



Faculty of Resource Science and Technology

**DIVERSITY OF FOOD PLANTS IN DIFFERENT FOREST TYPES AT BUKIT  
TRAMUO HERITAGE RESERVE, BAU, SARAWAK.**

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

**DIVERSITY OF FOOD PLANT IN DIFFERENT FOREST TYPES AT BUKIT  
TRAMUO HERITAGE RESERVE, BAU, SARAWAK**

Flora Anak Bah

A thesis submitted In fulfilment of the Requirements for The Degree of Bachelor of  
Science with Honours  
(Plant Resources Science and Management)

**Supervisor: Professor Dr Gabriel Tonga Noweg**

Programme of Plant Resource Science and Management  
Faculty of Resource Science and Technology  
UNIVERSITI MALAYSIA SARAWAK  
2022

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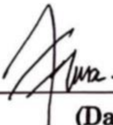
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# Diversity of food plants in different forest types at Bukit Tramuo Heritage Reserve, Bau, Sarawak

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## Abstract

Sarawak's tropical rainforest have many plant species and this makes the tropical forests are home to many numerous species. Bau's rural residents have long used plants as food and medicine. Rural people use the forest for food and medicine. This study aims to identify the food plant diversity in primary and secondary forests in Bukit Tramuo, Bau. This study used systematic line sampling with 10 m x 10 m plots. Data sampling was used to determine species diversity using the Shannon's Index. This study includes species density, relative frequency, important value, ratio, and diversity index to determine abundant species for two forest types. SPSS is used to compare primary and secondary forest species diversity. 508 people live on 16 two-type forest parcels. The secondary forest has 409 individuals, the most. The primary woodland had 99 food plants. Tibodak/Cempedak *Artocarpus integer* has 19 individuals and Sibilai *Plagiostachys sp* has 88.

Keywords: Food and medicinal plant, diversity species, primary and secondary forest

## Abstrak

Hutan hujan tropika Sarawak mempunyai kepelbagaian spesies tumbuhan dan ini menjadikan hutan tropika sebagai rumah kepada banyak jenis spesies. Penduduk luar bandar Bau telah lama menggunakan tumbuhan sebagai makanan dan ubatan. Penduduk luar bandar menggunakan hutan untuk makanan dan ubat. Kajian ini bertujuan untuk mengenal pasti kepelbagaian tumbuhan makanan di hutan primer dan sekunder di Bukit Tramuo, Bau. Kajian ini menggunakan pensampelan garisan sistematik dengan petak 10 m x 10 m. Pensampelan data digunakan untuk menentukan kepelbagaian spesies menggunakan Indeks Shannon. Kajian ini merangkumi kepadatan spesies, kekerapan relatif, nilai penting, nisbah, dan indeks kepelbagaian untuk menentukan spesies yang banyak untuk dua jenis hutan. SPSS digunakan untuk membandingkan kepelbagaian spesies hutan primer dan sekunder. 508 jumlah individu di 16 petak hutan dua jenis. Hutan sekunder mempunyai 409 individu, paling banyak. Hutan utama mempunyai 99 tumbuhan makanan. Tibodak/Cempedak *Artocarpus integer* mempunyai 19 individu dan Sibilai *Plagiostachys sp* mempunyai 88 individu.

Kata kunci: Makanan dan tumbuhan ubatan, Kepelbagaian species, hutan primer dan sekunder

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## **List of Abbreviation**

NTFP - Non-timber forest product

WHO - World Health Organization

IARC - International Agency for Research on Cancer

JKKK - Village Development Council and Security Council

H – Shannon Diversity Index

Ha – Hectare

M – Meter

F/M – Food/ Medicinal

Rd – Relative Density

Rf – Relative frequency

SPSS – Statistical Package for the Social Science

Idv – Individual

## CHAPTER 1

### 1.1 Introduction

The rapid change in the economic landscape and physical development around the Bidayuh communities of Bau, has resulted in vast areas of forest land being converted to other land uses. Despite these changes and their orientation to modern forms of livelihood strategies, there are many households who remain subsistence in their way of life. They are still depending on the forest for collection of non-timber forest products, hunting and fishing.

It is known that the Malaysian forests are rich in biodiversity, especially that of plants. Plant diversity is the number of plants or groups of plants that are found in the forest, normally in one ecosystem type. Diversity varies according to the type of ecosystem, as determined by other biotic and climatic factors. In Sarawak the natural forest has high plant diversity due to the great variety of habitats and ecosystems.

