have been given attention due to their economic potential. This reflected that the economic contribution of NTFPs based on the market values is still lower than timber. Statistic on the export of medicinal plants in Malaysia was estimated at about RM 55 million (Ng and Mohd Azmi, 1997) and RM 43 million (Anonymous, 1998) in 1996 and 1997, respectively. Studied by Mohd Azmi & Ahmad Fauzi

(1998) showed that the supply of *Eurycoma longifolia (*Tongkat Ali), one of the most famous medicinal plants in Malaysia, found that the average collection of *E. longifolia* roots and stems per trip in Kedah (based on ten respondents) was 10.7 kg or 154.1 kg per month. Therefore, the total collection *of E. longifolia* per year was 26,568 kg (by estimating that each respondent had an average of two trips of harvesting per month). By taking an average price of *E. longifolia* is at RM 13.50 per stem, the market value of resources was estimated about RM358, 670 per year or RM29, 890 per month.

There were no accurate data or information could quantify the use of raw materials from the wild by traditional medicinal industries. Therefore, it is difficult to recognize and estimate how much raw materials of medicinal plants had been collected and utilized and which plants is mostly needed by industries. However, study by Ng and Mohd Azmi (1997) showed that the trade of medicinal plants (raw materials and plant products) for ten years period in Malaysia was quite significant. It showed that our imports are always exceeding our exports since 1986 (Table 2.1). This shows that most of the raw materials used in the industries came from outside sources such as China, India and Indonesia which is mostly imported by Chinese and Indian traditional medicine industries.

Table 2.1: Trade of Medicinal Plants in Malaysia (1986-1998)

Year	Imports (RM)	Exports (RM)
1986	95,267,763	4,171,067
1987	87,654,774	5,227,073
1988	153,086,351	8,192,234
1989	168,694,676	12,263,211
1990	166,850,230	16,777,638
1991	187,156,231	18,725,948
1992	206,482,164	10,053,811
1993	223,901,918	21,925,302
1994	234,722,844	34,951,451
1995	271,325,265	41,241,046
1996	276,729,402	55,871,852
1997*	209,995,087	42,839,514
1998*	187,450,382	34,312,514

Source: Department of Statistics Malaysia, (1999).

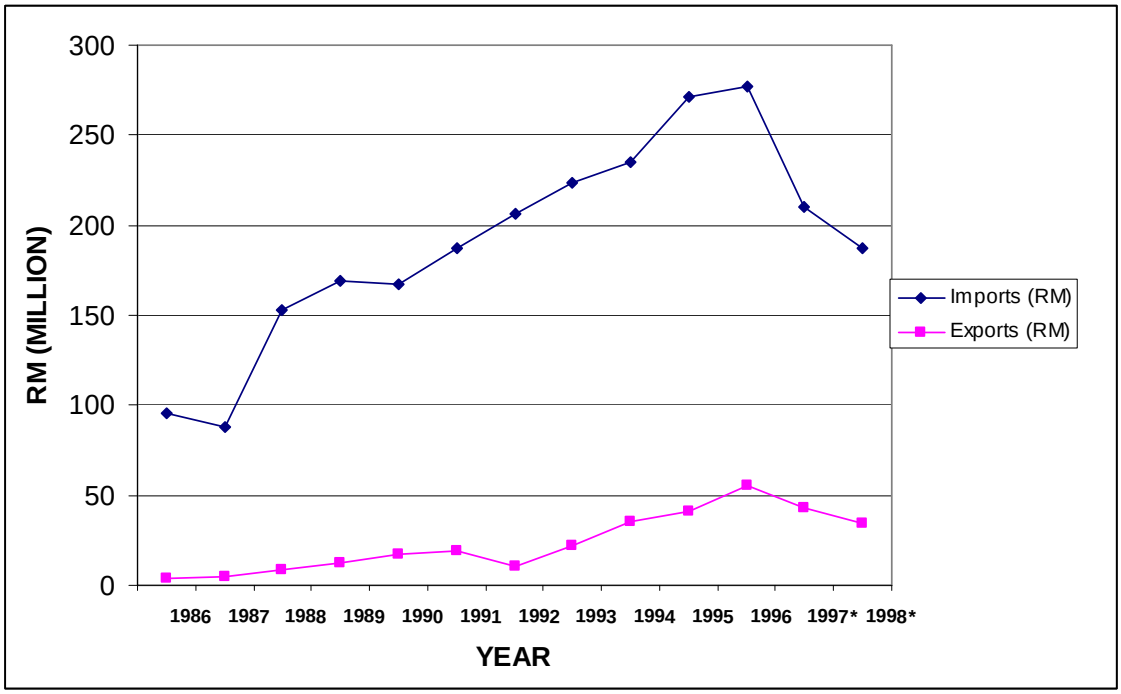

Figure 2.1: Trade of Medicinal Plants in Malaysia (1986-1998)

