

# Faculty of Resource Science and Technology

Diversity of medicinal plants in different forest types at Bukit Tramuo Heritage Reserve, Bau

Selvana Eyra Felix (71501)

Bachelor of Science with Honours (Plant Resource Science & Management) 2022

# Diversity of medicinal plants in different forest types at Bukit Tramuo Heritage Reserve, Bau

Selvana Eyra Felix

A thesis submitted in partial fulfilment of the Requirement of The Degree Bachelor of Science with Honours (Plant Resource Science & Management)

Supervisor: Professor Dr. Tonga Anak Noweg

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Tandatangan Penyelia

(Nama & Cop rasmi) Prof Dr Gabriel Tonga Noweg Principal Fellow institute of Biodiversity and Environmental Conservation INT/ERSITI MALAYSIA SARAWAK

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# Diversity of medicinal plants in different forest types at Bukit Tramuo Heritage Reserve, Bau

Selvana Eyra Felix

# Faculty of Resource Science and Technology University Malaysia Sarawak

#### ABSTRACT

Medicinal plants are plants that contain medical properties in one or more of their organs. Medicinal plants are used in both traditional and modern healing. Although medicinal plants are the oldest form of medicine, there is less documentation about the medicinal plants as they are passed down through generations informally. This study was carried out in two different forest types, which are primary forest and secondary forest. Data analyzed established medicinal plant distribution and plant diversity along with the medicinal usage, parts used, treatment, and preparation methods. There were 18 species of medicinal plants from 9 families recorded from both forest types. The diversity index (H=) of medicinal plants in the primary forest was 1.8890 and the diversity index (H=) of medicinal plants in the secondary forest was 1.4844. The independent T-test results show no significant difference between the diversity index of medicinal plants in secondary and primary forests. Even so, both forests consist of valuable medicinal plants and should be preserved.

Keywords: Medicinal plant; primary forest; secondary forest; distribution; diversity

#### ABSTRAK

Tumbuhan ubatan ialah tumbuhan yang mengandungi khasiat perubatan dalam satu atau lebih organnya. Tumbuhan ubatan digunakan dalam kedua-dua penyembuhan tradisional dan moden. Dokumentasi mengenai tumbuhan ubatan adalah kurang walaupun tumbuhan ubatan merupakan sumber perubatan yang terawal di dunia. Hal ini kerana, ilmu tentang pengunaan tumbuhan ubatan diturunkan secara tidak formal dari generasi ke generasi seterusnya. Kajian ini dijalankan di dalam dua jenis hutan yang berbeza iaitu hutan primer dan hutan sekunder. Analisis data tentang taburan dan kepelbagaian tumbuhan hutan dilakukan beserta dengan pengunaan tumbuhan ubatan, bahagian tumbuhan yang digunakan untuk rawatan, jenis rawatan dan akedah penyediaan. Terdapat 18 spesies tumbuhan ubatan daripada 9 famili direkodkan daripada kedua-dua jenis hutan. Indeks kepelbagaian (H=) tumbuhan ubatan di hutan primer ialah 1.8890 dan indeks kepelbagaian (H=) tumbuhan ubatan di hutan sekunder ialah 1.4844. Keputusan ujian-T bebas menunjukkan tidak terdapat perbezaan yang signifikan antara indeks kepelbagaian tumbuhan ubatan di hutan sekunder dan hutan primer. Walaupun begitu, kedua-dua hutan terdiri daripada tumbuhan ubatan yang berharga dan harus dipelihara

