

## FOREST PLANTS AS VEGETABLES FOR COMMUNITIES BORDERING THE CROCKER RANGE NATIONAL PARK

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### ABSTRACT

*The Kadazandusun and Murut communities in the interior parts of Sabah are traditionally dependent upon the forests as a source of food, medicines and building materials. A total of nine villages located along the eastern boundary of the Crocker Range National Park in Keningau and Tenom districts are surveyed for their pattern of utilisation of wild plant resources for food. The investigation focuses on types of wild plants commonly harvested as vegetables. Our finding indicates that a large proportion (about 70.6%) of the sample population are involved in collection of wild plants for vegetables. However, only 34.09% of the people surveyed claim that they are dependent on wild sources of vegetables. The survey also indicates that about 82% of households who collect wild vegetable do so solely for their own consumption. However, 18% collected for own consumption and sell the extras in the market. The current rate of harvest of wild vegetables is unlikely to upset the sustainability of the resource, except for that of the wild palms. Although occasional encroachment into the park is evident, the current situation can still be accommodated. Most of the species harvested are actually found in secondary forests, which are largely outside the park boundaries.*

### INTRODUCTION

The Crocker Range National Park (CRNP) is essentially a conservation area where most plants and animal species are protected. While conservation laws prohibit or limit the harvests of these resources, the native communities are often afforded the right of access, albeit for their personal consumption only. In the past, local communities around the CRNP were mainly foraging and hunting in areas outside the park boundary. Now, however, there are indications that the CRNP are continuously being encroached by the local people (Bennett, Nyaoi and Sompud 1995). For effective conservation and management of resources inside the park and in forested areas outside the park boundary, the nature of use and level of dependency of the local communities upon these forest food sources need to be assessed. Knowledge of the nature and level of use, primarily those that are extractive in nature, is of utmost importance to the park management. Aside from being just a contribution to the existing set of valuable knowledge on the relationships which exist between the human population and that of the natural forest environment, the information can be a basis for development of more effective management strategies, particularly in dealing with local community needs. These needs, if crucial for the communities concerned, need to be considered and incorporated into the overall park management planning. This will, in turn, minimise conflicts and thus will ensure strong public support for existing conservation efforts.

The proposed study is aimed at highlighting the utilisation pattern of just one category of

these minor forest products, that is, wild vegetables. First, the study documents the pattern of harvesting in terms of species types, plant parts utilised and method of preparations. Second, the study is also aimed at making a general qualitative assessment of the impacts of the utilisation of these resources on the efforts of Sabah Parks to preserve the natural and environmental resources of the CRNP and its immediate surrounding areas. The documentation of the study include: (i) identification of plant species commonly collected as vegetables, (ii) identification of plant parts consumed as food and method of preparation for consumption, (iii) notification of special dietary and nutritional requirements or restrictions for consumption and (iv) assessment of potential impacts of utilisation and consumption of these resources on conservation efforts by Sabah Parks, or vice versa.

## STUDY AREA

Nine communities, located on the eastern boundary of the Crocker Range National Park, are chosen as the study area. Three communities (Kampung Bariawa Ulu, Kampung Keritan Ulu and Kampung Senagang Ulu) are in Keningau district while the remaining six (Kampung Mongool, Kampung Pulong, Kampung Undusan, Kampung Sumbiling, Kampung Tukulilan and Kampung Mantailang) are in Tenom district. These villages are chosen based on their proximity to the park and are known to be dependent upon the forest, albeit at different levels or in different capacities.

## METHODOLOGY

Wild vegetable species as termed in this study refer to wild or non-domesticated plants normally collected from sources aside from farms and vegetable gardens. Some of these plants may well be from the domesticated species or their varieties, but are growing wild. They are also considered “wild” as they are collected from the primary or secondary forest areas that are not privately managed for other crops. These plants are therefore considered as common property resource. It should be noted also that not all the wild vegetable species collected and utilised are included in this study. The focus is limited to the most common species collected, and used as vegetables only in the communities under study.

Prior to the actual study, rapid field visits are made to all targeted communities. The purpose of the visits is to assess the physical location of the communities in relation to the park, and to examine the local cultural activities of the target communities with respect to utilisation of forest resources. The initial visits are also to set up arrangements for meetings, interviews and further field visits. During these initial visits, preliminary interviews are made with community leaders, officers from the relevant government departments (Forest Department and Agriculture Department) and other related agencies to solicit for secondary information, which are needed for further planning of the study.

For generating general background information, the Rapid Rural Appraisal (RRA) technique, in the form of group interviews, are used. Data collection using group interviews, a noble feature of the Rapid Rural Appraisal (RRA) approach, has been previously used by Noweg et al. (1998). The group interviews provide most of the details on various aspects of the

utilisation or consumption of wild plants, which are normally collected and used as vegetables. Several field trips into the forest areas close to the communities are made, in particular where actual foraging activities normally takes place. These field trips are primarily for the purpose of specimen collections, and at the same time to ascertain information gathered earlier via the RRA technique.

