Building upon Traditional Agriculture in Nagaland, India

IIRR
International Institute of Rural Reconstruction

Building Upon
Traditional Agriculture
in Nagaland, India

Nagaland Environmental Protection and Economic Development

IIRR *INTERNATIONAL INSTITUTE OF RURAL RECONSTRUCTION*

October 1999

The Nagaland Environmental Protection and Economic Development (NEPED) project was implemented in 1994 with the goal of sustainable management of the land base by the intensification of the slash and burn cultivation systems used in Nagaland. The strategy chosen was farmer-led development, testing and demonstration of agroforestry-based intensified systems. NEPED is jointly funded by the Government of Nagaland, India-Canada Environment Facility and International Development Research Centre.

IIRR

The International Institute of Rural Reconstruction (IIRR) is a non-profit, non-government organization that aims to improve the quality of lives of the rural poor in developing countries through rural reconstruction: a sustainable, integrated, people-centered development strategy generated through practical field experiences.

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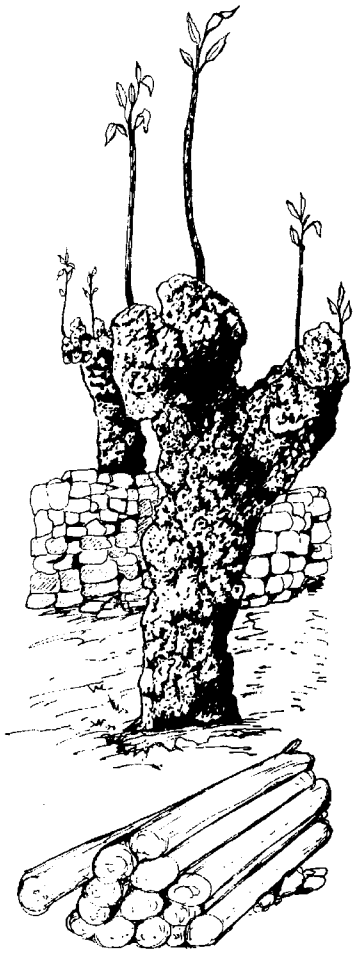
Contents

Foreword

Sustainable development of Nagaland is a high priority. With this viewpoint, the Nagaland Environmental Protection and Economic Development (NEPED) project was implemented in 1994, the first internationally-funded development project ever in Nagaland.

Over the course of the past five years, the strategy of farmer-led development, testing and demonstration of agroforestry-based intensified systems has proven effective. Farmers have actively participated in sharing their traditional knowledge with new concepts to bring about farmer-tested improvements.

The following observations can be made.



- NEPED has broadly reached down to the grassroots level, with a large share of project benefits going directly to farmers across most villages in Nagaland.

- NEPED has served as a catalyst for the Government of Nagaland, helping to encourage and spread new ideas for project management and implementation. This has been facilitated by the establishment of the Project Operations Unit as a special task force to implement NEPED.

This resource book aptly illustrates the broad range of practices and methods that can be used to build upon traditional agriculture in Nagaland. Government officials, NGOs, students, community groups and, most importantly, farmers themselves, will find many options for improving agricultural returns while operating in a more sustainable basis. The resource book is written to be read and used, not left lying on bookshelves.

Nagaland is rich in cultures and biodiversity, and this resource book clearly reflects this natural wealth. The botanical wealth in Nagaland has not yet been properly documented and most of the capacity to preserve it for the next generation of Nagas exists at the village level, in the elders and local experts who store an "oral botanical" record. By working directly with the men and women in the various villages of Nagaland, the project officers of NEPED have helped ensure that the record will be saved for the next generations.

It is my personal hope that the vast indigenous store of agricultural knowledge in Nagaland and the scientific approaches can continue to find a common ground in the years to come.

A. M. GOKHALE, IAS, PADMASHREE
Chief Secretary
Government of Nagaland

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All workshop participants and production staff (see annexes for full addresses).

Building Upon Traditional Agriculture in Nagaland: An Introduction

Nagaland, located in the northeastern region of India, with an estimated population of over 1.5 million, covers an area of 16,579 km^2. The climate of Nagaland ranges from sub-tropical to sub-temperate and the altitude varies from 200m to 3800m above sea level. The terrain is mountainous and covered mostly by forests, which are among the richest in the Indian sub-continent, so Nagaland is broadly recognized as an area of mega-biodiversity.

Agriculture is the main land use and occupation in Nagaland. Traditional agriculture has a rich and diverse history. Different systems have evolved over time to fit and mold into the different ecosystems and agro-climatic zones. Traditional farmers have adopted and adapted, looking at what nature gives them and devising ingenious systems that follow ecological principles while meeting basic needs for food, fuel, and housing materials.

- In high rainfall areas with land suitable for terraces, irrigated rice production systems have evolved; some hillside terrace systems have been sustainably managed for hundreds of years.

- In low rainfall areas, farmers practice various forms of slash and burn agriculture, often managing a complex array of up to 60 crops in a single field.

- Using the alder tree to fix nitrogen and contour bunding with stones to conserve soil, an extremely productive and intensive indigenous shifting cultivation system can be found.

- As a result of a broad-based community forest movement, Naga farmers have engaged in tree plantation on a massive scale to convert their shift and burn crop-based systems into agroforestry systems.

The practice of slash and burn agriculture in Nagaland (and the other hill regions of NE India) is known locally as "jhum," a word derived from the Assamese language meaning "collective work." In Nagaland, close to 17,000 sq km of the state is subject to jhum, with up to 1,000 sq km being jhummed in any one year. For the past years, jhumming has met the household needs of most Nagas while preserving the mountain ecosystems where it is practiced.

But rapid population growth in Nagaland is changing this. In the past, the jhum cycle (number of years the land is planted and then left fallow until the next cropping time) has been falling, from 15-20 years to an average of 9 years. Over time soils deteriorate, yields fall, and the forest biodiversity gradually deteriorates. So it is necessary to develop alternative land use systems in Nagaland.

However, traditional shifting cultivation methods need not be eliminated, but modified by adopting agroforestry and enriched fallow management systems. Combined with soil erosion control measures, these forest-based systems can improve land use, help insure food security, improve cash incomes, generate new employment opportunities, and conserve the rich biodiversity of Nagaland.

With a view to help farmers improve the land use system, and to protect the remaining forests, the Nagaland Environmental Protection and Economic Development (NEPED) project was established, partnering with the Government of Nagaland, International Development Research Centre and India-Canada Environment Facility. Beginning in 1995, NEPED has worked at the community level to encourage adoption of agroforestry by planting trees in jhum fields. The mechanism that was chosen was farmer-led selection, testing and demonstration of agroforestry, under the support of the Project Operations Unit of NEPED and State Agricultural Research Station.

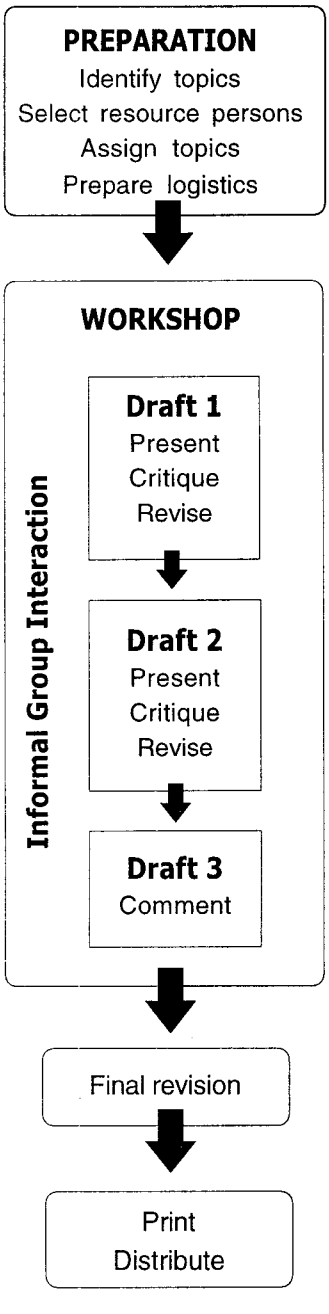
This publication documents the lessons learned over the five years of NEPED, highlighting field tested and farmer-approved practices that are used and can be adopted on a wider scale. Especially important are the indigenous practices that have worked for many years and serve as starting points for improvements. Throughout this book, readers will find many examples of these practices, which clearly demonstrates the important role that farmer-led testing and refinement has had in Nagaland and also offers solutions for the future. ■

How this resource book was produced

This publication is the final output of the workshop conducted at Northeastern Institute of Bank Management (NEIBM), Khanapara, Guwahati, India on 2-13 August, 1999. The workshop, organized by the Nagaland Environmental Protection and Economic Development (NEPED) and the International Institute of Rural Reconstruction (IIRR) brought together 26 extension workers and researchers. They worked closely with a production team of editors, artists and desktop publishing staff.

It is during this workshop that the field tested and farmer-approved practices were compiled and edited in a fully participatory manner. This publication is aimed at extension workers, farmers, community groups, NGOs, agricultural planners and researchers who are interested in farmer-tested methods to improve traditional shifting agriculture in the upland areas. The examples and practices featured in this book are mainly based on the Nagaland, India experience (as a result of the NEPED implementation) but many could prove useful elsewhere in Asia.