As shown in Table 2.1 and Figure 2.1, the imports of medicinal plants increased about 2.0% to 82.5% from 1987 to 1996 although there was a slight decrease in 1990 (1.1%). This shows that during the ten years period the traditional medicine industries have a tremendous utilization of imported raw materials and plant products for their production. By looking at the export pattern of medicinal plants, the scenario is basically the same as imports through the years. There was an increase in the exports of medicinal plants from 1986 to 1996 (as was the imports) about 11.6% to 118.1% and a slight decrease during 1992 (46.3%). This shows that beside imports, raw materials of traditional medicine and plant products in Malaysia had a great demand in Denmark and Asian countries such as Singapore, Thailand and Brunei.

The import of medicinal plants started to decline in 1997 (about 24.1%) due to the economic downturn in Malaysia. The same situation is recorded in 1998,

where about 10.7% of the imports were in declined. It is assumed that during 1997 and 1998, the industries are using alternative raw materials that could be found internally as a substitute to the imported raw materials previously or they tried to minimize cost by decreasing their production. The same situation was also shown in the export trend of medicinal plant during those years. The exports of the medicinal plants declined about 23.3% and 19.9% in 1997 and 1998 respectively. The economic downturn that affected Malaysian currency could have contributed to the problems.

2.3 Valuation Methods of NTFPs Resources

Economists generally depend on market prices to indicate the value of NTFPs. For particular NTFPs, which are traded in the market, information on the prices, quantities, cost of harvesting and other parameters can be obtained through market survey. However, not all NTFPs have market prices and their values would have to be estimated through other methods such as substitute good approach. There are many classifications of values and benefits found in the literature (Barbier, 1992; Munasinghe, 1993 & Pearce, 1993) as shown in Table 2.2

Table 2.2: Valuation of NTFPs to Determine Economic Value

NTFPs	**Type of Use**	**Traded / Non - Traded**	**Valuation Technique**
Rattan	Direct	Traded (International)	Market-based technique
Bamboo	Direct	Traded (local)	Market-based technique
Medicinal Plants	Direct	Traded (local/International)	Market-based technique, Substitute good approach, Contingent valuation method
Fruit trees	Direct	Some are traded local	Market-based technique Substitute good approach, Contingent valuation method
Recreation	Direct	Non-traded	Travel cost method, Contingent valuation method
Water or hydrological values	Direct	Traded and own consumption	Market-based technique, Contingent valuation method
Wildlife	Direct	Traded (International/local) & non-traded	Market-based technique Substitute good approach, Contingent valuation method
Palms	Direct	Some are locally traded	Market-based technique, Substitute good approach, Contingent, valuation method
Essential oils (Keruing oils)	Direct	Traded (International)	Market-based technique,
Foods	Direct	Some are traded locally	Market-based technique, Contingent valuation method, Substitute good approach
Carbon	Indirect	Traded (International) (carbon-offset)	Market-based technique
Resin	Direct	Traded	Market-based technique
Latex	Direct	Traded	Market-based technique
Honey	Direct	Traded	Market-based technique
Climbers	Direct	Some are traded	Market-based technique, Contingent valuation method, Substitute good approach
Gaharu (Karas)	Direct	Traded (International)	Market-based technique
Protected areas (national park)	Direct, Indirect	Not traded	Contingent valuation method, Choice modeling
Research	Direct	Not traded	Replacement Cost
Education	Direct	Not traded	Replacement Cost
Soil protection	Indirect	Not traded	Damage cost avoided
Genetic resources	Direct	Some are traded	Hedonic pricing, market price
Aesthetic value	Indirect	Not traded	Hedonic pricing

Direct use values refer to the productive or consumptive values of ecosystem components or functions. Direct uses may be marketed or non-marketed, with some of the activities often being important for the subsistence needs of local communities. An example of a marketed direct use is timber resource, which can be harvested and sold to consumers. The use of medicinal herbs collected from the forest resources by local communities is an example of non-marketed direct use. Marketed uses may be important for both domestic and international markets. In general, the value of marketed goods and services is easier to measure than the value of non-marketed and subsistence direct uses.

Indirect use values refer to the value of environmental functions that support or protect an economic activity. For instance, a tropical forest protects watersheds and store carbon dioxide. Tropical forests also include many plant species, which in turn may have established ecological functions. The values of environmental functions can be derived from the supporting or protecting economic activities that have directly measurable values (IIED, 1994).

The methods used to determine each value mentioned above depends on the nature of forest goods and services in question. For the direct use value, the methods available include market-based technique, changes in productivity approach, relocation cost, and damage cost avoided. The indirect use value, the contingent valuation approach can be used to value option and existence values. This method requires good understanding of forest goods and services production system. A good literature on the methods used can be found in Hanley & Spash (1993); IIED (1994).