At a later stage, the key-informant interviews are also conducted on knowledgeable members of the communities, particularly those known to have enormous experience with the forest and its wealth. This phase of the study is also aimed at further verification of disjointed and conflicting information collected from the group interviews. Finally, an overall household survey is administered to a representative sample consisting of 228 households from the eight villages or communities under study. A combination of techniques as used in this study is deemed as the most appropriate approach to achieve a comprehensive set of information in a fast manner (Ogle 1995).

Basic community data on collection and consumption of the plant resources are extracted from the main household survey and analysed statistically. A much more elaborate statistical analysis is deemed unnecessary and inappropriate with the available data set. The qualitative information on methods of vegetable preparations as well as their use limitations is carefully analysed. Detailed documentation of the various species is made following the approach used by Christensen (1997), Noor Azlin Yahya (1990) and a later work by Noweg et al. (1998). Sufficiently verified information via repeated consultations with key informants are then summarised and tabulated. The final tabulation, therefore, lists plant species by major groups, indicating families, vernacular names, parts of the plant used, methods of preparation and some use restrictions where available. Analysis is also made of the qualitative information obtained from group interviews and key-informants with respect to several aspects of vegetable resource management. Pertinent issues considered in the evaluation include current efforts taken, from the communities' perspectives, towards conservation or management of these resources, existing conflicts or differences that they may have (or otherwise) with the Sabah Parks management. This additional analysis hopes to expose some of the important socio-cultural elements, which are relevant and may be incorporated in management plans.

## RESULTS

Results of the study are presented in three sections. The first section describes the general use characteristics of the forests for both vegetable collection and other non-timber forest products. The following section describes the species of plants that are being collected as vegetables, method of preparation and, use limitations according to the major categories as set. In the final section, a brief discussion is made with respect to sustainability of the wild vegetable resource based on the qualitative information derived from members of the communities studied.

### *The Forest and The Communities*

Communities located close to the forest tend to be quite dependent upon the forest for several purposes. As expected, all the households surveyed indicate that they use the forest, but for different purposes. There are seven categories of plants being utilised by the communities

under study. These include timber, firewood, bamboo, rattan, wild vegetables, wild fruits and weaving materials (fibres).

In order to establish a general impression of the category of plant resources regarded as being more important, the respondents for the household survey are asked to indicate the most important group of plants his or her household normally collect. The most popular category quoted is firewood, whereby it is regarded as very important by some 20.62% of the households (Table 1). Wild vegetables (chosen by 19.30% of respondents) are reported as the second most important category, followed by timber for house construction (chosen by 17.98% of the respondents) in the third place. The frequency and percentages provided in Table 1 do not imply the exact percentage of the population that uses the different categories of plant resource. In this study, we are interested in investigating the use of plant resources for food, specifically as wild vegetables.

*Table 1. Frequency and percentage of households, by categories of forest resources considered most important for their domestic use.*

Categories of forest resources	Frequency	Percentage <sup>1</sup>	Preference or importance ranking <sup>2</sup>
Timber	41	17.98	3
Firewood	47	20.61	1
Bamboo	28	12.28	5
Rattan	35	15.35	4
Wild vegetables	44	19.30	2
Wild fruits	25	10.96	6
Weaving materials	8	3.51	7
Total	228	100.00	

<sup>1</sup> Percentage of all households surveyed. All households (228 in total) utilise the forest and its resources but for different purposes.

<sup>2</sup> Ranking based on the frequency. Higher frequency recorded indicates the higher use for the resource, and hence a higher ranking.

<sup>3</sup> Weaving materials include two very common plants: mengkuang (*Mapania palustris*, *Pandanus* sp.) and bemban (*Donax grandis*)

### **Wild Vegetable Collection**

Collection of wild vegetables is a common activity in all communities studied. The dependence of the members of the communities studied, however, differs. It is observed from the survey that only 15.35% of all respondents admit that their households are very dependent upon vegetables from the wild or forests (Table 3). Some 19.74% of the respondents, however, are not dependent upon vegetables from the wild source. The survey also indicates that about 82% of households who collect wild vegetable do so for their own consumption. Only 18% of them consume these produce and at the same time sell the extras in the market.