Workshop process



WORKSHOP OBJECTIVES

Process, **participation** and **product** were the **3Ps** stressed in the workshop that recognized the following objectives:

1. To compile the lessons learned over the five years of NEPED into a sourcebook for use and adaptation by other practitioners and organizations involved in shifting cultivation.
2. To produce a sourcebook based on field tested and farmer-approved practices.

WORKSHOP PROCESS

Planning and preparation for the production of the sourcebook started months before the workshop. Meetings were held and there were regular exchanges between IIRR and NEPED (through emails, fax, etc.) to discuss the publication content and develop the list of topics. IIRR developed guidelines for writing the first draft of the papers and sent to the Project Operations Unit (POU).

The workshop used a process developed and pioneered by IIRR: the same process used to produce information kits on a range of topics related to agriculture and natural resources management, including agroforestry technologies in the Philippines, integrated agriculture-aquaculture in Asia, ethnoveterinary medicine in Asia and environmental concepts and actions.

During the workshop, each participant presented his or her first draft paper, using overhead transparencies of each page. Copies of each draft were also provided to all other participants who critiqued the draft and suggested revisions.

After the first presentation, an editor-artist team helped the author revise and edit the draft and draw illustrations to accompany the text. The edited draft and artwork were then desktop published to produce a second draft.

Each participant then presented his or her revised draft to the group for the second time, also using transparencies. Again, the audience critiqued it and suggested revisions. After the presentation, the editors, artists and desktop publishing staff again helped the author revise the material and develop the third draft. At the end of the workshop, the drafts were routed for final comments and revisions by the participants.

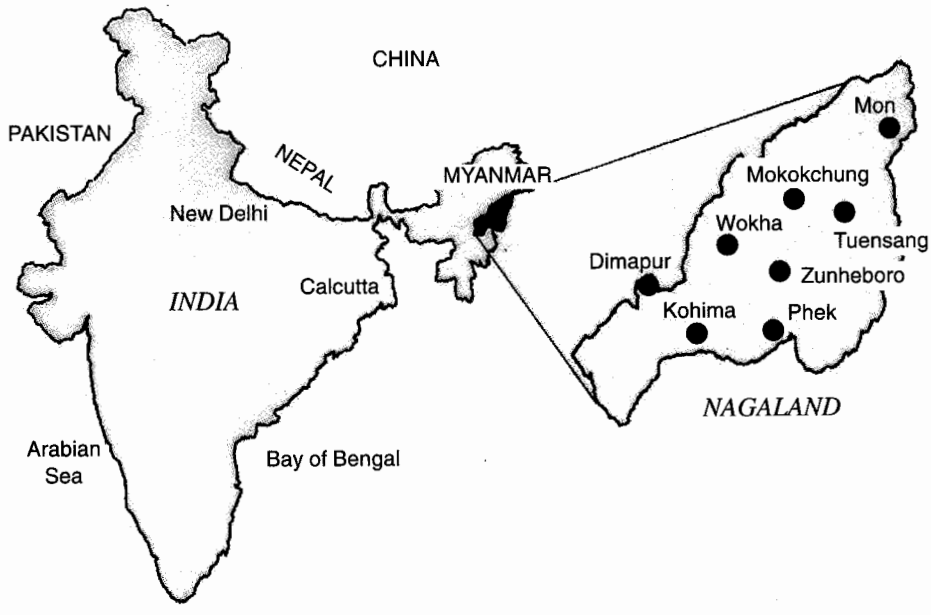
When the final comments and suggestions on the third drafts were incorporated, a mini workshop was again held in Nagaland, India facilitated by an editor, to have a final review of the materials and revise some illustrations and figures. Afterwards, a final version was produced.

Throughout the workshop, the participants worked together in informal groups to discuss and improve their manuscripts. Although the principal authors are listed on each paper in this resource book, all the papers were produced in a fully collaborative and participatory team atmosphere.

The workshop allowed inputs from all participants to be incorporated, taking advantage of the diverse experience and expertise of all present. The concentration of resource persons, artists and desktop publishing staff at one time and place enabled materials to be produced more quickly than is typical for similar publications. And the sharing of experiences among participants allowed the development of networks that would continue to be fruitful long into the future and would lead to concrete follow-up activities. ■

Overview

Overview of Nagaland, India



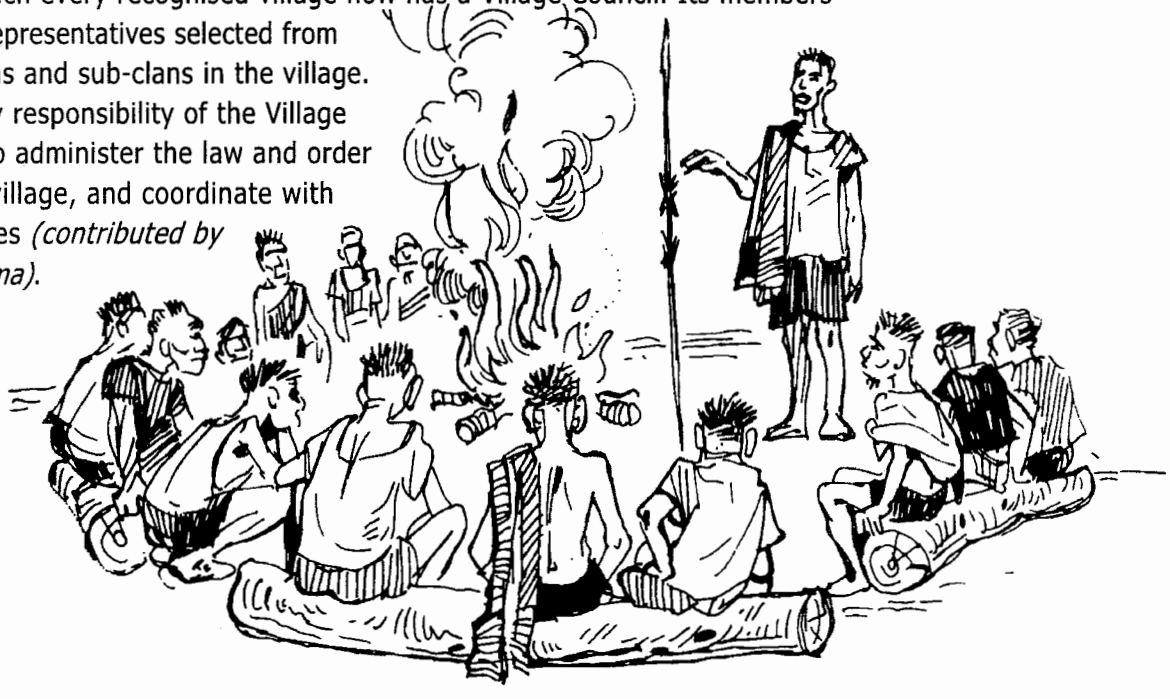
Nagaland is the sixteenth state of the Union of India. Covering a geographical area of 16,579 sq km, Nagaland is situated in the northeastern part of India. It is surrounded by the states of Arunachal Pradesh in the north, Assam in the west and Manipur in the south and straddles the Patkai mountain range, adjacent to Myanmar.

With altitudes from 200 to 3800 meters, the climate of Nagaland ranges from sub-tropical to sub-temperate, with an annual rainfall of 2,500 mm. The state is rich in biodiversity.

According to the 1991 Census, Nagaland has a population of 1.5 million with a decennial growth of 52% between 1981-1991. There are 16 tribes in Nagaland, each having their own distinctive dialect, customs and traditions. The state also has a high literacy rate of almost 62%. For administrative purposes, the state is divided into eight districts. The main source of livelihood of the Nagas is agriculture.

VILLAGE COUNCIL

The Naga tribal customs and traditions are diverse and governance varies from tribe to tribe. Some tribes have autocratic system where chieftains enjoy hereditary status, while others have a more democratic arrangement. Based on these traditional backgrounds, the Government of Nagaland enacted the "Village Council Act of 1967" through which every recognised village now has a Village Council. Its members consist of representatives selected from various clans and sub-clans in the village. The primary responsibility of the Village Council is to administer the law and order within the village, and coordinate with other villages *(contributed by Khekiye Sema).*



VILLAGE DEVELOPMENT BOARD (VDB)

Every recognised village has a Village Development Board. For the purpose of day to day management, the Village Development Board Management Committee (VDBMC) members are selected from within the clans and sub-clans in the village. Women and youth groups are also represented. The Secretary of the VDBMC is elected by the committee members from among themselves. This Committee is subordinate and answerable to the Village Council, which is the supreme body in the village.

The VDBs receive annual financial allocations from the state through the Department of Rural Development. The amount for each VDB is calculated on a household basis. The amount of funds granted by the government is declared in public meetings and the "Village Annual Plan" is decided through a resolution by the will of the majority. VDBs also have fixed deposits in banks against which villagers can obtain loans for developmental activities.

VDB is a unique infrastructure that truly brings out GRASSROOTS PLANNING *(contributed by Khekiye K. Sema).*

AGRICULTURE IN NAGALAND

Traditionally, all the tribes and villages in Nagaland practise slash-and–burn cultivation locally known as "jhum". The Angami, Chakhesang and Zeliang tribes have additionally developed a sophisticated system of Wet Terraced Rice Cultivation (WTRC), which they practise alongside jhum cultivation.

