## II. Methodologies and approaches in ethnobotany

# Documentation of Ethnobiological Information

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### Introduction

There is now growing recognition for the relevance of ethnobotanical knowledge and its potential role in the design of sustainable development and alternative economic options. Ethnobotanical knowledge refers to practical knowledge related to uses of biological resources within indigenous cultural groups based on their intimate experience accumulated over many generations. The term 'indigenous' or 'local knowledge' is used to refer to that knowledge which is generated and transmitted by communities, over time, in an effort to cope with their own agroecological and socioeconomic environments. The knowledge is generated and transferred through a systematic process of observing local conditions, experimenting with solutions, and readapting previously identified solutions to modified environment, socioeconomic and technological situations. Now it is also recognised that indigenous knowledge can cut research and development cost significantly.

Ethnobotany is an interdisciplinary science for documentation of indigenous knowledge and interactions between people and plants. Classical ethnobotany simply makes list of plants by local names, scientific names and their uses. However, the applied ethnobotany emphasizes many other aspects.

The salient aspects focus on:

- Systematic inventory of biodiversity;
- Assess the dynamic aspects on sustainable use of plant resources,

  particularly in the face of market economy;
- Document indigenous knowledge related to biological resources and their management;
- Transfer and replicate the indigenous practices and knowledge concerned into the places/situations/ systems, where conditions are similar for community conservation and development;
- Integration for alternative economic options.

Most of the ethnobotanical works are towards ethnopharmacology and medicinal plants. Application of ethnobotanical knowledge towards biodiversity management, community development and conservation is gaining momentum.

Traditionally, local communities world wide are extremely knowledgeable about local plant and other natural resources, on which they are so immediately and intimately dependent. Unfortunately, much of this wealth of knowledge is today becoming lost as traditional cultures become eroded.

Ethnobotanists can play very useful roles in rescuing disappearing knowledge and returning it to local communities, and reinforcing links between communities and environments.

Ethnobotanical field work is an art and skill practiced and conceived by the practitioners and researchers. Many people employ their own style. The following two books are important tools for conducting ethnobotanical studies:

Jain, S. K. (ed.) 1987. *A Manual of Ethnobotany*. Scientific Publishers, Jodhpur. 228 pp.

Martin, G.J. 1995. *Ethnobotany: A methods manuals*. Chapman & Hall, London. 268 pp.

A data sheet is enclosed for conducting ethnobotanical field studies. This form is not rigid, it is only tentative. Practice and experience can help one in documenting the data

## ETHNO-BIOLOGICAL DOCUMENTATION DATA SHEET

A. General Information

Serial No: Date:

Botanical name: Local name:

Recorded by:

Locality: Dist: Thana: Village/Para:

Local correspondent:/interpreter:

Name: Age: Sex: Profession:

B. Geographical information:

Latitude: Longitude:

Altitude: Communication:

Rainfall: Temperature: Wind storm, etc.:

Topography: Soil: Vegetation:

C. Social information: Name of the tribe:

Population size: Density: Economy/Mode of living:

Linguistic: Political/local institutions: Education:

Health care: Religion:

D. Botanical information: Habit: Habitat:

Mode of uses: Parts used: Modeof processing:

Mode of preservation/storage: Wild/cultivated: Mode of propagation:

Any management practice (thinning/lopping/seed collection etc. etc.)

Size of plant population: Scope for domestication:

Any mode of conservation: Marketing/opportunities:

Any rituals/taboos: Folklore and beliefs:

Any other information or observation:

# Ecological Techniques in Ethnobotanical Studies

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## Introduction

A vegetation is an assemblage of plants growing together in a particular location and may be characterized either by its component species or by the combination of structural and functional characters that characterize the appearance or physiognomy of the vegetation (Moore and Chapman 1986). Methods based on species composition or floristics are more useful for large scale ethnobotanical studies of a vegetation in a more detailed botanical nature. Detailed vegetation studies usually require an assessment of the species composition of an area. This may be accompanied by information about the amount or abundance of each species present in a particular site. Natural stands of vegetation also contain much historical detail which can be utilised in reconstructing a picture of the past status of the vegetation. By examining the live and fallen dead trees in forest sites, Henry and Swan (1974) and Oliver and Stephens (1977) where able to reconstruct the history and past structure of species population and vegetation.

Most exercises in practical ecology involve the collection of living organisms with a view to their subsequent identification and estimation. At the outset of the study the ecologists therefore, has to decide which method of description and analysis best suits the purpose of the study. The choice is difficult and the decision is affected by the purpose of study, the scale of enquiry, the botanical knowledge of the worker and the nature of vegetational variation itself (Webb 1954).

## Quantitative methods of studying plant community

The structure and species composition of a plant community can be well determined by sampling methods. The estimate of species content of a habitat will made by observing the plant species at different places or sample areas in the studied area. Several methods have been used by ecologists for this purpose which will vary with the kind of vegetation or community, the ecologist is sampling. Some of the methods used are as follows:

i) Quadrat method,

ii) Transect method,

iii) Loop method,

iv) Pointless or Point method, and

v) Circular line plot method.

## Quadrat method of sampling the vegetation

Quadrats have been used extensively in determining the distribution of plant communities, but can also be used with slow moving vertebrates such as those which occur in leaf litter or in intertidal habitats (Williams 1987). Quadrates are sampling units of a known area. The shape of a quadrate is usually square or rectangular and the size will be vary according to the kind of plant community that will be sampled. When using a quadrate it is assumed that its contents will be representative of the whole sampling area. Large quadrates can be laid out using string and pegs as in the case of sampling grassland and woodland communities.

### Kinds of quadrats

Depending on the uses, there are different types of quadrats:

*List quadrat :* The occurrence of a species in an area is determined by listing the name of the species only. It includes all the species botanically identified. A series of list quadrates gives floristic analysis of the community.

*Count quadrat or List-count Quadrat :* When the species name and the number of individuals of each species found in the sample area are recorded, the sample plot is called count or list-count quadrat. This type of quadrate is usually used in forest survey work.

*Cover quadrat :* When the actual or relative coverage is recorded usually as percentage of ground area covered or shaded by vegetation, the sample is known as cover quadrat.

*Chart quadrat :* Quadrats that are mapped to scales to show the location of individuals of species are called chart quadrats. This is very tedious work but applies to more scientific investigation of the changes that occur in vegetation in the area.

*Permanent quadrat :* Where quadrat is left undisturbed after studying the vegetation and the sample site is repeatedly observed over a long period of time.