*Table 2. Frequency and percentages of households, by level of dependency upon vegetables from the wild source.*

Level of dependence	Frequency	Percentage (%)
Very dependent	35	15.35

Somewhat dependent	45	19.74
Not so dependent	86	37.72
Not-dependent at all	45	19.74
Not sure	17	7.46
Total	228	100.0

*Table 3. Frequency, percentage of households and preference ranking for the “most frequently collected” vegetable types.*

Types of vegetables	Frequency	Percentage <sup>1</sup>	Preference Ranking
Low herbaceous plants (dry areas)	32	19.88	2
Low herbaceous plants (wet areas)	6	3.73	6
Bamboo shoot	74	45.96	1
Wild banana	20	12.42	3
Palms	8	4.97	5
Ferns	15	9.32	4
Wild ginger	6	3.73	6
Total	161	100.00	

<sup>1</sup> Percentage of all households that collect wild vegetables from the wild sources. Only a total of 161 out of 228 (i.e. 70.6%) reports of their involvement in collection and consumption of wild vegetables.

<sup>2</sup> Ranking based on the frequency. Higher frequency recorded indicates the higher used for the resource, and hence a higher ranking.

For the purpose of this study, the vegetables are grouped into several categories (Table 3). The different species included in each of these categories are as listed in Tables 4-9. In order to find which of these categories are more important in terms of being collected or harvested more often, respondents are asked to indicate the category of vegetables that they most frequently collected. Bamboo shoots appear to be the most frequently collected with 45.96% respondents indicating so, followed by low herbaceous plants with some 19.88% response. Wild banana ranks third (12.42%) followed by ferns (9.32%) in the fourth place and palms (4.97%) in the fifth rank.

### ***Species, Parts Utilised, and Methods of Preparation***

Plant species collected, utilised, and cooked for vegetables by the communities under study are numerous. It is not the intent of this study, however, to list down all these species. The focus of this study is on species commonly collected. As such, the reader may find that this documentation is not very comprehensive. It is indeed not intended to be as such.

Utilisation habits are often influenced by economic status that is further determined by myriad of other socio-cultural factors. It is expected, therefore, that information documented in this report differ from other similar reports for other parts of Sabah. This documentation, however limited in scope, hopes to provide some basic details on the utilisation of the more common plant species consumed as wild vegetables by local communities in the study area.

The following discussions are laid out according to the major categories indicated earlier.

**Ferns:** Ferns are among the wild plant groups that are easiest to collect. There are six species

of ferns collected by these communities (Table 4). From the six species, the most popular ones are *Stenochlaena palustris* (lambiding) and *Diplazium esculentum* (pakis). These two species are collected not just for home consumption but also are marketed to town areas. *Acrosticum aureum* (paku besar) and *Nephrolepis acutifolia* (paku putih) are not as popular due to their strong aroma (especially paku putih) and their slimy taste. *Helminthostachys zeylanica* (aruk-aruk) are also known to have a pleasant culinary appeal but are seldom found in large quantities.

Ferns are collected all year round as young shoots and only leaves are harvested. Although most species prefer moist areas of river bottoms and wet fields, some are found on drier sites. Examples are the lambiding (*Stenochlaena palustris*) and paku putih (*Nephrolepis esculentum*). Details on harvesting, methods of preparations and use limitations are as described as in Table 4.

Table 4. Local names, species and family, parts consumed, and methods of preparation and consumption limitations.

Local Name, (Species name), FAMILY	Parts Consumed/ Utilised	Methods of Preparation	Use Limitations
Aruk-aruk ( <i>Helminthostachys zeylanica</i> ) OPHIOGLOSSACEAE	Young leaves and shoots	The young plant is edible. The shoot can be cooked like asparagus or fried with garlic and anchovies	Seldom found in large quantity. Not appealing to many people, and only liked by a small percentage of local farmers.
Lambiding, ( <i>Stenochlaena palustris</i> ) POLIPODIACEAE	Young leaves and shoots	Fried with garlic and anchovies or shrimp paste (sambal belacan)	Very well-liked vegetable, and are widely served in restaurants. Very common wild fern found almost everywhere the forest has been disturbed.
Paku besar, ( <i>Acrosticum aureum</i> ) PTERIDACEAE	Young curled bud and leaves	Fried as vegetable	Quite rare and seldom found in large quantities and the taste tend to be somewhat slimy.
Paku, ( <i>Cyclosorus aridus</i> ) THELYPTERIDACEAE	Young shoots	Can be eaten as salad after being simmered briefly in boiling water	Not normally liked by many people because of its slimy taste.
Pakis, ( <i>Diplazium esculentum</i> , and formerly identified as <i>Athyrium esculentum</i> ) ATHYRIACEAE	Young shoots, leave buds	Fried with garlic and anchovies	Very well-liked vegetable, and are widely served in restaurants. Common wild fern found mostly in moist areas, particularly partially shaded riverbanks.