Natural forests in Sarawak are rich in valuable plants. Many of these plants are valuable ethnobotanical resources as they can be used for food and medicinal purposes. However, the majority of traditional knowledge on the use of food plants has been passed down orally from previous generations. Much of this knowledges is embedded in their culture, and is without any proper documentation by past generations who practiced these traditional skills.

In this study, the important forest resources traditionally used for food will be properly documented. The purposed study site (Bukit Tramuo) is a community Nature Reserve which has two distinct forest types: primary and secondary forests. In relation to this study topic, past documentation of wild food plants in Sarawak has been made by Kueh (2003) and similar documentation for medicinal plants was made by Chai (2006). These documentations, however, focused mostly on the Iban communities, as they are the largest

ethnic group in Sarawak. It is also recognized that each native ethnic community has their own specific use of wild plant species. The same plant species may be used quite differently in another community. For a better understanding of these resources, it is important that the diversity in use be recorded and properly documented for future references.

The types of food plants found in the primary forest are also different than those found in the secondary forests. Secondary forests, especially in Sarawak, are often of different ages as they are likely to have been farmed in the past. The Diversity of plants is also expected to vary according to the age of the secondary forest and primary forest.

## **1.2 Problem statement**

Wild plants are commonly sought as supplementary food sources in rural communities. For the proposed study site (Bukit Tramuo, Bau), it is observed that most of the Bidayuh people in the area is very familiar with wild plants used for food. Proper documentation of these plants, however, has not been made by the local village community. It is also observed that the Bukit Tramou has been conserved by the Village Development and Security Council (JKKK), as their nature reserve. The Village Development Council and Security Council (JKKK) are in the process of developing a plan to manage the area for ecotourism purposes. It is also for this reason that the required important information on the availability, abundance and diversity of all the food plants by forest types.

### **1.3 Objectives**

This project's goal is to assess the pattern of community use of food plants from the forest. The objectives are: a. to collect and analyze data on the relative density, relative frequency, and diversity of food resources in primary and secondary forests; b. to determine the types of food resources that are available in both types of forests; and c. to compare the diversity and distribution of food resources in primary and secondary forests. This study focused on food resources based on recorded traditional knowledge from within the Bidayuh Stass Bau community, as well as the responsible and sustainable use of food resources. This investigation was conceived in response to a paucity of information regarding the variety of edible plants that can be discovered in different kinds of forests. In addition, several ecological factors influence the various types of plant species that are found in forests. Therefore, statistics and information on the diversity of food plant resources in various types of forest are essential to the rural community to raise public awareness about the value of forest resources and to recommend food resource gathering in a sustainable manner. This can be accomplished by recommending that people gather food resources in a manner that is environmentally friendly.



## **CHAPTER 2**

### **Literature Review**

#### **2.1 Tropical Rain Forests**

The tropical rainforest is known as the most productive forest that is rich in biodiversity of flora and fauna. According to Gardner et al. (2009), tropical forest ecosystems host at least two thirds of the Earth's terrestrial biodiversity and provide significant local, regional, and global human benefits through the provision of economic goods and ecosystem services. Forests are indispensable to most wildlife and habitat species, and they all depend on healthy forest ecosystems. According to (Cambridge University Press, 1991), in terms of human existence, the tropical rainforest represents a store of renewable natural resources, which for eons by virtue of their richness in both animal and plant species, contribute a myriad of items for the survival and well-being of man. These include basic food supplies, clothing, shelter, fuel, spices, industrial raw materials, and medicine. Most importantly, they play a crucial role in climate change, both as a cause and as part of the potential solution (McMahon, 2014). It is an accepted fact that the tropical rainforest is the richest biome on earth. It is also an accepted fact that the tropical rainforest still represents one of the last and true great frontiers of wilderness, which still evokes awe and wonderment (Cambridge University Press, 1991).

## **2.2 Bidayuh community in Kampung Stass, Bau**

Based on the Department of Statistics Malaysia (2020), Sarawak has a 2.9 million total population with approximately 30 different ethnic groups and is divided into 40 sub-ethnic groups. In Sarawak, the Dayak communities have the biggest ethnic group, with 62.8% of the population. Bidayuh is known as the fourth largest ethnic group in Land Dayak communities, after Ibans, Malays, and Chinese. However, according to Noweg et al. (2014), the Bidayuh communities known as the third largest indigenous community in Sarawak, behind the Iban and Malay. The bidayuh community is mostly found in Kuching and Serian division.