Three considerations generally followed for the use of quadrates in vegetation study are:

* What size of quadrat should be used?
* How many quadrats in each sampling area?
* Where should the quadrats be positioned within the sampling area?

### What size quadrat?

If the dispersion, (i.e. way in which the individuals are arranged in space) of a population within the sampling area is truly random then all quadrat sizes would be equally efficient in the estimation of that population. However, the spatial dispersal of a population is seldom random irregular. To determine the optimum quadrat size for a particular type of vegetation, a series of quadrats of increasing size are laid out. The cumulative number of plant species counted after each successive increase in quadrat size, then the number of species found in the plots of different sizes are plotted on vertical axis (O-Y axis) against sample plot sizes plotted on the horizontal axis (O-X axis). The resulting sigmoid curve will be obtained, which is called the species-area-curve. The minimal quadrat size is determined by locating the point on the curve where line takes horizontal course and joining it to the horizontal axis will indicate the minimal size of the plot for that kind vegetation. In general, the grassland and herbaceous plant community will require small quadrat, usually one square meter or even as small as 20cm x 20cm. For shrubs and trees, the size is bigger(10m x 10m or even 20m x 20m) depending on the diversity of the forest.

### How many quadrats?

A large variation of species can be expected when sampling natural populations. In order to make the results statistically significant a large number of samples should be taken, but this becomes tedious and time consuming job. A similar exercise of the species-area-curve enables us to estimate the optimum number of quadrats required when studying the species composition of a particular site. A series of quadrats of satisfactory minimum size are placed randomly

across the sampling area. The cumulative number of species is recorded after each increase in quadrat number used. Eventually a point is reached when all the common species have been identified and a further increase in quadrat number will not merit the time and effort required.

**Where should the quadrats be positioned within the sampling area?**

Random sampling is usually preferred but how do we decide where to locate the quadrats? There are three commonly used methods and to illustrate these we will use in each case the example of an area composed of two soil types (A and B) on which we wish to sample the vegetation:

*Simple Random Sampling* (Fig. 2a): In this method, before sampling, the whole area is to be divided up into sampling units of equal size. Depending on the sampling points to be surveyed (say, 20), refer the sampling units randomly in their ordering. Random number tables should be used to give x and y co-ordinates. Each point on the actual sample area can be located either by pacing or measuring with a tape.

*Stratified Random Sampling* (Fig. 2b): In this method the area is sub-divided into sub-sets (site A and site B here, depending on the different site) and the random samples are drawn separately for each subset. It is also desirable to get a complete cover of the whole area with a proportionate number of sample points occurring on each soil type. Considering the figure 2b, two sub-sets are divided and soil A takes up 60per cent of the area and will thus receive 60per cent of the sample points (e.g. 12 sample points) and soil type B will receive 40per cent of the area (8 sample points). Simple random sampling methods will be followed for the two soil types, but should not allow any more sample points then the allocated number of points to fall on each type.

*Systematic Aligned Sampling* (Fig. 2c): In this method the sample points should be located in a regular or systematic fashion across the map or area (Williams 1987).

**Transect method**

A transect is a cross-section of any area used for studying, mapping or recording a vegetation. Transects can be divided into a strip transect or a line transect.

*Strip transect:* This strip method is generally used for studying trees and shrubs. In this method, strips of certain width and length are established. Within this strip, all vegetations are observed and measured. In this method, the total area of the forest to be studied is obtained and its length and width are computed. Based on sampling intensity, the number of strips are laid-out and the distance between these strips are determined. The width of the strip is fixed; for example 10 or 20 meters. After all these information are known, then laying out of the strips is done in the field. Initially a baseline is laid out and along this baseline strips are established perpendicular to it at the given width and distances between strips. The distance between strips is determined by using the following formula: Intensity of sampling (%) = Area to be sampled/Area of the studied vegetation.

*Line transect:* A line is laid-out using a metric tape or metal chain and observation and records were taken on the line. The line can be laid-out systematically or randomly over the study area. Generally a metric tape or metal chain is connected between two points. The line considered to be a one centimetre wide strip. One can move along this line and observe the plants and recorded the following information:

i) the number of times each individual species appears along the transect,

ii) the occurrence (in percentage) for each species in relation to the total species,

iii) the total linear distance is centimetre of each species along the line,

iv) the total distance of intercept by all species per transect line.

**Quantitative structure of plant communities**

The parameters that are commonly used to characterise the structure of a plant community are i) Density, ii) Frequency, iii) Abundance, iv) Cover, v) Dominance, vi) Association index, vii) Index of similarity, and viii) Importance value index.

*Density of a species*: Total number of individuals of a species in all the quadrates / Total number of quadrates studied.

*Relative density of a species*: (Total number of individuals of a species) / (Total number of individuals of all species) x 100.

*Frequency of a species*: (Total number of quadrats in which the species occurs) / (Total number of quadrats studied) x 100.

*Relative frequency*: (Frequency of one species) / (sum of all frequencies) x 100.

*Abundance of a species*: Total number of individuals of the species in all quadrats / Total number of quadrats in which the species occurred.

*Cover*: This refers to the area covered or occupied by a plant as it relates to the canopy level or basal area.

*Basal area*: Area occupied at breast height (1.3m height).

*Relative dominance*: (Combined basal area of a single species) / (Total basal area of all species) x 100.

*Association index and Index of similarity*: The inter specific association can be evaluated by association index and also by calculating the index of similarity.

*Importance value index*: The overall picture of ecological importance of a species in relation to the community structure can be obtained by adding the values of relative density, relative dominance and relative frequency. This total value out of 300 is called importance value index (IVI) of the species. A score of O in this index indicates absence of a species; a score of 300 indicates a single species in the stand.

*Phytographs*: The individual as well as combined aspects of the position of a species in the community structure can be shown with the help of a graph is called the Phytograph.

**References**


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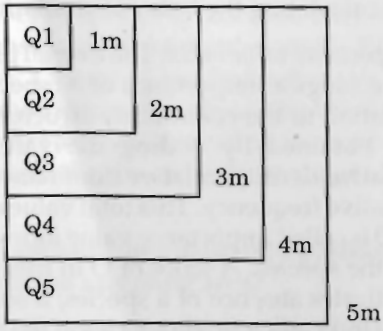


Fig. 1a : Nested quadrats

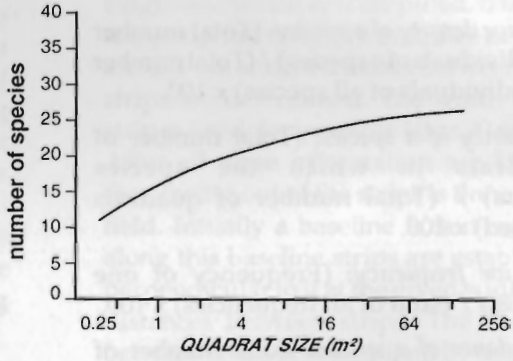


Fig.1b : Species-area-curve to determine the optimum quadrat size.

