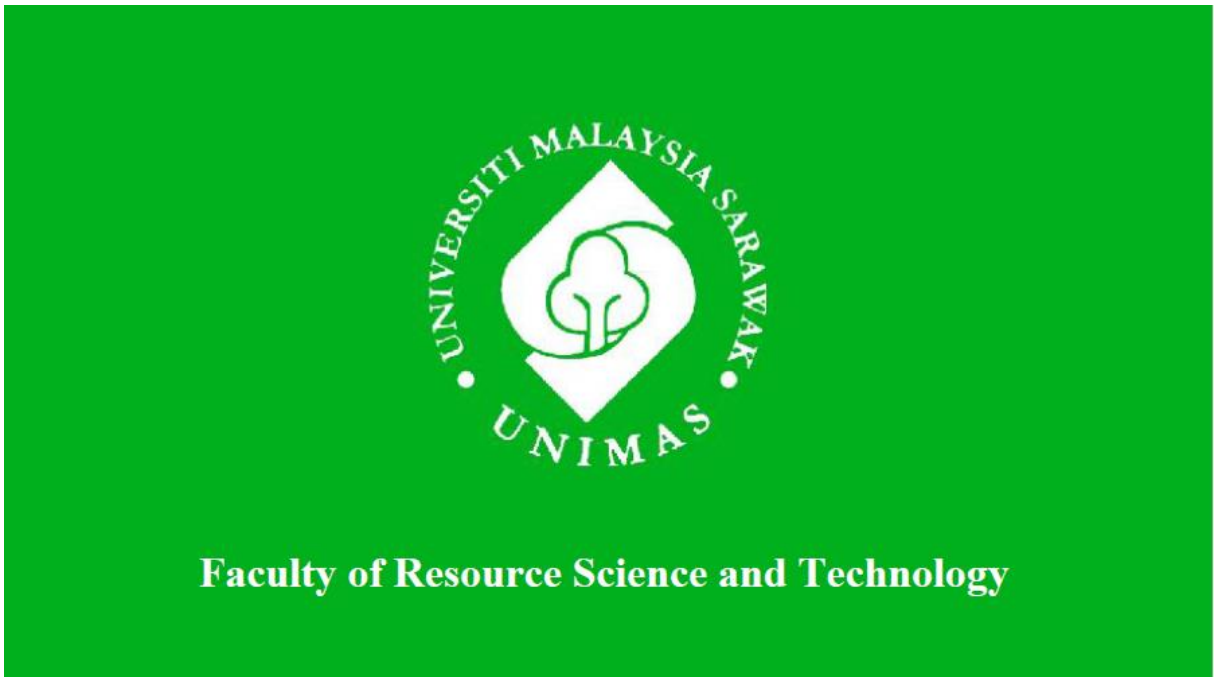

Utilization Pattern and Value of Traditional Medicinal Plant Use in Jagoi Area, Bau, Sarawak

Jovita Elderson Anak Ripen

Master of Science
(Botany)
2016

Utilization Pattern and Value of Traditional Medicinal Plant Use in Jagoi Area, Bau, Sarawak

Jovita Elderson Anak Ripen

A thesis submitted

In fulfillment of requirements for the degree of Master of Science (Botany)

Faculty of Resource Science and Technology
UNIVERSITI MALAYSIA SARAWAK
2016

ACKNOWLEDGMENTS

I would like to express my special thanks to my supervisor Professor Dr Gabriel Tonga Noweg for his guidance, valuable time, patience, and support throughout the period of completing this research. His comments, advices and suggestion have given me more confidents to complete my study.

My gratitude also goes to Medicine Man of Jagoi area especially to Mr Miseng akMagin, Mr Miku Angik ak Magin, Mr Ahsen ak Nyokew, Mr Lipien ak Gijud, Mr Jitem ak Mejes, Mr Regong ak Rajon, Mdm Lema ak Nopis and the late Mr Juho, for their valuable knowledge on useful plants that had been shared to me during the fieldwork, to all the respondents who agreed to participate in the questionnaire session and to all the residents in Jagoi area.

My special thanks also to Dr Paul Chai, Mr Lade Abo and Mr Jugah Tagi for sharing their valuable time and expertise, valuable information, special guidance and advice.

My utmost appreciation goes to Sarawak Biodiversity Centre for the moral supports I received. I value and appreciate the support from Sarawak Herbarium, Forest Department for allowing me to use their place for herbarium specimen identification.

To my study friends, Mr Ik Wadell Ik Pahon, Ms Julan Baling, Ms Erdiana Odan and Ms Bibian Diway I thank you all for your collegial support and care during the fieldwork.

Lastly, I would like to thank my husband, my children and also my parents for their moral support and love which have given me strength in completing the study.

DECLARATION

Name : Jovita Elderson Anak Ripen

Matric Number : 11021790

I hereby declare that this research is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by footnotes giving explicit references and a bibliography is appended.

Signature : _____

Date : 7th January 2016

TABLE OF CONTENTS

3.0 MATERIALS AND METHODS

4.0 RESULT, ANALYSIS AND DISCUSSION

LIST OF ABBREVIATIONS

CVM	Contingent Valuation Method
NCI	National Cancer Institute
SPM	Sijil Pelajaran Malaysia
SRP	Sijil Rendah Pelajaran
STPM	Sijil Tinggi Pelajaran Malaysia
WHO	World Health Organization
WTP	Willing to Pay
TMPs	Traditional Medicinal Plants
IUCN	International Union for the conservation of Nature Resources
WWF	World Wide Fund for Nature
SPSS	Statistical Package for Social Science

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

GLOSSARY

Age group	Age group of individual respondent who are household heads
Traditional medicine plant	The plants that had been used for medicine in generation
Traditional knowledge	The knowledge that had been pass from generation to another generation
Household income	The total of income from the family members
Kampung	Village
Economic value	
Conservation of forest	Protection of forest
Community-Based Natural Resource Management	Managing of forest by local community
Documentation of useful plants	Recording of useful plants information
Herbarium specimens	Sample of dried plant for references
Pilot test	Testing of a few sample for reliability of the research
Internal application treatment	Application by eat or drink the medicine
External application treatment	Application on the skin
Willingness to Pay	Willing to contribute

ABSTRACT

The use of medicinal plants based on traditional knowledge is widely known among the Bidayuh community in Sarawak. The local communities around Jagoi area, Bau are in the process of developing a strategic management plan to conserve their cultural heritage, the Mount Jagoi Community Forest. Based on a study carried out with the Bidayuh community of Jagoi area, a total of 117 species of plants with economic and cultural significance particularly plants with medicinal use were documented and collected. Of these, 60 species were recorded for medicinal purposes while 57 species of plants were for other uses. The plant family with the most species used are Euphorbiaceae and Moraceae (8 species each), Fabaceae (7 species), Arecaceae, Asteraceae and Dipterocarpaceae (5 species each) and followed by Piperaceae, Poaceae and Zingiberaceae (4 species each). Information were obtained by interviews with elderly informants recognized as having knowledge of their culture. Information collected included the species of plants used, their specific use, and the method of preparation or applications. In this study, the use of medicinal herbs collected from the forest resources by local communities is an example of non-marketed and marketed direct use. Market visits were made in local weekend markets in Bau district during weekends, when they were selling their plants and herbal products from the forest. Prevailing prices of the plants and herbal products were noted. For non- marketable resources the cost of plant and plant products were estimated based on replacement value and opportunity costs methods. The study results revealed that the total value of traditional medicinal plant use for the Jagoi Bidayuh community based on the current rate of household participation of 10% is at RM32286.85per year. The results of this study have provided baseline information on the annual economic value of the ethno medicinal plant resources from the Jagoi Community Forest. Such information is crucial for developing future plan towards a better management of the area as a community cultural heritage.

Keywords: Bidayuh, culture heritage, community forest, medicinal herbs, valuation of medicinal plants

Corak Penggunaan dan Nilai Tumbuhan Perubatan Tradisional di Kawasan Jagoi, Bau, Sarawak

Jovita Elderson Ripen

ABSTRAK

Penggunaan tumbuhan ubatan berdasarkan pengetahuan tradisional terkenal di kalangan masyarakat Bidayuh di Sarawak. Masyarakat tempatan di dalam kawasan Jagoi, Bau sedang dalam proses membangunkan satu pelan pengurusan strategik untuk memulihara warisan budaya mereka, iaitu Hutan Komuniti Gunung Jagoi. Berdasarkan kajian yang dijalankan dengan masyarakat Bidayuh kawasan Jagoi, sebanyak 117 spesis tumbuhan yang mempunyai kepentingan ekonomi dan budaya terutamanya tumbuh-tumbuhan dengan penggunaan ubat-ubatan telah didokumenkan dan dipungut. Daripada jumlah ini, 60 spesies telah direkodkan untuk tujuan perubatan manakala 57 spesies tumbuh-tumbuhan untuk kegunaan lain. Keluarga tumbuhan dengan kebanyakan spesies yang digunakan adalah Euphorbiaceae dan Moraceae (8 spesies masing-masing), Fabaceae (7 spesies), Arecaceae, Asteraceae dan Dipterocarpaceae (5 spesies masing-masing) dan diikuti oleh Piperaceae, Poaceae dan Zingiberaceae (4 spesies masing-masing). Maklumat diperolehi dengan mengadakan temu bual dengan pengamal perubatan tradisi yang dikenali mempunyai pengetahuan tentang budaya mereka. Maklumat yang dikumpul termasuk spesies tumbuhan yang digunakan, penggunaan khusus mereka, dan kaedah penyediaan atau aplikasi. Dalam kajian ini, tumbuhan ubatan yang digunakan dikutip dari hutan oleh masyarakat tempatan merupakan salah satu contoh produk yang digunakan dan dipasarkan dan yang digunakan tetapi tidak dipasarkan. Harga tumbuh-tumbuhan dan produk herba yang digunakan dalam analisis diperolehi melalui tinjauan yang dibuat di pasar tempatan di daerah Bau pada hujung minggu. Bagi tumbuhan yang tiada di pasaran, kos tumbuhan dan hasil-hasil produk dari tumbuhan dianggarkan berdasarkan kaedah kos penggatian (replacement cost) dan kos

pelepasan (opportunity cost). Hasil kajian menunjukkan bahawa jumlah nilai penggunaan tumbuhan ubatan tradisional bagi masyarakat Bidayuh Jagoi berdasarkan kadar semasa penyertaan isi rumah sebanyak 10% adalah RM32286.85 setahun. Hasil kajian ini telah menyediakan maklumat asas mengenai nilai ekonomi ethnoperubatan tahunan sumber tumbuhan daripada hutan komuniti Jagoi. Maklumat seperti ini amat penting untuk menyediakan pelan pembangunan masa depan kearah pengurusan warisan budaya komuniti yang baik.

Kata kunci: Bidayuh, budaya, hutan komuniti, herba perubatan, penilaian tumbuhan perubatan

CHAPTER I

INTRODUCTION

1.1 General Introduction

This chapter presents the general introduction on biological resources, overview on traditional medicine, problem statement, economic significance of medicinal plants and recent developments in the field of traditional medicine. The general overview discusses the importance of biological resources as traditional medicine, food, preservatives, building material, spiritual healing and other uses. The importance of documentation on useful plant and statement of the problem outlines the issues of interest to the study. Subsequently, the proposed objectives of the study are also clearly outlined.

1.2 General Overview on Biological Resources

The forest ecosystem is an important source of timber and non-timber forest products. The non-timber forest products provide a 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. 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. 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 annually 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*., 1997). 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 formulation of Traditional Medicine Program of WHO is based on the reality that:

- the majority of the world's population depends on traditional medicine for primary health care,
- the manpower represented by practitioners of traditional medicine is a potentially important resource for the delivery of health care, and
- medicinal plants are of great importance to the health of individuals and communities

Martin (1995) defines ethno botany 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 ethno botany 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 ethno botanical activities, biodiversity prospecting and other economic activities. The Forestry Department in Malaysia 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.

1.3 Overview of Traditional Medicine

Traditional medicine (TM) is defined by the World Health Organization (WHO) (2008) as, "the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and social imbalance, and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing".

According to World Health Organization (2008) in some Asian and African countries, 80% of the population depends on traditional medicine for primary health care. In many developed countries, 70% to 80% of the population has used some form of alternative or complementary medicine such as acupuncture. Herbal treatments are the most popular form of traditional medicine, and are highly lucrative in the international marketplace. Annual revenues in Western Europe reached US$ 5 billion in 2003-2004. In China, sales of products totaled US$ 14 billion in 2005. Herbal medicine revenue in Brazil was US$ 160 million in 2007.

1.4 Forest Valuation in Malaysia

In the past, the forest has been viewed mainly as a source of timber and other wood products. However there are other forest services such as water, recreation, eco-tourism, wildlife, non-

timber forest product, medicinal plants and carbon sequestration that provide benefits to mankind. Previous efforts to estimate economic value of forest resources in Malaysia have been progressing very well since 1990s. However, the focus of the previous studies has emphasized on certain forest resources only, particularly timber. Little study has been done to quantify the real economic value and benefits of non-timber forest products. Economic valuation of forest resources is an important task because it provides information on the benefits which could be derived from direct and indirect use of various forest goods and services from a given forest area.

1.5 Economic Significance of Medicinal Plants

In March 1988 an International Consultation on the Conservation of Medicinal Plants 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, WHO & WWF, 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*., 1997). The main features of the Chiang Mai Declaration (IUCN WHO & WWF, 1993) were the guidelines for the conservation and sustainable use of medicinal plants as 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, and
8. To build public support for the conservation of medicinal plants through communication and cooperation.

1.6 Problem Statement

The welfare contribution of traditional use of natural resources to a native community in Sarawak has not been studied widely. The call for conservation of forest lands around native communities in Sarawak is gaining momentum as the resource base is depleting rapidly. Land use conflicts are now more prevalent, and are often resulting in very controversial and sensitive political dilemma for politicians and the executive policy makers. Decisions made to resolve these conflicts are often keenly contested by opposing parties because of the difficulty of satisfying both or all of their needs and expectations.

Host communities of communal lands or communal reserves are often having difficulties in protecting these valuable resources that they inherited from their forefathers. Even with the official recognition of the rights to these resources through the native Adat or Customary Law (Bidayuh) and the Sarawak Land Code (1958), these communal forests or reserves are subjected to encroachments from land developers, be they government agencies or private

plantation developers. Poorly delineated boundaries and the failure of the Land and Surveys Department to effectively survey, mark and document these areas are often the root causes of conflicts. Financial and man-power constraints have resulted in further delays of land surveying and documentations, in particular for customary communal lands and Native Customary Lands (NCL). Encroachments from members of the host communities are also notoriously getting more prevalent as farming lands become scarce. To ensure protection of these valuable natural areas, reasonable justifications need to be forwarded to the government to set aside these areas as community reserves. The economic value that these resources contributed to the welfare of the host communities, and to society at large, has to be estimated and highlighted.

The most important resource which the community derives from the forest area are water supply, construction timber, and the other non-timber forest products. This proposed study is to focus on the traditional use of plant resources among host communities of communal forests or communal reserves. Noweg *et al.,* (2005) recorded traditional use of wild plants among the Kelabit communities but the study did not provide any indication on economic contribution to the host community. Another study by Tipot *et al.,* (2004) on the medicinal plant uses among the Loagan Bunut National park communities similarly did not estimate the value of these uses. A later study by Noweg & Songan (2009) on the communities in peat swamp areas around Roban Sarawak, made a "crude" assessment of the values of medicinal plant use, but failed short of estimating the implications on the economic welfare of the host communities.

The knowledge of useful plants in Bidayuh communities is normally passed on from generation to generation but this practice seems to be vanishing. General observations seem to

point to some impending issues which need to be considered in the study. These issues are as follows:

1. Only the elderly know most of the plants and where to get them: Some of the very useful medicinal plants are only known by the elderly members of the community.
2. Difficulties in finding the useful plant: The process of looking for the plants in the forest and the preparation of remedies are very laborious compared to buying them at the nearby market or obtaining modern medical treatments from the hospital. The modern facilities make rural people dependent on ready-made modern medicines.
3. Religion: Some religions or traditional beliefs do not allow the use of any biological material for medicines.
4. Loss of interest among younger generations: Traditional customs of plant utilization are gradually disappearing. The younger generation is generally unable to recognize neither the plants nor appreciating their traditional use. They are dependent on modern medicines.
5. Opening up of forests: In recent years, Kuching Division is experiencing a very rapid phase of forest clearing for development and agriculture. This has caused enormous changes to occur in Bidayuh communities lives and in the way they utilize plant resources.

In Sarawak very little documentation had been systematically made on the use of plants for medicinal purposes. The importance of ethno botanical resources to the native communities of Sarawak is one of the driving forces behind the current trend of Community-Based Resource Management (CBNRM). This need to conserve community owned natural resources for the Bidayuh community of Bau district has called for a systematic study to document the various uses, to assess the pattern of use, and subsequently to value these resources.

1.7 Purpose of study

There is none study had been done on the systematic documentation of medicinal plants used by Bidayuh community of Jagoi, Bau district and the estimations of economic value to the welfare of community. Locally the Jagoi community of Bau need data for management and conservation of Bung Jagoi forest. This study is purposely to provide them the tangible data to support the development of the plan to conserve the remaining forested lands in the area. This study also to verify the current public perception or common belief is that the use of medicinal plants is influenced by age, income and religion.

1.8 Objectives of the Study

The objectives of the proposed study are to document all traditional uses of plants resources in the Bidayuh communities in the Jagoi area of Bau District, and to estimate the economic contribution these resources provide to the welfare of the community. The specific objectives proposed, among others, include the followings:

1. To conduct a documentation of Traditional Knowledge on important plants of the Bidayuh Community in Jagoi, Bau District (Kampung Jagoi Gunung, Kampung Duyoh, Kampung Serikin, Kampung Srieng, Kampung Bogag, Kampung Sibobog, Kampung Stass, Kampung Serasot and Kampung Skibang),
2. To study the pattern of medicinal plant use in and among the communities,
3. To estimate the value associated with the use of these plant resources, and
4. To assess the perceptions towards management of the resources in the community forest.

1.9 Research Hypotheses

For this research, three research hypotheses that had been identified and analysed using Statistical Package for Social Science (SPSS) Version 19.0:

1. Relationship of use frequency and annual cost of traditional medication against households' income and age.
2. The significance relationship between frequency of collection medicinal plant and value of medicinal plant use against age group.
3. Relationship between the two medication types (traditional and modern) and the respondents from the two different religious groups (christian vs traditional adat believers)

This analysis are purposely to answer the current public perception or common belief that the use of medicinal plants is influenced by age, income and religion.

2.0 Study Justification

The local community is practicing Community-Based Natural Resource Management (CBNRM) at Mount Jagoi Community Forest. It is an initiative to involve local participation in management of natural resource and thereby securing the rights of the poor and marginalized groups in sustainable management as the central theme. Typically, this initiative involves international development assistance. The Jagoi Community needs a good baseline data for an effective management plan. Resource management and conservation requires that harvest should not exceed natural increment over the long term. This calls for a reasonably accurate knowledge about the extent and growth of the resource, as well as a reliable recording of harvest volumes.

The Jagoi Area Development Committee who manages the community forest requires some tangible data on the resource potential and annual extraction of the forest resources from the area. One of the most critical group of resources is the ethnobotanical resources which is the primary source of food and traditional medicine for a significant portion of the Jagoi Bidayuh community. This study is hoped to provide these set of critical information.

2.1 Study Limitation

This study focuses on only one community living in association with communally forest area. The study is focused on Jagoi Bidayuh Community in Bau District. The historical and cultural background of the community may be unique. The results obtained in the study are limited in its application. It cannot represent the other native communities with similar problem setting.

The other challenges of this study include the difficulty of obtaining the best data expected. Some knowledgeable respondents declined to be involved. The decline of medicinal plant resources may also influence the documentation and this may not reflect the actual traditional knowledge possessed in the community.

The information collected and used for the valuation processes were confined to observations and interviews or surveys which were conducted over a short period.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents the conceptual perspective of traditional medicine. It reviews the groups of traditional practitioners according to their practices. This chapter also covers traditional medicine in Malaysia and overview of the state on traditional medicine. The importance of economic value of plant resources is reviewed to understand the value of traditional medicine to the community. This chapter also presents the forest management and conservation, community-based natural resource management and importance of patenting the Sarawak plant resources.

2.2 Conceptual Perspective of Economic Value in Forest Resources

Forest provides valuable timber species, a source of food to local people, provides a source of ecotourism and recreation opportunities and helps maintain favorable environmental conditions. The benefits of forest resources are derived not only by the local people but also global community. Economic valuation of forest resources is an important tool in making the right choices for conservation and sustainable development as it presents the opportunity costs of these resources in the context of inter-temporal and inter-generation impacts (Ghani, 2010). Economic valuation is a simple task when the demand for the forest goods and services is easily estimated. A demand function relates the quantity of a good or service needed as a function of its own price, prices of other goods, especially of substitutes, income of the

consumers, tastes and preferences. Where goods and services in a plantation forest such as timber trees are traded, information derived from the demand function for timber can be used to estimate values. But many forest goods and services such as the recreational opportunities offered by a forest, do not have markets where no equitable payments are made to use the forest. So in order to examine changes associated with certain goods and services provided by the forest, the demand curves may need to be derived. When estimating economic value from the demand curve, it is necessary to look at the actions taken by both consumers and producers of the forest goods and services. The former include people who visit the forest, while the latter could include the owner of the forest who provide and generate goods and services from the forest land (Mohd & Samah, 2010).

The estimates of economic value in the forestry sector are divided into timber and non-timber categories. The economic value of timber is estimated based on standing timber in the forest, known as stumpage, and is relatively well researched and documented given its importance to the national economy. However, the study of the economic values of non-timber forest products (NTFPs) also play a significant role in the local economy but are often neglected because of the difficulties in quantifying their values since they are seldom traded in the market place. Services are the intangible value of the forest towards the environment such as protection for water catchments (Ghani, 2010).

According to Sabariah (1989), the forest provides valuable medicinal plants and estimates show that the forest supports more than 200 potential important medicinal plants. However, it is difficult and almost impossible to estimate the economic value of all medicinal plants as a source of medicinal products. Even though tropical forest has yielded several important drugs which are vital in the treatment of related diseases, the economic value derived from these

plants have to be assessed in terms its potential earnings, cost of prospecting, research and development and culture practices.

According to Ghani (2010), the need for economic valuation of environmental and forest resources can be summarized as follows:

1. To justify and decide how to allocate public spending on forest and environmental conservation,
2. To incorporate public willingness to pay (society value) and encourage public participation in forestry and environmental conservation project,
3. To determine and compare the benefits of different alternatives or competing projects, particularly projects involving forestry and environmental resources,
4. To priorities forestry and environmental development project at the local and national level,
5. To ensure that forest and environmental conservation or development project is maximized for each money spent in this effort, and
6. To determine the opportunity cost of utilizing forest and environmental resources for other uses.