The Bau district covers an area of about 884.4 square kilometers and has a population of about 62,200 people (Department of Statistics Malaysia, 2020). The bidayuh communities are the majority in Bau district. However, other communities like Chinese, Malays, and Iban also stayed in the area together with Bidayuh Bau. In a study by Chang (2002), there are currently 7,000 Bijagoi living in the nine villages, which are Bogag, Duyoh, Serikin, Sri'ieng, Serasot, Sebobog, Stass, Skibang, and Jagoi Gunong whereas there are around 10,000 more in Kalimantan, Indonesia. A long time ago, the Bidayuh community in this area were descendants of Bung Jagoi, called Bijagoi. The people in Bau still stay in the village even so, there are good infrastructure and facilities provided for their people need, which makes the area more developed than in the past. In fact, there are many Bidayuh Bau community have higher education and 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.

### **2.3 The importance of food plants**

Sarawak is part of a vast tropical rainforest covering an area of 8,700,000 hectares, which mainly contributes to the unique and bizarre plant diversity of Borneo (Muhd Arif Shaffiq et al., 2013). Many years ago, local people used some wild plants and fruits to serve as a source of food in their community. The food sources from the forest are used as supplements for food sources, in particular seasonal agricultural crops, and it can be used as emergency food supplies for the conditions of drought and war. Acquired knowledge passed from elders on wild plants has provided the local people with a wide selection of plants and fruits in their diets (Muhd Arif Shaffiq et al., 2013). The taste of the plants and fruits with many types of flavours (e.g., sour, bitter, sweet) is to determine the selection and mode of consumption or use. Other than providing a food source to the local community, food plants are also a source of income since some of the fruits are available in large quantities and are seasonally traded in local markets. Food plants can contribute to their uses in many various parts. Some of wild fruits have high amounts of vitamins and minerals, relatively lower amounts of carbohydrates and calories, and most importantly, they are free of any synthetic chemicals (Muhd Arif Shaffiq et al., 2013). Traditional knowledge on the nutrition properties of various species and varieties can provide good sources on a daily basis, and some wild fruits have a good source of free sugar in our diet.

## 2.4 Traditional Medicinal plants

Plants are commonly used as food in daily life, but plants are also used as traditional medicine for community people in Kampung Stass, Bau. For villagers, they believed some of the plants play important role for to keep healthy body. The community was very well acquainted with the plant uses that had been practiced and passed from the previous generation to the new generation. Some parts of plants have their own body part, and some of them can be used to cure mild illness. Plants are generally employed as decoctions or infusions for internal or external use, mashed as poultices or wound dressing or eaten (Gottesfeld, 1994). Many medicines are derived from body parts of plants like bark, leaves, fruit, stems, seeds, roots, and rhizomes. The function of body part is in different various depend on the uses in the culture and some culture believed some plants bring luck. In Bau community, there are many types of species that have been used for medicinal purposes. For example, *Dillenia suffruticosa* and *Lansium domesticum*. These two types of plants can be used as food or medicine depending on the body part of the plant.

## **2.5 Importance of medicinal plants**

Plants have been used by humans since the beginning of human culture for various purposes, for their survival, including medicine. According to (Cambridge University Press, 1991), in the most developing countries, where coverage by health services is limited, it is to the traditional practitioner or to folk medicine that most of the population turns in sickness and treatment is, in large part, based on the use of medicinal plants. However, according to Baling (2012), medicinal plants are easily found for consumption as compared to modern medicine which is quite costly. Some wild plants have their own distinct medicinal component. The plant taxa diversity of medical administration can be illustrated by their modes of applications. In the study area, various plant parts, such as barks, roots, rhizomes, bulbs, tubers, stems/branches, leaves, seeds, flowers/inflorescence, fruits or even the whole plant, were found to be used by the local inhabitants as drugs or medicine (Bhat et al., 2021).

A general study of WHO's priorities in the field for the next few years may be obtained from the medium-term programme for traditional medicine (WHO, 1987). Mostly, medicinal plants are used as raw materials for the production of new drugs in the medicine industry. About 50% of modern medicine and medical products come from plants (Chai, 2000). Besides, Joy et al. (1998) have mentioned that 80,000 out of 2,50,000 higher plant species are medicinal plants and around 15000-20,000 plants have good medicinal value, but only 7000-7500 of species are being used by the native communities. In other countries like China and India, it constitutes more than 80% of all plant drugs in total. Other country like the United States, it contributes only 25% of plant drugs. Countries like India are still dependent on medicinal plants compared to other countries. Meanwhile, some other countries have constituted measures to protect endangered species of medicinal plants, but the majority have yet to take such action. Through the Plant Conservation Programme, in

which medicinal plants are included, IUCN and WWF are collaborating with the government of Sri Lanka on a broad project for conserving the medicinal plants of this country (Hamann, 1991). About 80% of the population could not afford the medicine of Western Pharmaceutical Industry hence why they depend on the traditional medicines that are constitute of plant material (Joy et al., 1998).