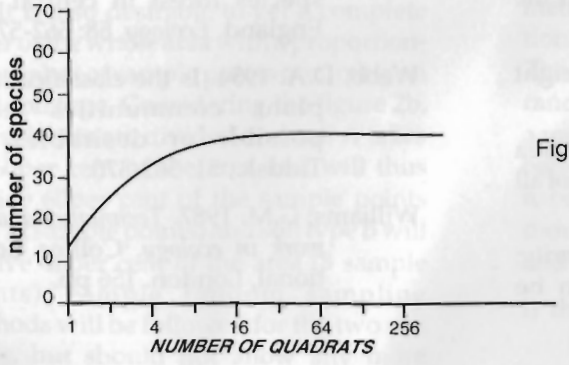


Fig.1c : A graph to determine the optimum number of quadrats for a vegetation survey.

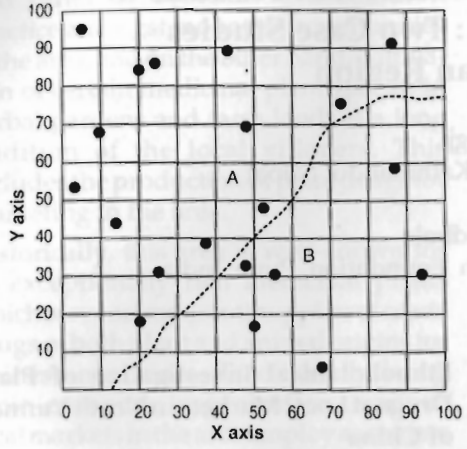


Fig. 2a : Random sampling, 20 sampling points are plotted on the map at random.

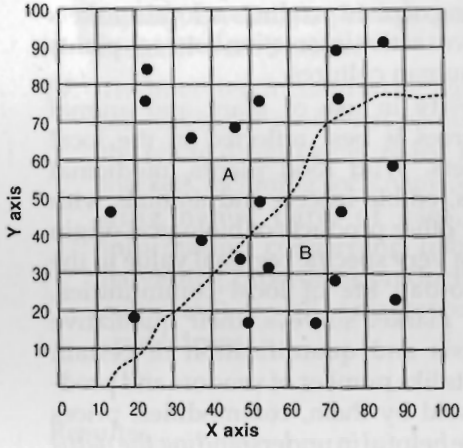


Fig. 2b : Stratified random sampling methods, 20 sampling points are plotted on the map, 40% (8 points) in area B which is also 40% of the total area.

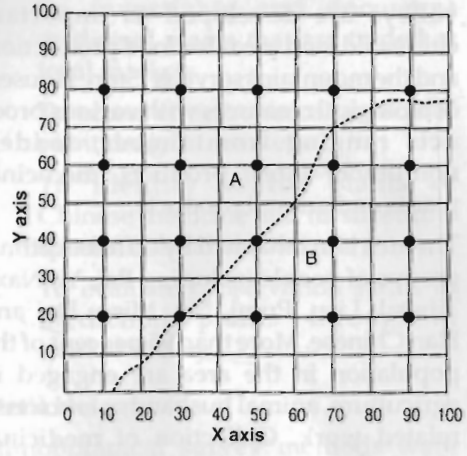


Fig. 2c : Systematic aligned sampling, 20 points are plotted on the map in a regular interval.

# Use of Market Surveys to Assess Plant Products in Ethnobotanical Studies : Two Case Studies from Himalayan Region

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## Introduction

Market survey is employed as an important field research method in areas with rich ethnobotanical knowledge for ethnobotanical studies of plant products. Trading of plant products at local markets involves active interaction between plants and human cultures.

Diversity in use of plant and animal resources is best reflected in the local markets. Wild food plants, medicinal plants, edible insects and animals with many other products of biological origin have a very specific regional value in the day-to-day life of local communities. Local market surveys, their qualitative analysis and quantification of certain aspects like number of vendors and products sold by them, commodities, prices etc. are helpful in understanding the natural resource use patterns and availability of natural resources within a particular region. Proper quantitative analysis might prove helpful to define the sustainability of natural resources used.

This paper highlighted the key methods and results that are employed in two case studies from Himalayan Region that are:

(1) Ethnobotanical Investigation of plant drugs at local markets in North West Yunnan of China, conducted in 1987-1989.

(2) Use of local market surveys to assess natural resource use patterns conducted in Kohima town, Nagaland, India during the Ethnobotanical Training Workshop in June 1997.

## Ethnobotanical Investigation of Plant Drugs at Local Markets in North Yunnan of China

### Background

North-west Yunnan covers an area of 72,531 sq. km and is located in the Hengduan Mountains ($24^0$-$28^0$ N; $98^0$-$102^0$E). The east appendages of the Himalaya, which consists of the Dali Bai Autonomous Prefecture, Lijiang Prefecture and Di-qing Tibetan Autonomous prefecture of Yunnan Province, and links up the Tibetan plateau in the north and Yunnan-Guizhou plateau in the east. The altitude ranges from 1200 to 6700m above the mean sea level. Mountains and river valleys occur alternatively stretching from north to south forming an undulated terrace (Li and Wang, 1986). All river valleys are developed as important cultivated land areas for food production, and the mountains serve as "Store Houses" of biological resources with various products ranging from timber, fodder, non-timber forest products, medicinal plants and animal products.

The area is in inhabited by different ethnic groups of people including Bai, Yi, Naxi, Tibetal, Lisu, Pumi, Nu, Miao, Dai and Han Chinese. More than 95 per cent of the population in the area are engaged in agriculture, animal husbandry and forest related work. Collection of medicinal plants from mountain forests, pastures

and other ecosystems is a common practice amongst mountain communities in the area, and on the other hand, cultivation of certain medicinal plant species in herbal gardens and farm lands is a long tradition of the local villagers. This includes the production of plant drugs for marketing in the area.