Modern scientific agriculture was introduced only in the 1960s. The impact has not been appreciable as most high-external input technologies were not suitable for high altitudes and rainfed conditions. Traditionally, Nagas did not cultivate any winter crops. Only in recent times, non-traditional winter crops such as wheat, barley and some pulses and oilseeds have been introduced.

JHUM CULTIVATION

Jhum cultivation, in many ways, is interwoven into the culture and traditions of the Nagas. In Nagaland, over 40% (approx. 7,000 sq km) of the geographical area is subjected to jhum cultivation and more forests are being cut down every year. This practice is widespread not only in Nagaland but also in the neighboring states, as well as in Myanmar.

Jhum cultivation in Nagaland bears many similarities to the slash and burn systems that are found elsewhere in tropical areas. The vegetation is slashed, burned, tilled and sown. After a year or two of culturing, the land is left fallow for some years to regain its fertility. Then the next slashing is done. The period from slash to slash makes a "jhum cycle".

Effects of Jhum Practice in Nagaland

- The soil, especially in the hill slopes, is subject to massive top soil erosion from March to May when the first monsoon rains occur and the crops have not grown enough to cover and protect the top soil.
- The Indian Council for Agricultural Research (ICAR) estimates that up to 40 metric tons of topsoil per hectare per year is eroded in a Naga jhum field.
- With increasing food demand due to increase in population, the "jhum cycle" has reduced leading to decreases in crop yields. This necessitates bringing larger areas of land under jhum cultivation. The vicious cycle gets perpetuated and accentuated.
- It is recognised that jhum cultivation cannot be eradicated in Nagaland. This is more so because the land belongs to the people, and there is no immediate alternative for the farmers to meet their food and other necessities.
- The contribution of pollutants to the atmosphere by burning the vegetation in jhum cultivation has not yet been determined, but is thought to be substantial.

Prepared by:
Razhukhrielie Kevichüsa

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Building Upon Traditional Agriculture: The Premise of NEPED

Traditionally, jhum cultivation was productive and sustainable. Honed over thousands of years, it is a system well suited to the needs of traditional subsistence farmers, with multiple intercropping of up to 60 food crops in one field. After one or two years of use, fields go into fallow. Farmers move to the next plot and forest land to protect the soil and allow for a build-up of nutrients.

When the cycle lasts 15-20 years, jhum is sustainable. However, increasing population has led to a shortened jhum cycle and land degradation. A possible alternative to jhum cultivation is terrace cultivation. But this, too, has its limitations because extensive parts of Nagaland are too hilly for economic use of terracing. Farmers must, therefore, cut down more primary forest for their food needs.

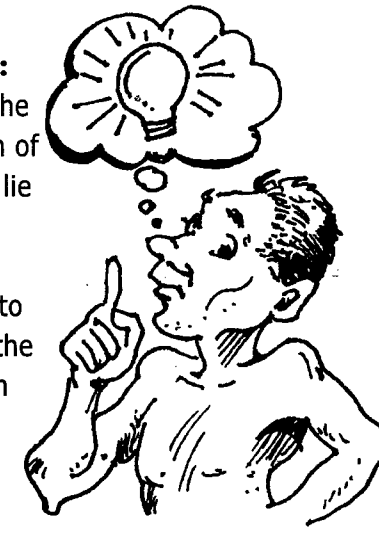
The possibility of having a soil-based economy in Nagaland has been well recognised. However, for long, no suitable approach towards afforestation in Nagaland could be conceived.

There were two confounding issues:

1. The foremost problem is the cultural reliance on jhum cultivation.
2. Subsidiary to this is the large-scale depletion of the natural forest caused by timber extraction.

Then the idea occurred:

1. That to a large extent the solution to the problem of jhum cultivation might lie in the practice itself.
2. The best method for afforestation might be to plant trees along with the jhum crops. It was then felt necessary to look into jhum practice in some depth.



Various schemes have been implemented to decrease the incidence of jhum cultivation, but these met with limited success. The increase in jhum cultivation both in intensity and extent far outstrips the results of implementation of past schemes to contain the practice. Also, the efforts made to replenish the forest cover have been lagging behind the rate of degradation.

In Nagaland, out of a total area of 7,000 sq km of jhumland, around 500 sq km is cleared of vegetation and burned annually for jhum cultivation. About 70% of the rural families subsist on jhum cultivation. As the land belongs to the people and is not owned by the State, there is hardly any way of externally regulating the land utilisation.

JHUM IS STILL NECESSARY

Although the practice has adverse effects, the following aspects cannot be ignored:

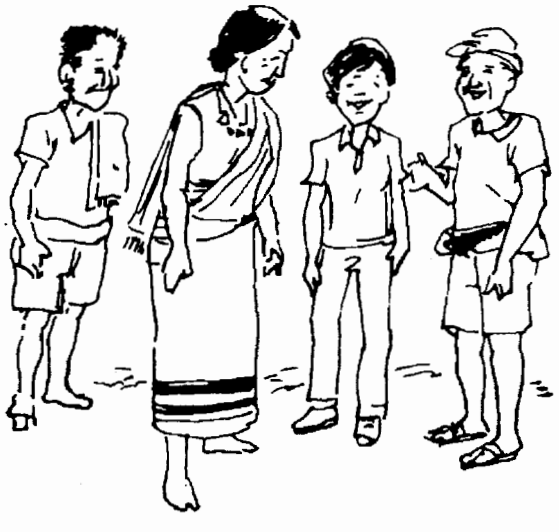
- Jhum assures a measure of food security for most of the people.
- In ecologically-sensitive and hilly terrains like Nagaland, application of modern technologies has limitations. Jhum, on the other hand, is the base for development and application of low-input technologies like "low-external agricultural input technology".
- The sustenance of agro-biodiversity of Nagaland may be attributed to the jhum practice.

THE CONCEPT

- Trees as a jhum crop. Jhum is a mixed crop system and adding one more "tree crop" will do no harm.
- Sowing of non-traditional winter crops like wheat, barley, pea and other crops after the harvest of traditional crops like rice, maize, millet, etc. in jhum fields.
- Selected shade-loving cash crops can be planted among the trees. These crops can yield income during the fallow period, which is also the gestation period of the trees.
- By adopting proper crop rotation and combination of trees and other crops, jhum cultivation can be turned into the main tool for economic development in Nagaland.

APPLYING THE CONCEPT

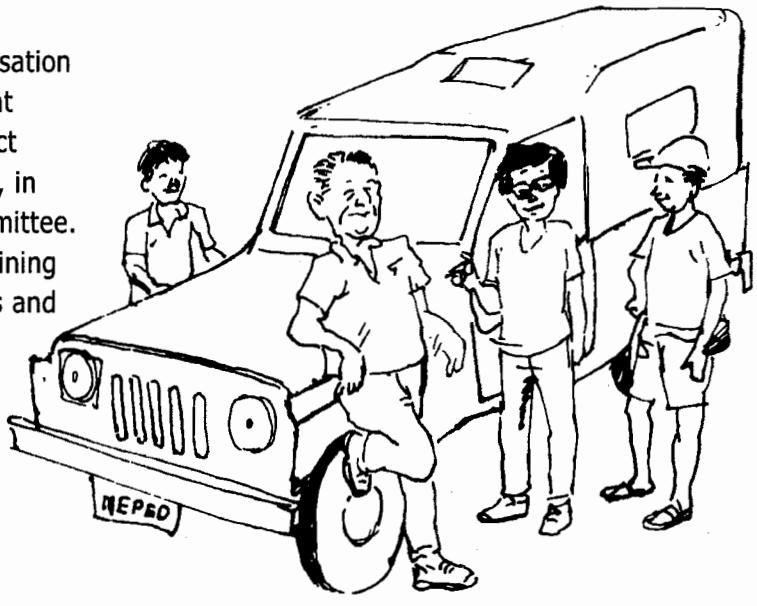
Motivating rapid based changes among a diversified region like Nagaland requires a broad-based project. At the same time of the initiation of NEPED, there were 1000 villages in Nagaland so the project targeted all of them.



The method selected for doing this was the establishment of two "test plots" in each village. The main thrust of NEPED project activities is on the test plot where farmers themselves would select, test and demonstrate agroforestry with technical support from NEPED. It is rather a "search-and find" type of project to establish a sound environment with sustainable economic development.