## **2.6 Abundance and diversity of edible wild fruit and plants**

Tropical forest is known as being rich with an abundance of plant species. According to Withmore (1988), tree species in tropical forests differ terms of composition and diversity due to heterogeneity in the environment and biogeography. Sarawak ecosystems are unique, consisting of many highland forests where the uniqueness contributes to high plant endemism. Sarawak consists of a large tropical rain forest with a large number of mountains rich in floristic and rare plant diversity. Sarawak tropical rainforest covers approximately 3,700,00 hectares and is part of Borneo Island, which also includes Sabah and Kalimantan. Borneo has the largest island in the worlds and has more than 3,000 species of diverse lants, of which more than 265 species are dipterocarps and about 155 are endemic to Borneo (Muhd Arif Shaffiq et al., 2013). According to Muhd Arif Shaffiq et al. (2013), the forest has always been an indispensable source of food, and some wild plants and fruits serve as a source of food in the local community diet. Meanwhile, Beluhan (2010) defines wild edible plants (WEPs) as plant species that are not cultivated or domesticated but are accessible from various natural habitations and used as food. A huge number of ethnic communities and local populations residing in developing countries draw a significant part of their subsistence and livelihood from wild plants (Schippmann, 2002).

Wild fruits are usually small or berry in size, but they contains high fibre and the fruit often tastes sour or even astringent. Wild fruits and plants play an important role in the local community since they provide nutrition since wild fruits have high levels of vitamins and minerals, relatively lower amounts of carbohydrates and calories, and are free from synthetic chemicals. Among the edible plants that have been used in the local community in Kampung Stass, Bau are *Etlingera punicea*, *Alpinia ligulate*, *Pithocelobium jiringa*, *Artocarpus integer*, and many more. These types of wild plants and fruits contain high fiber and nutrition, some of them from the zinger family, which is good for health. The relatively high importance of wild edible plants in the rainy season coincides with the time when most species are re-sprouting, flowering, and fruiting, thereby increasing their availability (Ojelel et al., 2019). Seasonality is also important in wild edible plants, as Sarawak, known as the tropical rainforest, is known for the growth of dominant edible plants in the tropical rainforest. Wild edible plants make human diets more diverse and add flavors, vitamins, and minerals. Globally, wild edible plants have been recognized as a key component in an ecosystem based on adaption and food scarcity copying strategy. Therefore, even if every rural household had enough food, the use of wild edible plants would still exist. It is important to ensure that the biological resources and the associated indigenous and cultural heritage of Bidayuh communities are preserved.

## 2.7 Previous Studies of Food Plants in Malaysia and Sarawak

Due to the factors of traditional medicinal popularity in the local community, most of the local community in Malaysia still depends on traditional medicines for their healthcare needs. There are about 1,200 species of higher plants in peninsular Malaysia and 2,000 species of plants that contain medicinal properties are available in Sarawak and Sabah (Chai et al., 1989). The local community at Kampung Stass, used to collect the plant from the jungle and cultivate it around their housing area. Some of the plants are for food and medicinal plants. For example, in Lasot (*Lansium domesticum*), they plant the tree near their housing. Lasot is a type of plant that can be used as food or medicinally. There were many studies that were conducted, including the research on the Bau area (Patrick, 2014; Biluh, 2009; Chai, 2006; Sayok et al., 2015; Kueh, 2003). In previous efforts, the study of traditional pants was often incorporated together with ethnobotany surveys, medicinal plant research, phytochemical studies, traditional ethnobotanical knowledge (TK) surveys, and socio-cultural studies (Kanak & Bakar, 2019). Since 1980, most people in Borneo have been scientifically carried out on ethnobotanical work. At the same time, the Sarawak Department of Agriculture is also doing substantial and collective research effort in the cultivation and domestication of Sarawak indigenous wild vegetables (Voon & Kueh, 1999). According to Voon & Kueh (1999), many research institutes are now more aware of the importance and potential of wild crop relatives and wild plants and are increasing their effort in studying and promoting these species to local farmers and to the public. However, there are few activities related to *in situ* conservation of wild crops relatives and wild plants for food production, most of which focus on medicinal and herbal plants, including those species for salad (ulam), fruit species, *Litsea* species, and *Clematis* species. Based on existing protected forest habitats in Malaysia, the total protected area amounted to 5.8% (763 300 ha), 8.9% (658 824 ha), and 2.3% (288 806 ha) of the total land area of Peninsular Malaysia, Sabah, and Sarawak,