Historically, this area is well-known for its exceptionally rich medicinal plants which serve as important supplies of crude drugs of both plant and animal origins for Chinese medicines. Traditionally being socio-economic organization, various local markets in the area employ as centers of trading of plant products including crude drugs of plant origin and exchange of information concerning plant products that are being traded between the Han Chinese and the indigenous minority groups in the area since ancient times (Pei and Guo 1989). Trading of plant drugs at local markets involves active interactions between people from different cultures in use of herbal medicine and knowledge concerning medicinal plants. This study was part of the project on Ethnobotanical Investigation of Plant Products at Local Markets in North -West Yunnan conducted in 1987-1989 and supported by the China Natural Science Foundation.

## Objectives

a. To investigate and document medicinal plants that are traded at local markets.

b. To access ethnobotanical aspects of plant drugs at markets.

c. To identify source plants of Chinese medicine and its substitute species at local market.

d. To evaluate conservation status of medicinal plants throughout market survey.

## Methodology

Ethnobotanical survey methods were employed in market and field investigation; interviews of villagers and vendors from different ethnic backgrounds in the local markets and collection of plant samples (including crude-drug samples and plant specimens) constituted the methodology. The study lasted for three years. The market listed below were visited by the research study team.

I. Annual March Fair in Dali county in March as per the Chinese lunar calendar lasting 1 day.

II. Annual Farmers' Fair in Eryuan County in February lasting 7 days.

III. Herbal-drug sections at various local markets and town centres of Dali, Lijiang, Eryuan, Jian-chuan counties of north-west Yunnan.

IV. The interview focused on indigenous knowledge of medicinal plants and the crude drugs being traded in the markets, including: local name, crude drug name, parts of uses, and information concerning habitats, harvesting, processing; production (if cultivated), as well as market price of crude drugs.

## Results

A total of 2614 items of crude-drugs of plant origin were recorded from the 542 crude-drug sections at Dali's March Fair (354 sections), Eryuanís Farmer's Fair (122 sections) and various town center markets (66 herbal-drug sections). The 2614 items were finally identified into 574 plant species belonging to 32 genus in 129 families of which 517 species were recorded from the March Fair in Dali county town; 330 species recorded from the Farmers' Fair in Eryuan county town and 267 species recorded from various herbal drug sections at different local markets and town centers of the area. All identified medicinal plants and information obtained through this ethnobotanical

investigation has been compiled into an inventory of medicinal plants at local markets in north-west Yunnan.

About 574 species of medicinal plants are traded as crude-drugs in various local markets of North-west Yunnan, China. These drugs of plant origin have been traditionally used in the Chinese medicine system throughout the country, and locally used in indigenous medicines by herbal doctors amongst different ethnic groups.

### Use of Market Surveys to assess Natural Resource Use Pattern in Nagaland, India

#### Introduction

These local market surveys were conducted in Kohima, and Mon townships in Nagaland, India. Kohima township is the capital of Nagaland with fair representation of all the Naga tribes. Various tribal groups are using many different plants and animals in their regular diet, as well as for other needs of day to day life. Most of these commodities are available in Kohima market, which caters to the need of almost all tribes. Kohima is located in the south western corner of Nagaland, therefore a supplementary survey was conducted in Mon township, located in northern Nagaland. Mon is mainly occupied by Konyak Nagas with few other tribes like Aao and Changs. The results presented in this section are a result of two years of field work. The comparative analysis of both the surveys indicated the differential natural resource use patterns as per the availability of commodities in the surrounding resource areas.

#### Objectives

The main objectives of local market surveys were:

a. To assess the local uses of the resources.

b. To find out natural resource use patterns for specific commodities.

c. To understand the dependence of Naga tribals on the surrounding resource areas.

d. To evaluate the sustainability of the natural resources and factors responsible for it.

#### Methodology

A simple methodology used for these local market surveys mainly involved the participatory observations along with semi-structured and structured interviews of the vendors and buyers. Similarly, informal discussions with interpreters helped to analyse the data collected during the market survey. After the repetitive market surveys in Kohima and Mon. Surveys of home gardens should also be carried out to check the origin of various commodities in the market; as was done in this case.

#### Observations

*Commodities diversity:* A variety of plants, animals and other products of biological origin were being sold (Table 3, 4 and 5). These products were either harvested from *jhum* fields, home gardens or collected from wild. There was a clear division of items available from Naga hills and from Assam plains. Most of the commodities were being sold in the raw form i.e. fruits, vegetables, meat, fish, insects. Only few products were sold in processed form i.e. fermented bamboo shoots, powder of *Rhus* seeds and dried *Zanthoxyllum* seeds.

*Vendors:* Permanent vendors have occupied the main shelter erected for the market. The temporary vendors can occupy any space after paying a nominal tax to Kohima town council. The number of temporary vendors far exceeded the permanent vendors in Kohima market. The permanent vendors are of Angami tribe, which is dominant in Kohima district. The temporary stall owners were of different tribes like Lotha, Chakesang and Semas occupying the districts adjoining Kohima. In Konyak area i.e. Mon

township the vendors were mainly Konyaks from the surrounding areas. In Mon, there is no permanent shelter available as market, but market is on the road with vendors on both the sides. Most of the vendors are temporary from villages surrounding Mon township but, occupy almost same place every day.

*Buyers :* In Kohima market, buyers are of different tribes like Angami, Aao, Chakesang, but Mon township market buyers are mainly Konyaks with some Aao and Angamis settled in Mon town for jobs etc. In Kohima market there is a lot of scope for various tribals to purchase the commodities of their interests, mainly the items collected from wild (ferns, birds, deer meat) and harvested from home gardens (beans, gourds and other vegetables). Such commodities are in demand as there is very little space and time available in Kohima for cultivation in home gardens or collection from wild. In Mon market demands for products of home gardens was less, as every village house still has a properly maintained home garden. Here the demand was mainly for the products like Tambul (processed Areca nuts), fish and other products from Assam plains, along with items like wild animals and birds.

*Role of women in the local markets :* It was observed both in Kohima as well as Mon market that 90 per cent to 95 per cent vendors and buyers were women. Women vendors informed that men are engaged in hunting and collection of commodities from wild. Women look after the management, cultivation, harvesting and processing of products. Sometimes men help in bringing the products from their village to the local market. They have also informed that, with such trading, they do get certain control over the household economy, but it is restricted to use the money gained from such marketing for buying other necessary commodities like cloths, salt, bamboo baskets etc.