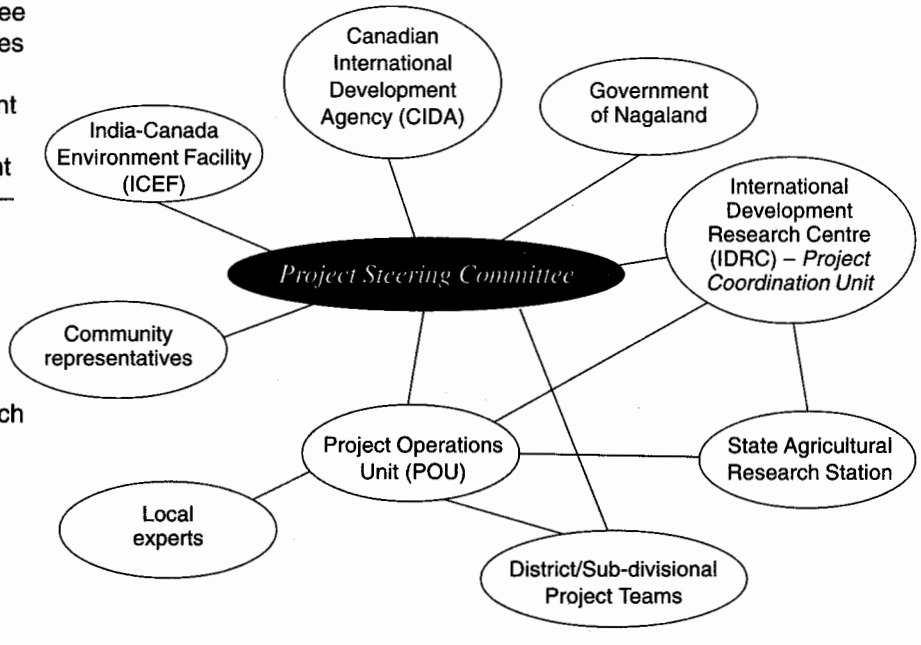
THE IMPLEMENTATION PROCESS

For the implementation, a separate organisation was formed drawing officers from different departments in Nagaland. Thus, the Project Operations Unit (POU) was formed which, in turn, is guided by a Project Steering Committee. Each POU member is given the task of training village councils, rural development boards and farmers. In addition, they are responsible for monitoring test plots and nurseries. They are the main links between insights gleaned from farmers and the technical expertise of agricultural researchers.



Organisational Structure

1. Project Steering Committee
2. Community representatives
3. Government of Nagaland
4. India-Canada Environment Facility (ICEF)
5. International Development Research Centre (IDRC) – Project Coordination Unit
6. Canadian International Development Agency (CIDA)
7. Project Operations Unit (POU)
8. State Agricultural Research Station
9. District/Sub-divisional Project Teams
10. Local experts



NEPED PRINCIPLE, GOAL AND OPERATION

- The principles underlying NEPED are sustainable livelihood, environment protection and development, putting rural people first.
- The project goal is sustainable management of the natural resource base, which would benefit the people of Nagaland. This project is specifically designed to improve lands under jhum.
- The project operation follows a participatory approach by involving the jhum farmers themselves in the selection, development and testing of agroforestry technologies.

Prepared by:
Razhukhrielie Kevichüsa

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

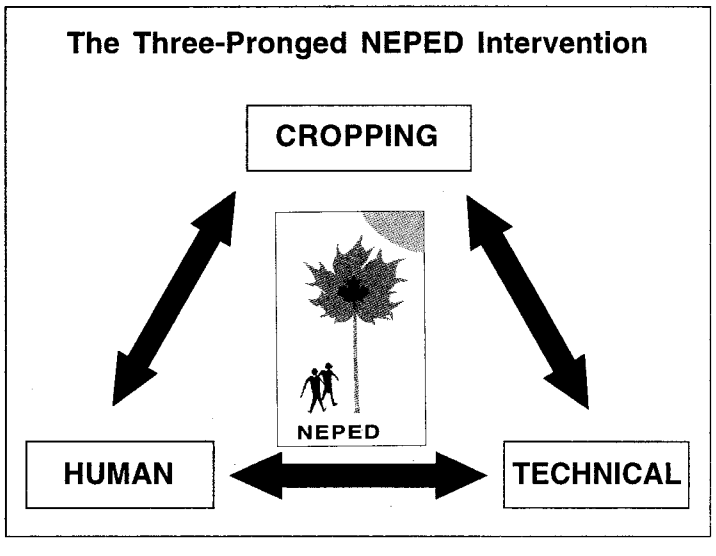
Agricultural Systems in Nagaland

NEPED Intervention in Naga Jhum Cultivation

Jhum or slash and burn cultivation is the traditional farming system of more than 80% of the Naga people who are subsistence farmers. The Naga way of life revolves around this system of cultivation which governs most of their life, culture and tradition.

Under more recent pressures and changes, the jhum system has been criticised as unsustainable. Before the Nagaland Environmental Protection and Economic Development (NEPED) project intervened, it was observed that:

- Jhum was poorly understood and actively discouraged by many researchers and development agencies.
- Jhum was regarded as a threat to the environment and a chief cause of soil erosion.
- Jhum cultivation was considered unproductive, especially where the cycles shortened.
- The practice looked like it would persist long into the future.



GENERAL BASIS OF NEPED INTERVENTION

NEPED aims to improve jhum from within by using the following interventions:

- To plant selected tree species as crops along with regular jhum crops.
- To improve upon existing soil and water conservation methods.
- To put **people first** and build their capacity for sustainable development.

It was observed that many native species of trees could be grown faster when planted in the jhum fields along with the other crops.This, therefore, initiated the concept of growing trees as a regular jhum crop and make jhum more productive and profitable.

CONTRIBUTION FROM FARMERS

- Jungle clearance, tree felling and burning of the jhum field in which the test plot is to be established
- Cultivation of the main jhum crop and subsidiary crops (first and second year)
- Protection of tree saplings (third year onward)
- Experimentation on different jhum crop-mixes
- Traditional knowledge and monitoring

CONTRIBUTION FROM NEPED

- Collection of tree seeds and /or establishment of nursery
- Funds for land shaping/terracing (first year) and repair/maintenance (second year)
- Funds for tree seeds or saplings (first year) and gap filling (second year)
- Funds for maintenance and protection of tree saplings (first and second year)
- Training and sharing of information
- Documentation and scientific research

ROLE OF THE NEPED PROJECT OPERATION UNIT (POU)

- Interact with villagers and with one another
- Provide technical and policy guidance to villagers
- Learn from the experiences and knowledge of villagers
- Oversee and verify the work
- Collect and document information and data
- Suggest specific changes to villagers for implementation of the project
- Monitor implementation

The Project Operations Unit (POU)

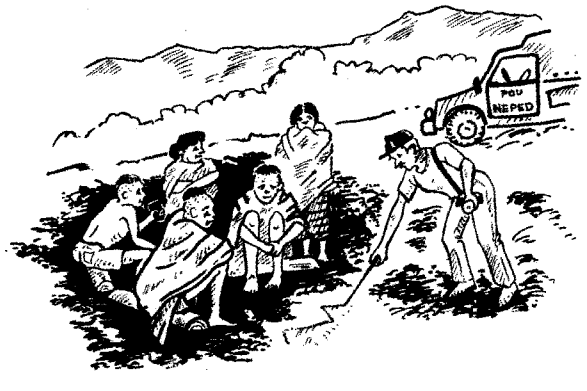
A separate organisation was formed for the NEPED implementation. Termed the POU, it draws officers from different departments of the Government of Nagaland and is guided by a Project Steering Committee. The committee consists of representatives from the community, government, funding agencies and other local groups.

NEPED INTERVENTIONS

JHUM ACTIVITIES

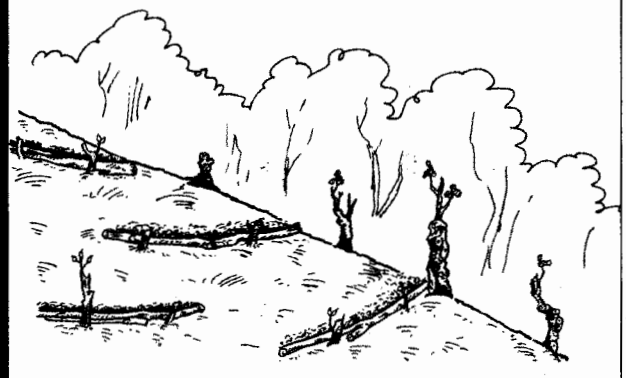
Clearing, collection of firewood, fibres and timber

NEPED ACTIVITIES



Training and selection of villages and test plots by District Project Teams and Village Councils

Burning of the jhum field



Test plot selection and start of land shaping

Land preparation

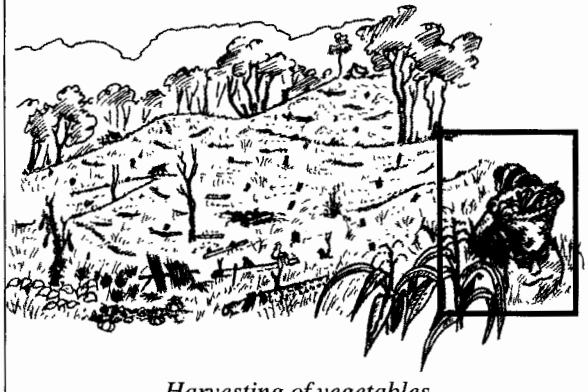
Land shaping and tree planting below contour bunds. Plant-to-plant distance (below contour) should be 2 m.