Paku putih, ( <i>Nephrolepis acutifolia</i> ) OLEANDRACEAE	Young leaves and shoots	Boiled and used eaten as salad or fried with other spices	Posses a distinct "stinging" smell that render it unpopular to many people.
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**Palms and bamboo:** Palms and bamboo are the two larger plants that are harvested for vegetable preparations. Bamboo is harvested at the shoot stage but the best vegetable materials from palms can only be obtained from a full-grown tree. Bamboo shoots mostly gave a pungent and bitter taste when eaten raw. Palm hearts, however, are a lot tastier and sweet even when eaten raw. This explains why collectors are willing to spend extra effort to extract the soft heart out.

As for bamboo, efforts to harvest the shoots are minimal and bamboo shoots are growing in abundance in the forest areas in the periphery of the villages under study. As seen from Table 3 previously, bamboo shoots are the most commonly collected wild vegetables. In this study, however, only two species of bamboo are recorded: *Dendrocalamus asper* (buluh betung) and *Bambusa* sp. (buluh bukit). These two species are popular because they produce relatively larger shoots. They are known to be able to thrive well in secondary forest environment as well. It is a common feature to see local farmers cultivating these species in their small rubber plots.

Four species commonly harvested are *Caryota* sp. (lurung), *Arenga pinnata* (puluk/polor), *Onchosperma tigilarium* (nibong/libung) and *Metroxylon sagus* (sagu). As mentioned earlier, the palms are not as frequently harvested compared to bamboo shoots and other wild vegetables. Apart from the large palm species, a species of rattan, *Plectocomiopsis geminiflora* (baruak), is also a popular vegetable species collected from the forests. This species is mostly found in the primary forests and fetches good price at the market.

The parts of the palm extracted, methods or preparation and special use limitations are as described in Table 5.

*Table 5. Local names of palms and bamboos, by families, parts consumed, and methods of preparation and consumption limitations.*

Local Name, (Species name), FAMILY	Parts Consumed/ Utilised	Methods of Preparation	Limitations
Lurung, ( <i>Caryota</i> sp.) PALMAE	Young inner shoot	Fried with onion, garlic boiled in soups	Can cause itchiness in the or mouth if not well prepared
Polor/Puluk, ( <i>Arenga pinnata</i> , <i>Arenga</i> sp.), PALMAE	Cabbage or palmite (young shoots at the base of the crown)	Boiled with other vegetables or meat or soup	Quite difficult to obtain. Ordinarily not cut for vegetables as it can produce saps for wine, vinegar and sugar as well.

Nibong / Libung, ( <i>Onchosperma tigillarum</i> ) PALMAE	Cabbage or palmito (inner shoot at the base of the crown)	Boiled with other vegetables or meat for soup	Difficult to obtain the shoot as the tree trunk is dense sharp spikes
Sagu, ( <i>Metroxylon sagus</i> ), PALMAE	Cabbage or palmito (inner shoot at the base of the crown)	Boiled or fried with spice as vegetables or soup	Extraction of the cabbage or young shoot is hindered by the slimy (often itchy) exudate from the leaves
Rotan/Baluak/Tambarluak, ( <i>Plectocomiopsis geminiflora</i> )	Cabbage or palmito (inner shoot at the base of the crown)	Boiled with other vegetables or meat in soups	Has a bitterish taste and may not be appealing to some people. There is also a poisonous species of rattan called “matar” which is easily mistaken for <i>P. geminiflora</i> .
Buluh betung, ( <i>Dendrocalamus asper</i> ), GRAMINAE	Young shoot which has just emerged one to two feet from the ground.	Boiled and eaten as salad, boiled and fried or cooked with other vegetables in mixed vegetable soup	In many communities, this species is highly valued for its bamboo and thus shoots are normally left not harvested.
Buluh bukit, ( <i>Bambusa spp.</i> ), GRAMINAE	Young shoot which has just emerged one to two feet from the ground.	Boiled and eaten as salad, boiled and fried or cooked with other vegetables in mixed vegetable soup	This species of bamboo is generally smaller in size compared to <i>Dendrocalamus asper</i> , and possess a stronger bitterish taste. It is recommended that sliced shoots be properly boiled (with salt added) to reduce bitter taste.

**Wild bananas:** Both primary and secondary forests produce wild bananas. Wild bananas are observed to grow well in disturbed areas. Throughout the study area, wild bananas are seen growing in abundance on shifting cultivation fallows, in secondary forests and inside small rubber plots. Most of these wild banana species are normally smaller than the domesticated species. Nevertheless, they all produce edible soft inner shoots which are popularly used as vegetables in the rural communities.

In general, wild bananas are harvested for their inner shoot more than they are harvested for their fruits. A total of five common species are popularly collected and used as vegetables, particularly in Kampong Keritan Ulu, Kampong Mongool and Kampong Senagang Ulu.

These include *Musa acuminata* and *Musa violascens* (both are referred to just as “pisang utan”), *Musa hirta* (tagutui), *Musa campestris* (kelalang), and *Musa beccarii* (powok). The parts of these plants, methods of preparation, and special use restrictions are as described in Table 6.