*Rhythms of the market:* It is very interesting to note the rhythms i.e. changes within the market at regular intervals. Within the first two hours there was a specific range of products exhibited for the sale like perishable vegetables, high demand items like hornet bees and their larvae, Oak leaf borer grubs etc. The marketing activities are at the peak within these two hours. After this initial sale another range of commodities like dried fish, spices, rats and snails, meat, fermented bamboo shoots etc. is available. The main reasons for such specific sale and changing pattern are, the limited space available for exhibition of items, creating false shortage of certain items and availability of storage space. The distance which has to be covered for bringing the product to market and the time required for travelling is also important. Temporary vendor stalls as well as vendors of Mon may not exhibit such rhythm and they exhibit all the items available for sale. Such changes at regular intervals are essentially a feature of bigger local markets. These markets are daily markets (Monday to Friday).

*Economic transactions:* Tribals carry their goods collected or harvested very early morning to market place. The permanent stall holders buy commodities from villagers on wholesale basis. Villagers who do not have the enough produce for sale in bulk to retailers, they occupy temporary places and sale commodities on the retail basis. Permanent vendors also have some products from their home garden or jhum field. Prices of sale were very high compared to amount, quantity and demand of particular commodities like dogís meat, birds, wild vegetables and ferns etc. All the transactions involved money, very rarely bartering observed.

*Geographical setting:* As stated earlier Kohima is located in the South Western

corner of Nagaland. Kohima township is surrounded by Phek, Zunebato and Wokha district. In Kohima and Phek district amount of *jhum* cultivation is comparatively less and there are better preserved forest areas in both the districts. I) Wokha and Zunebato districts are the areas of extensive *jhumming* without traditionally preserved forests and terrace cultivation. Communication facilities are poor, therefore quantity of commodities originated from *jhum* fields, homegardens and certain collections from jhum fallows is limited from Wokha and Zunebato districts. Forest originated products coming from Phek district are limited due to the distance and time required for travel. Bulk of forest products is supplied from Kohima district itself (i.e. from Zulake forest area). Interestingly products like fish, dried fish, oil, salt also have high demand which are coming from Assam plains. Poor communication facilities do not affect the supply as Kohima township is well connected to Assam via Dimapur.

In Mon market commodities are supplied from the surrounding villages like Mon village, Longching, Tanhai etc. Most of the villagers walk from their villages to Mon for sale in market. Most of the forest originated goods come from Northern Mon district that has preserved forests. Products from Assam plains like Tambul, fish etc. have high demand though Assam plains are comparatively far away from Mon town.

*Need of quantification*:To make a systematic appraisal of market transactions and to evaluate sustainability of natural resource use patterns of Nagas, quantification is very important tool. Quantification has been attempted for comparing prices, quantities available for sale, to know whether it serves as an indicator of availability of these items. Similarly quantification is also necessary in terms of number of vendors, their total supply and sale, as well as overall value of the resources. Such quantification in terms of vendors is important to estimate the cultural importance and assessment of local uses of the resources. Quantification would also help to give the rating as per the ecological and cultural values, and further to identify the needs of organised marketing of certain commodities and to design strategies for their protection and conservation in the wild. It is also necessary to quantify the market transactions and its relationship with average income of Nagas in Kohima, to understand the economics of natural resource use.

**Constraints**

A quantitative comparison of items is not possible as the units for sale and uses of each items are varied. A comparison between relative efforts needed for harvesting and collection from the wild and its relation with prices was not possible, because a method could not be worked out for calculating the labour involved in bringing produce to market. The cost of processing if any (e.g. fermented Bamboo shoots ) is not calculated and added to the prices of the commodities but considered as a part of day to day activities. Similarly both Kohima as well as Mon market are quite unorganised and there is no uniformity in the price indicators, which make the quantification more difficult. To estimate the cost of cultivation and other inputs for the production of various commodities from home gardens is also difficult, which is important factor in deciding the prices for sale. All the known methods used for collecting data for quantification are time consuming. It is necessary to develop simple, suitable and quick method for data collection as most of the local market surveys are a part of larger ethnobiological research projects.

## Conclusion

Daily markets in the townships like Kohima and Mon township focus on local demand. Such local market surveys could be used as a tool to identify the local resource needs. Such studies would also help to assess the role of existing agroecosystems in the natural resource use and management. The quantitative studies during such market survey will help to evaluate the sustainability of resource use. Such studies can also be used to identify commercial opportunities in resource utilization and if used properly will also be useful to develop an enterprises potential for economic and environmental sustainability. Fig. III explains the factors responsible for high prices and unorganized status of the local markets in Nagaland. The local markets and transactions within them throw light on cultural aspects of natural resource use patterns.

## Suggestions

Number of commodities like wild vegetables, fruits, insects, animals have high demand and there is a lot of scope for domestication of such items. Domestication will help in reducing the pressure on existing forests. It will also assure continuos supply. Some vegetables, fruits have high demand, but cannot be brought to the market due to non-availability of proper post harvest technology and storage facilities. A specific research is needed to develop proper strategies to improve post harvest technology and storage facilities. The overall market is unorganized. Domestication, improved post harvest techniques and organized markets will help to achieve the proper and sustainable resource use.

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Table 1. Plant-drug at local markets in north-west Yunnan

| Item | No. of medicinal plant species | Crude-drug sections investigated |
|---|---|---|
| Dali March Fair | 517 spp. | 354 sections |
| Eryuan Farmers' Fair | 330 spp. | 122 sections |
| Other Markets | 267 spp. | 66 sections |
| Total | 571 spp. | 542 sections |

Table 2: Inventory of medicinal plants at local markets in north-west Yunnan (cited as Sampling for Inventory Studies)

| Crude drug name Gymnospermae (6 spp.) | Scientific name | Parts of plant | Habitat | Voucher number |
|---|---|---|---|---|
| Bai-guo | ***Ginkgoaceae*** *Ginkgo biloba* | Sd | Cult | 300 |
| Guosongzi | ***Pinaceae*** *Pinus armandii* Fr. | Sd | Cult & Wild | 119 |
| Songbitou | *P.yunnanensis* Fr. | Rt & Rs | Wild & Cult | 258 |

Note : The inventory is arranged according to systematic approach standarised by the research institutions concerned.
The voucher is indicated by the voucher number for the concerned plant collected from the market.