Kata kunci: Tumbuhan ubatan; hutan primer; hutan sekunder; taburan; kepelbagaian

# TABLE OF CONTENTS

ABSTRACTVII
LIST OF FIGURES
LIST OF TABLES
CHAPTER 11
INTRODUCTION
CHAPTER 24
LITERATURE REVIEW
2.1 Primary Forest Habitat
2.2 Secondary Forest Habitat
2.3 Bidayuh community in Kampung Stass, Bau5
2.4 Traditional use of plants in medicine
2.5 Medicinal plants in modern medicine
2.6 Importance of understanding medicinal plants
2.7 Sources of Medicinal Plants in Malaysia9
2.8 Community use of medicinal plants9
2.9 Economics of medicinal plant use in Malaysian rural communities11
CHAPTER 3
METHODOLOGY
3.1 Study Area12
3.2 Sampling Methods
Data collection was carried out in two phases. The first phase consists of meetings with villagers and village leadership (JKKK, village elders, and so on). The second step is to count the number of plots in the forests of Bukit Tramuo (Stass Nature Heritage Park)
3.2.1 Community meeting
3.2.2 Forest sampling
3.3 Data Processing and Analysis
3.3.1 Data recording and processing
3.3.2 Plant Identification
3.4 Data Analysis
3.4.1 Species Diversity16
3.4.2 Independent T-test
CHAPTER 4
RESULTS

4.1 Species Distribution	
4.2 Species Diversity	24
4.3 Comparison of Diversity between Primary and Secondary Forests	26
DISCUSSIONS	27
4.4 Medicinal plants species and families	27
4.5 Species diversity	29
CHAPTER 5	30
CONCLUSION	30
REFERRENCES	31
APPENDICES	

# LIST OF FIGURES

Figure 1 : Study site (STASS Nature Heritage Park, Bau)	12
Figure 2 : Sampling plot design	. 14

# LIST OF TABLES

Table 1 : Medicinal plants found in primary forest, by local name, scientific name, family, num	ber
of individuals, habitat types, medicinal usage and parts used	19
Table 2 : Medicinal plants found in secondary forest, by local name, scientific name, family,	
number of individuals, habitat types, medicinal usage and parts used	20
Table 3 : Medicinal plants categorized based on their usage, local name, scientific name and       Image: scientific name and	
number of individual presented in each forest type	21
Table 4 : Medicinal plants listed based on their family name, local name, scientific name and       Image: scientific name and	
number of individuals found in each forest type	23
Table 5 : Diversity index for primary forest	24
Table 6 : Diversity index for secondary forest	25
Table 7 : Independent T-test for primary and secondary forest	26

#### **CHAPTER 1**

#### **INTRODUCTION**

Malaysia is rich and diverse with flora containing many valuable plants, such as medicinal plants. Medicinal plants are all plants that contain in one or more of their organs substances that can be useful for therapeutic purposes or that are precursors for the synthesis of useful drugs (Sofowora et al., 2013). They are the oldest form of medicine, used in traditional medicine in many countries around the world for thousands of years as they were the only treatment option in those times.

In this era of modernization, many structural developments have taken place, especially in rural areas. These rapid changes have resulted in large areas of forest being used for other purposes. Despite these changes and the orientation towards modern forms of livelihood, there are many households that continue to earn a living according to their way of life, such as the Bidayuh communities in Bau, Sarawak. They still rely on the forest for foraging and gathering non-timber forest products. Other than that, some community members still rely on traditional medicinal plants as a source of healing.

Previous study by Nareh (2008)) found that the use of ethnobotanical resources in the Jagoi area indicates that a significant portion of households in local communities in the Bau district are quite dependant on wild plants for medicine. The Jagoi Area Development Committee (JADC) also reported that the Jagoi Bidayuh, primarily in Kampung Duyoh and Kampung Jagoi Gunung, are protecting their communal forest for this specific purpose (Sayok et al., 2015).

Empirical knowledge of the beneficial effects of medicinal plants has been passed down within human communities over the centuries (Marrelli, 2021). However, the transmission of knowledge to younger generations is poor as the information is passed on informally

from the elders. Therefore, there is less documentation about the medicinal plants, which is important as they could become an alternative in curing diseases and diseases or used by people in their daily life.

In addition, the changes in the landscape due to development made access to the dissemination of medicinal plants present in the area difficult. Furthermore, most medicinal plant species are not cultivated but collected wild (Ong et al., 2011). Moreover, the distribution of medicinal plants in the world is not uniform, and the diversity and variation of medicinal plants in a forest is influenced by abiotic and biotic factors.