Medicinal plants constitute an important group among all of mankind's natural resources. Healing herbs have been traded and used since ancient times, but are often neglected by mainstream development (Lambert *et al.*, 1997). It is estimated that about 250,000 plant species are found in the world; about 150,000 are distributed in the tropics and about 35,000 in Southeast Asia (Henderson, 1959). From all these no less than 6,000 species are reported to have medicinal properties. The conservation, cultivation, collecting and processing of medicinal plant raw materials constitutes a large formal market and 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 is a sudden increase in trade of medicinal plants (Kumari, 1996). The flora and fauna of tropical forests hold an astonishing wealth of medicines for both 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. For example, quinine derived from the Cinchona tree is used to treat malaria. Rainforest plants also offer much promise of new treatments, even for potential treatments 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 normally collected in the wild, and, and these resources would be depleted if there are no measures taken to mitigate it. Due to that, agricultural departments in China 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). 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, 1975). In 1997, FAO estimated global value of plant based drugs is $US 43 billion a year. 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. Traditional medicine on the other hand, records annual sales of RM 2 billion (Anonymous, 1998).

2.3 Traditional Medicine

Traditional medicine (also known as indigenous or folk medicine) comprises knowledge systems that developed over generations within various societies before the era of modern medicine. The World Health Organization (WHO) defines traditional medicine as *"the health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral-based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being."* The WHO also notes, though, that "inappropriate use of traditional medicines or practices can have negative or dangerous effects" and that "further research is needed to ascertain the efficacy and safety" of several of the practices and medicinal plants used by traditional medicine systems. Core disciplines which study traditional medicine include herbalist, ethno medicine, ethno botany, and medical anthropology. Traditional medicine may include formalized aspects of folk medicine, i.e. longstanding remedies passed on and practiced by lay people.

According to WHO (2005), the populations throughout Africa, Asia and Latin America use traditional medicine (TM) to help meet their primary health care needs. As well as being accessible and affordable, TM is also often part of a wider belief system, and considered integral to everyday life and well-being. Traditional medicine includes diverse health practices, approaches, knowledge and beliefs incorporating plant, animal and/or mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to maintain well-being, as well as to treat, diagnose or prevent.

According to WHO (2005), as of the year 2000, 25 countries reported having a national traditional medicine (TM) policy. Such a policy provides a sound basis for defining the role of TM in national health care delivery, ensuring that the necessary regulatory and legal mechanisms are created for promoting and maintaining good practice, that access is equitable, and that the authenticity, safety and efficacy of therapies are assured. A national TM policy is urgently needed in those developing countries where the population depends largely on TM for health care, but without its having been well evaluated or integrated into the national health system. Many developed countries are now also finding that TM issues concerning, for example, safety and quality, licensing of providers and standards of training, and priorities for research, can best be tackled within the framework of a national TM policy.

The world's poorest countries are most in need of inexpensive, effective treatments for diseases. WHO estimates that one-third of the global population still lacks regular access to essential drugs, and that in the poorest parts of Africa and Asia, this figure rises to over 50% (WHO, 2000). In these regions, some form of TM is often a more widely available and more affordable source of health care. However, if access to TM is to be increased to help improve health status, two issues must be tackled. They are: development of reliable standard

indicators to accurately measure levels of access, and collection of qualitative data to identify constraints to extending access. Safe and effective TM therapies must also be identified, to provide a sound basis for efforts to promote TM. The focus should be on safe and effective treatments for diseases which represent the greatest burden for poor populations, i.e. for malaria and HIV/AIDS. Cooperation between TM providers and community health workers needs to be increased too. In some countries, notably in Africa, the links between, for example, traditional birth attendants and primary health care providers are being strengthened. But in many others, these two types of heath care provider work in isolation from one another. TM therapies then risk being sidelined. Opportunities to deliver health messages are also lost. At the same time, some TM providers lack knowledge of primary health care and perform practices that carry health risks. The challenge is to recognize and ensure that the health skills and knowledge of TM providers are optimized. Other access issues relate to protection of TM knowledge and sustainable use of natural resources. Many methods and regimes can be used for protecting TM knowledge, such as creating a national inventory of medicinal plants, recording TM knowledge, and creating a national policy on protection of TM knowledge. Sustainable use can also be promoted by several means, including adoption of good agricultural practices.

To meet growing challenges in the area of TM, WHO has formulated a comprehensive working TM strategy for 2002–2005 (WHO, 2005). The strategy is flexible enough to integrate the needs of each WHO Region and Member State. It also addresses issues relating to national policy, safety and efficacy, access, and rational use of TM. The World Health Assembly (WHA) resolution on TM, adopted in 2009, requested the WHO Director-General to update the WHO Traditional medicine strategy 2002-2005, based on countries' progress and current new challenges in the field of traditional medicine. The WHO Traditional

Medicine Strategy 2014-2023 thus reappraises and builds on the WHO Traditional Medicine Strategy 2002–2005, and sets out the course for TM and complementary medicine (CM) (T&CM) in the next decade. The WHO Traditional Medicine (TM) Strategy 2014–2023 was developed in response to the World Health Assembly resolution on traditional medicine (WHO, 2013)

The goals of the strategy are to support Member States in:

1. Harnessing the potential contribution of TM to health, wellness and people centred health care;
2. Promoting the safe and effective use of TM by regulating, researching and integrating TM products, practitioners and practice into health systems, where appropriate.

The strategy aims to support Member States in developing proactive policies and implementing action plans that will strengthen the role TM plays in keeping populations healthy. It seeks to build upon the WHO Traditional Medicine Strategy 2002–2005, which reviewed the status of TM globally and in Member States, and set out four key objectives:

1. Policy-integrate TM within national health care systems, where feasible, by developing and implementing national TM policies and programmes.
2. Safety, efficacy and quality-promote the safety, efficacy and quality of TM by expanding the knowledge base, and providing guidance on regulatory and quality assurance standards.
3. Access-increase the availability and affordability of TM, with an emphasis on access for poor populations.
4. Rational use-promote therapeutically sound use of appropriate TM by practitioners and consumers.

2.4 Traditional Knowledge and Medicinal Plants of Malaysia

Traditional medicine is widespread throughout the world and Malaysia is no exception. According to Latiff (1991), much of this knowledge is still dominant in the culture of the various ethnics in an unrecorded form. They are assumed to be passed from one generation to another generation in the traditional manner. The traditional knowledge of medicinal plants has been the key for the survival of the ethnic groups who live in the interior. As a modern medicine is hardly available, all forms of medicines are derived from plants, animals or minerals. Plants are also important for the supply of construction materials and for their food source.

Medicinal plants are defined as those which produce one or more active constituents capable of preventing or curing an illness. In traditional medicine, the drugs are usually prepared by boiling the plant parts or by soaking them in cold water for some time (Juriyati *et al.*, 1995). According to Ghazally & Laily, 1995, the Malaysian forest represents the richest of the region tropical forest but is also in serious danger of over-exploitation (Ghazally & Laily, 1995). About 1 200 of the higher plants in Malaysian forests are reported to have medicinal properties. Currently only about 200 are used in preparing various traditional medicines, but plant-based products such as herbal medicines and health foods are also gaining more popularity among Malaysians. Based on data obtained from 4 000 Chinese herbal stores in Malaysia, the annual sales value was about RM500 million in 1994. The estimated market value of traditional medicine was between RM1 to 2 billion in 1995 (Kadir & Ali, 1998).

Many aromatic plant species in local rain forests have potential use for the production of essential oils, turpentine, flavours and fragrances. Although many aromatic and medicinal

plant resources are available locally for industry, the supply of materials continues to come mainly from China, India and Indonesia, with only a small amount being harvested from Malaysian forests (Kadir & Ali, 1998). 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. The knowledge of medicinal plants 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 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 are such as hydroelectric dams and rural settlements (Latiff *et al.,* 1984). Various plant families such as those of the Euphorbiaceae, Fabaceae, Poaceae, 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, 1989). 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, Orang Asli and other ethnic group of Sarawak and Sabah. Latiff (1989) 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. According to Sabariah, (1989), 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, 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 that reported by 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 ethno medical 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.

According to Kumari (1996), 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. There are also preparations and infusions for diabetes, diarrhea, rheumatism, coughs, anemia and smallpox.

Kress (1995), reported that sometimes the same plants are used by the rural people for multi-purposes. For example, tubers of *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 *sentawar* (*Amischotolype griffithii)* to treat fevers but the Orang Asli tribes use them for snake or centipede bites. 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.

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

According to Mohd Azmi & Ahmad Fauzi, (1998), 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.

2.5 Medicinal Plants of Sarawak

Sarawak is the largest Malaysian state with a land area of 124,000 sq. kilometers with 9,500 species of recorded plant. Sarawak population of 2.2 million is made up of 30 ethnic groups, each own unique rich and colourful cultures and traditions. The indigenous communities

have, for many generations; relied heavily on the forest to supply them with everything they needed (Chai, 2006).

The use of plants for medicinal purposes has not been formally documented in Sarawak although the practice may have dated back to as early as the first existence of the nomadic tribes on the island. More contemporary records on use of wild plants for medicinal purposes had been made for the Kedayan communities in Sarawak by Ahmad (1993), the Iban communities in Batang Ai areas and Kelabit communities in Pa Derung, Bario by Christensen, (2002), and the Bidayuh-Selako communities in Lundu areas of Sarawak by Khamisiyah, (2006). As part of a comprehensive documentation on ethno botany of the Lanjak-Entimau Wildlife Sanctuary area in Sarawak, Chai (2000) further identified and documented many more uses for wild plants. Uses identified included wild vegetables, wild fruits, edible oil, traditional medicine, firewood, materials for arts and crafts, as well as construction materials.

The more recent studies on medicinal plants of the state had been reported in Medicinal Plant of Sarawak (Chai, 2006). This study has recorded a total of 608 species of medicinal plants used by many communities of Sarawak. Other study on the useful plants of state had been reported in The Flora of Pulong Tau National Park (Pearce, 2006). This study had recorded 27 plant species for medicinal uses for humans and as many as 40 medicinal uses of Park plants for humans were provided by the local. Similar efforts were made by Noweg *et al.,* (2006) to document plants used by the Penan and Berawan communities around Loagan Bunut National Park and had included basic toxicity test on extracts from key medicinal plants identified.

2.6 Forest Economic Valuation

Economic valuation is a key step in biodiversity assessment and planning. Economists and decision-makers have traditionally seen the value of biological resources only in terms of the direct uses they support such as the raw materials they provide for human production and consumption (for example the timber value of natural forests or the fisheries value of coastal and marine ecosystem). Economists generally depend on market prices to indicate the value of goods and services. For a good and service exchanged in a well-defined market, information on prices and quantities are readily available. This information can be used to estimate the value of a particular goods and service. However, for non-timber forest product or services such as water, recreation, wildlife, wild fruits and genetic resources the value would have to be estimated through non-market valuation methods. According to Ghani (2010), the major role of valuation is to assign an appropriate value to goods and services in terms of their opportunity cost by asking their true willingness to pay to consume a particular goods or service. Typically, the benefits derived from forest resources are to be measured in terms of Willingness-to-pay (WTP) of users or consumers for using and experiencing the goods and services. An approximation of user's WTP for a particular recreational opportunity, for instance, can be developed from a demand curve which indicates the quantity of use that users in a market would be willing and able to purchase at each price. Other estimates could be in terms of expenditures on preventive measures taken by consumers or users to avoid a future loss. Thus, conservation of forest resources could be seen as a form of WTP for current and future benefits.

By setting up a hypothetical market to establish monetary value for environmental goods and services, it is possible to estimate how much individuals would be WTP for an environmental

benefit (McNally & Mohd Shahwahid, 2002; Jamal & Mohd Shahwahid, 1999). It is quite difficult to measure prefect WTP, however, Contingent Valuation Method appears to provide values that may resemble those generated by cash transactions (Bishop & Heberlein, 1987). According to Pak *et al.*, 2010, the economic values can be divided into two categories: use and non-use values. The use values comprise direct, indirect and option values while the non-use values consist of existence and bequest value.

Ghani (2010) classified the economic values as bellows:

Direct Use Values: refer to the productive or consumptive of ecosystem components or functions. Direct uses may be marketed or non-marketed, with some of the latter activities often being important for the subsistence needs of local communities. An example of a marketed direct use is timber resources, 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 ecological functions. The values of environmental functions can be derived from the supporting or protecting economic activities that have directly measurable values.

Option Values: relate to the amount that an individual or society would be willing to pay to conserve an ecosystem for future use. For example, preservation or biological diversity can

preserve wild genetic for future use such as the development of a new pharmaceutical drug. Wild fruit and fishes may prove to be extremely valuable genetic stocks in the future, because many of these wild plants and fishes have genes that can help resist some kinds of diseases.

Existence values: refer to society's willingness-to-pay (wtp) to conserve biological resources for their own sake, regardless of their current or optional uses. For instance, many people reveal their wtp for existence of biological resources such as a wildlife and landscape without participating in the direct use of the wildlife and landscape through recreation.

According to Pak *et al*, 2010, *bequest value* is defined as the willingness to pay to pre- serve some resource for future generation (Klemperer, 1996). The concept produces a willingness to pay at present point in time in order to ensure that certain values are maintained and made available to future individuals. If these individuals are immediate descendants then the respondents would be fairly confident at guessing the nature of the beneficiaries' preferences. However, it would not be too difficult to make reasonably accurate guesses about the preferences of distant generations on the basic issues such as clean air, clean water, maintenance of natural wonders, soil fertility and so on (Kula, 1994). In the bequest value context of forest resource, land-scape, recreation, energy and raw material availability, biodiversity, environmental conditions e.g. related to carbon storage, affecting future generations may be considered (Merlo & Briales, 2000)

According to Ghani, 2005, the economic values of forest can be categorized into 2 categories: use and non-use values. The types of economic values and possible valuation techniques for forest are as presented below (Table 2-1).

Table 2-1: Forest uses and its associated value types

Items	**Use Values**			**Non-use values**
	Direct	**Indirect**	**Option**	**Existence/Bequest**
Values	Wood product (timber & fuel)	Watershed protection	Future uses	Biodiversity
	Non-wood collection (food, medicine, genetic material)	Nutrient cycling		Culture, heritage
	Educational activities	Air pollution reduction		Intrinsic worth
	Recreational uses	Microclimatic regulation		
	Cultural	Carbon store		
	Human habitat	Habitat for wildlife		
	Environmental education			
	Amenities			
	Research			
	Local community use			
	Scientific expedition			
Valuation techniques	Market prices and cost-based analysis	Production function	Contingent valuation	Contingent valuation
	Related/substitute goods techniques	Preventive expenditures	Choice model	Choice model
	Contingent valuation	Replacement cost		
	Hedonic price	Contingent valuation		
	Replacement costs	Choice model		
	Travel cost method			

Source: Ghani (2005)

According to Principe (1989), the economic value of resources represents all of the societal benefits that are derived from that resource. There are two aspect of economic value in medicinal plants:

- Economic value of the drugs derived from plants includes not only the market value but also the societal benefits from increases good health.
- There are non-pharmaceutical uses and benefits that the plants provide.

2.7 Previous Studies on Economic Value of Medicinal Plants in Malaysia

Ng and Mohd Azmi, 1997, reported that statistics on the export of medicinal plants in Malaysia was estimated at about RM 55 million in 1996 and Anonymous, 1998, reported that

statistic on the export of medicinal plants in Malaysia was estimated at about RM 43 million in 1997. Studied by Mohd Azmi & Ahmad Fauzi (1998), showed that the supply *of tongkat ali (Eurycoma longifolia),* 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, a 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.

The import and export of medicinal plants for pharmaceutical uses in Malaysia, 1986 to 1996 was show as below:

Table 2-2: The Import and export of medicinal plants for pharmaceutical uses in Malaysia, 1986 to 1996

Year	**Import (RM)**	**Export (RM)**
1986	93 426 747	4 171 067
1987	85 219 513	5 227 073
1988	143 862 161	8 192 234
1989	160 250 315	12 263 211
1990	160 426 878	16 777 638
1991	181 474 845	18 725 948
1992	197 678 880	10 053 811
1993	212 619 287	21 925 302
1994	224 971 213	34 951 451
1995	256 673 093	41 241 046
1996	264 756 564	55 871 852

Source: Statistical Department (1996) in Azizol Abdul Kadir and Rasadah Mat Ali (1998)

Respectively, the import value for both medical and aromatic plants increased from RM141 million in 1986 to RM431 million in 1996 and the exports increased from RM5.9 million to RM63 million over the same time (Teik & Idris, 1997).

According to Chai (2006), Malaysia's herbal market has an estimated worth of around RM5 billion in 2006. However, as little as five per cent of the products are said to be produced locally. Owing to its diverse ethnic's compositions, Sarawak probably has the most extensive ethnobotanical knowledge compared to other state in Malaysia.

Efforts to include aspects of value assessments to these ethnobotanical resources were made for the communities surrounding the limestone forests in Bau district in 2004 and Maludam National Park in Betong Division in 2004. In both studies the annual value of ethnobotanical resources consumed were estimated to be approximately RM 60 and RM 50 per household respectively (Noweg, 2004 & Noweg, *et al.*, 2004).

A similar assessment made for communities around peat swamp forest in Kabong, Roban sub-district indicates that annual value of household use of ethnobotanical resources was as high as RM 180 (Noweg & Songan, 2009). Nareh (2008) in her study among the Krokong Bidayuh communities reported the average annual household use of medicinal plants was value of wild plants for medicinal purpose was around RM250 while the value of wild plants for food was lower at RM50.

2.8 Forest Management and Conservation Status of Medicinal Plants in Malaysia

According to FAO (1997), the forest genetic resources can be defined as the economic, scientific or social values of the heritable materials contained within and between species. They are associated with different levels of natural diversity from ecosystems to species, populations, individuals and genes. Conservation of forest genetic resources means managing forest genetic resources for human use to yield the greatest sustainable benefits for present generations, while maintaining their potential to meet the needs and aspirations of future generations.

Malaysia is fortunate in having extensive areas of valuable natural tropical forests, richer in plant species diversity than other similar areas in Africa and South America. They are, in fact, the most species-rich communities known anywhere in the world (Whitmore, 1975).

Most of the forest conversion in the peninsular portion of Malaysia, then, has been for cultivation, mainly of rubber and oil palm. Early agricultural conversion had been for rubber plantations, but since the rubber market was not expanding and became less profitable, much land was logged for small farmer-settlers and also for large-scale oil palm plantations. Thus Malaysian forest conversion has been mainly for cash crops (Brookfield *et al.*, 1993). Land development was part of government policy which aimed to eliminate rural poverty and to provide a source of government income. FELDA, the government agency entrusted with the accomplishment of this goal, has turned into a vast agribusiness enterprise, and has recently restructured the agricultural activity of Peninsular Malaysia from rubber to oil palm cultivation. Additionally, by the late 1970′s, more than 250,000 people had been resettled on cleared forest land, and FELDA had become by far the largest land-conversion organization in

Malaysia (more than 6000 km^2 by early 1980′s). The World Bank assisted by funding large "development" projects in the peninsular interior, and helped establish new urban centers there (Brookfield *et al.*, 1993).

Very little lowland forest remains in Peninsular Malaysia, and even montane forests up to 1500 m are being cleared. Some rainforest remains in the north and elsewhere in isolated and mountainous patches, but the connection between the two large northern forested areas has been severed. Peninsular Malaysia can no longer provide much timber, but for the past 30 years much of the world supply of hardwood has come from Borneo (including Kalimantan, Indonesian Borneo).

In Borneo most of the deforestation has been for the purpose of supplying the timber industry. Fifty years ago Sarawak, one of the two Malaysian states on the north coast of Borneo, was almost entirely covered with forest, but by 1989, 60% of the land had been licensed for timber extraction and huge areas have since been logged. By the late 1980′s, this area supplied almost one-third of the world's hardwood timber. Lately, the proportion has dropped, due to resource exhaustion, and attention has now shifted to the neo-tropics (Rainforest Conservation Fund, 2015).

With the decline in hardwoods, timber extraction has turned to less-desirable, softer wood species. Timber-processing has become a big business, and consumes species which would not have been utilized in the boom days of the timber industry in Asia. Much of this processed wood is exported. In Borneo, interestingly, the middlemen who buy timber for the mills have become the controlling factor in these enterprises. They can buy logs obtained from illegal

sources, and they can buy immature trees, which should be left to provide a future supply of timber (Brookfield *et al.*, 1993).

Sadly, much of the logging has been extremely wasteful. In Borneo, loggers remove all accessible hardwood trees in areas designated for cutting, rather than only 56-72% as required by regulations, and the formerly huge expanse of dipterocarp forest has been chopped into fragments. While logging, the timber companies routinely harvest 57% of the forest area in a patchwork of sites; however, they also degrade another 20-30% of the land for roads, logging yards and camps. Little is left, usually less than 20% as undisturbed forest, and that only in isolated pieces (Curran, 1999). Even worse, the forest is not left to regenerate but is usually replanted with exotic commercial species in monocultures.

Prior to substantial logging activity, there was little hunting, but once logging roads had been built, hunting became intensive. "Anything seen was shot at." (Bennett and Dahaban, 1995) In Indonesian Borneo (Kalimantan) logging has been just as intense. According to Siegert, *et al.*, (2001) more than 180 million m^3 of logs have been harvested there since 1969. Approximately 800,000 hectares in Malaysia are protected as parks; about one million hectares as reserves; 600,000 hectares as wildlife reserves; 100,000 as "protection forests" plus a few others, altogether amounting to about 1,700,000 hectares. Only the national forest, Taman Negara, is secure, and it represents only one ecosystem – lowland moist forest, and contains only 3% of the endemic tree species and 30% of known palm species in Malaysia. Completely unprotected are mangrove forests, wetland forests, and highland forests. Many of the reserves are fragments only, and of these, a substantial number have been reduced in size or used for other purposes (Soepadmo & Wong, 1995). Wildlife sanctuaries have restrictions on hunting but are not completely protected. In Sabah and Sarawak, which formerly had huge

forests, exploitation is rampant, protection is inadequate, there is little forest management, and there is much illegal agricultural conversion and logging. The protected areas are not adequate to maintain the wide range of biodiversity in this rich area. It is anticipated that, at present rates of deforestation, more than 50% of Malaysian forest species will become extinct, many of them endemic to this area (Rainforest Conservation Fund, 2015).

In Sarawak, the gazette area of Gunung Gading and Gunung Mulu National Parks are clear testimony to the genuine commitment by the state authorities to preserve biodiversity of Malaysia indigenous flora and fauna (Soepadmo, 1991)

2.9 Community-Based Natural Resource Management (CBNRM)

The Community-Based Natural Resource Management (CBNRM) approach combines conservation objectives with the generation of economic benefits for rural communities. The three key assumptions being that, the locals are better placed to conserve natural resources, people will conserve a resource only if benefits exceed the costs of conservation and people will conserve a resource that is linked directly to their quality of life. When a local people's quality of life is enhanced, their efforts and commitment to ensure the future well-being of the resource are also enhanced. Regional and community based natural resource management is also based on the principle of subsidiary (Leach & Scoones, 1999).