**Wild ginger:** One of the more popular vegetable-producing groups of plants is the wild ginger. Wild gingers grow mostly in secondary forest environment or in primary forests, forest gaps or areas that have been previously disturbed, either naturally or by human activities. Although some species produce stems suitable for extraction of weaving materials for baskets, most wild gingers are utilised as wild vegetables. There are many species harvested by the local villagers but only four are considered of importance. These few species include *Etlingera elatior* (tuhau/tikoloh), *Etlingera punicea* (tuhau/tepu/tutubuh), *Achasma megalochelios* (tepu), and *Hornstedeia* sp. (talirusan). The details on utilisation of these species are as described in Table 7.

Table 6. Local names of wild bananas, parts consumed, and methods of preparation and consumption limitations.

Local Name, (Species name), FAMILY	Parts Consumed/ Utilised	Methods of Preparation	Use Limitation / comments
Pisang utan, ( <i>Musa acuminata</i> ), MUSACEAE	Fruit, flower inflorescence, heart of inner shoot	Tender heart of the shoot are also eaten raw as salad or boiled in soup with meat. Flower inflorescence (jantung) maybe boiled and taken as salad or refried with anchovies and earlic.	Fruit can be eaten when ripe but do not taste that good as it has a strong “wild” smell.
Tagutui, ( <i>Musa hirta</i> ), MUSACEAE	Heart of inner shoot, inflorescence of flower	Inner shoots are often eaten raw with chilli sauce and sambal. Flower inflorescence are normally boiled and eaten as salad with anchovies sambal or fried with other vegetables.	If eaten raw, it posses a taste which may be unpleasant to many people
Pisang hutan, ( <i>Musa violascens</i> and <i>Musa acuminata</i> ), MUSACEAE	Fruit, Heart of inner shoot and flower inflorescence	Fruit eaten when ripe. Heart of inner shoot are either eaten raw with chilli sauce or anchovies “sambal” or cooked with other vegetables in soup, or fried with garlic and onion. The flower inflorescence are boiled till soft and taken as salad with any type of dressing (salad	Ripen fruits are often not as tasty as domesticated species. Both species produces fruits that have seeds. These seeds when chewed produce a somewhat bitterish taste, and thus making it unpleasant to eat. When boiled cook, it may cause the soup to turn dark in colour.

		dressing or sambal biris, or just chilli sauce)	
Pisang hutan/Kelalang, ( <i>Musa campestris</i> ), MUSACEAE	Heart of inner shoot, flower inflorescence	Heart of inner shoot may be eaten raw with chilli sauce or sambal biris, or just chili sauce)	If eaten raw, it posses a taste which may be unpleasant to many people
Pisang liar/powok, ( <i>Musa beccarii</i> ), MUSACEAE	Heart of inner shoot	Eaten raw with chilli sauce or sambal. Cooked with other vegetables in soup.	If eaten raw, it posses a taste which may be unpleasant to many people



*Talirusan/ Talirusan*  
(*Hornstedia* sp.)



*Tuhau* (*Ethingera elatoir*)  
- flower bud used in flavouring

It is worthwhile mentioning here that the tuhau is a very significant species to the communities under study. In addition to the normal way of eating this species, it is also pickled. The tuhau inner shoots and flowers are sliced and preserved together with other vegetables in vinegar, sugar and salt. This preserved (semi-fermented) pickle (locally known as jeruk tuhau) is a popular local mouth-watering appetiser, and is commonly sold at the farmers market.

*Table 7. Local names of wild ginger, parts collected and consumed, methods of preparation and consumption or use limitations.*

Local Name, (Species name), FAMILY	Parts Consumed/ Utilised	Methods of Preparation	Use Limitation/ comments
Tuhau/Tikaloh, ( <i>Ethingera elatoir</i> ) ZINGIBERACEAE	Heart of shoots, flower buds, fruits	Used as condiments, cooked as vegetables or eaten raw as salad. In many cases, the soft inner shoots and flower inflorescence are sliced and blended with other vegetables such as bunch onions, garlic and onions and preserved with vinegar, salt and sugar to produce a dish (pickle) well liked by locals.	Heart of shoot has strong smell but is more appealing to most people, particularly the locals. This species is heavily harvested as it is commonly sold in town and city markets. Some farmers are beginning to grow them in their home gardens.