Therefore, this study focuses on the diversity of medicinal plants in different forest types, namely the primary forest and the secondary forest, in the study area of Bukit Tramuo, Bau. Primary forest is a forest that is slightly disturbed by human disturbance over a long period of time, while secondary forest is the regrowth of forest after natural or human activities in the native forest.

The objective of this study is to assess the distribution and calculate the diversity index of medicinal plants in different forest types and, to compare the diversity index of medicinal plants in different forest types. It is expected that the diversity index in primary forest is higher than in secondary forest as primary forest receives less disturbance from human activity.

Through this study, the empirical knowledge about the benefits and proper use of medicinal plants as well as the distribution and variation of medicinal plants between different forest types can be appropriately documented. This documented information can be used in an orderly manner by future generations, and to help villagers have proper documentation of the richness, diversity, and abundance of medicinal plant resources in Bukit Tramuo, Bau. In addition, the Kampung Stass Development and Security Council

(JKKK), which is keen on preserving its ethnobotanical resources, said that this information is crucial for the development of a management plan for the Bukit Tramuo Natural Heritage site.

During this study, some limitations occurred incidentally. There were a limited number of experienced local people involved during data collection, so plant identification was limited. Finally, this study required more time and a larger plot size for detailed information.

#### **CHAPTER 2**

### LITERATURE REVIEW

#### 2.1 Primary Forest Habitat

Primary forests are forests of native tree species where there is no clearly visible evidence of human activity and where ecological processes are not significantly disturbed. This type of forest also has the greatest biological diversity (Butler, 2012). This forest has a full canopy and multiple layers of undergrowth that let very little light through, and the ground floor is generally free of heavy vegetation.

International Union for Conservation of Nature (IUCN, 2020) mentioned that primary forests are important as they protect cultural and linguistic diversity, and they are fundamental to the livelihood of local people as they are often the usual home of indigenous people. In addition, primary forests offer a variety of ecosystem services, such as the protection of most of the carbon and biodiversity, producing clean fresh water, regulating the flow of water, having a locally cooling effect, and preventing erosion.

#### 2.2 Secondary Forest Habitat

Secondary forests are forests that, regenerate on native forests that have been cleared by natural disasters or man-made causes such as agriculture or ranching. Rejuvenation occurs largely through natural processes at some point in time or over a period and which show a large difference in forest structure and/or canopy species composition compared to pristine primary forests (Liss et al., 2003). Secondary forests can slowly return to the original type in the absence of recurrent disturbances such as grazing, tree felling, and frequent fires. However, the rate depends on the frequency and intensity of the disorder and the availability of seed parents.

Secondary forests offer a variety of products and services that can help alleviate poverty, improve socio-economic conditions especially in rural areas, protect water catchment areas, combat runoff and erosion, and extract commercially valued timber and Non-wood Forest Product (Liss et al., 2003). In addition, secondary forests, can reduce pressure on the remaining primary forest, effectively conserving biodiversity, and genetic resources when managed properly.

# 2.3 Bidayuh community in Kampung Stass, Bau.

Bidayuh is one of the two largest ethnic groups within the Dayak society in Sarawak (Minority Rights Group International, 2018). Dayaks are the non-Muslim indigenous communities take make up 40% of Sarawak's population.

Bidayuh communities constitute the majority in the Bau district. However other communities such as Chinese, Malay, and Iban also remained in the area along with Bidayuh Bau. Bau is situated within Kuching Division. It is an inland district about 35 km by road from Kuching and has an area of 884.40 square km (Bau Town, n.d.).

According to Chang (2002), the Jagoi Bratak tribe arrived in Bung Bratak around 750 years ago after migrating from Mount Sungkong in West Kalimantan, Indonesia. Bung Jagoi was the area's first Bidayuh village. As the population grows and more farmland is needed, many families relocate to the surrounding foothills, eventually forming eight villages known as Bogag, Duyoh, Serikin, Sriieng, Serasot, Sebobog, Stass, and Skibang. The Bidayuh communities in this area were descended from Bung Jagoi, who was known as Bijagoi.