Key to the Parts of Plant and Habitat in the Inventory

Bb - Bulbule
Bd - Buds
Bk - Bark
Bl - Bul
Cm- Corm
Cult - Cultivated
(D) - Dai nationality
Fb -Flower buds
Fm - Filament
Fl - Flower
Fp - Fruit-peel
Fr - Fruit
Hk - Hooker
Hs - Husk
Kn - Kernel
Lf - Leaf
Mc - Mycol-root
Pl - Pollen
Rs - Resin
Rt - Root
Rz - Rhizome
Sd - Seed
Sp - Sporophore
Spt - Sporophyte
St - Stem
Tb - Tuber
Wd - Wood
Wp - Whole plant

Table 3 : Products of animal origin

| No. | Animal | Unit | Price | Availability |
|---|---|---|---|---|
| 1. | Honey bees with comb | piece | Rs. 25 | W |
| 2. | Hornet nest | piece(30cm x45cm) | Rs. 150 | W |
| 3. | Borer larvae - 1 | tub | Rs. 50 | W |
| 4. | 2 | number | Rs. 100 | W |
| 5. | 3 | tub | Rs. 50 | W |
| 6. | 4 | tub | Rs. 50 | W |
| 7. | Frogs back legs | number | Rs. 250 | S&B |
| 8. | Frogs front legs | number | Rs. 200 | S&B |
| 9. | Frogs smoked | number | Rs. 50/6 | S&B |
| 10. | Frogs live | number | Rs. 20/6 | S&B |
| 11. | Snails var. 1 | mug | Rs. 20 | W |
| 12. | Snails var. 2 | mug | Rs. 20 | W |
| 13. | Snails var. 3 | mug | Rs. 20 | W |
| 14. | Snails var. 4 | mug | Rs. 20 | W |
| 15. | Snails var. 5 | mug | Rs. 20 | W |
| 16. | Birds- sengye | number | Rs. 50 | W |
| 17. | Ewu | number | Rs. 50 | W |
| 18. | Green pigeon | number | Rs. 50 | W |
| 19. | Kev | number | Rs. 50 | W |
| 20. | Goofy | number | Rs. 50 | W |
| 21. | Blue rock pigeon | number | Rs. 50 | W |
| 22. | Duck | number | Rs. 50 | W |
| 23. | Squirrel | number | Rs. 35 | W |
| 24. | Bay bamboo rat | number | Rs. 30 | W |
| 25. | Deer | kg. | Rs. 50 | W |
| 26. | Dog | kg. | Rs. 100 | H |
| 27. | Smoked fish (17 types) | kg. | Rs. 100 | P |
| 28. | Fresh fish | number | Rs. 20 | P |
| 29. | Fish fry | packet | Rs. 10 | S&B |

**Table 4. Products of plant origin**

| No. | Plant | Part used | Unit | Price | Availability |
|---|---|---|---|---|---|
| 1. | (Liliaceae) | leaves | bundles | Rs. 10 | HG |
| 2. | *Allium cepa* | cloves and leaves | bundles | Rs. 20 | HG |
| 3. | *Allium sativum* | bulbs | bundles | Rs. 10 | HG |
| 4. | *Amorphophallus sp.* | corm | kg. | Rs. 10 | S&B |
| 5. | *Ananas comosus* | fruits | piece | Rs. 2 | S&B |
| 6. | *Areca catechu (tambul)* | fruits | bundles | Rs. 5 | P |
| 7. | Bamboo shoots 1 | shoots | number | Rs. 10 | W |
| 8. | Bamboo shoots 2 | shoots | number | Rs. 10 | W |

Table 4 Contd.

| No. | Plant | Part used | Unit | Price | Availability |
|---|---|---|---|---|---|
| 9. | Beans | sprouts | bundles | Rs. 10 | HG |
| 10. | Black beans | pods | bundles | Rs. 10 | HG |
| 11. | *Brassica* sp. | leaves | bundles | Rs. 10 | HG |
| 12. | *Capsicum annuam* dried | powder | packets | Rs. 25 | HG |
| 13. | *Capsicum annuam* var. 1 | fruits | bundles | Rs. 10 | HG |
| 14. | *Capsicum annuam* var. 2 | fruits | bundles | Rs. 10 | HG |
| 15. | *Capsicum annuam* var. 3 | fruits | bundles | Rs. 10 | HG |
| 16. | *Capsicum annuam* var. 4 | fruits | bundles | Rs. 10 | HG |
| 17. | *Capsicum annuam* var. 5 | fruits | bundles | Rs. 20 | S&B |
| 18. | *Colocasia* sp. | leaves | bundles | Rs. 10 | S&B |
| 19. | *Colocasia* sp.1 | stem | number | Rs. 10 | S&B |
| 20. | *Colocasia* sp.2 | stem | number | Rs. 10 | HG |
| 21 | *Coriandrum sativum* | leaves | bundles | Rs. 10 | HG |
| 22. | *Cucurbita maxima* | fruits | number | Rs. 2-5 | HG |
| 23. | *Cucurbita* sp. | leaves | bundles | Rs. 5 | HG |
| 24. | *Cucurbita* sp. | fruit | size | Rs. 10 | HG |
| 25. | *Cyphomandra betacia* (Tree tomato) | fruits | bundles | Rs. 10 | HG |
| 26. | Dried mushrooms | fruit bodies | packets | Rs. 10 | W |
| 27. | Fermented bamboo shoots shoots | packets | Rs. 20 | W | |
| 28. | Fermented *Glycine max* | pods | packets | Rs. 20 | S&B |
| 29. | Fern | fronds | bundles | Rs. 5 | W |
| 30. | *Ficus carica* | fruits | number | Rs. 10 | HG |
| 31. | *Garcinia* sp. | fruit | bundles | Rs. 15 | W |
| 32. | *Hibiscus mutabilis* | leaves | bundles | Rs.10 | HG |
| 33. | *Litsea citrata* | seeds | bundles | Rs. 5 | W |
| 34. | *Lycopersicum esculantum* var.1 | fruits | bundles | Rs. 10 | HG |
| 35. | *Lycopersicum esculantum* var.2 | fruits | bundles | Rs. 10 | HG |
| 36. | *Mentha viridis* | leaves | bundles | Rs. 10 | HG |
| 37. | Millet 1 | seeds | packets | Rs. 10 | S&B |
| 38. | Millet 2 | seeds | packets | Rs. 10 | S&B |
| 39. | Millet dehusked | seeds | packets | Rs. 20 | S&B |
| 40. | *Momordica charantia* | fruits | kg. | Rs. 10 | HG |
| 41. | *Musa sapiantum* var. 1 | leaves | bundles | Rs. 5 | S&B |
| 42. | *Musa sapiantum* var. 1 | fruits | number | Rs. 10-12 | S&B |
| 43. | *Musa sapiantum* var.2 | stems | number | Rs. 5/3 | S&B |
| 44. | *Musa sapiantum* var.2 | fruits | number | Rs. 10 | S&B |
| 45. | *Ocimum* dried | leaves | bundles | Rs. 5 | W |
| 46. | *Ocimum* sp. | leaves | bundles | Rs. 5 | W |