Sowing and dibbling of seeds

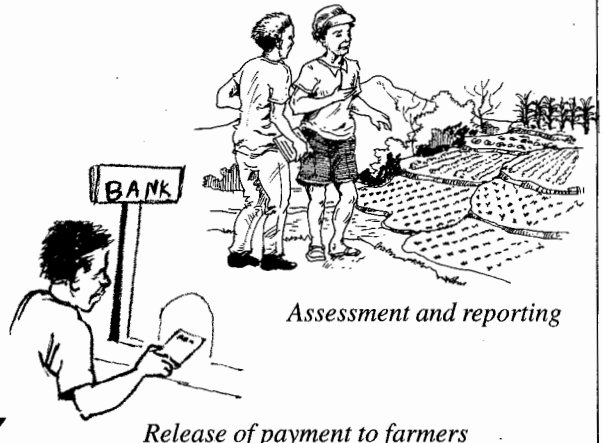
Verification by POU and District Project Team

Inter-culture operation

Maintenance of trees



Harvesting of vegetables

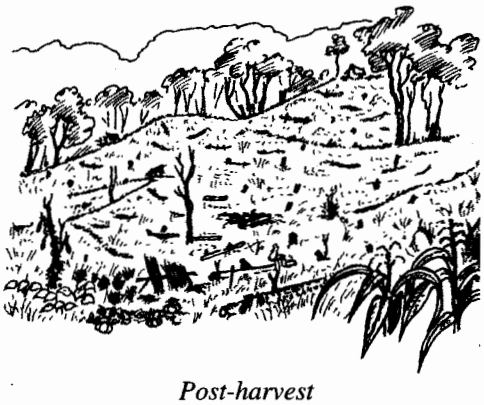


Assessment and reporting

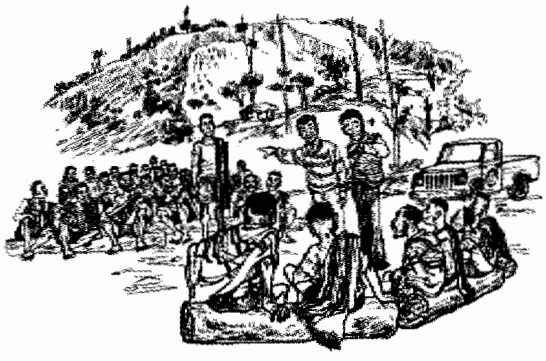
Release of payment to farmers

Harvesting of main crop

Maintenance of test plots



Post-harvest



Mass motivation and awareness activities

Slashing of forest for new jhum fields

Survey and assessment of survival rate of trees

NEPED Suggestions to Naga farmers

- Conserve soil and moisture in your jhum field.
- Use soil bunds across slopes to check erosion.
- Protect soil erosion in your jhum field.
- Use poles, stones, bamboo and logs across slope to check erosion.
- Plant one more crop called "tree crop" in your jhum fields.
- Inter-crop fast growing species of trees in your jhum fields.

Prepared by:
Zuchamo Kikon and
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Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Agricultural and Cropping Systems in Nagaland

AGRICULTURAL SYSTEMS

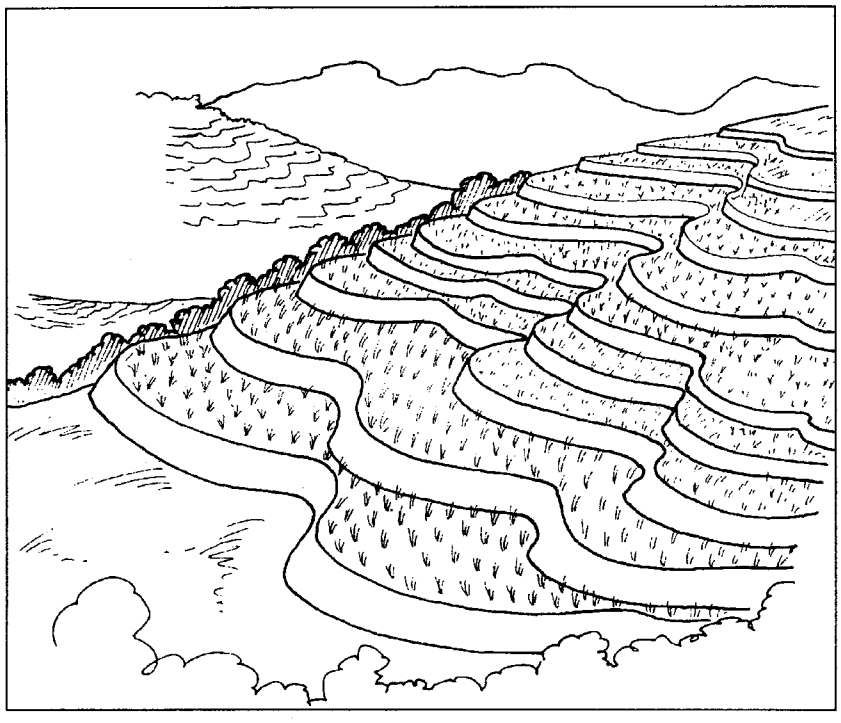
In Nagaland, agricultural systems are mostly based on traditional, cultural, geographical and socio-economic factors. There are four recognised systems:

1. Wet rice cultivation (WRC)

Bunds are constructed to divide the plot into a number of smaller sections. This is done to keep the crops partially submerged for some parts of the year. The crop is then planted within the sections and kept well irrigated. An abundant supply of water is necessary in this type of cultivation. WRC is carried out in the rainfed lowlands of Nagaland. It can be seen in the low-lying areas like Dimapur, Jaluki, Tizit and Baghty. Rice is grown followed by wheat, mustard and cole crops.

2. Wet Terrace Rice Cultivation (WTRC)

The crops are planted in terraces built along the slopes in WTRC. Abundant rainfall and/or irrigation is an important factor. The land may also be used for cultivation of crops like rice, potato, garlic and cabbage. Rice and potato are the two main crops grown in the Angami areas of southern Kohima district. In certain other areas like Kohima, Mon and Tuensang, winter wheat is also grown.



3. Jhum

The slash and burn method of cultivation is the most common agricultural system in Nagaland where roughly 80% of all cultivable land is under jhum. Mixed cropping is practised in the jhum fields with rice as the main crop, although in some cases, maize and millet are the staple.

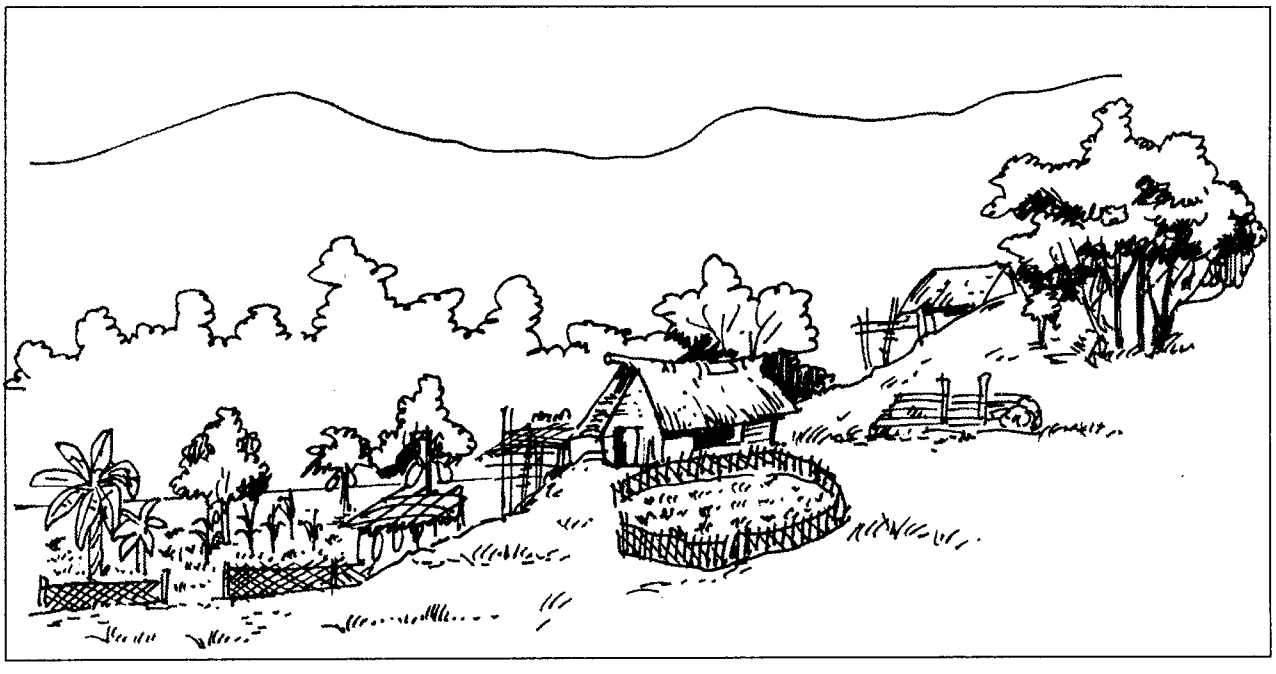
Between 15 to 60 different species of crops can be found in a single jhum field. Aside from the staple crop, supplementary crops include maize, millet, job's tears, legumes, beans, oilseeds, root crops and vegetables. After the harvest of cereals or oil seed, the fields are generally left fallow and only a few vegetables like ginger, beans, chillies, colocassia and green vegetables are grown.