Tuhau/tepu/Tutubuh, ( <i>Etilingera punicea</i> ), ZINGIBERACEAE	Heart of young shoots, flower buds, fruits	Eaten raw as salad or cooked as fried vegetable	Heart of shoot does not produce as much smell as <i>E. Elatoir</i> . Also may not be appealing to many people.
Tepu, ( <i>Achasma megalocheilos</i> ), ZINGIBERACEAE	Heart of young shoots, flower buds, fruits	Eaten raw as salad with anchovy sauce/sambal belacan. Also are cooked or fried by itself with garlic or together with other vegetables.	Heart of shoots has strong smell, which is unpleasant to many people.
Talirusan/Talirusan ( <i>Hornstedia</i> sp.), ZINGIBERACEAE	Heart of young shoots, flower buds, fruits- seeds	Soft heart of shoot is known to have been eaten raw with sambal belacan as salad. It can be cooked as fried vegetable. Composite flower inflorescence (an elongated cup- shaped) is also reported to be edible but not popular.	Heart of shoots has strong smell, which is unpleasant to many people. Ripen fruits have tiny seeds, sweet to the taste and are often eaten by farmers and forest workers.

**Low herbaceous plants:** Apart from the ferns, bamboos, palms, bananas and gingers, there are other plants, generally categorised as herbaceous plants, that are collected as vegetables. These include all non-woody plants such as creepers, tubers, aroids and climbers. Here these plants are grouped according to the habitat they are found: wet and dry areas (*tanah kering* and *tanah basah*). The grouping, as used in this study, is for convenience purposes and to harmonise with the classification traditionally used by the locals.

In dry areas, the most commonly collected species are leaves of tapioca (*Manihot esculenta*), undom (*Solanum torvum*), and jambutan (*Passiflora foetida*). These species are very common and harvested by most rural communities in Sabah and Sarawak. Somewhat unique to the area under study, the tutans (*Solanum nigrum*) are found to grow profusely on newly burnt farms. The species is therefore harvested seasonally which comes after the burning phase of the farming cycle. Strangely, this particular herbaceous plant is not commonly found in Sarawak.

A species of climber called binatong (*Poikilospermum* sp.) found in abundance in both Sabah and Sarawak is also collected and cooked as vegetable. Although popular as a vegetable in all the communities studied in Crocker Range Sabah, there is no record of the same species being consumed in Sarawak. It is often found growing in a variety of habitats including forests of both lowland and higher altitudes.



*Tutan* (*Solanum nigrum*)



*Binatong* (*Poikilospermum* sp.)

Another species, an aroid, which is normally ignored by wild vegetable collectors in other parts of Malaysia, is the undipoh (*Amorphophyllus prainii*). This species of aroid normally grows single-stemmed. It is often mistaken for seedling of woody plants except for its soft, spongy-succulent stem.

Table 8 details the utilisation characteristics of these dry land herbaceous plant species.

*Table 8. Local names of/ow herbaceous plants found on dry, parts collected and consumed, methods of preparation and consumption or use limitations.*

Local Name, (Species name,) FAMILY	Parts Consumed/ Utilised	Methods of Preparation	Use Limitation/ Comments
Tutan hitam/memuntih, ( <i>Solanum nigrum</i> L.) SOLANCEAE	Young leaves and shoots	Cooked like spinach-fried or with other vegetables in mixed soup	Found only in cleared and burnt areas, growing naturally in hill rice farms
Tutan putih, ( <i>Solanum</i> sp.) SOLANCEAE	Young leaves and shoots	Cooked like spinach-fried or with other vegetables in mixed soup	Found only in cleared and burnt areas, growing naturally in hill rice farms
Binatong, ( <i>Poikilospermum</i> sp.) URTICACEAE	Young leave and shoot at the tip of the vines	Normally stir-fried or boiled in mixed vegetable soup	The plant is a climber, and thus collection of sufficient amount of vegetable material is sometimes difficult.
Udom/Tarong, ( <i>Solanum torvum</i> ), SOLANCEAE	Young leaves and berries (fruits)	Boiled fruits are either eaten as salad or fried. Young leaves can be fried as vegetables.	Fruits are best when young as they are tender and taste better.
Ubi kayu liar, ( <i>Manihot esculenta</i> ), EUPHORBIACEAE	Young leaves and shoot, and roots (tuber)	Leaves are boiled and eaten as salad with sambal or fried. Roots are peeled and boiled, or fried into biscuits.	The wilder varieties tend to be a lot bitterer in taste as the cyanide content may be higher. Longer boiling time be needed.
Bingol/Hampagat, ( <i>Erechitias, hieraiifolia</i> ), COMPOSITAE	Young leaves and stem	Fried or boiled with other vegetables	Has a distinct smell and taste that some people cannot appreciate