A problem of CBNRM is the difficulty of reconciling and harmonizing the objectives of socioeconomic development, biodiversity protection and sustainable resource utilization. The concept and conflicting interests of CBNRM, show how the motives behind the participation are differentiated as either people-centered (active or participatory results that are truly

empowering) or planner-centered (nominal and results in passive recipients). Understanding power relations is crucial to the success of community based natural resource management (NRM). Locals may be reluctant to challenge government recommendations for fear of losing promised benefits (Warner & Jones, 1998)

CBNRM is based particularly on advocacy by nongovernmental organizations working with local groups and communities, on the one hand, and national and transnational organizations, on the other, to build and extend new versions of environmental and social advocacy that link social justice and environmental management agendas with both direct and indirect benefits observed including a share of revenues, employment, diversification of livelihoods and increased pride and identity. CBNRM has raised new challenges, as concepts of community, territory, conservation, and indigenous are worked into politically varied plans and programs in disparate sites (Li, 2007).

How does CBNRM link economic development and natural resource management? In CBNRM there are both direct and indirect links between development and natural resource management:

1. Direct benefits

I. Investment in rural infrastructure through CBO projects

II. Direct cash dividends earned from partnerships

III. Employment opportunities with private sector

IV. Employment opportunities with community based organisations

2. Indirect benefits

I. Maintenance or growth of stocks of natural resources

II. Capacity – building

III. Opportunities to diversify local economy, and integration into the market place

Source: Shackleton et al. 2002

3.0 Importance of Patenting the Sarawak Plant Resources

In some countries plants can be covered by patent claims provided that the patent applications are able to meet all of the necessary standards and requirements that exist in that country for patentability. Under the Trade-Related Aspects of Intellectual Property Agreement which binds World Trade Organization members, member countries that choose not to provide such mechanisms for plants under their national patent system must provide an alternative way in which an entity may claim that it has a legal right to intellectual property, to the partial exclusion of the rights of others, in plants and plant products.

According to Parry (2001), one of the medicinal plants that has been discovered and been patented by National Institute of Health (NIH) in Malaysia is Bintangor tree that contain Calanolide A and B to be active against HIV. National Cancer Institute (NCI) awarded MediChem an exclusive license to their patents that covered the preparation and use of calanolides. After our plants have been taken away by foreigners, then local people started to realize the economic value of our plants. Local people were beginning to calculate the value of the plants, which they have neglected before.

While the biological resources belong to the State of Sarawak, the study and research into use of such resources for the development of pharmaceutical products are primarily carried out by scientists from the developed countries and in laboratories outside Malaysia. Such a situation

brings about two inherent problems. First, the difficulty in sustaining Sarawak's claim for any intellectual property or patent rights to the invention derived from the state's plant because, legally, whether a product was originally derived from plant is not a pertinent consideration in regard to the grant of a patent. Second, the difficulty in securing for Sarawak, any benefit, if at all both monetary and technological, from the development of any pharmaceutical products based upon resources indigenous to the State of Sarawak (Chung, 1996)

In 2010, Sarawak Biodiversity Council declares the biological resources namely the trees of species *Aglaia stellatopilosa* Pannel and *Aglaia faveolata* as protected resources for purposes of the ordinance (The Sarawak Biodiversity Centre Ordinance, 1997). In 2012, the Intellectual Properties of *Litsea cubeba* were registered, as follows:

• Patented oral care product (LitsaraTM Toothpick).

• Geographical Indicator (Sarawak Litsea).

• Trademark (Litsara TM).

According to Chung, (1996), the knowledge of indigenous people of Sarawak on the medicinal properties of the plants or their components and on their traditional practices is invaluable to those who undertake scientific research into our indigenous plants. In such a case, the Sarawak Government will have to insure that contribution of our indigenous people towards the utilization of our biological resources for medicinal purposes are acknowledged and adequately rewarded.

Therefore, Sarawak has introduced guidelines and regulations on the use of biological and genetic resources of the State for scientific and pharmaceutical research. These guidelines cover the access by both foreign and Malaysian nationals to plant materials found in the

forests on State's land, both communal and protected forests, for scientific research. A permit system will be introduced, so that no one can undertake collection of plant materials for scientific research without a permit issued by the government. A permit will only be issued after the applicant has entered into an Agreement with the State as regards the following:

- Use of the materials
- Supply of information and data on materials taken
- Results of research undertaken
- Right of the state to patents or intellectual properties
- Royalties and compensation in the event that research results in the discovery and development of any drug or pharmaceutical products

IP (Intellectual Property) protection is important to ensure that rights are retained. Patent is one of the IP types under Sarawak Intellectual Property Section. The Act defines an invention as an idea of an inventor which permits in practice the solution to a specific problem in the field of technology. An invention may be, or relate to, a product or process.

CHAPTER 3

MATERIALS AND METHODS

3.1 Introduction

This chapter presents the conceptual framework used in the study. It is then followed by the procedures for collection of data which includes the first phase of data collection and the second phase of data collection. The first phase of data collection is the ethno botanical data that includes plant documentation, collection and identification and key informant in-depth interview. The second phase of data collection is the socio-economic survey that includes 3 sections: the socio-demographic data of surveyed households, utilization pattern and value of medicinal plant, and importance of forest management and conservation. The methods used to estimate the economic benefits of the medicinal plants to the community and the subsequent data analysis are described.

3.2 Study Site

The study was carried with the Bidayuh Jagoi community in and around Gunung Jagoi, Bau District of Sarawak. Jagoi area is located in the southern part of Bau District, Sarawak. It is approximately 45 km south-west of Kuching, the capital city of Sarawak and can be reached by tar-sealed road via Bau town and then south towards the Indonesian border.

Source: http://www.malaysia-maps.com

The study involved with nine villages around Gunung Jagoi namely Kampung Bogag, Kampung Duyoh, Kampung Gunung Jagoi, Kampung Serikin, Kampung Serasot, Kampung Sibobog, Kampung Sekibang, Kampung Sri'ieng and Kampung Stass. These villages are close-knit communitiy and share the same common cultural. The Bidayuh Jagoi community in this area is still practicing traditional medicine, of which wild plants are of paramount importance (Sayok *et al.*, 2014)

Source: http: //www.Google Earth Image 2015-Jagoi map

3.3 Ethno Botanical Data

3.3.1 Documentation, Plant Collection and Specimen Identification

The local community leaders were approached to help identify informants who were knowledgeable on what the community considers as important medicinal plants. These informants comprised of individuals knowledgeable in the use of traditional medicinal plants. They were incorporated in the study as field guides. For this study, plant collections were carried out with the same informants to allow consistency and to avoid conflicting species identifications and unreliable information. In the study, field parameters recorded include the details of location, habitat and all related information concerning the use of the plant. The specimens of each species were taken and brought to Sarawak Herbarium (SAR) for

identification. The herbarium specimens were deposited at UNIMAS herbarium for references.

3.3.2 Key Informant In-Depth Interview

Information were obtained by interviews with seven medicine men and one medicine woman recognized as having knowledge of their culture. The interview sessions were carried out during the weekends when they were at their own home. Information collected included the species of plants used, their specific use, and the method of preparation or applications. While in the field, key informants accompanied the researchers to help in identifying and collecting specimens for botanical identification as well as preparation of voucher specimens. The information were systematically recorded and photographs of the plants were taken. Both wild and domesticated vascular plants (fern, monocots and dicots) were included.

3.4 Socio-economic Survey

3.4.1 Survey Design and Approach

The approach of this research follows a non-experimental one-shot survey of the respondents to establish the relationships or differences between a set of parameters and their dependencies on traditional herbs. This approach was adopted from Cavana *et al.*, (2001), where the researcher know very little about the situation of the study area or when no information is available on how similar problems or research issue had been resolved in the past. In this case, it is about the direct usage or dependence on traditional herbs available in the Mount Jagoi and surrounding communities. As reported by Cavana *et al.* (2001), extensive preliminary work needs to be done to gain familiarity with the phenomena in the situation, and to understand what is occurring, before the researcher should set up a design for a

comprehensive research or study. Hence, in this case extensive interviews with small groups of people were carried out. There were two main components in determining who need to be interviewed. The first is to decide on what kind of households to interview. First of all the households who were involved in this questionnaire study were identified through discussion with the community leader and key informants. A list of households who are full-time residents and known to be involved in using traditional medicine were compiled in each of the villages chosen. The households from each of the villages were then selected using purposive sampling method whereby they were selected based on the fulltime resident households and using the medicinal plants. The next thing to decide is the required number of household sample size need to interview. The decision about the sample size based on factors such as the intended degree of precision, time available, and funds available.

3.4.2 Structured Questionnaires Survey

For this study, the questionnaire includes both the structured questionnaires and perception surveys. The interview questions also cover on the socio-demographic characteristics of the respondents, respondent's treatment of illness, the use of plants for traditional medicine, utilization pattern of traditional medicinal plants and preference of household medication, the respondent's awareness and understanding of forest management and conservation issues and willingness to pay for their forest conservation and management. A set of structured questionnaires were used to collect data to be used to achieve the research objectives and to answer the research hypotheses. A questionnaire is a pre-formulated written set of questions to which respondents record their answer, usually within closely defined alternatives. The questionnaires were pre-tested to determine the reliability and validity of instruments. The questionnaire survey used in the study is as shown in Appendix B.

3.4.3 Population and Sample

Sampling is part of the element in the population. In determining the sample size, the issues of precision and level of confidence is important. The necessary sample size depends on three factors namely the level of confidence required, the margin of error the researcher will tolerate and the variability in the population being studied. Once had decided how accurate the sample data to be, then the number of how many respondents needed can be calculated. In this study, non- probability sampling was employed. Given the demographic details of the families studied, it was possible to determine the sample size using a purposive sampling method. This method is applicable when population is homogeneous and readily available.

The sampling process comprises several stages. Firstly the defining of the population of concern, then specifying a sampling frame, a set of items or events possible to measure and a sampling method for selecting items or events from the frame, determining the sample size, implementing the sampling plan, collecting data and reviewing the sampling process. The sampling strategy that adopted in this study is homogeneous sampling where the survey had been done in homogeneous population with similar backgrounds and experiences

In this study, nine villages namely Kampung Bogag, Kampung Duyoh, Kampung Gunung Jagoi, Kampung Serikin, Kampung Serasot, Kampung Sibobog, Kampung Sekibang, Kampung Sri'ieng and Kampung Stass were selected based on their higher population size and proximity to Mount Jagoi. The effective population size for this study consisted of fulltime resident households and using the medicinal plants. The effective total household population was 1104 households. It was further assumed that the population homogeneity

(with similar background and experiences) was at 90 percent. At 95% confidence level and margin of error at 5 percent, the sample size was determined, as follows:

i) Initial sample estimate, n: -

$$n = \frac{Z^2 \times (p)\ (1\text{-}p)}{c^2}$$

$$n = \frac{(\pm 1.96)^2 \times (0.9)\ (1\text{-}0.9)}{0.05^2}$$

$$n = 138$$

Where,

Z= Z value (±1.96 for 95 percent confidence level)
p = percentage of estimated population homogeneity
c = margin of error

Using the above formula, n was found to be 138.

ii) Final sample size, n_1 :-

$$n_1 = \frac{N \times n}{N + n}$$

$$n_1 = \frac{1104 \times 138}{1104 + 138}$$

$$n_1 = 122$$

The 122 households were then proportionately allocated between the sample villages based on their effective total population. From that population sample size, a total of 81 sample questionnaires were effectively used in the analysis while the other 17 questionnaire sets were not returned and 24 were rejected for being incomplete and having various irregularities.

A set of semi-structured questionnaire survey was developed for assessing the use of traditional medicinal plants. The interview questionnaire consists of the following parts:

a. Basic socio demographic information

b. Pattern of use of traditional medicinal plants, and

c. Common chronic diseases in the surveyed households (their prevalence and types).

3.4.4 Pilot Test

Pilot study refers to a trial study that had being administered to a selected small group of respondents using the instrument which was similar to the actual study. This pilot study is meant to test the reliability and the validity of the items in the questionnaire that are to be answered by the respondents in the study. By using this pilot study, researcher would be able to identify the items that need to be improvised or deleted in order to produce an instrument of high degree of reliability and validity. The reliability of the questionnaire can be assured through its Cronbach's Alpha level. Cronbach's Alpha is the reliability coefficient of all the items to form one set of questions (Sekaran, 2005).

The objectives of this pilot study are as follows:

1. Find out the problems of understanding and interpreting the questionnaires.
2. Evaluate the responses of the respondents towards the statements and questions of its validity and reliability.
3. Find out the time frame needed for the respondents to answer the items in the questionnaire.
4. Obtain valuable feedback on improving the items and questions in the survey form.

In this study, pilot study was conducted by 20 respondents selected randomly from the respective clusters of residential areas. These respondents were being chosen from amongst local community in the area of study. The respondents were given flexible time to complete the questionnaire within one day. A simple analysis to be conducted is based on the 20

questionnaires to identify the Cronbach's Alpha value to determine in internal consistency or reliability of the instrument. In order to determine the validity of 'r' and 'p' value, Pearson's correlation analysis will be deployed.

Re-test Reliability Analysis

The objective of Re-test Reliability Analysis is assessing data reliability and un-dimensionality statistically for items before use for final analysis. The procedures taken are item-total correlation and Cronbach's Alpha. In order to ensure content validity of the instrument, the Cronbach's Alpha test was used while pilot tests been utilized to determine the reliability of the instrument. The instrument used in this research has to be reliable and valid in order to provide consistently possible results.

Reliability analysis will apply to both the pilot test and the actual study. Cronbach's Alpha was used as a reliability coefficient that indicates how well the items in a set were positively correlated to one another. In general, coefficient alpha would range from 0.00 to 1.00. A figure below 0.600 would have a Poor Strength in Coefficient, 0.600 to 0.700 would be Moderate Strength in Coefficient, 0.700 to 0.800 would be a Good Strength in Coefficient, 0.800 to 0.900 would have excellent Strength in Coefficient. The closer Cronbach's alpha to 1.000, the higher the internal consistency reliability. Hence, the reliability analysis was used in this study to ensure the results were valid and research findings were consistent to describe the reliability of measurement.

Based on the pilot test conducted in this study, data was key in into SPSS programme to generate statistical analysis. The instrument was tested for its reliability and validity using

based on Cronbach's Alpha value (Cavana *et al.* 2001). The reliability test was on 114 items in the survey instrument that use nominal scales. The result yielded a Cronbach's Alpha value of 0.749, which indicated that the instrument had "Moderate Strength" in capturing the intended information.

3.4.5 Unit of Analysis

Unit of analysis for this research is the households using traditional medicines. For this research, data were collected from local community in different clustered locations in the area under study.

The raw data obtained from the questionnaires were analysed using the Statistical Package for Social Science (SPSS) Version 19.0 for Window to test the research hypotheses and objective of the study. The raw data were analysed using both descriptive statistics and inferential statistics.

The following types of data analysis were deployed in this study:

Pearson Correlation Analysis

Pearson Correlation analysis is concerned with the relationships between variables. Correlation Analysis is a method that measures the strength of a linear relationship between variables (Elliot & Woodward 2007).

In this study statistical analysis in the form of Pearson's correlation coefficient was been used to measure the strength of a linear relationship between independent and dependent variable.

The Pearson correlation coefficient tested the research hypotheses concerning the relationship between variables which determine the relationship between the factors. Pearson correlation value, which has a value between -1 and +1 determines the strength and direction of the relationship between two variables (Cooper & Schindler, 2008). This analysis was applied to examine the relationship between demographic backgrounds with dependencies on medicinal herbs. The 'r' value and 'p' value are the indicators to be studied deeply. For this study, significant level is at 0.05 or at 95 percent confident level for two-tail analysis. The prediction of strength of relationship between variables by Miller (1991) is shown in Table 3-1 below:

Table 3-1: Interpretation of the value of Pearson correlation coefficient

Correlation coefficient r (+/ -)	**Relationship between variables**
– 0.20	Little or no relationship
0.20 – 0.40	Some slight relationship
0.40 – 0.60	Substantial relationship
0.60 – 0.80	Strong useful relationship
0.80 – 1.00	High relationship

Source: Miller (1991)

One Way ANOVA analysis

A statistical analysis tool that separates the total variability found within a data set into two components: random and systematic factors. The random factors do not have any statistical influence on the given data set, while the systematic factors do. The Analysis of Variance or ANOVA test was used to determine the impact independent variables have on the dependent variable in the analysis.

The ANOVA test is the initial step in identifying factors that are influencing a given data set. After the ANOVA test is performed, the analyst is able to perform further analysis on the systematic factors that are statistically contributing to the data set's variability. This is a way

to test for significant differences among sample means when the independent (predictor) variable is a set of discrete categories, and the dependent variable is continuous, ordinal, or dichotomous. ANOVA test can be used to test the null hypothesis. The null hypothesis is that the sample means are so similar that they have been obtained by drawing samples from the same population.

That is,

H_0: $m_1 = m_2 = m_3 = ... = m_k$

It is also noted that the t-test would have been used if the null hypothesis had concerned only two groups. The t-test is to examine the comparisons of a *single* sample mean with the population mean and of *two* sample means with each other. ANOVA should be viewed as an extension of the t-test, to be used when there are more than two comparison groups.

The research hypotheses were examined using one-way ANOVA, in which there are three or more comparison groups each representing a category of a single predictor variable. It is possible to extend the logic of ANOVA to investigate the impact of two or more predictor variables considered simultaneously. The results of ANOVA analysis were discussed in Chapter 4 as study findings.

_t_-Test Analysis

t-Tests offer an opportunity to compare two groups on scores such as differences, for instance between gender among respondents. A *t*-test is a type of inferential statistic, that is, an analysis that goes beyond just describing the numbers provided by data from a sample but seeks to draw conclusions about these numbers among populations. To do this, the *t*-test

analyzes the difference between the two means (a.k.a. two averages) derived from the different group scores. *t*-Tests tell the researcher if the difference between two means is larger than would be expected by chance (i.e. *statistically significant*). In this guide we went through two common types of *t*-Test:

Results of one samples *t*-test indicate whether the difference between two means (e.g., means of variables are larger than expected by chance.

A summary of the types of analysis associated with each of the hypotheses testing is contained in the table below:

Table 3-2: The types of analysis performed to test the associated null hypotheses

No	**Null Hypotheses**	**Type of Analysis**
H_{01}	There is no significant relationship between frequency of use, cost of traditional medication with households income and age	Correlation Analysis
H_{02}	There is no significant difference between frequency of medicinal plant collection with age group	One Way ANOVA
H_{03}	There is no significant difference between value on medicinal plant use with age group	One Way ANOVA
H_{04}	There is no significant difference between religion and choice for traditional medication	*t*-Test

3.5 Medicinal Plants and Biodiversity Conservation Valuation of Jagoi Community Forest

To be able to provide sound assessment of forest goods and services, the types of benefits and costs of Jagoi community forest should be identified. The benefits or economic values can be divided into two categories: use and non-use values. The use values comprise direct, indirect and option values while the nonuse values consist of existence and bequest values. The economic values of the Jagoi communities study area can be presented as below (Table 3-3).

Table 3-3: Types of values and possible valuation techniques for Jagoi community forest

Items	**Category**		
	Use values		**Non-use values**
Values	**Direct**	**Indirect**	**Existence/Bequest**
	Medicinal plant	Watershed protection	Biodiversity
	Recreation uses	Nutrient cycling	Culture & heritage
	Wood product (timber)	Carbon store	
	Education/ Scientific expedition/ Research	Habitat for wildlife	
Valuation techniques	Market price and cost	Replacement cost	Contingent valuation
	Contingent valuation	Contingent valuation	Contingent valuation
	Replacement cost		
	Travel cost		

In view of the importance of forest goods and services to the policy makers and local community, the following forest goods and services were selected for valuation in the case study:

- Medicinal Plants
- Biodiversity conservation

3.5.1 Valuation of Medicinal Plants Used

The use of medicinal herbs collected from the forest resources by local communities is an example of non-marketed and marketed direct use. There are 3 approaches used in the valuation of medicinal plant used by the community. For readily available marketed products direct market value are use. For non-marketed products, valuation is based on replacement value or replacement cost and opportunity cost.

- Direct market valuation

During this study, market visits were made in all local market in Bau district during weekends. Interviews were conducted with people selling plants and herbal products. The price of the plants and herbal products were noted.

- Replacement Value

For valuation of plant used as medications which do not have readily market values, the replacement cost approach was used. In this approach, the cost for specific treatment of sickness is replaced by the value of a similar treatment received from a private clinic.

- Opportunity Cost

For the use of medicinal plant that does not have the readily available market value nor was the similar treatment from the modern medication, the valuation based on the opportunity cost approach. The opportunity cost was calculated to include the cost of collecting the plants material, the cost preparation to treat the illness and other costs in administering the treatment. How easy or difficult to get the plant and how many hours do they spend to get the plant are also being considered.

3.5.2 Contingent Valuation Method for Conservation Value of Jagoi Community Forest

Conservation Value of Bung Jagoi Forest can be measured using Contingent Valuation Method (CVM). The CVM is a method of estimating the non-market value of environmental attributes or amenities such as values of certain areas, endangered species, recreational opportunities, scenic resources and others. These values are generally measured based on the willingness to pay (WTP) for improved environment, the willingness to accept (WTA) compensation for damaged environment or to accept a condition of being deprived of the improved environment. The most appealing aspect of the CVM is that it allows estimation of total value rather than components of the total value itself (Bateman et al. 2002). Basically, the respondents are asked to complete a questionnaire which includes questions on WTP to conserve an area. The aim of CVM is to elicit valuations that are as close as possible to what would be revealed if a market actually existed.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter details the results of the study. The ensuing discussions include the documentation, collection and identification of the useful plants used by the Jagoi, Bidayuh. The socio-demographic characteristics of the respondents such as population structure and dynamics, treatment of illness (Health Services or Frequency of Visits to Health Centre), the use of plants for traditional medicine, utilization pattern of traditional medicinal plants and preference of household medication are also discussed. The respondent's awareness and understanding of forest management and conservation issues are presented. Their willingness to pay (wtp) for forest conservation and management is also discussed. Subsequently the household participation in and preference of medication methods are also discussed based on the correlation between frequency and cost of medication and households' income and age. The results of the One way ANOVA, t-Test and preferences for medicinal treatments are also discussed. The willingness to pay for the medicinal plant and the values for traditional medicine based on the households responses are presented. Subsequently, the estimated value of annual usage of plant resources by community is presented and discussed.