Agroforestry Development

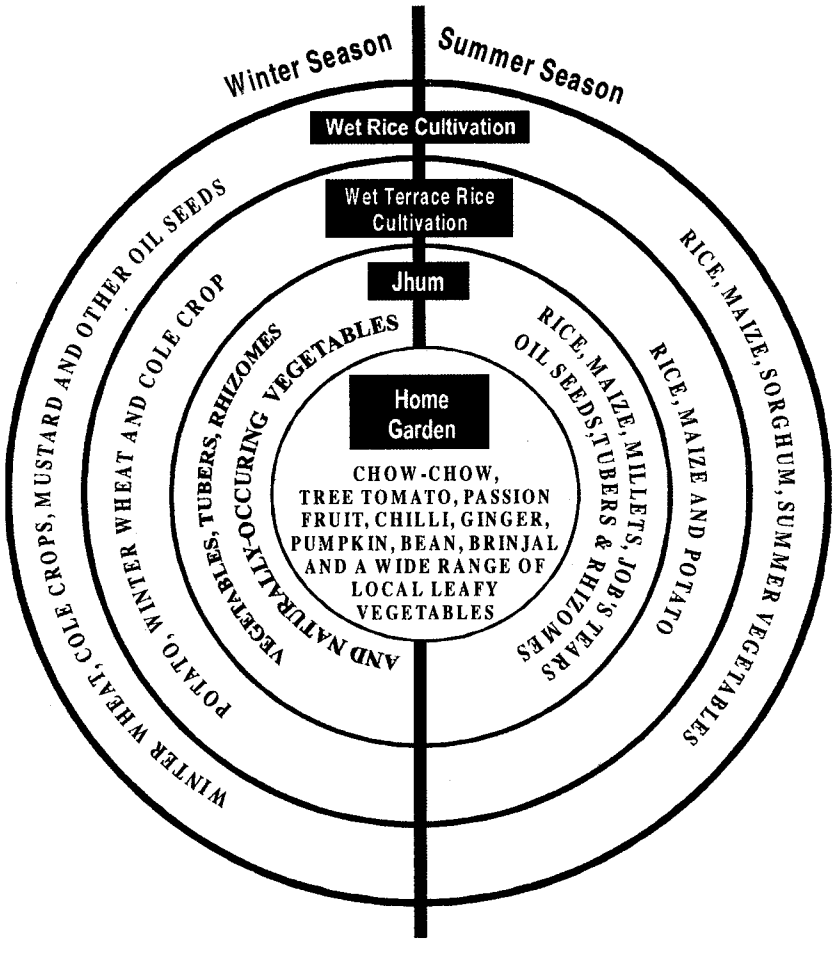
Recently, farmers in Nagaland have started planting trees in the jhum fields. Trees have come to the forefront as more and more people are realising the benefits of growing timber trees like teak, gomari and the nitrogen-fixing alder.

4. The Home Garden

The home garden is generally located close to the house and is used for growing vegetables, fruits and other food crops for the family. A wide variety of crops are grown throughout the year in home gardens including potato, cabbage, chilli, chow-chow, maize, tree tomato, bean, carrot, onion, garlic, orange and passion fruit (a separate topic on home garden is on page 151).



AGRICULTURAL SYSTEMS IN NAGALAND



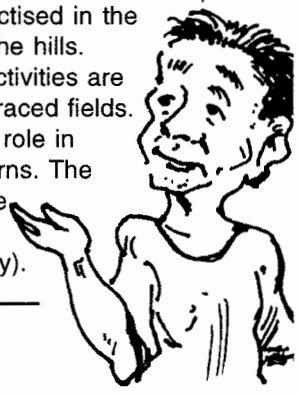
CROPPING SYSTEMS

Within each agricultural system, there is a large range of crop types as well as physical and temporal arrangements. These are termed cropping systems.

In Nagaland, the cropping systems are mostly based on traditional, cultural, geographical and socio-economic factors.

In Nagaland,

- Different tribes practise different systems of cropping.
- The topography and climatic conditions play a major role in determining the cropping system. Mono cropping is normally practised in the plains and mixed cropping in the hills.
- About 70% of all agricultural activities are carried out in the jhum and terraced fields.
- The seasons play a distinctive role in determining the cropping patterns. The two main cropping seasons are kharif (summer: June-October) and rabi (winter: November-May).



TYPES OF CROPPING SYSTEMS

I. Mono-cropping

A single crop is grown in one season and the same crop is grown every year. Crops like rice, maize and potato can be monocropped.

- Used for high-yielding varieties and cash crops. Rice is mono-cropped in Nagaland.
- More susceptible to total crop failure due to pests and diseases.

II. Multiple cropping

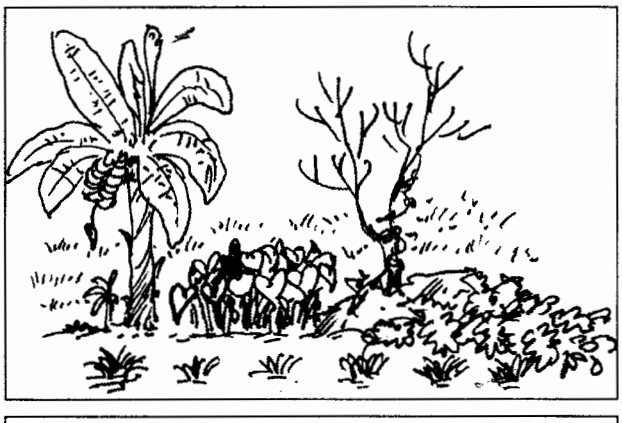
Two or more crops are grown on the same plot of land during a single year.

- Optimises the utilisation of natural resources like land, water, nutrients and sunlight.
- Increases the annual net yield per plot.
- Averts total crop failure due to pests, diseases or insufficient rainfall.

TYPES OF MULTIPLE CROPPING

a) Mixed Cropping

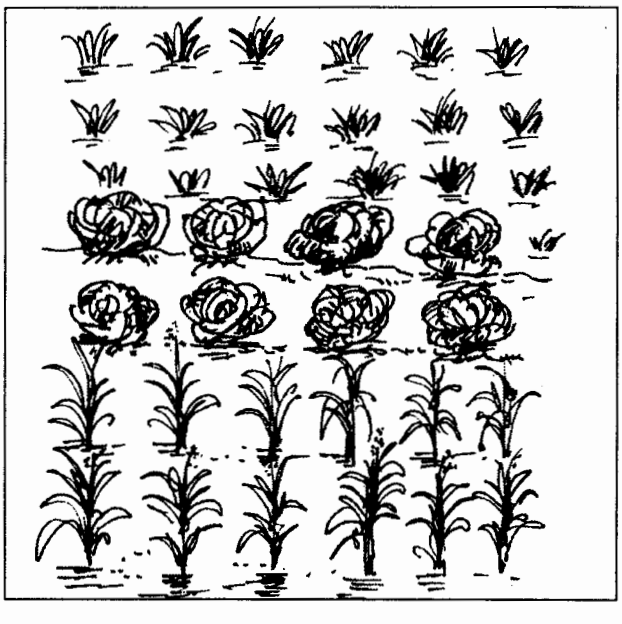
Many crops are grown randomly in a single season. The best example of this can be found in the jhum fields where farmers grow a wide variety of crops during the same season.



b) Inter-cropping

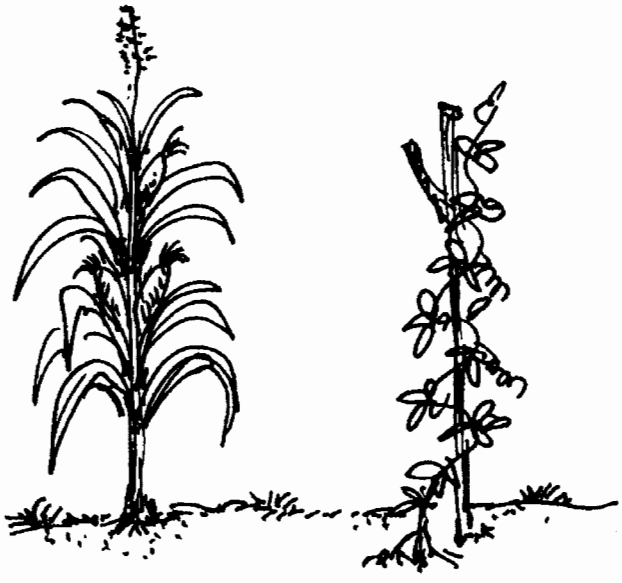
Two or more crops are grown together at a given time. The planting is done in a specific manner to ensure optimum growth and yield.

For example, crops could be grouped together or planted in rows depending upon the varieties involved. Rice and maize are inter-cropped in this manner.



c) Sequential Cropping

Two or more crops are grown in succession in a single year. For example, rice could be planted first and harvested, followed by maize. Relay cropping too is a kind of sequential cropping where the first crop is allowed to mature before the second crop is planted.



IMPROVING CROPPING SYSTEMS

An ideal cropping system should take into account:

- soil and water conservation;
- effects on soil fertility;
- diversity of crops;
- food security;
- high-yielding varieties of cash-crops;
- optimising the yield;
- market opportunities;
- plant interactions; and
- ecosystem impacts.