Bayam liar, ( <i>Amaranthus</i> sp.) AMARANTHACEAE	Young leaves and stem	Fried or boiled with other vegetables	Has the same characteristics of the domesticated spinach – marshy when over cooked
Jambutan, ( <i>Passiflora foetida</i> ), PASSIFLORACEAE	Young leaves, shoot and fruit	Fried as vegetables	Has sweet taste but with strong smell if not properly spiced up.
Undipoh, ( <i>Amorphophyllus prainii</i> ), ARACEAE	Shoot and leave at the stage where the bud just break open	Boiled independently or together with other vegetables	Not found in large quantity. Harvested only when farmers are in desperate need of vegetables
Apak, ( <i>Pycnarrhena tumetacta</i> ) MENISPERNACEAE	Leaves and young buds and shoots	Leaves are often crushed or crumbled and added to cookings to add flavour. The sweetness of the flavour likens that of monosodium glutamate.	Quite difficult to find as the species in solitary

Another species, which is seldom used anymore in Sarawak rural communities, is the apak (*Pycnarrhena tumetacta*). This climbing plant is still widely used by rural communities in Sabah. Both the leaves and young shoots of this climber are edible. In the case of the Muruts and Kadazandusuns, the leaves of the apak are more commonly used as condiments, to add sweet flavour to their cooking.

In the wet areas around ponds, drainage ditches, and along streams, a wealth of herbaceous plants are found growing wild. Many of these plant species are utilised both for food and medicinal purposes. The local villagers in the study areas are noted to utilise about 30 species of herbs found growing in wet areas. For the purpose of this study, however, only the most commonly collected vegetable plants are recorded.

The most popularly collected species include pagaga (*Cantella asiatica*), Tayaan (*Monocharia vaginalis*), kakatong (*Limnocharis flava*) and kasou (*Ipomea* sp.). These plants are also consumed by many other farming communities in Malaysia, and quite commonly sold at farmers' markets throughout Sabah and Sarawak. What is relatively uncommon in Sarawak and other states is the harvesting and utilisation of the stolons of the wild yam (*Colocasia* sp.). The Muruts and Kadazandusuns claim that it is a good substitute for the yam. Another species utilised by the communities under study and not known to be edible elsewhere is the dukaruk (*Schistmatoglottis* sp.). This species is commonly found in small mountain streams in the forested areas. This wild vegetable plant is reputed to have a taste similar to kakatong (*Limnocharis flava*). Yet it is not as mushy as the kakatong when cooked. The only disadvantage it has, in the natural state, is that it is seldom found in large quantity, and hence have little potential for the market.



Dukaruk (*Schismatoglotis* sp.)

Government forest policies in the past have been primarily concerned with utilisation of forest resources for the production of timber and, secondarily, fuel wood. Tropical forests, however, yields many other products. In some of the tropical countries, non-timber products are of comparable value to timber, or even higher (Myers 1992). In Malaysia, as is globally, local communities living close to the forest are often found to be quite dependent upon forest produce for their livelihood. Among the most important use of forests, especially for many native communities in the Malaysian Borneo states of Sabah and Sarawak, is as a source of food. These are primarily from the plants. A handful of past studies had attempted to document plant species consumed as food by different ethnic groups of Sarawak (Christensen 1997, Mertz 1997, Noweg et al. 1998) and the Orang Asli of Peninsular Malaysia (Noor Azlin Yahya 1982).



Tayaan (*Monochoria vaginalis*)



Kakatong (*Limnocharis flava*)

Despite a wealth of information on the importance and widespread use of forest plants as a major source of food for many indigenous communities in the developing nations, many

nations, particularly in the tropics, are putting a low priority attention to non-timber forest products. Efforts to sustainably manage forest resources are primarily channelled at accomplishing the bigger agenda of national economic pursuit instead of the provision of ample food supply to the rural communities. In Peru, for instance, the calculated value of plant resources on a research site in a typical forest was estimated to generate a net present value (NPV) of about US\$9,000 per hectare (Peters et al. 1989). In comparison, using a similar approach in economic analysis, another study in Brazilian Amazonia (Anderson 1983) estimated that an intensively managed plantation of *Gmelina arborea* had an NPV of about US\$3,184 per hectare. The NPV per hectare of a natural forest of Sarawak and Sabah forests is expected to be much higher. An anonymous writer reported that the NPV for medicinal plants in Belize was US\$3,327 per hectare. Another case in point to illustrate the economic value of forest non-timber resources is that of rattan in Indonesia. In Kalimantan, rattan is still one of the major export items (Peluso 1993). In the early 1990s the average annual worth of its rattan export trade was about US\$100 million (Panayotou and Ashton 1992).

A study carried out among rural communities in Teng Bukap subdistrict of Kuching, Sarawak indicates that dependency on forest products, in particular wild vegetables, is quite substantial (Burgess 1982). Nearly 97% of all households surveyed claim that they are dependent upon the forest for their household items. A quick survey made in Bario, Sarawak also indicates that all Kelabit communities have high dependency on the wild plant species for their vegetable needs (Noweg et al. (1998). It is clear, therefore, that non-timber forest products often contribute significantly to socioeconomic development of a country.