4.2 Documentation, Collection and Identification

There were 116 plant species belonging to 59 families being documented for the Jagoi community of Bau District. The local names are included based on the names commonly used

by the Bidayuh of Jagoi area. The method of preparations, part used and usage of each species are included (Table 4-1). Of these, 60 species were for medicinal purposes while 55 species were other useful plants. There are 96 species found to be indigenous while 19 are introduced, naturalised, or only known from cultivation. There are 8 species that had been recorded are protected species under the Sarawak Wild Life Protection Ordinance, 1998 (Chapter 26); *Shorea macrophylla* (de Vriese) P.S.Ashton, *Koompassia excelsa* Taub, *Ficus crassiramea* (Miq.) Miq, *Ficus grossulariodei* var *grossularioides, Ficus ruficaulis* Merr, *Aquilaria malaccensis* Benth, *Lycopodium cernuum* L and *Nepenthes ampullaria* Jack. The plant family with the most species used are Euphorbiaceae and Moraceae (8 species each), Fabaceae (7 species), Arecaceae, Asteraceae and Dipterocarpaceae (5 species each) and followed by Piperaceae, Poaceae and Zingiberaceae (4 species each). Some of these plants were sold in the local market.

Table 4-1: List of documented plants

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
1	Acanthaceae	*Andrographis paniculata* Nees.	Pudun tanak	Leaf	To relief fever and reduce hypertension pressure	Leaves boiled and taken orally
2	Acanthaceae	*Justicia gendarussa* Burm.f.	Pinyongoh	Leaf	1. To treat cuts 2. For food	1. Leaves pounded and apply onto the affected part 2. The fresh leaves can be eaten
3	Alangiaceae	*Alangium javanicum* var *ebenacum*	Moran	Fruit	For food	Ripen fruit is edible
4	Aloaceae	*Aloe vera* L.	Lidah buaya	Leaf	To relief itches and inflammation	The leaves cut to get the sap and apply onto the affected part.
5	Amaryllidaceae	*Proiphys amboinensis* L.	Sekidip	Whole plant	For ritual	Put the plants in the house of paddy worship to keep paddy spirit so that paddy will ever growing in future
6	Anacardiaceae	*Mangifera indica* Blume.	Asuom	Fruit	For food	The fruits are edible
7	Anacardiaceae	*Mangifera pajang* Kosterm.	Bowang (Bajang)	Fruit	For food	Edible fruit
8	Anacardiaceae	*Mangifera torquenda* Kosterm.	Motan	Fruit	For food	Edible fruit
9	Anisophylleaceae	*Anisophyllea disticha* Baill.	Pijurud	Leaf	For food	Ripen fruit is edible and the young leaves eat as *ulam*
10	Annonaceae	*Annona muricata* L.	Dian belanda	Flower	1. To relief hypertension 2. For food	1. Flowers boiled and taken orally 2. Edible fruit
11	Annonaceae	*Goniothalamus* sp.	Kenamai	Root	To relief stomach-ache	The leaves boiled to make a drink
12	Apiaceae	*Centella asiatica* (L.) Urban	Pegaga	Leaf	To reduce hypertension pressure and to rebuild energy reserve	The leaves taken as vegetable
13	Apocynaceae	*Alstonia* sp.	Gitie (Pelai)	Stem	For building material	For wood

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
14	Apocynaceae	*Hoya* sp.	Dowon kapal	Leaf	To relief hypertension	Leaves boiled and taken orally
15	Apocynaceae	*Dyera costulata* Hook.f	Grituong	Bark	For fuel	For fuel
16	Araceae	*Homalomena paludosa* Hook.f.	Tunguon	Rhizome	To treat gastric (dugal: Bidayuh)	Rhizomes sliced and dried. The slice soak in the water and taken orally
17	Araceae	*Homalomena propinqua* Schott.	Dowon ulik	Tuber	To treat the wound	A paste of the tuber is poultice and apply on the wound
18	Arecaceae	*Areca catechu*	Ba'ai	Fruit	To relief stomach-ache	Slices of the ripen fruit boiled to make a drink
19	Arecaceae	*Calamus* sp.1	Wii sogoh	Stem	For handicraft	The bark of the stem used to make mat
20	Arecaceae	*Calamus* sp.2	Wee rotan	Fruit	For food	Ripen fruit is edible
21	Arecaceae	*Caryota mitis* Lour.	Sidudui	Fruit	For food	Ripen fruit is edible
22	Arecaceae	*Cocos nucifera* L.	Kelapak butan	Fruit	1) Jaundice 2) Skin rashes	1) The water from the young coconut is used to bath the infants 2) The fruit flesh blended and cooked to extract the oil. The oil applied onto the rashes skin
23	Asteraceae	*Blumea balsamifera* DC.	Dowon susuoh	Leaf	To relief fever	The leaves boiled in water. The water is taken for bath
24	Asteraceae	*Elephantopus scaber* Linn.	Pudun bumi	Leaf	To reduce body temperature and hypertension pressure	Leaves boiled and taken orally
25	Asteraceae	*Gynura procumbens* Merr	Tibokus	Leaf	To treat the wound	The leaves chewed and applied onto the affected part.
26	Asteraceae	*Vernonia arborea* Buch. Hum	Mupuot	Whole plant	For ritual	The whole plant is believed to chase ghost

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
27	Begoniaceae	*Begonia* sp.	Sijobet	Leaf	For food	The young leaves cook as vegetable
28	Blechnaceae	*Blechnum orientale* L.	Sonu	Young shoot	To treat boils	The end of the shoots is removed to make a hole. The young shoots put onto the boil area and pressed to take out the boil or the young shoot punched and put onto boils area. Boils will dried and easy to be taken out
29	Bombacaceae	*Durio graveolens* Becc.	Dien Muot (Durian)	Fruit	For food	Ripen fruit is edible
30	Bombacaceae	*Durio zibethinus* L.	Dien (durian)	Fruit	For food	Ripen fruit is edible
31	Clusiaceae	*Cratoxylum glaucum* Korth.	*Tuma kiriep*	Young leaves	For supplement	Take the young leaves as supplement
32	Clusiaceae	*Garcinia mangostana L.*	Sikuk (manggis)	Fruit	For food	Edible fruit
33	Costaceae	*Costus speciosus*	Sijujut	Flower	For ornamental	For ornamental
34	Dilleniaceae	*Dillenia suffruticos*a Martelli	Buan	Young shoot	To treat the wound	The young leaves pounded or chewed and applied onto the affected part.
35	Dilleniaceae	*Tetracera akara* Merr.	Dowen ties	Leaf	For sand paper	Lower surface of the leaves is use as sand paper
36	Dipterocarpaceae	*Anisoptera* sp.	Mersawa kunyit	Stem	For building material	For wood
37	Dipterocarpaceae	*Anisoptera marginata* Korth.	Mersawa	Stem	For building material	For wood
38	Dipterocarpaceae	*Dipterocarpus sarawakensis* Slooten.	Keruing	Stem	For building material	For wood

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
39	Dipterocarpaceae	*Shorea macrophylla* (de Vriese) P.S.Ashton	Kabang	Stem	For building material	For wood
40	Dipterocarpaceae	*Shorea dasyphylla* Foxw.	Meranti	Stem	For building material	For wood
41	Euphorbiaceae	*Manihot esculata* Crantz.	Banuk	Rhizome	To relief stomach-ache and edible rhizome	The leaves heated and put onto the stomach-ache. The tuber cooked for food.
42	Euphorbiaceae	*Agrostistachys longifolia* Benth	Bajau	Stem	To relief tooth ache	Stem burned to produce yellow liquid. The liquid applied (turning black when it cold) on the teeth that perforated. It can numb toothache and treat the toothache
43	Euphorbiaceae	*Baccaurea bracteata* Mull. Arg.	Topui	Oil from the fruit	To treat scabies	Apply the oil that had been extract from the fruit on the affected area
44	Euphorbiaceae	*Baccaurea motleyana*	Gruming	Fruit	Food flavouring	Edible fruit
45	Euphorbiaceae	*Elateriospermum tapos* Blume.	Lopi (Perah)	Fruit	For food	Ripen fruit is cook as nut
46	Euphorbiaceae	*Endospermum peltatum* Merr.	Ngibulan	Stem	For fuel	For fuel
47	Euphorbiaceae	*Macaranga* sp	Badad	Bark	Gastric (dugal)	The inner bark pounded with *Tetracera acara, Cassia alata, Dillenia suffriticosa and Spatholobus ferrugineus* and boiled. The water taken orally.
48	Euphorbiaceae	*Macaranga gigantea*	Badad	Leaf	Wrap the rice	The leaves are used to wrap the rice
49	Fabaceae	*Abrus praecatorius* L.	Teh bokah babai	Leaf	For tea and sugar replacement	The leaves are used for tea and can mix with other tea for sugar replacement

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
50	Fabaceae	*Archidendron jiringa* (Jack) I.C.Nielsen	Joring	Fruit and Leaf	To relief hypertension	Leaves and fruits boiled and taken orally. Young leaves can be eaten as *ulam*
51	Fabaceae	*Cassia alata* L.	Dowon sulok	Leaf	Skin disease for the baby	The sap from pounded leaves is applied on the affected part
52	Fabaceae	Koompassia excelsa Taub.	Dooh	Stem	For building material	For wood
53	Fabaceae	*Parkia speciosa* Hassk.	Potah	Leaf	To relief hypertension	Leaves and fruits boiled and taken orally. Young leaves can be taken as ulam
54	Fabaceae	*Spatholobus ferrugineus* Benth.	Tibodu	Shoot	For gastric (dugal: Bidayuh)	Young shoot boiled with other plant namely *Nepenthes ampullaria*, *Macaranga* sp. and *Dawon saing* and taken orally.
55	Fabaceae	*Pitchelolbium jiringa*	Joring	Fruit	To treat hypertension	The fruit cook as vegetable or as *ulam*
56	Flacoutiaceae	*Flacourtia rukam* Zoll. & Moritzi	Poya	Fruit	For food	Ripen fruit are edible
57	Flacourtiaceae	*Pangium edule* Reinw	Poyang	Leaf	To treat the wound	The leaves are pounded and put onto the affected part.
58	Gleichnaceae	*Gleichenia linearis* C.B.Clarke	Dumam (Resam)	Bark	For handicraft	The inner part of the stem is used for rope.
59	Gnetaceae	*Gnetum gnemon* L.	Dodah	Leaf	For food	The young leaves are cook as vegetable
60	Ixonanthaceae	*Allantospermum borneense* Forman	Tongon raas	Bark	For fuel	For fuel
61	Lamiaceae	*Orthosiphon aristatus* (Blume) Miq.	Misai kucing	Leaf	To relief joint pain	Leaves boiled and taken orally

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
62	Lamiaceae	*Pogostemon auricularius* (L) Hassk.	Bunga dilam	Leaf	To relief hypertension	Leaves boiled and taken orally or the solution used as shampoo to smoothen the hair.
63	Lauraceae	*Lindera lucida* Boerl.	Pola	Leaf	For insect repellent	The leaves placed underneath the pillow to kill the insect.
64	Lauraceae	*Litsea garciae* S.Vidal	Bikala	Fruit	For food	Ripen fruit are edible
65	Loganiaceae	*Norrisia major* Soler.	Ridean	Stem	For fuel	For fuel
66	Lycopodiaceae	*Lycopodium cernuum* L.	Sorin ieng	Root	For ritual	The whole plants applied on the whole body while chanting: *ni,duoh, taruh, pat, limoh, nuom, ju, mun itih ku nusu, ku nubie, paguh monam pakung pasut nusu tubu suo gonan, suo poreng, mun sigien suo tubu suo poreng, neg tuben poon, pusah buu tudu tuan raja odop ingan. Jak mokat ponu*. The stroke person is believed immediately will get up.
67	Malvaceae	*Hibiscus rosa- sinensis*	Terping siyok	Leaf	Headache	The leaves pounded and rubbed on the head
68	Melastomaceae	*Melastoma malabathricum* L.	Rusak	Leaf	To stop bleeding and to treat wound	The leaves crushed and applied onto the affected area
69	Meliaceae	*Lansium domesticum* Jack.	Laset	Fruit	To treat cuts and sores	The seeds sliced into a small pieces and applied on the affected area
70	Menispermaceae	*Pycnarrhena borneensis* Diels	Dawon sisong	Leaf	For food	For food flavouring: mono-sodium
71	Moraceae	*Artocarpus integra* Merr.	Tibodak	Fruit	For food	The fruits are edible

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
72	Moraceae	*Artocarpus kemando* Miq.	Puduh (Pudau)	Fruit	For food	The fruits are edible
73	Moraceae	*Artocarpus odoratissimus* Blanco	Terap	Fruit	For food	The fruits are edible
74	Moraceae	*Artocarpus* sp	Kolon	Stem	For building material	For wood
75	Moraceae	*Ficus crassiramea* (Miq.) Miq.	Rokan	Leaf	For food	The young leaves are taken fresh for *ulam* and unripen fruit for *sambal*
76	Moraceae	*Ficus grossulariodei* var *grossularioides*	Rokan	Leaf	For food	The young leaves are taken fresh for *ulam* and unripen fruit for *sambal*
77	Moraceae	*Ficus ruficaulis* Merr	Siluri	Stem	To treat shingles	The latex of the cutting stem is applied on the affected area
78	Moraceae	*Ficus* sp	*Sipin*	Fruit	For food	Ripen fruit is edible and unripen fruit for *sambal*
79	Myristicaceae	*Knema* sp	Pang (Kumpang)	Fruit	For food	Ripen fruit is edible
80	Myrsinaceae	*Labisia humilis* Benth. & Hook.f.	Popar Doya	Whole plant	To relief fever	The whole plant boiled and the water used for bath.
81	Myrtaceae	*Psidium guajava* L.	Jambu biabas	Leaf	To remove excess wind from the body	The young leaves boiled and drink the water
82	Myrtaceae	*Syzygium longiflorum* Wall.	Bah (Ubah)	Stem	For building material	For wood
83	Nepenthaceae	*Nepenthes ampullaria* Jack	Dawon tiramuo	Pitcher	For food aroma	The pitcher is used to cook the rice for aroma smell and taste.
84	Ochnaceae	*Euthemis leucocarpa* Jack	Tijoran	Whole plant	To relief joint pain	The whole plant boiled and drink the water
85	Oleandraceae	*Nephrolepis biserrata* (Sw.) Schott	Poku kubuk	Shoot	To remove excess wind in the body	The young shoot boiled for soup
86	Oxalidaceae	*Averrhoa carambola* L.	Giruming	Leaf	To treat hypertension	The young leaves are crushed and added into warm water to make a drink

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
87	Pandanaceae	*Pandanus amaryllifolius* Roxb	Dowon pandan	Leaf	To remove toxic from the body	The leaves sliced and boiled in water. Drink the water.
88	Passifloraceae	*Passiflora foetida* L.	Dowon kelaseh	Leaf	To treat diarrhoea	The leaves boiled and drink the water. Ripen fruit can be consumed
89	Piperaceae	*Piper caninum* Blume	Dowon boid	Leaf	For postnatal treatment after delivery	The leaves boiled in a big pot then sit on it when it warm
90	Piperaceae	*Piper nigrum* Wall.	Lada songgot	Fruit	To remove excess wind for adult people	6 pieces of seeds boiled to make a drink
91	Piperaceae	*Piper* sp	Boid gajah	Leaf	To reduce hypertension pressure	The leaves boiled to make a drink
92	Piperaceae	*Piper porphyrophyllum* N.E.Br.	Tibug (Papar deya)	Leaf	To treat blood coat	Heat the lower part of this leaf and put onto the affected part.
93	Plantaginaceae	*Plantago major* L.	Suut kosoung	Leaf	To treat diarrhoea, stomach ulcers, and bladder infections	The dried leaves boiled in water. Drink that water
94	Poaceae	*Bambusa* sp	Puti	1) Young shoots 2) Stem	1) Food 2) Building material	1) Young shoots cook as vegetables 2) The stem use as building material
95	Poaceae	*Cymbopogon citratus* Stapf	Sorai	Stem	Reduce body temperature	The stem boiled in water. The water is taken for bath.
96	Poaceae	*Imperata cylindrica* (L.) P. Beauv.	Lalang	Root	To stop external bleeding	The young root are pounded and rubbed onto the affected area
97	Poaceae	*Paspalum conjugatum* P.J.Bergius	Tupai bisina	leaf	To stop external bleeding	The young leaves pounded and applied onto the wound area
98	Rubiaceae	*Morinda citrifolia* L.	Bikudu	Fruit	To reduce hypertension pressure and alleviate cough	The unripe fruit boiled in water and drink the water or the ripe fruit is for jus.

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
99	Rubiaceae	*Psychotoria elmeri* Merr.	Pijar	Leaf	Skin injured	The leaves pounded and applied onto the affected part. (4 times a day for 5 days)
100	Rubiaceae	*Uncaria gambier* Roxb.	Gomier	Leaf	1)To numb the injury part 2) For massage	1) The leaves boiled to extract the white latex. Dried the latex until it become hard. The harden latex is use to numb the injury part. 2) The leaves boiled to extract the latex. The leaves mixed with *Piper betle* and massage on the affected part
101	Sapindaceae	*Nephelium cuspidatum* Blume.	Sibu	Fruit	For food	Ripen fruit is edible
102	Sapotaceae	*Palaquium* sp	Jotuh Dien	Stem	For fuel	For fuel
103	Scrophulariaceae	*Scoparia dulcis* L	Duh kerambu	Root	To treat sore throat	The whole plant boiled in water and drink the water.
104	Selaginellaceae	*Selaginella* sp.	Sangrigu	Leaf	To reduce the itchiness of ants bites	The leaves chewed and apply onto the ants bites.
105	Solanaceae	*Nicotiana tabacum* L.	Tibakus	Leaf	For cigarette	The leaves is use for cigarette
106	Sterculiaceae	*Scaphium macropodum* Beumee ex K.Heyne	Dowon komang	Seed	To treat diarrhoea	The seeds of the plants are soaked in water for a night. Drink the water
107	Taccaceae	*Tacca borneensis* Ridl.	Tibuog	Leaf	For food	The young leaves can be eaten as *ulam*
108	Theaceae	*Adenandra dumosa*	Simupak	Bark	For fuel	For fuel
109	Theaceae	*Ploiarium alternifolium* Melch.	Sirumah	Stem	For building material	For wood
110	Thymeliaceae	*Aquilaria macrophylla* Miq.	Tabak	Stem	For wood	The stems are used to produce boat
111	Thymeliaceae	*Aquilaria malaccensis* Benth.	Tabak	Stem	For wood	The stems are used to produce boat

Table 4-1 (Continued)

No	Family	Species	Local Name	Part of used	Usage	Method of Preparation
112	Urticaceae	*Leucosyke capitellata* Wedd.	Kerangan	leaf	To lower the high body temperature	The dried leaves are for tea
113	Vitaceae	*Vitex pubescens* Vahl.	Ngiriwat	Leaf	To treat gastric (*dugal*: Bidayuh)	The young shoots are taken fresh
114	Zingiberaceae	*Alpinia galanga* (L.) Willd.	Rikug	Rhizome	To relief fever	The rhizome pounded and used for massage
115	Zingiberaceae	*Curcuma domestica* Val.	Umi'et	Leaf and rhizome	1. To treat diarrhoea 2. To treat wound 3. Food flavouring	1. The rhizome pounded to extract the juice. Drink the juice. 2. The rhizome pounded and rubs onto the affected area. 3. The leaves are used in cooking for flavouring
116	Zingiberaceae	*Zingiber cassumunar* Roxb.	Ngolai	Rhizome	Used for massage mother after childbirth to remove excess wind	The rhizome pounded to extract sap. The sap is use for massage.
117	Zingiberaceae	*Zingiber officinale* Roscoe	Ro'ie	Rhizome	To remove wind from the body	The rhizome pounded and boiled in water for 2-3 hours. Drink the water.

Source: Fieldwork, 2012

4.2.1 Plant Uses

From the study, a total of 60 species were found to be used for medicine, 30 species each for wild vegetables and other food uses and wild fruits and 17 species for timber and other wood products. There were 3 species for religious purposes, 2 species for handicraft and 1 species each for others uses such as insect repellent, ornamental, cigarette, wrapping and sand paper. Some of the species may have more than 2 uses. An example of *Alpinia galanga* Willd. It is used to treat fever, skin diseases and for postnatal treatment after delivery (Figure 4-1).

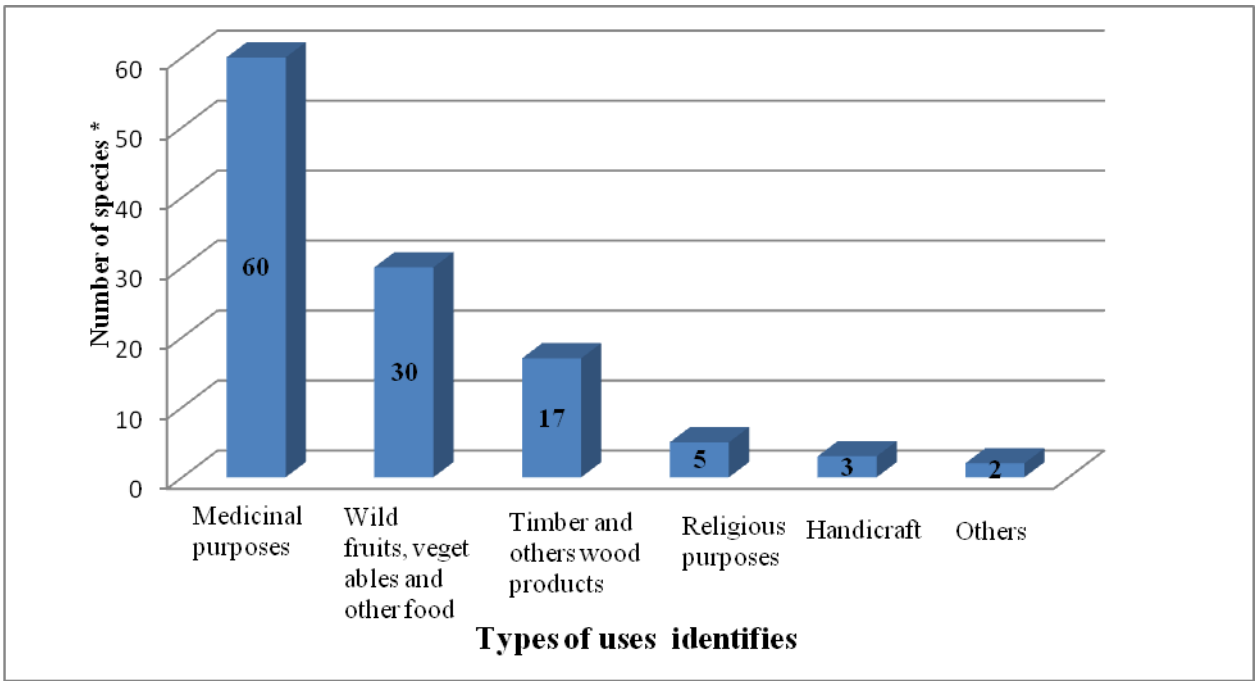

Figure 4-1: Number of species and types of uses identified from the Jagoi community, Bau District
*Some of the species are applicable in more than one types of use

4.2.2. The Most Common Plant Species Used by the Community

Out of 117 species of medicinal plants documented, 6 species are most commonly used by the respondents in this area (Figure 4-2). The most common plant species used by the community in

Jagoi area are *Likug* (*Alpinia galanga* Willd.), *Pudun tana* (*Andrographis paniculata* Nees) and G*omier* (*Uncaria gambier* Roxb.) A total of 68 respondents use *Likug* (*Alpinia galanga* Willd). to treat their fever, skin diseases and to remove excess air from the body of women during the postnatal period. *Pudun tana* (*Andrographis paniculata* Nees.) is used to treat hypertension, diabetes, fever and stomachache. A total of 67 respondents use *Uncaria gambier* Roxb. for cuts and sores, relief for back pain and joint pain, headache and stomachache. The second common plants used are *Tomu* (*Curcuma domestica* Val.), *Potah* (*Parkia speciosa* Hassk.) and *Duh kelamu* (*Scoparia dulcis* L.) Out of 81 respondents, 39 of them use *Curcuma domestica* Val. to treat wound, diarrhoea and kill parasites (worm) in stomach and use *Parkia speciosa* Hassk. to reduce the hypertension, diabetes, ring worm and liver disorders. A total of 38 respondents used *Scoparia dulcis* L. to treat sore throat (Table 4-2).