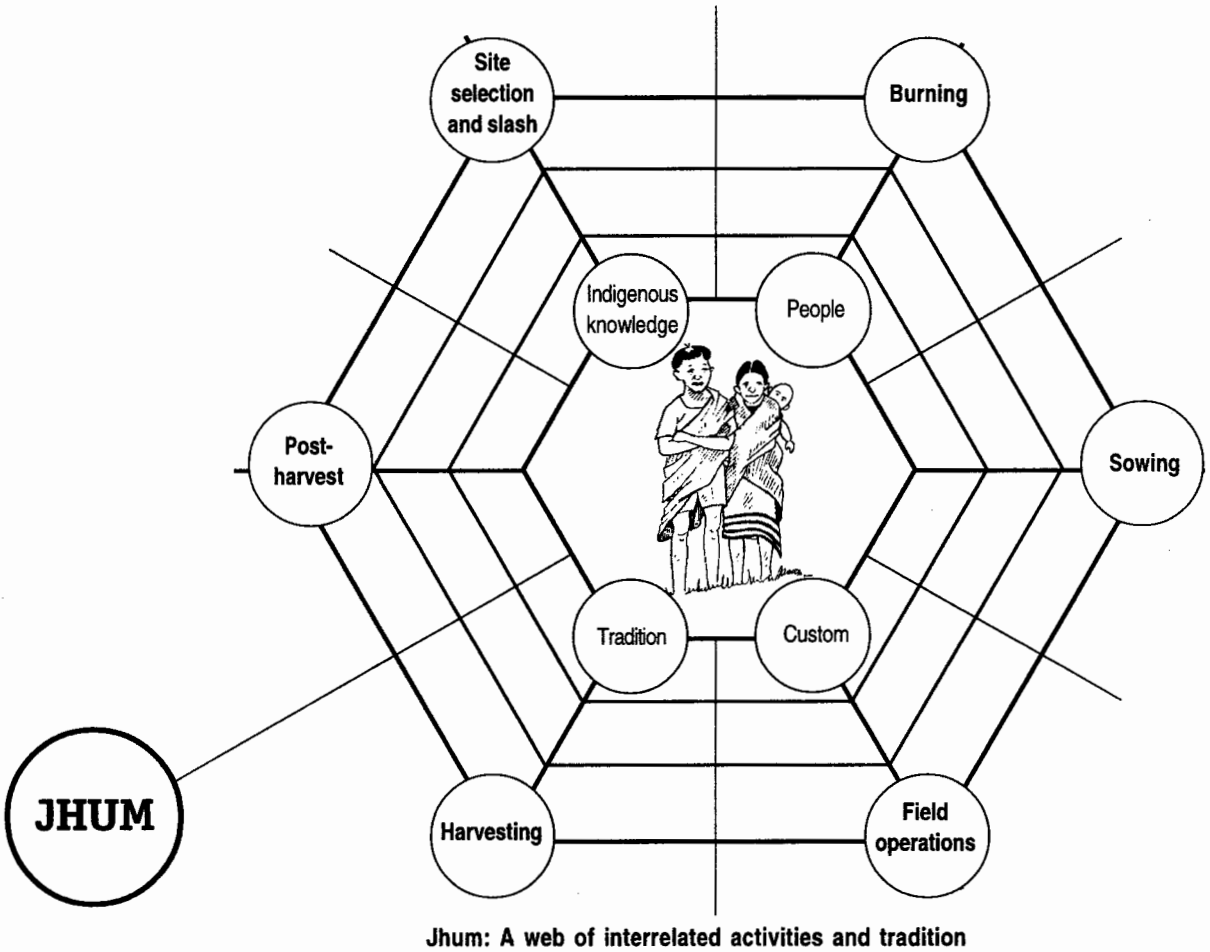
Prepared by:
Zuchamo Kikon

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Jhum: More than Just a Farming System

Many scientists view jhum or shifting cultivation as unproductive and destructive. It may, at times, be unsustainable. But there is no denying that jhum is a time tested system of cultivation, drawing upon traditional knowledge and indigenous practices. Unfortunately, this aspect has not been given sufficient attention.

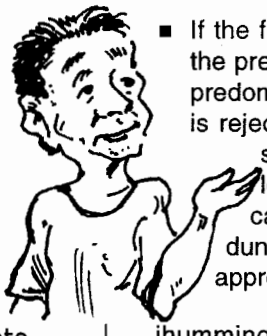
Jhum cultivation is deeply rooted in the Naga psyche, having evolved through the years and being rooted in customs, beliefs and folklore. Traditional jhum influences the Naga mindset. It influences the cultural ethos of its agrarian society and social fabric. For the Naga farmers, jhum is much more than a form of sustenance, it reflects the "reason" for their existence.



Jhum: A web of interrelated activities and tradition

NAGA TRADITION AND JHUM

- The Village Council, as the apex regulatory body in the village, decides on and pronounces the calendar of events involved in jhum.
- The Village Council also regulates other activities like assigning roles for the various groups that exist in the village. These groups are divided mainly on the basis of age, a traditional and intrinsic part of the Naga society, wherein each group has its role defined through historical perspectives.
- Another important role of the Village Council is to coordinate other jhum-related communal activities like clearing and maintenance of the footpath from the village to the jhum fields, construction of cattle fences and barricades, etc.
- In some tribes, the Village Council, along with other elderly and respected persons, conduct a day-long survey of the proposed sites intended for jhumming in the year to come. They return to the village the same evening.
- The next morning, all those involved meet together to discuss their visions and dreams of the preceding day. These are interpreted to relate with traditions and folklore of the selected areas to arrive at a consensus. If there is no consensus, the proposed site is discarded and another survey is carried out.
- The slashed fields are set afire by the middle-aged group whereas the eldest group is asked to remain behind to guard the village. The younger men take over to tend the fire and to take effective fire control measures.
- Besides the peer groups, there are other traditional groups separated on the basis of clans and *Khels* (division of various sectors within the village). These groups are also collectively involved in various jhum activities that include weeding, harvesting and carrying the harvest from the fields to the village granaries.
- Women are involved in almost all important activities in jhum. They identify and set aside the viable seed stock that shall be used for planting crops in the following year. This is usually done before the main crops are harvested.



Examples

- If the forest they chose the previous day had a predominance of ferns, it is rejected. But if they saw an area with a lot of earthworm castings (mud dung), the site is approved for jhumming.
- Dreams about barren scenes, infertility and nudity suggest the need to review the usefulness of a site. Conversely, if the dreams denote signs of feasting and fertility (this may range from child bearing to trees bearing fruits), the proposed site is selected.
- When the fields are set on fire, the talented hunters, who may be from any peer group, take advantage of the flight of wild animals from the fire to hunt them down. Each hunter has his role defined viz. the stalkers, the beaters, the hunting dog owners, etc.
- If the hunt is successful, there is an elaborate meat-sharing ritual where every person involved gets a piece of the game, starting with the man who shot the animal. He gets the head and one hind leg.

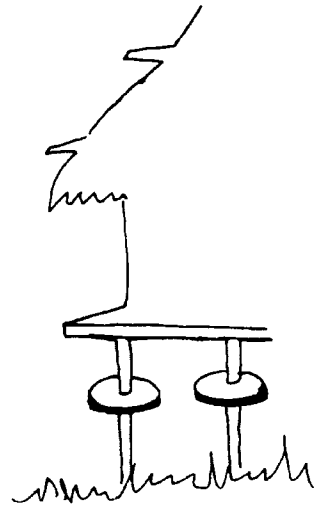
It is established that jhum is a well-organised and regulated *social system* of cultivation in Nagaland. The intensive year-round activities of jhum have ensured its assimilation into the social structures of the Nagas. Besides involving the entire village community in a participatory manner, it has built a bond that has blended various societal groups to create a social cohesion that has withstood the ravages of time and modernism.

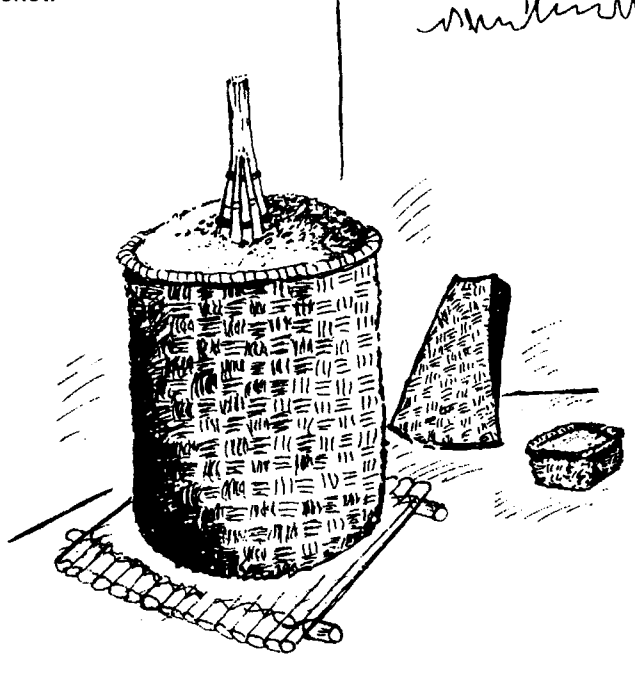
Interwoven with the culture and tradition of jhum is a complex system of indigenous knowledge based on experimentation and innovation. This knowledge is manifested in the Nagas' tools for hunting and planting; the containers for grain storage; the processes for decision-making; and in countless other ways.