Nowadays, the people in Bau are still staying in the village. However, this does not mean that they still live in undeveloped areas. There is good infrastructure and facilities provided for their people's needs, which makes the area more developed than in the past. The Bidayuh community in Bau also received higher education and has extensive knowledge. With all the uniqueness and traditional practices of the old generation, all the knowledge learned will be contributed to the new generation. Old people have the expertise to identify plants used in daily life, whether for food or medicinal.

# 2.4 Traditional use of plants in medicine

Plants are sources of early food and medicine for humans. Certain parts of the plants may be eaten and could be used as medicine to treat injuries, diseases, and infections. Fasihuddin and Din (1999) listed medicinal plants used by various ethnic groups in Sarawak. They also recorded the medicinal uses, parts used, and the preparation guidance. The data was obtained through interviews of respondents from each village. There were 18 plant families listed, namely Acanthaceae, Annonaceae, Blechnaceae, Convolvulaceae, Cyperaceae, Euphorbiaceae, Labiate, Lauraceae, Leguminosae, Menispermaceae, Moraceae, Myrtaceae, Piperaceae, Polygalaceae, Rubiaceae, Schizaeaceae, Simaroubaceae, and Zingiberaceae.

The medicinal uses of plants listed by Fasihuddin and Din (1999) are to treat skin diseases, hypertension, diabetes, done fractures, sprains, backaches, stomachaches, fever, diarrhoea, food poisoning, cuts and wounds, poisonous caterpillar stings, rashes, cough, asthma, ringworms, jaundice, snake bites, dysentery, rheumatism, general malaises and are also used as tonics, poison antidote, and postpartum aids.

The parts used in each plant are different. Some plants are used whole, while others only use the roots, tubers, stems, leaves, young leaves, or fruits. Each medicine is also prepared differently; some must be burned before being pounded and applied to the infected area, others must be boiled for drinking, and still others can be taken orally (Fasihudin & Din, 1999).

# 2.5 Medicinal plants in modern medicine

Other than traditional use, medicinal plants also play an important role in modern medicine. Medicinal plants contribute to the development of potent therapeutic agents (Verma & Singh, 2008). Most of the information was originally discovered through the study of traditional remedies in the folk knowledge of indigenous peoples, and some could not be replaced despite the tremendous advances in synthetic chemistry (Gilani, 2005).

Examples of early drugs derived from plants are Aspirin which derived from the willow bark, Digoxin derived from Foxglove, Morphine derived from Opium poppy, Quinine derived from Cinchona skin and Pilocarpine derived from Maranham Jaborandi (Jamshidi-Kia et al., 2018). These drugs are used to cure mental illness, skin diseases, tuberculosis, diabetes, jaundice, hypertension, and cancer.

Another study by Gilani (2012), mentioned that medicinal plants have successfully contributed to cardiovascular research; firstly, with the discovery of digitalis and cardiac glycoside derived from foxglove, *Digitalis purpurea*; and secondly, with the isolation of reserpine. Digitalis and cardiac glycoside produce a positive inotropic effect on failing heart, which basically helps the heart pump more blood with fewer heartbeats. Other than that, they are valued in the treatment of atrial fibrillation, which is a heart condition that generate irregular and rapid heart rate. Gilani (2012) stated that digitalis and cardiac glycosides are the most toxic groups of clinically used drugs, but they have a unique mode of selection with selective cardiac activity, with no accompanying tachycardia.

#### 2.6 Importance of understanding medicinal plants

In this era of modernization, modern medicine may be the first choice for treating illness. Nevertheless, in Sarawak, a large majority of rural communities still depend on medicinal plants to treat a variety of ailments, mainly due to two factors. First, prescription drug prices are often beyond their financial reach unless they visit government hospitals and clinics. Secondly, due to the distance they must travel to visit even the nearest government hospitals and clinics, rural dwellers may abandon such plans and seek remedies from plants that can be gathered in forests or fields near their settlements (Lee, 2004). Therefore, it is important to understand medicinal plants as it serves as it could be used in a state of emergency when we are far from any hospital or clinic or when we are financially unable to afford medications from a pharmacy.