Table 4 Contd.

| No. | Plant | Part used | Unit | Price | Availability |
|---|---|---|---|---|---|
| 47. | *Oryza sativa* | grain | kg. | Rs. 12 | S&B |
| 48. | *Parkia roxburghii* | pods | bundle | Rs. 8 | W |
| 49. | *Passiflora edulis* | fruit | number | Rs. 10 | HG |
| 50. | *Passiflora edulis* | leaves | bundles | Rs. 5 | HG |
| 51. | *Piper betel* | leaves | bundles | Rs. 5 | HG |
| 52. | *Psophocarpus tetragonolobus* | pod | sbundles | Rs. 10 | HG |
| 53. | *Punica granatum* | fruits | number | Rs. 4 | HG |
| 54. | *Pyrus malus* | fruits | kg. | Rs. 30 | HG |
| 55. | *Pyrus* sp. | fruit | number | Rs. 10 | HG |
| 56. | Red beans | pods | bundles | Rs. 10 | HG |
| 57. | *Segium edule* | leaves | bundles | Rs. 10 | HG |
| 58. | *Segium edule* | fruits | number | Rs. 10/6 | HG |
| 59. | *Solanum melongena* var.1 | fruits | bundles | Rs. 5/15 | S&B |
| 60. | *Solanum melongena* var.2 | fruits | bundles | Rs. 5/15 | HG |
| 61. | *Solanum melongena* var.3 | fruits | bundles | Rs. 5/15 | HG |
| 62. | *Solanum tuberosum* | tubers | kg. | Rs. 8 | HG |
| 63. | *Tamarindus indica* | pods | packets | Rs. 10 | P |
| 64. | *Zanthoxyllum* sp. | seed | bundles | Rs. 10 | W |
| 65. | *Zea mays* var.1 | cobs | number | Rs. 10/6-8 | S&B |
| 66. | *Zea mays* var.2 | cobs | number | Rs. 10/6-8 | S&B |
| 67. | *Zingiber officinale* var. 1 | rhizome and leaves | bundles | Rs. 10 | HG |
| 68. | *Zingiber officinale* var. 2 | rhizome and leaves | bundles | Rs. 10 | HG |

Table 5: Other products of biological origin

| No. | Product | Unit | Price | Availability |
|---|---|---|---|---|
| 1. | Brooms | number | Rs. 10 | H |
| 2. | Candle stand | number | Rs. 20 | H |
| 3. | Containers made of gourd | number and size | Rs.5-15 | HG |
| 4. | Honey bottle | number | Rs. 250 | W |
| 5. | Honey with comb pieces | packet | Rs. 20 | W |
| 6. | Ornamental plants | number | Rs. 10 | P |
| 7. | Rhus seed coat powder | glass | Rs. 5 | W |
| 8. | Shawls | number | Rs. 250 | H |
| 9. | Sponge | number | Rs. 5/3 | HG |

| Availability | Wild | S&B | P | F | HG |
|---|---|---|---|---|---|
| No. of products | 34 | 22 | 5 | 3 | 40 |

Abbreviations : H : House, HG : Homegarden, P : Plains, W : Wild,
S&B : Slash and Burn Cultivation

# Basic Survey and Assessment Methodology for Applied Ethnobotanical Research

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## Introduction

Wild plant resources provide a variety of basic needs to rural and urban communities: building materials, fuel, food supplements, materials for crafts, medicines and are a source of income. Depletion of favoured plant resources results in loss of self sufficiency and economic opportunities for local people. It can also lead to resource management problems in conservation areas as they become focal points for harvesting selected species, resulting in the loss of diversity and growing conflict between resource users and resource managers.

The traditional utilisation of biologically diverse resources in the mountain region of the Himalayas not only reflects a diverse resource use pattern, but also the way of maintaining biological diversity in mountain ecosystem by the mountain people. Natural resource management systems are localised systems that form the basis for decision making for rural people. Since the majority of land of land-based production systems in the Himalayan region operate under indigenous knowledge systems, they are not only of value to cultures from which they evolve, but also for scientists and planners striving to improve conditions in rural societies. However, there is tremendous pressure of socio-economic change and with this the ecological knowledge and cultural traditions which have been continuously developed and transferred from generation to generation are beginning to be lost.

Participatory, community based work to document, apply and build on local knowledge of botanical resources and their management can be a part of the process of copying with such changes without losing valuable local knowledge and biodiversity hence the importance of ethnobotany applied in conservation and community development. Understanding of the indigenous knowledge of mountain people in relation to biodiversity resource management is one of the key issues for development of the Hindu Kush-Himalayas Region today.

## Interdisciplinary nature

Ethnobotany by nature is an interdisciplinary field, encompassing inputs from various subject areas such as: Botany, Anthropology, Ecology, Economics and Linguistics. In addition, ethnobotanical studies are specifically oriented towards traditional health care systems and medicinal plants utilisation. Ethno-pharmacology is a major field. Within these disciplines there are four interrelated endeavours in ethnobotany. They are :

- basic documentation of traditional botanical knowledge including ethnobotanical inventory;
- quantitative evaluation of the use and management of botanical resources and impact on the environment;
- experimental assessment of the human interactions with the plants and its environment;

- applied projects that seek to maximize the value that local people attain from their ecological knowledge and resources.

The first three elements may be referred to as Basic, Applied and Quantitative Ethnobotany.

The interactive discussions on methodology and conceptual framework drawing inputs from above mentioned major disciplines and fields of study could be concentrated on the following aspects (Martin 1995).

*Field techniques:* Choosing the appropriate methodology, quantitative and qualitative approaches; database and statistical techniques; applied ecological appraoches; voucher specimens collection; and field recording/inventories.

*Systemic approach:* How to replace ethnobotanical assessment within the resource use patterns (calendar, food habits, etc.); production systems (farming, hunting, etc.); and world view systems of thought.

*Institutional approach:* Land tenure - local control of resources, laws regarding resource appropriation and right of access - decision making.

*Participatory approach:* Participatory research appraisal techniques including participatory biodiversity appraisal.

*Ethics and socially responsible research:* Local communities follow a cooperative innovation system and every project and study should assist in furthering the advancement of indigenous knowledge, maximising the benefits to the communities out of their knowledge systems and safeguarding their intellectural property rights.