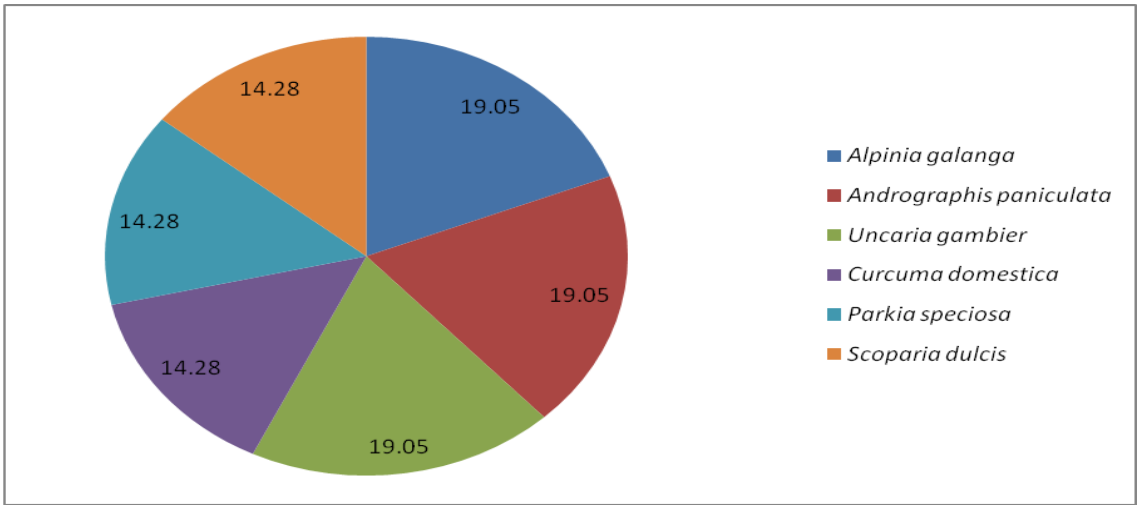

Figure 4-2: The most common species represented in percentage used by the Jagoi community

Table 4-2: Medicinal plant species commonly used by the community, by number of household and percentage

Species	**No of household**	**Percentage**
Alpinia galanga Willd.	68	83.9
Andrographis paniculata Nees.	68	83.9
Uncaria gambier Roxb.	67	82.7
Curcuma domestica Val.	39	81.5
Parkia speciosa Hassk.	39	48.1
Scoparia dulcis L.	38	46.9

It needs to be noted here that some of the species recorded in this study are also recorded and used in other ethnic communities in Sarawak. Although most of the species are used for the same purposes (similar treatments), a few species, however, are used for different purposes and for treating different ailments. Some of the past studies are summarized below:

- *Andrographis paniculata:*Use to treat cancer, diabetes, high blood pressure, ulcer, leprosy, bronchitis, skin diseases, flatulence, colic, influenza, dysentery, dyspepsia and malaria (Okhuarobo, 2014)
- *Alpinia galanga*: Use for carminative, antipyretic and anti-inflammatory qualities and used in the treatment of various diseases such as bronchitis, heart diseases, chronic enteritis, renal calculus, diabetes, rheumatism and kidney disorders (Bao, 2011)
- *Annona muricata*: The fruit and fruit juice are taken for worms and parasites, to cool fevers, to increase mother's milk after childbirth, and as an astringent for diarrhoea and dysentery. The crushed seeds are used against internal and external parasites, head lice, and worms. The bark leaves, and roots are considered sedative, antispasmodic, hypotensive, and nervine, and a tea is made for various disorders toward those effects (Taylor, 2012)
- *Blumea balsamifera*: Use to treat eczema, dermatitis, beriberi, lumbago, menorrhagia, rheumatism, skin injury and used as insecticide (Pang, 2014).
- *Centella asiatica*: It has ability to rebuild energy reserves (mental and physical power) (Trivedi, 2006)

Many species that were recorded are medicinal plants among the Jagoi Bidayuh had undergone laboratory chemical evaluations and were found to demonstrate potentials for development of pharmaceutical products.

These past studies are as listed below:

- *Alpinia galanga:* Contain essential oils such as cineole, methyl cinnamate, myrecene, and methyl eugneol and also said contain various flavones such as galangin, alpinin, kampferide and 3-dioxy-4-methoxy flavones [3, 4] which are known for antimicrobial, antioxidant, antifungal, anti-cancer, and gastroprotective activities (Jaju, 2009)
- *Annona muricata:* Contains acetogenins which are demonstrating the strongest anticancerous, antitumorous, antiparasitic, insecticidal, and antimicrobial activities and antiviral properties (Taylor, 2012)
- *Andrographis paniculata:* Contain diterpenoid that cause bitter taste and used as a bitter tonic, febrifuge, dysentery, cholera, diabetes, piles, gonorrhoea, blood purifier and a cure for liver dysfunction (Daniel, 2006)
- *Blumea balsamifera:* Contain volatile oils and flavonoids which known for antitumor, hepatoprotective, superoxide radical scavenging, antioxidant, enhancing percutaneous penetration, anti-obesity activities and insecticidal (Pang, 2014).
- *Centella asiatica*: Contains saponins (also called triterpenoids), which include asiaticosides, in which a trisaccharide moiety is linked to the aglycone asiatic acid, madecassoside and madasiatic acid. These triterpene saponins and their sapogenins are mainly responsible for the wound healing and vascular effects by inhibiting the production of collagen at the wound site. Crude extract containing glycosides isothankuniside and thankuniside showed antifertility action in mice. Centelloside and its derivatives are found to be effective in the treatment of venous hypertension. (Kashmira, 2010)

4.3 Socio-demographic Characteristics of the Respondents

4.3.1 Population Structure and Dynamics

Generally, the demographic information was about gender, age, marital status, household size, occupation, religion, and education level. A total of 81 respondents answered the questionnaires. The details of the socio-demographic characteristics of the respondents are presented in Table 4-.3. The data is presented using means and percentages.

Table 4-3: Distribution of respondents by socio-demographic characteristics (n=81)

Socio-demographic variables	**Characteristics**	**Number of Respondents**	**Percentage (%)**
Gender	Male	30	37.04
	Female	51	62.96
Age (years) (Mean=49.53, Mode=15a)	30 and below	17	20.99
	31-40	8	9.88
	41-50	15	18.52
	51-60	16	19.75
	61-70	18	22.22
	71-80	5	6.17
	80 and above	2	2.47
Race	Bidayuh	81	100.00
Religion	Christian	68	84.00
	Traditional Religion	13	16.00
Occupation	Farmer	26	32.10
	Civil Servant	8	9.90
	Private sector	11	13.60
	Entrepreneurs	6	7.40
	Housewives	19	23.50
	Others	11	13.60
Monthly Income (RM)	RM100-RM500	47	58.03
	RM501-RM1000	18	22.22
	RM1001-RM1500	6	7.41
	RM1501-RM2000	7	8.64
	RM2001-RM2500	2	2.47
	RM2501-RM3000	1	1.23

Gender and Age

The majority of the respondents were female. The table show that 51 (62.96%) of them are females and 30 (37.04%) are males. This gender breakdown is recorded because the majority of the male are away for work during the questionnaire interview. The majority of the respondents were between 61 to 70 years old (22.22%).

Race and Religion

All (81 persons) of the respondents are Bidayuh where 68 or 84% are Christians and 13 or 16% are still practicing the traditional Bidayuh belief or commonly known as 'Pagan' or "animistic".

Occupation

The majority of the respondents are farmers where 32.1% of them are staying in the villages and do various types of farming. Meanwhile 23% are housewives, 13.6% are working with the private sector, 9.9% are working with the public sector, 7.4% are entrepreneurs and 13.6% are students in higher institutes of learning.

Personal Income

A total of 47 persons or 58.03% of the respondents are from the lowest income level with earning between RM100-RM500 a month. Eighteen persons or 22.22% of the respondents earned between RM501-RM1000 a month. The others, 6 respondents (7.41%) and 6 respondents

(8.64%) are in RM1001- RM1500 and RM1501-RM2000 income bracket respectively. Two of the respondents earned between RM2001-RM2500 a month and only 1 respondent earned M3000 a month which is the highest income level.

4.3.2 Socioeconomic Status of Households

Household size

The average household size is about four persons (Table 4-4). The most common household size in Jagoi was 3-4 persons which about 33.3% of all households. The second highest household size was 7-8 persons, which about 25.9% of all households. About 23.5% of households have 5-6 persons and 14.8% of households have 1-2 persons. There are only 2 households (2.5%) that have 9-10.

Table 4-4: Distribution of households by number of family members (size)

Household Size	No. of household	Percentage (%)
1-2	12	14.8
3-4	27	33.3
5-6	19	23.5
7-8	21	25.9
9-10	2	2.5

n=81, Mean= 4.88 persons per household

Monthly Household Income

The distribution of household income is shown in Table 4-5. The average household cash income is RM1918.52 per month. The majority group of household income was between

RM1001-RM1500 per month. The second highest household income was between RM 500-RM1000 and RM1501-RM2000 per month. There are ten households (12.3%) and five households (6.2%) earning between RM2501-RM3000 and RM2001-RM2500 per month respectively. There are two households (2.5%) each earning between RM3001-RM3500 and RM3501-RM4000 per month. Only one household (1.2%) each earning between RM4001-RM4500, RM4501-RM5000 and RM5501-RM6000 per month. The recorded figures are based on the estimation of monthly household cash income. This cash income is including the value of the plants that they harvest from the jungle and sell in the local market.

Table 4-5: Distribution of respondents by household monthly income

Income Level	**No. of household**	**Percentage (%)**
RM500-RM1000	17	21.0
RM1001-RM1500	25	30.9
RM1501-RM2000	17	21.0
RM2001-RM3000	15	18.5
RM3001 and above	7	8.6

Education

Majority of the respondents have their formal education. There are only 13 (16%) of them do not have their formal education (Table 4-6). Out of 81 respondents, 32 (39.5%) of them have attended school up to secondary school education. There are 30 (37%) of them have attended school up to primary level, 4 (4.9%) of them have their Diploma and only 2 (2.5%) of them has college degree education.

Table 4-6: Distribution of households by level of education

Level of Education	No. of respondents	Percentage (%)
Never go to School	13	16
Primary School	30	37
Secondary School	32	39.5
Diploma	4	4.9
Degree	2	2.5

4.4 Respondent's Treatment of Illness

This section discusses how a typical household responds to an illness or a medical problem. It also identifies the frequency of respondent's visits to health center in a year.

4.4.1 Health Services

When the respondents were asked on what they do if they fall sick, the majority of them (79 persons or 97.5 %) answered that they prefer to go to the clinic and also prepare home medicine from plants. This is because the Jagoi area is more developed where they have a government clinic facility and is easily reached by road. Only 1 (1.2%) of them admits seeking treatment from a medicine man to treat their ailment and go to clinic. There is only 1 (1.2%) of them prefer to attend medicine man alone (Table 4-7).

Table 4-7: Distribution of respondents treatment types (n=81)

Treatment Types	Number	Percentage (%)
Clinic and Home Prepared Medicine	79	67.9
Clinic and Attend to Medicine man	1	1.2
Attend to Medicine man only	1	1.2

4.4.2 Frequency of Visits to Health Centre

The majority of the respondents visits health centres on occasionally basis, which about 48 (59.3%) of them followed by 25 (30.9%) of them who visit frequently and 7 (8.6%) of them who always visit the health centre. The study shows that only 1 (1.2%) of them never visit the centre as he depends absolutely on the practice and belief of the medicine man (Table 4-8).

Table 4-8: Frequency of respondents visit to health centre (n=81)

Frequency	Number	Percentage (%)
Always	7	8.6
Frequently	25	30.9
Occasionally	48	59.3
Never	1	1.2

4.5 Household Utilizations of Plants for Traditional Medicine

This section identified the number of respondents with use the traditional medicine, cost of the traditional medicine, the ease to obtain the medicinal plant, their informant for the traditional plant and the sources of the plants.

4.5.1 Types of treatment for illness

Majority of the respondents use traditional medication and modern medication to treat their illness (Table 4-9). There are about 80 (98.9%) of them that use both of the traditional and modern medication while only 1 (0.1%) of them preferred to use traditional medication alone.

Table 4-9: Distribution of respondents response to the usage of traditional and modern medication (n=81)

Household Response	Number	Percentage
Usage of Both Medication (Traditional and Modern)	80	98.9
Usage of Traditional Medication alone	1	0.1

4.5.2 Use of Traditional Medicine

The analysis on the use of Traditional Medicine focuses on 81 respondents that use the medicinal plants to treat their illness (Table 4-10).

Table 4-10: Distribution of respondents response to the payment, easiness to obtain, informants of traditional medicine and sources of medicinal plants (n=81)

Household Response	Characteristic	No. of Respondent	Percentage (%)
Pay for Traditional Medicine	Yes	20	24.7
	No	61	75.3
Easy to Obtain Medicinal Plant	Yes	45	55.5
	No	36	44.5
Ways to Obtain Medicinal Plant	Available at home	31	38.3
	Collect	30	37.0
	Purchase	3	3.7
	Parents	9	11.1
	Friends	8	9.9
Informants for Traditional Medicine	Grandparents	53	65.5
	Parents	16	19.7
	Friends and Neighbors	4	4.9
	Practitioners	2	2.4
	Public	6	7.5

Out of 81 respondents, majority of them, 61 (75.3%), did not pay for the medicinal plant. This means that they are collecting the plants from the jungle or from their gardens or plants that are planted in their area. There are only 20 (24.7%) of them who pay for medicinal plant which they buy from the local market or from their relatives and friends. A majority of 45 (55.5%) respondents said that the plants were easy to obtain while 36 (44.5%) of them said that the plant were not easy to obtain, as the plant species are rare. A total of 31 (38.3%) respondents said that they planted the medicinal plants at home area and 30 (37.0%) respondents said that they collect

the medicinal plant while 9 (11.1%) and 8 (9.9%) respondents get the plants from their parents and friends respectively. Only 3 (3.7%) of the respondent purchase the medicinal plants. Majority of the respondents, 53 (65.5%) know the traditional knowledge of the medicinal plants from their grandparent. However, 16 (19.7%) respondents know form their parent, 6 (7.5%) respondents knows from public, 4 (4.9%) respondents know from their friends and neighbors and only 2 (2.4%) respondents know from practitioners.

4.6 Utilization Pattern of Traditional Medicinal Plants

4.6.1 Utilization of Traditional Medicinal Plants Identified by Community

The plant species identified and recorded in this study are claimed to be used to treat various diseases and ailments. There 31 human diseases or ailments applicable. These plant species included herbs, shrubs, climbers and trees. Herbs are the most common medicinal plants. Bidayuh Jagoi community use single plant or mix different plants as a medicine to treat single disease. It is also found that a single plant is used in different diseases. Most of the plants are used for the treatment of fever, stomach-ache, headache, hypertension, remove excess wind from the body, wounds and skin diseases. (Table 4-11)

Table 4-11: Utilization of medicinal plants identified by the community

a) List of plants to treat fever/ reduce body temperature

Famili	Species	Local Name	Parts of used	Usage	Preparation
Acanthaceae	*Andrographis paniculata* Nees.	Pudun tanak	Leaf	To relief fever/ Reduce body temperature	Leaves boiled and taken orally.
Asteraceae	*Blumea balsamifera* DC.	Dowon susuoh	Leaf	To relief fever/ Reduce body temperature	The leaves boiled in water. The water is taken for bath.
Asteraceae	*Elephantopus scaber* Linn.	Pudun bumi	Leaf	To reduce body temperature	Leaves boiled and taken orally
Myrsinaceae	*Labisia humilis* Benth. & Hook.f.	Popar doya	Whole plant	To relief fever/ Reduce body temperature	The whole plant boiled in water. The water used for bath.
Zingiberaceae	*Alpinia galanga* (L.) Willd.	Rikug	Rhizome	To relief fever/ Reduce body temperature	The rhizome pounded and use for massage.
Poaceae	*Cymbopogon citratus* Stapf	Sorai	Stem	To relief fever/ Reduce body temperature	The stem boiled in water. The water is taken for bath.
Piperaceae	*Piper caninum* Blume	Dowon boid	Leaf	To relief fever/ reduce body temperature	The leaves boiled in water in a big pot then sit on it when it warm.

b) List of plants to treat stomach-ache, gastric, diarrhoea and bladder infection

Famili	Species	Local Name	Parts of used	Usage	Preparation
Acanthaceae	*Andrographis paniculata* Nees.	Pudun tanak	Leaf	To relief stomach-ache	The leaves boiled to make a drink.
Araceae	*Homalomena paludosa* Hook.f.	Tunguon	Rhizome	To treat gastrict (*dugal*: Bidayuh)	The rhizome sliced (strong aromatic smell) and dried. The dried rhizome boiled to make a drink
Arecaceae	*Areca catechu* L.	Ba'ai	Fruit	To relief stomach-ache	The ripe fruit boiled to make a drink.

Table 4-11 (continued)

Famili	Species	Local Name	Parts of used	Usage	Preparation
Euphorbiaceae	*Manihot esculata* Crantz.	Banuk	Rhizome	To relief stomach-ache	The leaves are cooked as vegetable and the tuber are cooked for food.
Fabaceae	*Spatholobus ferrugineus* Benth.	Tibodu	Shoot	Gastric (dugal: Bidayuh)	Young shoot boiled with *Nepenthes ampullaria*, *Macaranga* sp. and *Dawon Saing.* Drink the water.
Nepenthaceae	*Nepenthes ampullaria* Jack.	Dawon tiramuo	Shoot	Gastric (dugal: Bidayuh)	Young shoot boiled with *Spatholobus ferrugineus, Macaranga* sp. *Dawon Saing.* Drink the water.
Vitaceae	*Vitex pubescens* Vahl.	Ngiriwat	Leaf	Gastric (dugal: Bidayuh)	The young shoot boiled in water boiled to make a drink.
Passifloraceae	*Passiflora foetida* L.	Dowon kelaseh	Leaf	To treat diarrhoea	The leaves boiled to make a drink. Ripen fruit is edible.
Plantaginaceae	*Plantago major* L.	Suut kosoung	Leaf	To treat diarrhoea, stomach ulcers, and bladder infections	The leaves dried and boiled to make a drink.
Sterculiaceae	*Scaphium macropodum* Beumee ex K.Heyne	Dowon komang (Kembang semangkuk)	seed	To treat diarrhoea	The seeds of the plants are soaked in water for a night. The water then is used for drink.
Zingiberaceae	*Curcuma domestica* Val.	Umi'et	Leaf and rhizome	1) To treat diarrhoea 2) To treat wound 3) For food	1) The rhizome pounded to extract the juice. Drink the juice. 2) The rhizome pounded and applied onto the affected area. 3) The leaves are used in cooking
Rubiaceae	*Uncaria gambier* Roxb.	Gomier	Leaf	To treat stomachache	The dried leaves mixed with *Piper betle* and massage on the affected part

c) List of Plants to treat hypertension, reduce hypertension pressure, stroke, headache and cough

Famili	**Species**	**Local Name**	**Parts of used**	**Usage**	**Preparation**
Acanthaceae	*Andrographis paniculata* Nees.	Pudun tanak	Leaf	To relief hypertension	The leaves boiled to make a drink.
Annonaceae	*Annona muricata* L.	Dian belanda	Flower	To relief hypertension	The flowers boiled to make a drink.
Apiaceae	*Centella asiatica* (L.) Urban	Pegaga	Leaf	To reduce hypertension pressure	The leaves taken as vegetable.
Apocynaceae	*Hoya* sp.	Dowon kapal	Leaf	To relief hypertension	The leaves boiled to make a drink.
Asteraceae	*Elephantopus scaber* Linn.	Pudun bumi	Leaf	To reduce hypertension pressure	Leaves boiled and taken orally
Fabaceae	*Archidendron jiringa* (Jack) I.C.Nielsen	Joring	Fruit and leaf	To relief hypertension	The leaves boiled to make a drink. The fruit and young shoot taken fresh *(ulam)*
Fabaceae	*Parkia speciosa* Hassk.	Potah	Leaf	To reduce hypertension pressure	The leaves and fruit taken fresh *(ulam)*
Lamiaceae	*Pogostemon auricularius* (L) Hassk.	Bunga dilam	Leaf	To relief hypertension	The leaves boiled to make a drink or the solution used as shampoo.
Lycopodiaceae	*Lycopodium cernuum* L.	Sorin ieng	Root	Believe: To treat stroke	The whole plant mixed with any other plant and applied on the whole body while chanting: *ni,duoh, taruh, pat, limoh, nuom, ju, mun itih ku nusu, ku nubie, paguh monam pakung pasut nusu tubu suo gonan, suo poreng, mun sigien suo tubu suo poreng, neg tuben poon, pusah buu tudu tuan raja odop ingan. Jak mokat ponu.*
Oxalidaceae	*Averrhoa carambola* L.	Giruming	Leaf	To treat hypertension	The young leaves are crushed and added into warm water to make a drink
Piperaceae	*Piper* sp.	Boid gajah	Leaf	To reduce hypertension pressure	The leaves boiled to make a drink

Table 4-11 (continued)