A seminal study by Jamshidi-Kia et al. (2018) found that plant-derived compounds can dramatically improve difficult-to-treat diseases like cancer. To date, more than 64 plants have been found to have significant antibacterial properties, and more than 24 plants have anti-diabetic properties (Verma & Singh, 2008).

According to the World Health Organization (WHO), currently more than 80% of the world's population relies more often on traditional drugs, mainly plants, as the main source of health care (Jamshidi-Kia et al., 2018). In 1992, Zargari reported that the importance of medicinal plants and their products is increasingly recognized and the public's trust in their use is constantly being strengthened, as some of the medicinal products of this origin and specially developed in laboratories cause certain damage to the body. Rasool Hassan (2012) , who did another important study, believe that the toxicity and side effects of conventional and allopathic drugs have also played a big role in the sudden rise in the population's demand for herbal drugs, the rise in the number of herbal drug manufacturers, and the drop in the use of chemical drugs.

Therefore, it is important to understand the use of medicinal plants as they are becoming more and more valuable, economically and clinically.

#### 2.7 Sources of Medicinal Plants in Malaysia

Medicinal plants are rarely cultivated and mostly found in the wild. However, not all medicinal plants can be found in one place. They existed based on the land's suitability. For example, *Nephenthes sp.* shows a low index of occurrence in the burned area of Klias Forest Reserve, which have peat swamp soil with pH 3.66 - 3.56 (Kodoh et al., 2010). This is because the area was not suitable for *Nephenthes sp.* growth. It usually lives in moist and shaded areas. Meanwhile, the burned area of the forests shows an abundance of *Stenochlaena palutris*, which could be usually found in peat swamps, open areas, and soil with rich sulphate acid (Rukayah, 2006; Kodoh et al., 2010).

Based on Baling et al. (2017) survey on wild medicinal plants along both trails from Duyoh village and Serasot Village to the summit of Mount Jagoi, only 55% of medicinal plant species are found in the wild. More than 31% were found in the nearby open spaces and in the immediate vicinity of the garden, which are easily accessible. These include *Passiflora foetida*, *Nephrolepsis biserrate*, *Melastoma malabatrichum*, *Dillenia suffruticosa*, *Ploiarium alternifolium*, and *Cassia alata*. The remaining 45% were raised by the local community in various locations such as flowerpots especially the non-native species such as Aloe vera.

### 2.8 Community use of medicinal plants

There are a summarized number of medicinal plant specimens which are recorded and collected from various communities in Sarawak; the Chinese have 57 species,

Malay/Melanau has 213 species, Bidayuh/Selakau has 266 species, Iban has 297 species, and Orang Ulu has 387 species of medicinal plant (Lee, 2004).

*Acanthus ebracteatus* is used to treat skin disease by pounding the fruits and applying the paste to the infected area (Fasihuddin & Din, 1999). *Andrographis paniculata*, known as Akar cerita by the Malays and Hempedu bumi by the Kadayan ethnics, is used to cure hypertension, diabetes, and used as tonic for heart problems by boiling the leaves and consuming them as tea. On the other hand, *Blumea balsamifera*, which is known as Sisuoh by the Bidayuh has many ways to be used to treat different types of medical problems. The leaves of Sisuoh could treat fever and dizziness by boiling the leaves and applying the mas tea. It can also be used to treat wounds and cuts by pounding the leaves and applying the paste to the affected area. Lastly, it can be used as a postpartum aid for mothers by boiling the leaves and using the boiled water for bathing.

The list recorded by Fasihuddin and Din (1999) also stated that *Mapania cuspidate*, known as Daun sangkor among Iban people, is used to treat poisonous caterpillar stings by applying the burned leaves or roots, mixed with coconut oil to the affected area. Furthermore, the decoction of roots of *Mapania petioata*, which the Kadayan people call Penawar Fatimah, can be used as a poison antidote.