**Systematic data collection**

There is a wide variety of methodologies available for data collection and analysis contributed by the various related academic disciplines depending on the choice of research topics. Therefore, as a starting point, it is essential to define a domain for the subject of interest that not only limits the scope of data collection effort but also helps to build up the data more systematically. Systematic data collection using explicit methodology ensures arriving at logical conclusions, one of the primary requirement for any scientific study (Martin 1995; Weller and Romney 1988).

Since most of the ethnobotanical research rests on interviewing; the domain may be defined as an organised set of words, concepts or sentences all on the same level of contrast, that jointly refer to a single conceptual sphere. For greater precision, the domain should be defined by the informants. There are many ways to compile the list of items to define the domain of study items and the most useful general technique is the Free Listing Task.

**Free listing**

This technique helps us to understand if the domain is considered culturally important and easily recognisable by the people being interviewed. By framing a right question, free listing can provide a fairly complete set of native categories. When, people are asked to recall things, they tend to list the most significant ones. In addition, prominent categories are cited by almost everybody, thus giving some idea of the things that are culturally more important. This information helps to come up with a kind of ranking index. This index can be used to decide the size of the data set to be included in the domain.

It would also help in deciding the number of respondents for the free listing task. However, for a medium sized domain (less than 100 or so total categories), the

inquiry should be made with approximately 20-30 people. Once, it is observed that most of the responses given by new informants are being repeated from the old lists, sample is considered fairly complete. A composite list may be obtained by accumulating information from all the lists.

**Identification task**

The free listing task can be followed by an Identification Task. A simple way to do it is by the collecting the specimens of the items mentioned in the free lists and taking the specimens back to the respondents for identification. It is important to have a proper sample to facilitate identifcation. The responses from each of the respondents should be separately recorded and later verified for the number of correct answers. This tehnique provides some idea of who are more knowledgeable people in the community for the kind of study being undertaken and also helps to resolve confusion on account of synonyms for the same item. It is more useful to carryout further detailed study with this group of subject matter specialists after through identification task and removing all the anomalies associated with multiple local names.

**Preference ranking**

Preference ranking can either be accomplished from the positions in the free lists or obtained by asking the key group of informants again to arrange the items in the order of preference. Each person arranges the items according to personal preference, perceieved importance in the community or any other criterion. Each rank is given an integer value (1,2,3 and so on) with the most important or preferred item assigned the highest number. These numbers are summed for all respondents, giving an overall ranking for the item by the sample group of respondents. Efforts should be made to cross-check this order of preference with data obtained from interviews or other sources to see if there is consistency in the responses. A more complex version of preference ranking useful for ranking based on multiple dimensions is known as Direct Matrix Ranking, Direct Matrix Ranking takes into consideration several attributes at a time to provide more composite scores of the overall multiple use value of the items.

**Pairwise ranking**

In a paired comparison task, items are presented two at a time and responmdents are asked which is 'more' or which is 'less'. For no items, a pair comparision design creates n(n-1)/2 pairs. For example, if we want someone to order ten items using this method, we would then create 45 pairs and randomise the order both within and between pairs. For each pair respondents are asked which is 'more'. A total order is obtained by summing the number of times each item was chosen. To tabulate the response,simply sum together all the codes or ranks assigned to each item and present in the Table 1 as shown.

In order to gain insight into people's reasoning, respondents can be asked to describe why one option is better or worse than the other. In addition, you can ask if the preferred item has any negative qualities or if the one not chosen has any positive aspects. Some researchers ask for these comments after each choice, whereas other prefer that respondents complete the entire task before giving their general observations on the overall pattern that emerges.

**Pile sorting**

Pile sorting is initiated after the study items have been selected for more

detailed data collection. In pile sorting, informants are asked to sort either the items or cards, each bearing the name/ figure of an item, into piles so that items in a pile are more similar to each other then they are to items in separate piles. In the unconstrained version of the pile sorting task, respondents can make as many or as few piles as they wish. In the constrained version of the pile sorting task, respondents are asked to create a specified number of piles. Respondents are generally asked to group items according to their similarity, without reference to specific criteria. The respondents rather than the researcher decides what criteria are more salient and determine similarity. Pile sorting is easy to administer and allows for the collection of data among a large number of items.

**Pile sort tabulation**

An item-by-item similarity matrix is created from each individual's sort by tabulating the co-occurrence of items in piles so that items that are together counted as being similar. For example, if we collect data on the similarity of seven items and a respondent put items A, B and C together in a pile: D and E in a pile; and left F and G by themselves (see Table 2) are would create a 7 by 7 table to tabulate similarity among the items. Since A,B and C are categorised together, A and B are similar, B and C are similar, and A and C are similar. Thus each pair would get "a point of similarity". This is indicated in the table with a one. For this individual, all other pairs are "dissimilar" and are recorded as zeros. Similarity matrices are tabulated for each individual and then combined across people. The similarity matrix can then be analysed with a descriptive method such as hierarchical clustering or multidimen-sional scaling.

These are some of the basic steps that one could follow to elicit ethnobotanical information that can be analysed by using standard statistical methods. These methodologies are also helpful in bringing about greater capabilities in data on socio-economic preferences and ecological aspects in applied ethnobotanical research. However these simple methods are helpful at the level of defining the domain of the research questions. For greater and in depth work on indigenous knowledge, the research design needs to accommodate more diverse qualitiative and quantitative methods.

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Table 1. Scores and ranks assigned to each item using Pairwise Ranking Method

| . | AB | C | D | E | F | G | H | I | | | SCORE | RANK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | A | | |
| | | | | | | | | | | B | | |
| | | | | | | | | | | C | | |
| | | | | | | | | | | D | | |
| | | | | | | | | | | E | | |
| | | | | | | | | | | F | | |
| | | | | | | | | | | G | | |
| | | | | | | | | | | H | | |
| | | | | | | | | | | I | | |

Table 2. An individual's items sorted into piles

| | | | | |
|---|---|---|---|---|
| A | | | | |
| B | | D | | |
| C | | E | E | G |
| Pile 1 | Pile 2 | | Pile 3 | Pile 4 |

Since A, B, C were together in a pile:

cell (A, B) = 1
cell (A, C) = 1
cell (B, C) = 1

Similarity Matrix

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| A | 1 | | | | | |
| C | 1 | 1 | | | | |
| D | O | O | O | | | |
| E | O | O | O | 1 | | |
| F | O | O | O | O | O | |
| G | O | O | O | O | O | O |