Famili	Species	Local Name	Parts of used	Usage	Preparation
Rubiaceae	*Morinda citrifolia* L.	Bikudu	Fruit	To reduce hypertension pressure and alleviate cough	Unripe fruit boiled in water and drink the water. The juice is extract from the ripe fruit.
Lamiaceae	*Pogostemon auricularius* (L) Hassk.	Bunga dilam	Leaf	To treat headache	The leaves boiled in water. Drink the water. Or the solution used as shampoo.
Malvaceae	*Hibiscus rosa- sinensis* L.	Terping siyok	Leaf	To treat headache	The leaves pounded and rubbed on the head.
Plantaginaceae	*Plantago major* L.	Suut kosoung	Leaf	To treat headaches	The dried leaves boiled to make a drink.

d) List of Plants to treat diabetes

Famili	Species	Local Name	Parts of used	Usage	Preparation
Acanthaceae	*Andrographis paniculata* Nees.	Pudun tanak	Leaf	To treat diabetes	The leaves boiled to make a drink
Apocynaceae	*Hoya* sp	Dowon kapal	Leaf	To treat diabetes	The leaves boiled to make a drink
Fabaceae	*Archidendron jiringa* (Jack) I.C.Nielsen	Joring	Fruit and leaf	To treat diabetes	The leaves and the fruits boiled to make a drink or the fruit can be taken fresh
Fabaceae	*Parkia speciosa* Hassk.	Potah	Leaf	To treat diabetes	The leaves and the fruits boiled to make a drink or the fruit can be taken fresh

e) List of Plants to treat wounds, cuts and sores and external bleeding

Famili	**Species**	**Local Name**	**Parts of used**	**Usage**	**Preparation**
Acanthaceae	*Justicia gendarussa* Burm.f	Pinyongoh	Leaf	To treat cuts	The leaves pounded and applied onto the affected part.
Araceae	*Homalomena propinqua* Schott.	Dowon ulik	Tuber	To treat the wound	A paste of the tuber is poultice and applied on the wound.
Asteraceae	*Gynura procumbens* Merr	Tibokus	Leaf	To treat the wound	The leaves chewed/ pounded and applied in onto the affected part.
Dilleniaceae	*Dillenia suffruticosa* Martelli	Buan	Young shoot	To treat the wound	The young leaves chewed/ pounded and applied onto the affected part.
Flacourtiaceae	*Pangium edule* Reinw	Poyang	Leaf	To treat the wound	The leaves pounded and applied onto the affected part.
Lycopodiaceae	*Lycopodium cernuum* L.	Sorin ieng	Root	Cuts and sores	Chew the whole plant and put onto the affected part.
Melastomaceae	*Melastoma malabathricum* L.	Rusak	Leaf	To stop bleeding and to treat wound	The leaves are crushed and applied onto the affected area.
Meliaceae	*Lansium domesticum* Jack.	Laset	Fruit	Cuts and sores	The seed sliced into small pieces and applied onto the affected part.
Poaceae	*Imperata cylindrica* (L.) P. Beauv.	Lalang	Root	To stop external bleeding	The young root are pounded and rubbed onto the affected area.
Poaceae	*Paspalum conjugatum* P.J.Bergius	Tupai bisina	leaf	To stop external bleeding	The young leaves pounded and applied onto the affected part.
Rubiaceae	*Psychotoria elmeri* Merr.	Pijar	Leaf	To treat skin injured	The leaves pounded and applied onto the affected part. (4times a day for 5 day).
Zingiberaceae	*Curcuma domestica* Val.	Umi'et	Leaf and rhizome	To treat wound	The rhizome pounded and applied onto the affected area.
Rubiaceae	*Uncaria gambier* Roxb.	Gomier	Leaf	To numb the cuts and sores	The leaves boiled to extract the white latex. The white latex is dried to make it hard. The harden latex mixed with water and applied on the affected part.

f) List of plants to treat backaches, bone fractures, sprains and join pain

Famili	**Species**	**Local Name**	**Parts of used**	**Usage**	**Preparation**
Acanthaceae	*Justicia gendarussa* Burm.f	Pinyongoh	Leaf	To treat backaches, bone fractures and sprains	The leaves pounded and applied onto the affected part.
Lamiaceae	*Orthosiphon aristatus* (Blume) Miq.	Misai kucing	Leaf	To relief joint pain	The leaves boiled to make a drink.
Ochnaceae	*Euthemis leucocarpa* Jack	Tijoran	Whole plant	To relief joint pain	The whole plants boiled and drink the water.
Rubiaceae	*Uncaria gambier* Roxb.	Gomier	Leaf	To treat back pain and join pain	Boil the leaves to remove the latex. Dried that leaves and mix with *Piper betle* and massage on the affected part.

g) List of plants to treat itches and inflammation

Famili	**Species**	**Local Name**	**Parts of used**	**Usage**	**Preparation**
Aloaceae	*Aloe vera* L.	Lidah buaya	Leaf	To relief itches and inflammation	The sap of the leaves applied onto the affected part.

h) List of plant to treat jaundice

Famili	**Species**	**Local Name**	**Parts of used**	**Usage**	**Preparation**
Arecaceae	*Cocos nucifera* L.	Kelapak butan	Fruit	To treat jaundice	The water from the young coconut is used to bath the infants.

i) List of plants to treat skin diseases, ringworms, boils, scabies, skin rashes and shingles

Famili	**Species**	**Local Name**	**Parts of used**	**Usage**	**Preparation**
Arecaceae	*Cocos nucifera* L.	Kelapak butan	Fruit	To treat skin rashes	The fruit flesh blended and cooked to extract the oil. The oil applied onto the rashes skin
Blechnaceae	*Blechnum orientale* L.	Sonu	Young shoot	To treat boil	The end of the shoots is removed to make a hole. The young shoots put onto the boil area and pressed to take out the boil or the young shoot punched and put onto boils area. Boils will dried and easy to be taken out
Dilleniaceae	*Dillenia suffruticosa* Martelli	Buan	Young shoot	To treat skin disease	The young leaves pounded/ chewed and applied onto the affected part.
Euphorbiaceae	*Baccaurea bracteata* Mull. Arg.	Topui	Oil from the fruit	To treat scabies	Apply the oil that had been extract from the fruit on the affected area
Fabaceae	*Cassia alata* L.	Dowon sulok	Leaf	To treat skin disease for the baby	The young leaves pounded to extract the sap. The sap applied onto the affected part of the baby.
Fabaceae	*Parkia speciosa* Hassk.	Potah	Leaf	To treat ringworms	The leaves are taken fresh.
Moraceae	*Ficus ruficaulis* Merr	Siluri	Stem	To treat shingles	The latex from cutting stem applied on the affected area.
Zingiberaceae	*Alpinia galanga* (L.) Willd.	Rikug	Rhizome	To treat skin diseases	The rhizome pounded and applied onto the affected part.

j) List of plants to remove excess wind from the body

Famili	Species	Local Name	Parts of used	Usage	Preparation
Asteraceae	*Ageratum conyzoides* L.	Sipotum	Leaf & stem	To remove excess wind from the body	The leaves and the stem boiled in water with *Piper beetle.* The water is taken for bath
Myrtaceae	*Psidium guajava* L.	Jambu biabas	Leaf	To remove excess wind from the body	The young leaves boiled in water and drink the water
Zingiberaceae	*Alpinia galanga* (L.) Willd.	Rikug	Rhizome	To remove excess wind from the body of delivery women	The rhizome pounded and use it for massage
Theaceae	*Ploiarium alternifolium* Melch.	Silumah	Leaf	Remove excess wind for baby	The leaves boiled in water and the solution used for baby bathing
Vitaceae	*Vitex pubescens* Vahl.	Nyiriwat	Leaf	To treat gastric (dugal: Bidayuh)	The young shoot taken fresh
Zingiberaceae	*Zingiber officinale* Roscoe	Ro'ie	Rhizome	To remove wind from the body	The rhizome and stem boiled for 2-3 hours. Drink the water.
Piperaceae	*Piper nigrum* Wall.	Lada songgot	Fruit	To remove excess wind for adult people	6 pieces of seeds boiled in water and drink the water
Oleandraceae	*Nephrolepis biserrata* (Sw.) Schott	Poku kubuk	Shoot	To remove excess wind in the body	The young shoot boiled to make a soup
Piperaceae	*Piper caninum* Blume	Dowon boid	Leaf	For mother after childbirth to remove excess wind	The leaves boiled in a big pot then sit on it when it warm
Zingiberaceae	*Zingiber cassumunar Roxb.*	Ngolai	Rhizome	Used for massage mother after childbirth to remove excess wind	The rhizome pounded to extract the sap. The sap is use for massage.
Zingiberaceae	*Alpinia galanga* (L.) Willd.	Rikug	Rhizome	To remove excess wind from the body of delivery women	The rhizome pounded and use it for massage

k) List of plants to relief toothache

Famili	Species	Local Name	Parts of used	Usage	Preparation
Euphorbiaceae	*Agrostistachys longifolia* Benth	Bajau	Stem	To relief tooth ache	The stem burned to extract out yellow liquid. The liquid (turning black when it cold) applied on the teeth that perforated. It can numb toothache and treat the toothache.

l) List of plants to treat liver diseases

Famili	Species	Local Name	Parts of used	Usage	Preparation
Fabaceae	*Parkia speciosa* Hassk.	Potah	Leaf	To treat liver diseases	The leaves taken fresh.

m) List of plant to remove toxic from the body

Famili	Species	Local Name	Parts of used	Usage	Preparation
Pandanaceae	*Pandanus amaryllifolius* Roxb	Dowon pandan	Leaf	Remove toxic from the body	The leaves sliced and boiled to make a drink.

n) List of plant to treat asthmatic

Famili	Species	Local Name	Parts of used	Usage	Preparation
Sterculiaceae	*Scaphium macropodum* Beumee ex K.Heyne	Dowon komang	Seed	To treat asthmatic complaints	The seeds of the plants are soaked in water for a night. The water then is used for drink.

o) List of plant to kill parasites (worms) in the stomach

Famili	Species	Local Name	Parts of used	Usage	Preparation
Zingiberaceae	*Curcuma domestica* Val.	Umi'et	Leaf and rhizome	Kill parasites (worms) in the stomach	The rhizome pounded to extract out the juice and drink the juice.

p) List of plant to treat sore throat

Famili	Species	Local Name	Parts of used	Usage	Preparation
Scrophulariaceae	*Scoparia dulcis* L	Duh kerambu	Root	To treat sore throat (*bodier:* Bidayuh)	The roots boiled to make a drink.

q) List of plant to treat internal bleeding

Famili	Species	Local Name	Parts Plant used	Plant Usage	Preparation
Piperaceae	*Piper porphyrophyllum* N.E.Br.	Tibug (Papar deya)	Leaf	To treat internal bleeding	The lower part of the leaves heated and put onto the affected part.

The plant parts that are normally used are leaves or few pieces of root, rhizome, stem or bark, flowers, fruits and seeds. For small herbs, the whole plant or a few plants may be used. Leaves are the most common part used. The fruits are the second most common plant part used, followed by rhizome or tuber and the stem. They are used fresh or dry. The herbal preparation is usually taken until the patient recovers (Figure 4- 3)

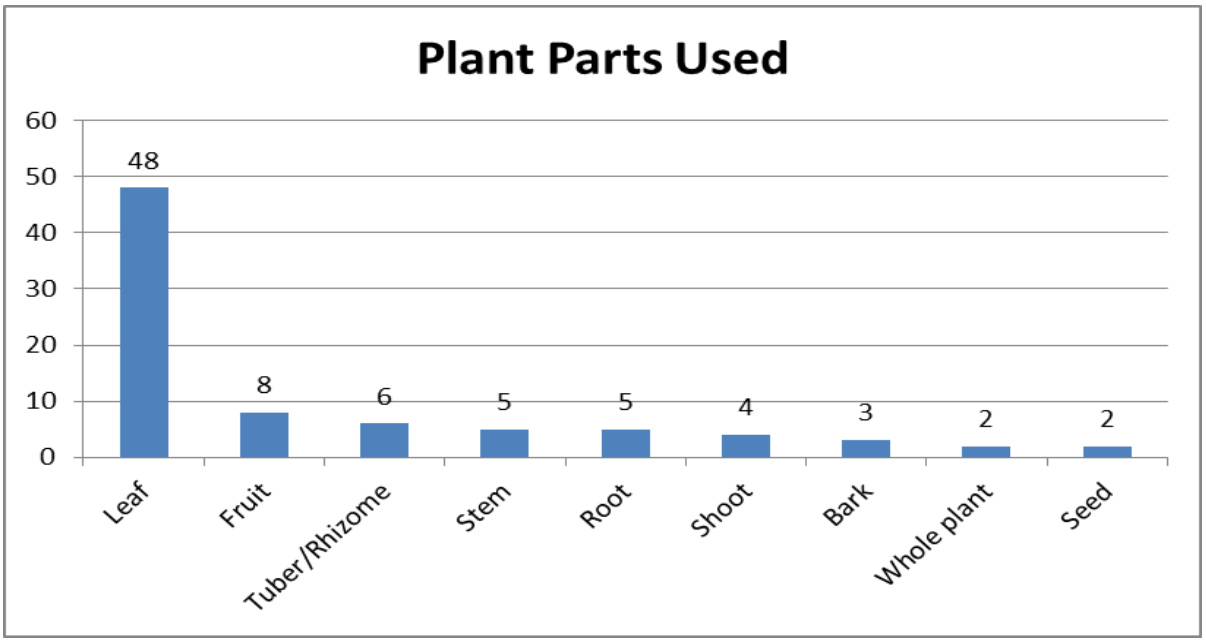

Figure 4- 3: Medicinal plant parts used by the Jagoi Community of Bau District

4.6.2 Types of Treatment Application Methods (Internal and External Application)

There were two types of treatment application methods: internal application and external application. Out of 33 illnesses, 21 illnesses can be treated by internal application method (by oral means) and 10 illnesses treated by external application methods. The internal application methods can be applied for illnesses such as fever, stomachache, gastric, diarrhea, bladder infection, hypertension, stroke, headache, diabetes, backache, bone fractures, sprain, join pain, jaundice, air in the body, toothache, liver diseases, toxic in body, asthmatic, parasites in stomach,

sore throat and internal bleeding. The external application method can be applied for the illness such as minor cuts and sores, wounds, external bleeding, itches, inflammation, skin diseases, ringworm, boils, skin rashes and shingles. For internal application methods, the useful plant parts will be boiled and decoction is drank, fresh part are pounded and drink as juice, add into warm water and drink the water or eat directly. For external application methods, the useful plant parts will be pounded, chewed or blended or apply directly to the affected part of the body. Some applications will do with chanting by the medicine man. (Table 4-12).

Table 4-12: Number of illness treated by internal and external application methods

Treatment methods	**Number of Illness**	**Percentage**
Internal application	24	70.6
External application	10	29.4
Total	34	100

4.7 Preference of Respondents Medication

This study found that majority of the respondents' response indicating that not all illness can be treating by traditional or modern medication alone. Respondents have variety of methods to cure their illness. It depends on their belief and preference for the medication. A total of 80 respondents preferred both modern and traditional medication. Out of 80, some 49 (60.5%) respondents gave reasons that they had experience that it was effective, 21 (25.9%) of them confident with traditional medication treatment can treat some of illness, 10 (12.4%) of them said that traditional medication was cheaper than modern medication and they will choose traditional medication if they felt that the illness can treat by this traditional medication, while only 1 (1.2%) belief that modern medication cannot treat some illness. Some of the respondents also said that some illnesses only can be cured through traditional medication treatment even though there was

no scientific explanation for the treatment; however they still depend on modern medication especially for the serious illness such as heart attack, hypertension, asthma, diabetics and appendicitis. The use of traditional medication alone also has much to do with religious and traditional belief (Table 4-13).

Table 4-13: Distribution of respondent's response to the preference of traditional medication

Reason	**No of household**	**Percentage (%)**
Effective	49	60.5
Confident with Traditional Medication Treatment	21	25.9
Cheaper than Modern Medication	10	12.4
Belief that Modern Medication Cannot Treat Illness	1	1.2

4.8 Pattern of Use of Traditional Plants for Medicine

4.8.1 Relationship of Use Frequency and Annual Cost of Traditional Medication against Households' Income and Age

A correlation analysis (Pearson's, *r*) was carried out to investigate the relationship between use frequency and annual cost of traditional medication against households' income and age. The results revealed that age among respondents had significant relationship with the frequency of use of medicinal plants, in the positively correlated direction (Table 4-14).

The Pearson's correlation level at 0.536 indicates positive relationship between use frequency and respondents age. The use of medicinal plants was more frequent among the older age group compared to the younger generation. For relationship between the amount spent on medicinal plants and respondents age, a positive relationship was noted (*r* is 0.526). The older generation pay more for medicinal plant use compare to the younger generation (Table 4-14).

On the other hand, household incomes record a weak correlation with frequency of collection of medicinal plants. This indicates that income is not influencing their decision to use or not to use medicinal plants. This is in contradiction to the belief that poorer member of the community are likely to depend more on wild plants for medicine. Subsequently, the correlation between the amount households' spent on medicinal plants and household income is also weak and in the negative direction.

It seems, therefore, that dependency on traditional plants for treatment was influenced by age but not household income. Both frequency of medicinal plant collection and the amount spent on medicinal plants are not influenced by the household income.

Table 4-14: Correlation (Pearson's) between the frequency of collecting medicinal plants and cost of medicinal plant use annually against household income and age

	Age	**Household Income**
Frequency of collecting medicinal plants	0.536****	-0.046
Amount spent on medicinal plants	0.526****	-0.097

**. Correlation is significant at the 0.01 level (2-tailed).

4.8.2 The Significance Relationship between Frequency of Collection Medicinal Plant and Value of Medicinal Plant Use against Age Group.

In this research, the ANOVA was applied to investigate the significance of the differences between groups in the population for a certain parameter measured. A significant p-value resulting from a one-way ANOVA test would indicate that the values observed are differentially expressed in at least one of the groups analysed. However, the one-way ANOVA does not specifically indicate which pair of groups exhibits statistical differences.

The first analysis was to observe the differences in frequency of collection of medical plants among the age groups as required in the hypothesis stated earlier:

$H_{02:}$ There is no significant difference between frequency of medicinal plant collection with age group

H_a: There is significant difference between frequency of medicinal plant collection with age group

The one-way ANOVA result indicates p=0.000 with significance value $p<0.005$ (Table 4-15).

The null hypothesis (H_{02}) is rejected, as there is significance relationship between frequency of collection medicinal plant between age group.

The second analysis was carried out to test the hypothesis stated on the value on medicinal plant use and age group, as follows:

$H_{03:}$ There is no significant difference between value on medicinal plant use with age group

H_a: There is significant difference between value on medicinal plant use with age group

The one-way ANOVA result indicates p=0.000 with significance value $p<0.005$ (Table 4-15). The null hypothesis (H_{03}) is rejected and the alternative hypothesis (H_a) is accepted. There is significance difference between value of medicinal plant use with age group.

Table 4-15: One Way ANOVA test analysis

Null Hypothesis	**F**	**Significant Level***
$H_{02:}$ There is no significant difference between frequency of medicinal plant collection with age group	4.439	0.000
$H_{03:}$ There is no significant difference between value on medicinal plant use with age group	4.436	0.000

* Significance value $p<0.005$

4.8.3 Relationship between the Two Medication Types (Traditional and Modern) and the Respondents from the Two Different Religious Groups (Christian vs Traditional Adat Believers)

At the onset of the study, it was hypothesised that religious practice has influence on the preference for either traditional or modern medicine, as measured by the level of use. A *t*-test analysis was carried out to assess the significance of the differences in level of use of the two medicinal types (traditional and modern) between the respondents from the different religious groups (Table 4-16). The result shows that there is significant difference in level of use between religious groups for each medicinal type. The H_{03a} and H_{03b} have to be rejected as the test significant at $p<0.05$ at 95 percent confidence level for the two-tailed analysis. These results indicate that religious groups (Christian vs Traditional Adat Believers) are factors that influence the level of use of either the traditional medicine or modern medicine. Traditional medicine using medicinal plants were more commonly found in Jagoi community following the Traditional Adat Believers or native religious practice.

Table 4-16: *t*-Test analysis

Null Hypothesis	**Significance Level**
$H_{03a:}$There is no significant difference between religion with level of use of modern medication	.000
$H_{03b:}$There is no significant difference between religion with level of use of traditional medication	.000

4.9 Values of Medicinal Plants

The value of medicinal plants utilized in the general study area is a reflection of the dependence of residence in and around Jagoi Community Forest on traditional medicinal plants. This

information will also be of immense importance for the local community development committee in their effort to manage their natural heritage. In this study, marketed resources were valued based on prevailing price at various weekend markets. Additionally, interviews were conducted with villagers selling plants and herbal products who operate outside the weekend market system. For non- marketable resources the values were estimated based on the replacement values and opportunity cost approach. The total estimated annual value of traditional medicinal plants treatments for the sample was are RM1040.00, averaging only at RM12.83.

Based on household survey carried out on 33 types of diseases, there is only 2 types of diseases that does not use traditional medicinal treatment namely heart attack and appendicitis. This is because these illnesses are serious and require surgery. The average cost for using traditional medicinal treatment for stomach-ache is RM32.72 per year. The largest number of respondent for cost of traditional medicinal treatment is RM41-RM50 per year, where there are about 21 respondents.

The average cost for using traditional medicinal treatment for influenza is RM5.25 per year. Out of 81 respondents, only 7 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM41-RM50 per year, where there are about 5 respondents.

The average cost for using traditional medicinal treatment for headache is RM9.51 per year. Out of 81 respondents, only 15 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM51-RM60 per year, where there are about 11 respondents.

The average cost for using traditional medicinal treatment for backache is RM6.73 per year. Out of 81 respondents, only 10 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM51-RM60 per year, where there are about 7 respondents.

The average cost for using traditional medicinal treatment for hip ache is RM6.98per year. Out of 81 respondents, only 10 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM51-RM60 per year, where there are about 8 respondents.

The average cost for using traditional medicinal treatment for toothache is RM6.11 per year. Out of 81 respondents, only 8 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM41-RM50 per year, where there are about 5 respondents.

The average cost for using traditional medicinal treatment for fever is RM9.38 per year. Out of 81 respondents, 10 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is R71-RM80 per year, where there are about 8 respondents.

The average cost for using traditional medicinal treatment for cough and sore throat is RM6.05 per year. Out of 81 respondents, 10 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM41-RM50 per year, where there are about 6 respondents.

The average cost for using traditional medicinal treatment for asthma, diabetics, ulcer, sprain,

snake bite and malaria are RM1.17, RM4.01, RM0.74, RM0.99 and RM1.36 per year. Out of 81 respondents, only 1 respondent each use medicinal plants for treatment at the cost of RM41-RM50 per year for asthma and diabetics, RM51-60 per year for ulcer, RM31-RM40 per year for sprain and snake bite and RM31-RM40 and RM71-RM80 each for malaria.

The average cost for using traditional medicinal treatment for hypertension is RM21.23 per year. Out of 81 respondents, 25 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM51-RM60 per year, where there are about 14 respondents.