The list goes on with *Ficus crassiramea*, or called Kara Kajang by the Iban community, which could be used to treat snake bites by pounding the leaves of the plant and pasting them on the affected area (Fasihuddin & Din, 1999). They also mentioned *Fibraruea tinctorial*, which is known as Akar Badi by the Iban and Malay communities. The roots of Akar Badi are boiled for drinking to cure food poisoning. Meanwhile, *Lygodium sancdens* and *Eugenia paradixa* are used to cure diarrhoea. For *L. sancdens*, the whole plant is used

by boiling, and the boiled concoction is drunk. However, for *E. paradixa*, only the leaves are boiled and drunk.

#### 2.9 Economics of medicinal plant use in Malaysian rural communities

The rural people gather medicinal plants for personal use and sell them in rural and urban markets. An interview was conducted by Ripen and Noweg (2016) with the sellers of plants and herbal products that operate outside of the weekend market system. From the interview, the values of non-marketable resources were estimated based on the replacement value and the opportunity cost approach. The estimated total annual value of traditional medicinal herb treatments for the sample was RM 1,040.00, an average of only RM 12.83. At the informed level of participation or involvement, the projected annual value of traditional medicinal medicinal herbs for the entire Jagoi community is RM 32,286.85 (Ripen & Noweg, 2016).

Noweg (2004) and Noweg et al. (2004) stated that the annual value per family of the ethnobotanical resources used by the communities around the limestone forests in Bau District in 2004 and Maludam National Park in Betong Division in 2004 was estimated at RM 60 and RM 50, respectively.

# **CHAPTER 3**

# METHODOLOGY

# 3.1 Study Area

STASS Nature Heritage Park, Bau, Sarawak was previously known as Bukit Tramuo and is located in Kampung Stass, Bau. Bukit Tramuo is located about 40km by road from Kuching town and is surrounded by forest and hilly terrain.



Figure 1: Study site (STASS Nature Heritage Park, Bau)

The Nature Heritage Park consists of a small hill called Bukit Tramuo (Refer Figure 1), partly in primary forest and partly in old secondary forest. It has an area of about 20 hectares and is surrounded by community farmlands, community fruit forests, and individual farmers' cash crops. The Park was established as a recreation and heritage area in 2005 when the Kampung Stass community decided to conserve the remaining forested land for conservation and recreation purposes.

The majority of the people in this community are Jagoi Bidayuh. The villagers are mixed in terms of livelihood. Although most of the older members of the households are considered farmers, the younger household members are taking up other jobs in the public and private sectors. Their proximity to town centres (Bau and Kuching) allows villagers to commute daily to work in Bau and Kuching. Their attachment to the use of natural resources, including traditional medicine from plants, remains strong. This information was related to the researcher during a meeting with the villagers. The study has been conducted in both primary forest and secondary forest in Bukit Tramuo.

#### **3.2 Sampling Methods**

Data collection was carried out in two phases. The first phase consists of meetings with villagers and village leadership (JKKK, village elders, and so on). The second step is to count the number of plots in the forests of Bukit Tramuo (Stass Nature Heritage Park).

# **3.2.1** Community meeting

The purpose of the community meeting was to assess the state of use of ethnobotanical resources (food plants and medicinal plants) in the community informally. The Kampung Stass village leadership (Headmen and their committees) were the primary targets. Separate meetings were held with the farmers, the women's group, and the youth. Information from the interviews was used as basic knowledge of the level of use of traditional medicinal plants, the section of the community most involved, and the state of the existing or remaining resources.

## **3.2.2** Forest sampling

Field sampling was carried out to gather data on the distribution and diversity of medicinal plants. The study areas include both primary and secondary forests. A systematic sampling technique was used to collect the data. Systematic sampling was used to ensure a good representation of the medicinal plants sampled in the two forest types. The collected data