### **Resource Base and Sustainability**

A primary concern for common property resource is that of the absence of management and restrictions on use. Although there may be some common understanding and agreement on territorial boundaries between communities, property rights to forest areas within a community's territory is still not clearly defined. It is observed that members of the same community can collect vegetable resources from land and forest areas that do not belong to him or her. Essentially every member of the community can draw on the same resource base. The absence of a clearly defined community or individual property rights can cause the resource base to be over exploited.

Qualitative examination of the forest areas where vegetable harvesting was taking place, however, indicates that the common property resource issue does not seem to be of any immediate concern. Most of the foraging areas are located in secondary forests rather than primary forests. There are, however, some exceptions. While most of the species listed above are found in secondary forests, the palms are found in primary forests or very old secondary forests. Due to its relative scarcity, it is noted that harvesting of palm parts is in general, are not as frequent as recorded for other species.

Villagers were asked to assess the existing resource to see if they see any current problem with respect to supply from existing forests, and also their expectation of the future. The results indicate that only 35.09% of the respondents think that there exists a current shortage in wild vegetable resources while some 57.02% do not concur with such view. The remaining respondents were unsure of the actual situation (Table 9). For their expectation of the future state, however, about 64.03% of the respondents are anticipating significant shortage if the

current population increase is assumed, and that there is no additional effort to better manage the resource.

*Table 9. Local names of low herbaceous plants found in wet areas, by families, parts collected and consumed, methods of preparation and consumption or use limitations.*

<b>Local Name, (Species name), FAMILY</b>	<b>Parts Consumed/ Utilised</b>	<b>Methods of Preparation</b>	<b>Use Limitations / Comments</b>
Dukaruk, ( <i>Schismatoglottis</i> sp.), ARACEAE	Young leaves and buds	Cooked boiled in soup or fried	Seldom found in large quantities
Pagaga, ( <i>Centella asiatica</i> )	Leaf and leaf stalks	Eaten as salad with sambal. Alternatively, it can also be cooked in soup or fried.	No limitations in use. It has spicy taste and is also believed to have some medicinal value.
Tayaan, ( <i>Monochoria vaginalis</i> ), PONTERERIACEAE	Young leaves	Cooked boiled in soup or fried	Often appear mushy when boiled or over-fried
Keladi, ( <i>Colocasia</i> sp.), ARACEAE	Tuber, leave stalk, lateral stolons	Tuber can be boiled, fried to make "cucur" or yam biscuits. Leaves stalks and long lateral stolons are normally boil cooked	The wild species are seldom in quantities. May cause irritation to the throat (itchy feeling) if not properly boiled or cooked
Kakatung / Balehir, ( <i>Limnocharis flava</i> ), BUTOMACEAE	Young leaves and soft herbaceous leave stalks	Normally boiled and taken as salad. Frequently fried with shrimp paste or boiled with other vegetables.	Vegetable looks marshy if overcooked
Kasou, ( <i>Ipomea</i> sp.), CONVOLVULACEAE	Young shoot and leaves	Best fried with shrimp paste and anchovies	This wilder species of kangkong may requires sufficient boiling time as it has a slight bitterish taste

The result from the survey thus provides some indications of the local impression of the resource base now and the future. Their foresight of the future, however, may be misleading them because through the interviews, it is quite clear that most villagers (or respondents) are assuming that other factors (economics, political, etc.) remain *status quo*. Unfortunately, the structure of the rural economy will change. Future changes in land use may also occur drastically because of population increase. If the rural population increases significantly without an equivalent increase in the non land-based economy, it is likely that there will be severe pressures on the forests for farming purposes. This scenario can lead to a faster rate of reduction of the remaining forested areas which in turn can further aggravate the already existing encroachments into the national park areas.

Table 10. Frequency and percentage of respondents, by their impressions of the current and near future state of wild vegetable resources

State	Current situation		Near future (10 years time)	
	Frequency	Percentage	Frequency	Percentage
No shortage	80	35.09	32	21.92
Observable shortage	130	57.02	146	64.03
Unsure	18	7.89	50	14.04
Total	228	100.00	228	100.00

### Implications on Crocker Range National Parks Management

In general, the collection and utilisation of wild plants for vegetable do not seem to have a significant impact on the national park at the current time. What appears to be a more direct threat is shifting cultivation. This conclusion is arrived at after studying the harvesting habits of the local villagers. The relative frequency of collectors entering the primary forests inside the national park boundaries is insignificant compared to their entry into the secondary forests where most of the wild vegetables are found.

The categories of wild plant that are harvested from the primary forests are the palms. The palms, however, rank fifth on the list of seven groups of vegetables that are most frequently collected from the forests (Table 3). This data in itself indicates that the actual rate of harvesting of palm tree species for vegetable is very small. Most of the harvesting takes place in conjunction with other activities, which include collection of wild fruits, cutting of timber and hunting.

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