The average cost for using traditional medicinal treatment for jaundice is RM4.80 per year. Out of 81 respondents, 7 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM21-RM30 per year, where there are about 3 respondents. The average cost for using traditional medicinal treatment for constipation is RM4.32 per year. Out of 81 respondents, majority 7 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM31-RM40 per year, where there are about 4 respondents.

The average cost for using traditional medicinal treatment for sore eye is RM1.85 per year. Out of 81 respondents, 5 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM10-RM20 per year, where there are about 3 respondents.

The average cost for using traditional medicinal treatment for gastric is RM2.47 per year. Out of 81 respondents, 3 respondents use medicinal plants. The largest number of respondent for cost of

traditional medicinal treatment is RM51-RM60 per year, where there are about 3 respondents.

The average cost for using traditional medicinal treatment for bleeding from a cut is RM11.48 per year. Out of 81 respondents, 18 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM31-RM40 per year, there are about 3 respondents.

The average cost for using traditional medicinal treatment for swollen body is RM5.62 per year. Out of 81 respondents, 8 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM51-RM60 per year, there are about 3 respondents.

The average cost for using traditional medicinal treatment for scabies wound is RM12.65 per year. Out of 81 respondents, 16 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM51-RM60 per year, there are about 3 respondents.

The average cost for using traditional medicinal treatment for insect bite is RM5.99 per year. Out of 81 respondents, 9 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM31-RM40 per year, there are about 3 respondents.

The average cost for using traditional medicinal treatment for boil is RM19.69 per year. Out of 81 respondents, 23 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM71-RM80 per year, there are about 13 respondents.

The average cost for using traditional medicinal treatment for burned is RM5.86 per year. Out of

81 respondents, 7 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM71-RM80 per year, there are about 13 respondents.

The average cost for using traditional medicinal treatment for measles is RM13.52 per year. Out of 81 respondents, 19 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM41-RM50 per year, there are about 19 respondents.

The average cost for using traditional medicinal treatment for small pox is RM11.79 per year. Out of 81 respondents, 18 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM41-RM50 per year, there are about 13 respondents.

The average cost for using traditional medicinal treatment for chicken pox is RM11.85 per year. Out of 81 respondents, 16 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM51-RM60 per year, there are about 15 respondents.

The average cost for using traditional medicinal treatment for ring worm is RM8.33 per year. Out of 81 respondents, 10 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM41-RM50 per year and RM71-RM80; there are about 4 respondents each.

The average cost for using traditional medicinal treatment for skin diseases is RM9.01 per year. Out of 81 respondents, 11 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM71-RM80 per year, there are about 6 respondents.

The average cost for using traditional medicinal treatment for mother after delivery and shingles is RM25.19 per year. Out of 81 respondents, 22 respondents use medicinal plants. The largest number of respondent for cost of traditional medicinal treatment is RM81-RM90 per year, there are about 19 respondents (Table 4-17).

Table 4-17: Distribution of household respondents by average cost of Traditional Medicinal per year by the Jagoi Community, Bau District.. (n=81)

Types of Illness	**RM0 /not use**	**RM10 - RM20**	**RM21 - RM30**	**RM31- RM40**	**RM41 - RM50**	**RM51 - RM60**	**RM61 - RM70**	**RM71 - RM80**	**RM81 and above**	**Average Cost of using TM (Means) (RM)**
Appendices	81									0
Asthma	80								1	1.17
Backache	71			2	1	7				6.73
Boil	58			1	2	7		13		19.69
Burned	74				2			5		5.86
Chicken pox	63					15			1	11.85
Constipation	74			4		1		2		4.32
Cough or Sore throat	71		2		6			2		9.38
Cut bleeding	63			9	2	1	4	3		11.48
Diabetics	77								4	4.01
Fever	71					2		8		9.38
Gastric	78					2		1		2.47
Headache	66	2		1	1	11				9.51
Heart attack	81									0
Hip-ache	71			1	1	8				6.98
Hypertensions	56					14	1	9	1	21.23
Influenza	73				5	2		1		5.25
Insect bite	72		1	4		1		3		5.99
Jaundice	74		3			2			2	4.80
Malaria	79			1				1		1.36
Measles	60				19	1			1	13.52
Ringworm	71				4	1		4	1	8.33
Scabies wound	65		1	1	2	5		7		12.65
Shingles or supplement for mother after delivery	59			1		2			19	25.19
Skin diseases	70			1	3	1		6		9.01
Smallpox	63				16	1			1	11.79
Snakebite	79			2						0.99
Sore Eyes	76	3				2				1.85
Sprain	79			2						0.99
Stomach-ache	24		15	1	21	19		1		32.72
Swollen body	73				2	6				5.62
Toothache	73				5	2			1	6.11
Ulcer	80					1				0.74

4.10 Value of Annual Usage of the Plant Resources by Jagoi Community, Bau District

This section is to discuss on the value of annual usage of the plant resources used by the community in 9 villages namely Kampung Bung Jagoi, Kampung Sibobok, Kampung Duyoh, Kampung Sri'ieng, Kampung Serasot, Kampung Skibang, Kampung Serikin, Kampung Stass and Kampung Bogag. The estimation of the annual value is based on the cost the community covered to get the traditional medicinal treatment per year. A total of 64 respondents use the medicinal plants to treat the illnesses as listed in Table 4-17, while a remaining 17 respondents use the medicinal plants to treat other illnesses such as bladder infection, muscle inflammation and to remove excess gaseous built up in the body.

The annual value on usage of the plant resources used by the Jagoi community is calculated based on the values derived from actual usage of treatments received from traditional medicine as reported by the households surveyed in each of the 9 villages in the study area (Table 4-18). The average annual value and total annual value for surveyed households, by village are as shown in Table 4-18.

Example of calculation for total annual value and average annual value by Bung Jagoi community:

Where,

The total annual value for traditional medicine used by 8 household respondents= RM3700

Household respondents= 8

Average Annual Value of Traditional Medicine:

= Total Annual Value/No. of household respondents

= RM3700/8

= RM462.50

Table 4-18: Average annual value and total annual value of traditional medicinal plants use, by village

Name of Villages	**No. of respondents**	**Total Annual Value of Traditional Medicine (RM)**	**Average Annual value of Traditional Medicine (RM)**
Bung Jagoi	8	3700	462.50
Sibobok	6	3285	547.50
Duyoh	10	4025	402.50
Sri'ieng	4	1890	472.50
Serasot	9	2355	261.67
Skibang	4	575	143.75
Serikin	8	2805	350.63
Stass	7	1315	187.00
Bogag	8	1340	167.00

One of the objectives of the study is to estimate the total use value for the whole Jagoi community. Based on the derived average annual value per household in the respective village (Table 4-18) the estimated community value are calculated and are as shown in Table 4-19. The estimation is made based on different assumption on the percentage of villagers who are actively using traditional medicinal plants. There are four level of percentage of household participation assumed: 2.5%, 5%, 10% and 20%. This assumption is made as the actual percentage of villagers participating or actively using traditional medicinal plants. The percentage of use are not constant and appears to be quite dynamic, changing with time as influenced by changing social environment and economic developments that take place in the area.

Table 4-19. Total annual use of traditional medicinal plants, by village and assumed level of participation

Name of Villages	No. of Resident Households	Value of use for assumed participation level (RM)			
		2.5%	5%	10%	20%
Bung Jagoi	26	300.62	601.25	1202.50	2405.00
Sibobok	88	1204.50	2409.00	4818.00	9636.00
Duyoh	180	1811.25	3622.50	7245.00	14490.00
Sri'ieng	40	472.50	945.00	1890.00	3780.00
Serasot	150	981.26	1962.52	3925.05	7850.10
Skibang	130	467.18	934.37	1868.75	3737.50
Serikin	150	1314.86	2629.72	5259.45	10518.90
Stass	200	935.00	1870.00	3740.00	7480.00
Bogag	140	584.50	1169.00	2338.00	4676.00
Total	1104	8071.71	16143.43	32286.85	64573.70

Example of calculation for value of use for assumed participation level, by Bung Jagoi community:

(Assumed participation level X No of resident household) (Average Annual Value of Traditional Medicine)

Where,

Assumed participation level= 2.5%

No of resident household= 26

Average Annual Value of Traditional Medicine= 462.50

$$= \frac{2.5 \times 26}{100} \; X \; 462.50$$

$$= 300.62$$

Based on the above calculation, the value of traditional medicinal plants used varies quite significantly with the different level of participation. With a 2.5% of the whole Jagoi community's involvement or participation, the estimated value is at RM8,071.71. For the 5% participation or involvement level, the total value is RM16,143.43. For the assumed participation level of 10% and 20%, the estimated values are RM32,286.85 and RM64,573.70 respectively.

4.11 Respondent's Awareness and Understanding of Forest Management and Conservation Issues

Many of the benefits and services from Jagoi forests are un-priced and this can lead to faulty land use decision making. Non market valuation can provide important information on the value of many currently un-priced items and enable decision makers to consider the opportunity costs of proposed land use changes. Total economic value (TEV), which includes use and non-use values, is a complex method to determine the estimated total benefits for tropical forest. Non-use benefits refer to all values that not associated with direct or indirect human uses (i.e. existence and bequest value).This study reports on a contingent valuation study of existence value (non-use value) of the Jagoi community forest. The economic value is based on the mean maximum willingness to pay (wtp) of the households in Jagoi area to conserve the Jagoi community forest.

A specific question being asked to respondents willingness to pay (wtp) to support the conservation programme of Jagoi community forest was as below;

1. *Are you willing to contribute if the state government of Sarawak decided to organize a special trust fund to conserve Jagoi community forest? (Yes or No), if yes go to next question*

2. *What is the maximum amount that you are* willingness to pay (wtp)*? (RM? Per year)*

4.11.1 Awareness and Understanding of Forest Management and Conservation Issues

All the respondents were also asked their opinion regarding the management of forest conservation in Sarawak. Three answer options were provided. Out of 81 respondents (42%)

stated they did not understand and know nothing about the management of forest conservation in Sarawak. About 33.3% thought that there is a need for improvements in the management of forest conservation while 24.7% were satisfied with the current process of forest conservation management (Table 4-20).

Table 4-20: Management of forest for conservation (n=81)

Opinion on management of forest conservation	**No of Household**	**Percentage (%)**
Don't know about the management of forest conservation	34	42
Need improvements	27	33.3
Satisfied with the current management of forest conservation	20	24.7

4.11.2 Reason Why Forest Conservation is Not Important

A total of 34 respondents who don't know about the management of forest conservation give reason that they did not pay close attention to the forest conservation issues in Sarawak. There were some reasons why these respondents did not pay close attention to these issues. By grouping the answers to four main groups, most of them (47.06%) believed that the related government agency such as Sarawak Forest Department should take full responsibility on every issue related to forests and should not burden the public with forest issues. The second notable reason (25.53%) was their high commitments to their work and personal life. They felt that they utilized their precious time by focusing on their career and family and left the forest conservation issues to be managed by the government. While 17.65% stated they lacked exposure to items on the importance of forest and conservation issues from the relevant agencies and mass media. Only 11.76% claimed that social issues are more important than forest conservation issues (Table 4-21).

Table 4-21: Reason why forest conservation is not important

Reason why forest conservation is not important	No of Household	Percentage (%)
Government responsibility	16	47.06
High work and personal commitments	8	23.53
Lack of exposure	6	17.65
Social issues are more important	4	11.76

4.11.3 Suggestions to improve the current management of forest conservation

Some 27 respondents felt that the related government agency such as Forest Department needs to improve the current management of forest conservation. Some measures have been suggested by the respondents. Majority of them (62.96%) concluded that the state Forest Department needs more assertive and firm actions in enforcement of forest laws especially those that are related to encroachment and illegal logging activities. The second suggestion (25.93%) was the government (through related agency) should provide efficient, accessible information channels to the public regarding the forest conservation issues. Early exposure to the importance of forest conservation to humans and ecosystems should begin in early school and continue until the tertiary education. Results from scientific research related to forest conservation should be conveyed in laymen terms to educate the publics as well as to increase their awareness on any illegal activities and current forest management issues. Only 11.11% suggested the establishment of specific federal unit or agency for the purpose of monitoring the problem of forest encroachment and illegal logging (Table 4-22).

Table 4-22: Suggestion to improve management of forest for conservation

Suggestion	No of Household	Percentage (%)
Forestry Departments need to be more assertive and firm in managing forest conservation	17	62.96
Educate the public on the importance of forest conservation	7	25.93
Establish specific federal agency for monitoring purposes	3	11.11

4.11.4 Community Based Natural Resource Management (CBNRM)

The Jagoi Area Development Committee (JADC) embarked on a series of conservation awareness programmes since the late 1990s. Funds were made available by both government and non-governmental organisations to develop training programmes on conservation and the initiation of development and management plans for Bung Jagoi (Mount Jagoi) cultural heritage site. Included in this plan is the proposed gazettement of the Jagoi forest area as a communal forest. Up to the end of the study, however, the committee (JADC), which is a voluntary entity, had not been able to effectively implement its plan due its inability to officially gazette the area as communal forest. Much of the result of the perception study may have been influenced by the current level of success of the JADC, that is biased towards dependence on the government.

4.12 Willingness to Pay (WTP) for Jagoi Community Forest Conservation

The respondents are being asked whether they are willing to pay to support the conservation and protection of Jagoi community forest by assuming that a special trust fund to support the conservation and protection of Jagoi community forest has been established. The state government is encouraging residents of Jagoi to participate in the programme.

4.12.1 Estimation of Respondent's Willingness to Pay

After explaining the purpose of establishing the conservation trust fund, 80.1% of respondents agreed to participate. Their maximum WTP ranged from RM1 to RM20 with a weighted average of RM10.50 per year (Table 4-23).

Table 4-23: Estimation of respondent's willingness to pay (n=81)

Willing To Pay	**No of Household**	**Percentage (%)**
Yes	65	80.1
No	16	19.9

4.12.2 The Maximum amount Respondents Willingness to Pay

The result shows that majority of the households (80.1%) are willing to contribute to support the conservation program. The survey indicated that more than half (67.9%) of the respondents were willing to contribute at the second lowest range group of WTP, ranged between RM6 to RM10 per year to the Jagoi community forest conservation trust fund. The second highest percentage of respondents (11%) was in the group of WTP with the lowest range group, willing to pay RM1-RM5 per year. There are only 1.2% of the respondents willing to pay more than RM10 per year for the Bung Jagoi forest conservation (Table 4-24).

Extrapolating the result of the estimation to the whole population (1104 households) indicates that some 884 (80.1%) household are willing to pay annually. Assuming the mean annual contribution is RM10.50 per household, and then the total fund made available from the community would be RM9,282 annually.

With a good amount of WTP, it clearly shows respondents felt that the experience they gained from the forest services are much more valuable compared to the amount of money they paid. The fact that they are willing to pay more for the conservation effort indicates their awareness and inclination to protect and conserve the forest and its surrounding natural resources. This indication is good since the main purpose is to promote environmental awareness, further enhance nature appreciation amongst the public and convince the related bodies and ministers to organized management and conservation of the area. In conclusion, this study has provides the management with valuable information regarding the WTP value of Bung Jagoi which can be used as an indicator in revising the pricing policies, hence contributes to future planning for a sustainable management of the Jagoi community forest.

Table 4-24: The maximum amounts that willing to pay (WTP) (n=65)

Amount (RM)	**No of Household**	**Percentage (%)**
RM1-RM5	9	11
RM6-RM10	55	67.9
RM10-RM20	1	1.2

4.12.3 Reasons for lack of Interest in Paying for Forest Conservation

The numbers of 16 respondents who are not willing to pay give reasons on why they not willing to contribute to the Jagoi forest conservation (Table 4-25). Most of them (43.75%) believed that the government should bear the cost of forest conservation as the cost can be covered with the profit gained from logging activities. About 25% of respondents agreed that paying an amount to the conservation trust fund is only to those who receive direct benefits from Jagoi forest especially the community who stay in nearest forest. About 12.5% respondents each agreed that the contribution would not result in better forest conservation and prefer to donate to other trust funds related to humanity. Many respondents stated there should be changed in attitude and ethics

amongst the public towards the importance of forest and its relationship to human needs. The publics should be given sufficient information on current status of forest resources as well as future management plans for the forest area. Some respondents stated the possibility of misuse of money from the proposed conservation trust fund is high as has happened in many cases related to public donations. Only 6.25% of respondents provided other reasons such as cannot afford to pay.

Table 4-25: Reasons for lack of interest in paying for forest conservation (n=16)

Reason	**No of respondents**	**Percentage (%)**
I cannot afford to pay	1	6.25
I do not believe that paying such amount will result in improved forest conservation	2	12.5
Cost of forest conservation should be borne by the government	7	43.75
I prefer giving money to humanitarian causes instead	2	12.5
Only people who directly benefit from the existence of Bung Jagoi forest should pay for the fund	4	25

CHAPTER V

CONCLUSION & RECOMMENDATION

5.1 Introduction

The community still depends on the natural resources of Jagoi community forest for medicine, vegetable, fruits and handicrafts making. The Jagoi Area Development Committee (JADC) is putting up the effort to gazette the Gunung Jagoi Forest as a communal forest reserve and to develop it as a cultural heritage site for the Jagoi community. In so doing, the committee needs reliable information on the resources potential, the existing pattern of exploitation and the level of community dependence on the forest. The traditional knowledge and practices of the Bidayuh Jagoi on the utilization of wild plants as medicine has been studied and analysed. The pattern of utilization indicates that certain demographic factors are influencing the level of use. The value of medicine derived from wild plants in the sample population was estimated and extrapolated to the total population of Jagoi area.

5.2 Major Finding

5.2.1 Documentation of Traditional Knowledge on Important Plants

1. Species of plants used

There were 117 plant species belonging to 59 families being documented for the Jagoi

community. Of these, 60 species were for medicinal purposes while 57 species were other useful plants. The study shows that this community is still depending on the natural resources of the Jagoi forest for medicine, vegetable, fruits and handicraft making. It was noted that there were many species recorded in this study which were also used and recorded in other ethnic communities as reported in past studies.

5.2.2 The Pattern of Medicinal Plant Use among the Community

The study had compiled 33 types of human diseases that can be cured by the different types of medicinal plants. Out of these medicinal plants some are herbs, some are shrubs, climbers, and some are trees. Herbs are the most common medicinal plants. The Jagoi Bidayuh community use single plant or mix different plants as a medicine in a single disease. It is also found that a single plant is used in different diseases. The study found that there were two types of treatment application methods. There were internal and external treatment application methods. The internal application methods are used for illnesses such as fever, stomach-ache, gastric, diarrhoea, bladder infection, hypertension, stroke, headache, diabetes, backache, bone fractures, sprain, join pain, jaundice, wind in body, toothache, liver diseases, toxic in body, asthmatic, parasites in stomach, sore throat and internal bleeding. The external application method can be used for the illness such as cuts and sores, wounds, external bleeding, itches, inflammation, skin diseases, ringworm, boils, skin rashes and shingles. For internal application methods, the useful plant parts are boiled and drank, or are simply pounded and the juice are drank, or steeped in hot water before drinking or eaten directly. For external application methods, the useful plant parts are pounded, chewed or blended and applied directly to the affected part of the body. Some applications will involve chanting of prayers by the medicine man. The plant parts that are

commonly used are leaves and roots.

5.2.3 Relationship of Use Frequency and Annual Cost of Traditional Medication against Households' Income and Age

A correlation analysis (Pearson's, *r*) show positive relationships for both frequency of collection of medicinal plant and amount spent on the medicinal plants with age. This explained that the older age group more collecting and use medicinal plants compare to the younger generation. In addition, older generation found to be actively depending on medicinal plant to treat their illness. Due to more frequent use of medicinal plants, the older generation pay more cost for traditional treatment using medicinal plants.

On the other hand, household incomes record a weak correlation and in the negative direction for both frequency of collection of medicinal plants and amount households spent on the medicinal plants. This indicates that income is not influencing their decision to use or not to use medicinal plants.

Hence, it can be concluded that dependency on traditional plants for treatment was influenced by age but not household income. Both frequency of medicinal plant collection and amount spent on medicinal plants are not influenced by the household income. Cost for traditional treatment is not an issue among local community due to the available sources of plant in the nearest forest.

5.2.4 The Difference in Frequency of Collection of Medicinal Plants and Value of Medicinal Plant Use among the Age Groups

The result of one-way ANOVA show there are significant differences in frequency of collection of medicinal plants and the value on medicinal plant use among the age groups. The both H_{02} and H_{03} show the significant level at 0.000. This explained that the respondents among the older age group indicate higher cost for traditional plant medication and collection more of medicinal plants compare to the younger generation. This is because, the older age group of participants confident on the medicinal plant medication and had been practice the medication in generation.

5.2.5 The Difference between Religion and Choice for Traditional Medication using Medicinal Plants

The result shows that there is significant difference in level of use between religious groups for traditional medication. The null hypothesis have to be rejected as the test significant at $p<0.05$ at 95 percent confidence level for the two-tailed analysis. These results indicate that religious groups (Christian vs Traditional Adat Believers) are factors that influence the level of use the traditional medication. Participants who practices Traditional Adat or native religious are found to use more the traditional medication using medicinal plants compare to Christian' s participants. In addition, the traditional medication is not allowed by the Christian.

5.3 Willingness to Pay for Conservation of Jagoi community Forest in Relation to Community Management

Willingness to Pay (WTP) is the amount or value of money that the respondents are willing to pay for a good and services of Mount Jagoi Community Forest. It measures either the respondent is willing to sacrifice their income. Each of the respondents was briefed on the details of the purpose of fund and preservation of area. Respondents were asked the following question and required to respond either 'YES' or 'NO'

The study shows that majority of the households (80.1%) are willing to contribute to support the conservation program. More than half of the respondents were willing to contribute at the ranged between RM6 to RM10 per year to the Bung Jagoi forest conservation trust fund. Assuming the mean annual contribution is RM10.50 per household, and then the total fund made available from the community would be RM9,282 annually. The study has provides the management with valuable information regarding the WTP for conservation of Mount Jagoi Community Forest which can be used as an indicator in revising the pricing policies, hence contributes to future planning for a sustainable management of the Mount Jagoi Community Forest. The public's preferences as measured by their WTP for forest conservation should be given due consideration in decision making to promote sustainability of forests.

The community had identified Mount Jagoi Community Forest to be gazetted as forest reserve so that activities such as logging and deforestation for cultivation purposes and hunting are absolutely forbidden. Some initiatives had been made to secure fund to conserve Mount Jagoi Community Forest. Donors include Small Grant Programme (SGP)- Global Environment

Facility (GEF) of the UNDP, Malaysian SHELL, Ministry of Tourism and other government and non-governmental organisations. Jagoi Area Development Committee (JADC) has been cooperating with local institutions and research agencies especially UNIMAS to conduct multi-disciplinary studies in the area during the 2011 and 2012 period. The aim of the study is to establish scientific baseline critical for development of future conservation and management plans.

In effort to conserve the useful plants, community has established community herbal garden in year 2013. There are more than 30 species of useful plants such as for medicine, food, condiment and local fruits planted in this herbal garden. Among them are tongkat ali (*Eurycoma longifolia*) and kacip Fatimah (*Labisia pumila*).

5.4 The Community's Preferences for General Healthcare Based on Traditional Practices

This study found that majority of the respondents' stated that not all illness can be treated by traditional or modern medication alone. Respondents have variety types of methods to cure their illness. It depends on their belief and preference for medication. A total 80 of the respondents preferred both modern and traditional medication. Out of 80, 49 (60.5%) of the respondents gave reasons that they had experience that it was effective, 21 (25.9%) of them confident with traditional medication treatment can treat some of illness, 10 (12.4%) of them said that traditional medication was cheaper than modern medication and they will choose traditional medication if they felt that the illness can treat by this traditional medication. The remaining 31 (1.2%) believe that modern medication cannot treat some illness. Some of the respondents also said that some illnesses can only be cured through traditional medication even though there was

no scientific explanation for the treatment. In practice, however, they still depend on modern medication especially for serious illness such as hypertension, asthma, diabetes and appendicitis.

None of the participant preferred modern medication treatment alone but they explained that the modern medication treatment are more rationale and scientific and they experience that the traditional medication cannot treat some of the illness such as appendices and heart attack. However, only one of the respondents prefer traditional medication only. The use of traditional medication alone also has much to do with religious belief.

5.5 Value of Annual Usage of Plant Resources by the Community

The value of traditional medicinal plants used varies quite significantly with the different level of participation. With an assumption that 2.5% of the whole Jagoi community's involvement or participation, the estimated value is at RM8,071.71. For the 5% participation or involvement level, the total value is RM16,143.43. For the assumed participation level of 10% and 20%, the estimated values are RM32,286.85 and RM64,573.70 respectively. Based on community meetings and the field conservation as well as the questionnaire survey, our estimate of effective annual participation or involvement level for the Jagoi community is at about 10%. Thus, the value of traditional medicinal, plant use in the community is RM32,286.85. The value estimated can provide policy makers an indication of the importance of unpriced plant resources as a whole in monetary terms. Information on the social benefits of maintaining forests product should be available before decisions on forest conversion occur.

5.6 Recommendations

The following recommendations are made:

1. The traditional knowledge and practices of the local ethnic communities of Sarawak on the utilization of plant resources as medicine should be documented and preserved before these resources disappear and informers pass on. The accessibility to market plants used for medicine or food should be created to ensure that the knowledge of the people is conserved while generating economic benefit to the community.
2. The elder generation are found to use more traditional medicine compare to the younger generation as stated in this study. For any effective management plan or conservation plan for these forest resources, is to include the view of this group of the society which is older generation.
3. Religion affiliation (christian vs traditional adat believers) is observed to influence the level of use of these traditional medicinal plants. People practicing the traditional adat believers practices appears to be using or participate more to the traditional medicinal use. These people who are practicing traditional religion are more associated to the forest as they use more forest resources for traditional healing, offering, ritual and religious ceremony. The basic right of this group of society have to be respected. As stated in Article 31, United Nations Declaration on the Rights of Indigenous People 2008, the indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions and it is not wrong that they demand that government should contribute for their conservation of cultural and heritage.

Bibliography

Ahmad, F. B. (1993). Medicinal plants used by the Kadayan community in Sarawak. *Sarawak Museum Journal* 44 (65), pp. 45-57.

Anonymous. (1994). *Pharmaceuticals From Plants: Great Potentials, Few funds, The Lancet*. pp. 1513-1515.

Anonymous. (1998). *Medicinal Plants of India*. Guidelines for National Policy and Conservation Programmes. Ministry of Environment and Forests, New Delhi, India.

Bao, Z. X. (2011). Current pharmacological and phytochemical studies of the plant Alpinia galanga. *National Center for Biotechnology Information*, pp.1061-1065.

Bateman, I.J., Carson, R.T., Day, B., Hanemann, M., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Mourato, S., Ozedemiroglu, E., Pearce, D., Sugden, J. & Swanson, J. (2002) *Economic valuation with stated preference techniques: A manual,* Edward Elgar, Cheltenham, UK.

Bennett E.L & Dahaban Z. (1995). *Wildlife Responses to Disturbances in Sarawak and Their Implications for Forest Management.* pp. 66-86. In Primack R.B & Lovejoy T.E. (Eds), Ecology, Conservation and Management South East-Asian Rainforest. Yale University Press, New Haven, USA & London, UK.

Bidin, A. A. & Latiff, A. (1995*). The status of terrestrial biodiversity in Malaysia. In: Prospects in Biodiversity Prospecting.* A. H. Zakri (ed.). Genetic Society of Malaysia and Universiti Kebangsaan Malaysia, pp. 59-76.

Bishop, J. T. (ed.) (1998). *Valuing Forests: A Review of Methods and Applications in Developing Countries*. London : International Institute for Environment and Development.

Bishop, R.C. & Heberlein T. A (1987). *The Contingent Valuation Method in Valuing the Environment.* In Geoffrey N.K and Basil M.H.S (Eds). Christchurch NZ: Centre for Resource Management, University of Canterbury, pp. 99-115

Brookfield, H., & Byron, Y. (1993). *South-East Asia's environmental future: the search for sustainability*. United Nations University Press.

Burkill, I. H & Hanniff M. (1930). *Malay Village Medicines.* Garden's Bulletin Straits Settlements Volume 6. pp. 165-321.

Burkhill, I.H (1935), *A Dictionary of Economic Products of the Malay Peninsula, Vols. I & II*, Department of Agriculture, Kuala Lumpur.

Cavana, R. Y., Delahaye, B. L., & Sekaran, U. (2001). *Applied Business Research: Qualitative and Quantitative Methods*. Queensland : John Wiley & Sons Australia, Ltd.

Chai, P. K. (2000). Ethnobotany. In Soepardmo, E. & Chai, P. K. (Eds), *Development of Lanjak-Entimau Wildlife Sanctuary as a Totally Protected Area – Phase I & Phase II, Scientific Report, Forest Department Sarawak and International Tropical Timber Organization, Kuching*, pp. 175-188.

Chai, P. K. (2006). *Medicinal Plants of Sarawak*. Kuching : Lee Ming Press.

Christensen, H. (2002). *Ethnobotany of the Iban & the Kelabit*. Forest Department Sarawak, Malaysia.

Chung, F. J. (1996). Interests and policies of the state of Sarawak, Malaysia regarding intellectual property rights for plant derived drugs. *Journal of Ethnopharmacology*, *51*(1), pp. 201-204.

Cooper, D.R., & Schindler P.S. (2008). *Business Research Methods.* (10th ed). Singapore: McGraw-Hill.

Curran (1999). Borneo rain forest on verge of total destruction, obtained from CNN. Com Website.

Daniel, M. (2006). *Medicinal plants: chemistry and properties*. India: Science publishers.

Elliot, A.C. & Woodward, W.A (2007). *Statistical Analysis Quick Reference Guidebook With SPSS Examples.* United States of America: SAGE Publication, Inc.

Farnsworth, N. R., & Morris, R. W. (1975). Higher plants--the sleeping giant of drug development. *American journal of pharmacy and the sciences supporting public health*, *148*(2), pp.46-52.

Food and Agriculture Organization (FAO). (1997). *Asia-Pacific Forestry Sector Outlook Study: Country Report – Malaysia.* Working Paper No: APFSOS/WP/07. Forestry Department Headquarters, Peninsular Malaysia, Kuala Lumpur, Malaysia and Forestry Policy and Planning Division, Rome. Bangkok, FAO Regional Office for Asia and the Pacific.

Ghani, A. N. A. (2005). *Application of Total Economic Valuation Methods to Ayer Hitam Forest Reserve Puchong*. National Workshop on Economic Valuation for Conservation Management. University Putra Malaysia.

Ghani, A. N. A. (2010). *Economic valuation of forest resources: current status and the way forward.*

Ghazally, I. M & Laily B.D (1995). *Chemical Prospecting in the Malaysian Forest*. Pelanduk Publications (M) Sdn Bhd, Malaysia. pp. 228.

Gimlette J.D & Burkill, I. H (1930). *Malay Drugs.* Garden's Bulletin Straits Settlements Volume 6, pp. 6-15.

Henderson M.R (1959). *Malayan Wild Flowers. Dicotyledons.* Malayan Nature Society, Kuala Lumpur, Malaysia, pp. 472.

Huxley, A. (1984). *Green inheritance: the world wildlife fund book of India*. *Collins/Harvel, London*.

Hurst, (1990). Malaysian Forest as a Source of Medicinal Plants. In Lee. S.S. (Ed) *Conservation, Management and Development of Forest Resources: Proceedings of the Malaysia-United Kingdom Programme Workshop, 21-24 October 1996,* Kuala Lumpur, Malaysia.

IUCN, WHO & WWF (1993), Guidelines on the Conservation of Medicunal Plants, International Union for the Conservation of Nature and Natural resources, Gland, Switzerland.

Jagoi Bau, Sarawak Map, obtained from http://www Google Earth Image 2015-Jagoi map.

Jaju, SB. N. I. (2009). Galangoflavonoid Isolated from Rhizome of Alpinia. *Tropical Journal of Pharmaceutical Research*, pp. 545-555.

Jamal, O. & Mohd Shahwahid, H.O. (1999). Constructed/Hypothetical Market Methods: Contingent Valuation (CV). In *Manual on Economic Valuation of Environmental Goods and Services of Peat Swamp Forest*. Malaysian-DANCED Project on Sustainable Management of Peat Swamp Forests, Peninsular Malaysia. Forestry Department of Peninsular Malaysia (FDPM) and Danish Cooperation for Environment and Development (DANCED). pp.119.

Juriyati J, Aishah A., Norazrina A, Siti S.O & Loh W.T (1995). Effects of Aqueous Extract of *Prismatomeris glabra* Root on Non-Spatial. Memory in Rats Using Object Discrimination Test. Sains Malaysiana 40(10)(2011), pp. 1097–1103.

Kadir, A. A., & Ali, R. M. (1998). Medicinal plants in Malaysia: their potential and utilization. In Nair, M. N. B., Sahri, M. H., & Ashaari, Z. (Eds.). *Sustainable management of non-wood forest products. Proceedings of an International Workshop held at Universiti Putra Malaysia, Serdang, 14-17 October 1997*. Serdang: Universiti Putra Malaysia Press.

Kashmira, J. G, J. A. (2010). Pharmacological Review on Centella asiatica: A Potential Herbal Cure-al. *Indian Journal of Pharamceutical Studies*, pp. 546-556.

Khamisiyah, S. (2006). *Medicinal plants of the Selako-Bidayuh community at Sematan, Lundu, Sarawak*. Kota Samarahan: Universiti Malaysia Sarawak.

Klemperer, W. D. (1996). *Forest resource economics and finance*. McGraw-Hill Inc.

Kress, M. (1995). *Medicinal chest from Malaysian Jungles.* Wing of Gold- Kuala Lumpur, pp.16-22.

Kula, E. (1994). *Economics of natural resources, the environment and policies*. London: Springer Science & Business Media.

Kumari, K. (1996). Sustainable forest management: myth or reality. *Exploring the.* Malaysia.

Latiff, A. et al. (1984). In Kumari K. (Ed) *Mainstreaming Biodiversity Conservation: A Peninsular Malaysian Case.* Centre for Social and Economic Research on the Global Environment, University of East Anglia and University College London.

Latiff, A. (1989). In Globinmed. *Malaysian Perspective. Consumption of Medicinal Plant in Malaysia, 10 November 2009* obtained from http://www.//globinmed.com.

Latiff, A. (1991). *Plant resources for natural products: An Ethnobotanical perceptive*. ln: Khozirah, S et al (Eds): Proceedings of the Conference for Medicinal Products from Tropical Rain Forests.l3-15 May 1991. Forest Research lnstitute Malaysia, Kuala Lumpur, pp.1-12.

Lambert, J., Srivastava, J., & Vietmeyer, N. (1997). *Medicinal plants: rescuing a global heritage* (Vol. 355). World Bank Publications.

Law of Sarawak (1991). *Land code. Chapter 81 (1958 edition).* State Attorney-General's Chambers Kuching. Percetakan Nasional Malaysia Berhad, Kuching Sarawak.

Law of Sarawak (1998). *Wildlife Protection Ordinance, 1998*. Chapter 26. Section 2 (1).

Li Chaojin (1987). Management of Chinese Traditional Drugs. In Akerele O., Stott G. & Welbo L. (Eds). *The Role of Traditional Medicine in Primary Health Care in China.* American Journal of Chinese Medicine, pp. 39-41.

Li, T.M (2007). *Manuscript of Practices of Assemblage and Community Forest Management. Economy and Society.* University of Toronto, pp. 263-293.

Leach, M., Mearns, R., & Scoones, I. (1999). *Environmental entitlements: dynamics and institutions in community-based natural resource management*. World Development, pp.225-247.

Martin, G. J. (1995). *Ethnobotany: A Methods Manual*. Cambridge: University Press.

McNally, R. and Mohd Shahwahid, H.O. (2002). *Environmental Economics: A Practical Guide*. WWF-UK and Universiti Putra Malaysia (UPM). ISBN: 983-41144- 0-0, pp.134.

Merlo, M., & Briales, E. R. (2000). Public goods and externalities linked to Mediterranean forests: economic nature and policy. *Land use policy*, *17*(3), pp.197-208.

Miller, D. C. (1991). *Handbook of research design and social measurement (5th ed.).* Newbury Park, CA: Sage.

Mohd Azmi M.I & Ahmad Fauzi P. (1998). *Harvesting, Production and Marketing Aspects of Medicinal Plants: the Case of Tongkat Ali (Eurycoma longifolia).* Paper presented in Workshop on Forestry Economics and Policy : R & D Towards Achieving Sustainable Forest Management. Faculty of Forestry, Universiti Putra Malaysia, Serdang, Selangor. 10 –11 November 1998.

Mohd, S. H. O., & Samah, A. K. A. (2010). *Prosiding Persidangan Kebangsaan Penilaian Ekonomi Sumber Hutan*. University Putra Malaysia, pp. 231-249.

Muhamad Z. & Mustafa A.M (1994*). Traditional Malay Medicinal Plants*. Penerbit Fajar Bakti

Nareh, J. (2008). *Valuing the annual utilization of wild plants for food and medicinal use in community owned forest*. Unpublished Bachelor of Science Final Year Project, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak. pp. 110

Ng L.T. & Mohd Azmi M.I. (1997). *Trade in medicinal and aromatic plants in Malaysia (1986–1996)*. FRIM Reports. Kuala Lumpur.

Noweg, G. T. (2004). Socioeconomic assessment of communities surrounding the limestone forests in Bau District. *Sarawak Musuem Journal 80*(6), pp. 25-39.

Noweg, G. T., Shebli, Z., & Schrevel, A. (2004). *Socio-economic study of the population in the vicinity of Maludam National Park, Betong Division, Sarawak*. Forest Department Sarawak, ALTERA, and Sarawak Forestry Corporation, 115 pp.

Noweg, G. T., Razip, M., Tipot, E., & Liam, J. (2005). Medicinal plants of Loagan Bunut National Park. In Tuen, A. A., Sayok, A. K., Efransjah, E., & Noweg, G. T. (Eds.), *Scientific Journey Through Borneo: Loagan Bunut.* (pp. 202-207). Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, Kota Samarahan and UNDP-GEF Peatswamp Project, Forest Research Institute of Malaysia, Selangor.

Noweg, G. T., Razip, A. M., Tipot, E., & Liam. (2006). Medicinal plants of Loagan Bunut National Park, Sarawak. In Tuen, A. A., Sayok, A. K., Toh, A. N., & Noweg, G. T. (Eds.) *Scientific Journey Through Borneo: Loagan Bunut, PSF Technical Series No. 5*, Sarawak Forest Department and Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, pp 202-207.

Noweg, G. T., & Songan, P. (2009). Ethnobotanical resources in peat land forests in Kabong, sub-district of Roban, Sarawak, Malaysia. In Ainsworth, G., & Garnett, S. (Eds.) *RIMBA: Sustainable forest livelihoods in Malaysia and Australia*, pp. 35-46. Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia.

Okhuarobo, A. 1. J. (2014). Harnessing the medicinal properties of Andrographis paniculata for diseases and beyond: a review of its phytochemistry and pharmacology. *Asian Pacific Journal Tropical Diseases*, pp. 213-222.

Pak, M., Türker, M. F., & Öztürk, A. (2010). Total economic value of forest resources in Turkey. *African Journal of Agricultural Research, 5*(15), pp 1908-1916.

Pang, Y. D. W. (2014). Blumea balsamifera - A Phytochemical and. *Molecules*, pp 9453-947.

Parry, R.L. (2001). Bio-*Pirates Raid Trees in Swamps of Borneo,* obtained from http://news. Independent.co.uk/uk/environment/story.

Pearce KG (2006). *The flora of Pulong Tau National Park. ITTO Project PD 224/03 Rev.1 (F) Transboundary biodiversity conservation-The Pulong Tau National Park, Sarawak, Malaysia*. Yokohama: International Timber Organisation, Malaysia: Japan & Sarawak Forest Department.

Prescott-Allen, R. L. C. (1982). *What's Wildlife Worth?* Earthscan, London.

Principe, Peter P. (1989). *The Economic Significance of Plants and their Constituents as Drugs.* In Wagner, H., Hikino, Hiroshi & Farsworth, Norman. R (eds.), Economic and Medicinal Plant Research, Vol 3, Academic Press Limited.

Rainforest Conservation Fund (2015). *Case Study in tropical Deforestation*, obtained from http:// www.rainforestconservation.org.

Sabariah, Z. (1989). Kajian Ethnobotany di Tiga Kampung, Daerah Sering, Kota Baru, Kelantan. In Soepadmo, E., Goh, S. H., Wong, W. H., Laily, D., & Chuah, C. H. (Eds.), *Proceedings of a Seminar on Malaysia Traditional Medicine, 10-11 June, 1988*. Institute of Advanced Studies, Malaysian Institute of Chemistry, Kuala Lumpur.

Sarawak Map obtained from http://www.malaysia-maps.com.

Sayok, A. K, Noweg, G.T & Pahon, I.W (2014). *Jagoi Heritage- A Peek at the Ancestral Sites, Forest and Community.* Universiti Malaysia Sarawak (UNIMAS) in collaboration with Jagoi Area Development Committee (JADC).

Sekaran, U. (2005). *Research Methods for Business: A Skill-building Approach (4th edition).* New York: John Wiley & Sons.

Shackleton, S., Campbell, B., Wollenberg, E., & Edmunds, D. (2002). *Devolution and community-based natural resource management: creating space for local people to participate and benefit?*. London, UK: Overseas Development Institute.

Siegert, F. , Ruecker, G., Hinriches, A & Hoffmann, A.A (2001*). Increased Damage from Fires in Logged Forests during Droughts caused by El Nino.* Nature 414, pp. 437-40.

Soepadmo, E. (1991). *Conservation Status of Medicinal Plants in Peninsular Malaysia. Proceeding of the Medicinal Products from Tropical rain forest Conference*, 13-15 May 1991, FRIM, Kuala Lumpur, Malaysia.

Soepadmo, E. (1992). *Conservation Status of Medicinal Plants in Peninsular Malaysia. In* Shaari K, Kadir A.A & Mohd. Ali A.R, (Eds.). Medicinal Products from Tropical Rain Forests, FRIM, Kuala Lumpur, Malaysia, pp.13−23.

Soepadmo, E & Wong, KM (1995). *Tree Flora of Sabah and Sarawak Volume 1*. FRIM, Kuala Lumpur, Malaysia.

Soepadmo, E. Saw, L. G. Chung, R. C. K. (2002). *Tree flora of Sabah and Sarawak, vol. 4* Ampang Press Sdn. Bhd., Kuala Lumpur, Malaysia.

Taylor, L. M. C. (2012). Graviola (Annona muricata). *Tropical Plant Database* .

Teik, N. L., & Idris, M. (1997). Trade in medicinal and aromatic plants in Malaysia. *Forest Research Institute of Malaysia Report*, pp 71.

The Sarawak Government Gazette (Part II), (2010). The Sarawak Biodiversity Centre Ordinance, 1997. *The Sarawak Biodiversity (Declaration of Protected Resources) Notification.*

Tipot, E., J. Liam and A. K. Sayok. (2004). *Tumbuhan ubatan di Taman Negara Loagan Bunut.* pp. 91.

Trivedi, P. C. (2006). *Medicinal plants: traditional knowledge*. IK International Pvt Ltd.

United Nations, Article 31 (2008). *United Nations Declaration on the Rights of Indigenous People,* pp. 11. United Nations.

Warner, M. & Jones, P. (1998). *Assessing the need to manage conflict in community-based natural resource projects.* Natural Resource Perspectives. Overseas Development Institute.

Whitmore, T. C. (1975). *Tropical Rain Forests of the Far East*. Clarendon Press, Oxford and London.

World Health Organization. (2000). *Medicines Strategy: Framework for Action in Essential Drugs and Medicines Policy - 2000 - 2003*, pp. 81.

World Health Organization. (2002). *Traditional Medicines Strategy 2002-2005*. World Health Organization, Geneva, Switzerland.

World Health Organization. (2005). *WHO Global Atlas of Traditional, complementary and alternative medicine*. World Health Organization.

World Health Organization (WHO), (2008). *Policy Perspective on Medicine. Traditional Medicine: Growing Needs and Potential.* World Health Organization.

World Health Organization (WHO), (2013). *Traditional Medicine Strategy 2014-2023*. World Health Organization.

Plate 1: *Agrostistachys longifolia* Benth (Bajau-Bid.)
Usage: relief tooth ache

Plate 2: *Andrographis paniculata* Nees. (Pudun tanak-Bid.)
Usage: relief fever and reduce hypertension pressure

Plate 3: *Baccaurea bracteata* Mull. Arg. (Tijirak-Bid.)
Usage: treat scabies

Plate 4: *Elephantopus scaber* Linn. (Pudun bumi-Bid.)
Usage: reduce body temperature and hypertension pressure

Plate 5: *Leucosyke capitellata* Wedd. (Kerangan-Bid.)
Usage: lower the high body temperature

Plate 6: *Lindera lucida* Boerl. (Pola-Bid.)
Usage: insect repellant

Plate 7: *Melastoma malabathricum* L. (Rusak-Bid.)
Usage: to stop bleeding

Plate 8: *Scoparia dulcis* L. (Duh kelamu-Bid.)
Usage: to treat sore throat

Plate 9: *Spatholobus ferrugineus* Benth. (Tibodu-Bid.)
Usage: treat gastric

Plate 10: *Uncaria gambier* Roxb. (Gomier-Bid.)
Usage: for numb and body massage