Farmer Innovations

Farmers construct barns that stand on stilts to store the rice. This provides protection from birds and rodents. Flat planks or inverted cup-shaped materials are attached to the stilt, to obstruct rats and rodents climbing into the barn.

To facilitate aeration of grains stored in baskets, a bamboo, split into a funnel shape with the narrower end protruding upwards, allows air to enter the basket.





Prepared by:
Sanchothung Odyuo, Pfukrulhou Koza and Raj Verma

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Alder-based Cash Crop Systems

Farmers in the uplands of the sub-Himalayas mainly depend on jhum. However, certain limiting factors affect the productivity and sustainability of the system.

Agroforestry systems can be integrated into jhum systems for economic reliance. Alder-based systems are profitable and can be adopted widely in fallow jhum fields in some parts of the sub-Himalayan region. Farmers can cultivate cash crops in alder systems not only to sustain their income but also to improve their lifestyles. Some examples of alder-based systems and their beneficial effects are described.

ALDER-CARDAMOM SYSTEM

- The system is commonly practiced in Sikkim and Darjeeling in India, in Nepal and Yunnan Province in China.
- Cardamom is a perennial, high-value, low-volume, non-perishable cash crop. It is an important spice and is used to flavour food products.
- Cardamom requires shade. The yield is increased due to shade provided by alder trees.
- Alder is a fast-growing and nitrogen-fixing tree. Alder-cardamom cropping maintains the soil fertility resulting in minimal fertiliser use.

ALDER-TEA SYSTEM

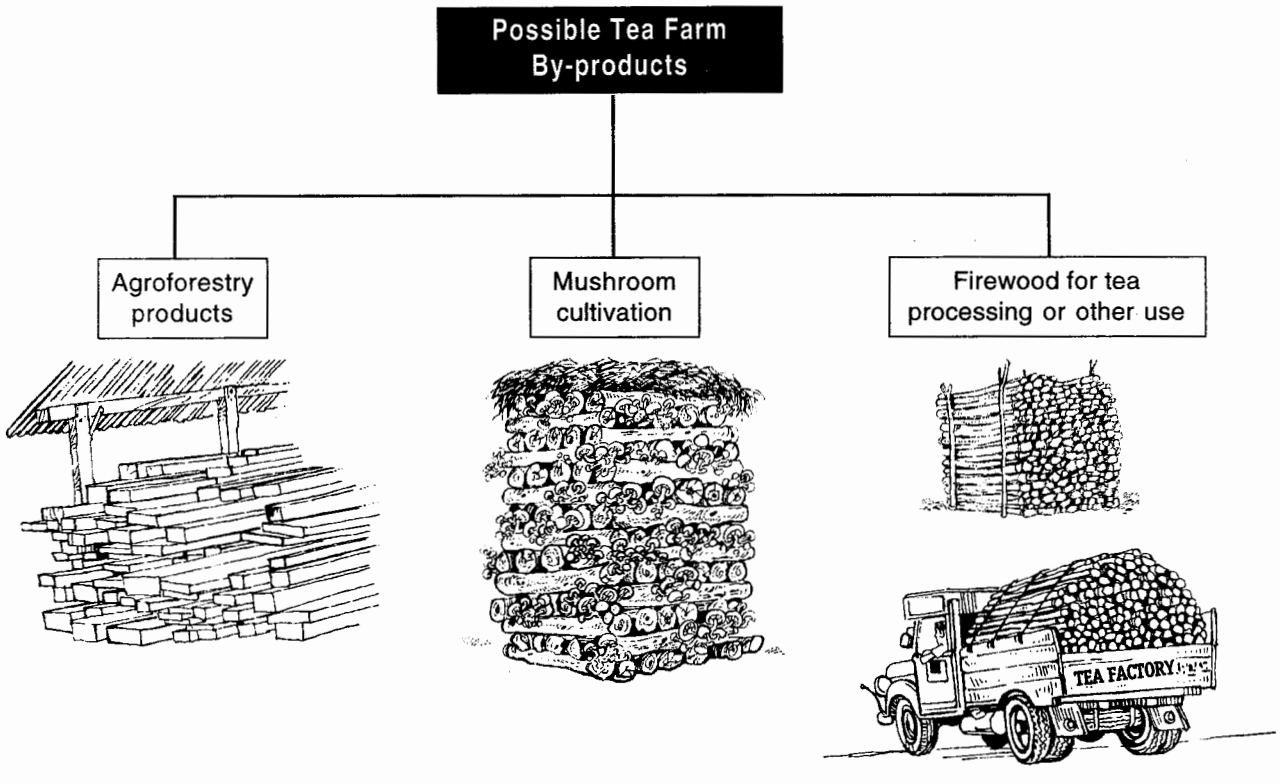
- The system is common in Yunnan Province in China.
- Tea is an important cash crop.
- Leaves of alder are used in tea plantations for green manuring and mulching.
- The trees provide shade and suppress weeds.
- Alder trees serve as better hosts for some insects that also attack tea plants.
- Alder wood stack is used as substrate for edible mushroom cultivation.
- The wood is used for timber and as fuel in tea factories in China.

OTHER ALDER SYSTEMS

- In Yunnan Province, alder seeds are broadcast in jhum fields as fallow vegetation to improve soil nutrients and enhance crop productivity for the next jhum cycle.
- Alder seeds are also broadcast in tree plantations (e.g., pine and Chinese fir) to supress weeds and replenish the soil nutrients.

IMPLICATIONS FOR NAGALAND

- Few farmers in Nagaland use alder-cardamom systems and the alder-tea system is not used.
- The beneficial effects of alder systems indicate the potential of widespread adoption for fallow management in jhum.
- Alder, being a nitrogen fixer, requires minimal use of chemical fertilisers. It also acts as a "catch" plant for insects, particularly in alder-tea systems. Hence, the use of pesticides is also minimal.
- The alder system is not labour-intensive.
- It is stable, self-sufficient and ecologically sound and also provides high economic returns.
- Tea farmers in Nagaland can possibly adopt the alder-tea system to diversify the farm production activities and increase their income as described below.



Prepared by:
Amenba Yaden

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Alder-based Jhum System of Khonoma Village

Khonoma village is located about 20 km west of Kohima, the capital of Nagaland. The village is interspersed with alder trees, some of these are more than 200 years old and are still healthy. A unique and highly productive form of jhum has been developed in this village based on the alder tree.

The alder-based jhum system is extremely important because it provides at least 57 food crops to supplement the rice staple grown in nearby Wet Terrace Rice Cultivation (WTRC). It is not possible to grow these cereals and green leafy vegetables in the WTRC.

The Alder Tree

Botanical name : *Alnus nepalensis* D Don
Family : Betuloceae
Common name : Alder
Local name : *Rupuo* (Angami)
Ongpangsülem (Ao)
Yangpou (Konyak)
Litusu/Lutusu (Sema)

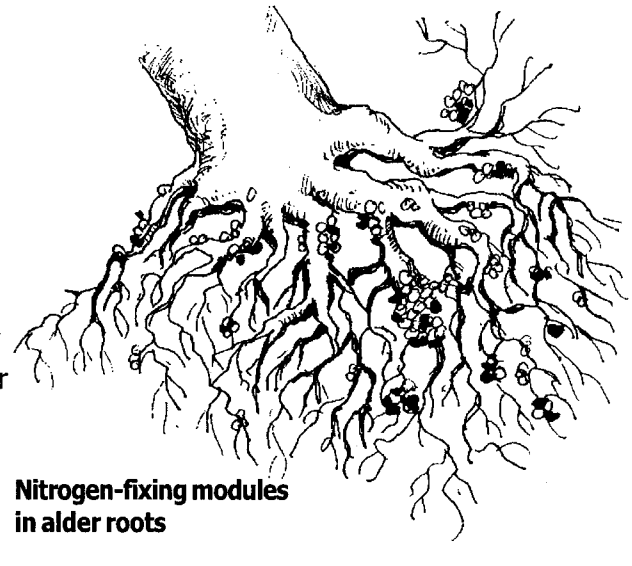
Distribution
The genus Alnus is widely and generally distributed throughout the cooler parts of the northern temperate region, extending southward at high altitudes in Columbia, Peru, Bolivia, Japan, southern China, Northeast India, Myanmar, Malaysia and Algeria.

Plant description
Alder is a large deciduous tree which is usually found in clusters. It can be easily recognised by its greyish, dark green bark, often with yellowish patches of horizontal lenticels in young plants that become thick, grayish to dark brown with corky fissuration when the trees are 6 to 8 years old. The leaves are 8-20 cm long and 5-10 cm wide.

Ecology
Alnus nepalensis is a pioneer species of degraded lands. It grows well in full light and is moderately shade-tolerant. It does not require fertile soil. It prefers permeable soils and thrives on land with a high water table but not completely waterlogged. It is a rapid coloniser of gravelly lands and old cultivated lands which are frequently unstable. It is often found growing along water courses, gullies and shady ravines, usually in gregarious strips.

Uses
The wood is used in various domestic needs such as fuelwood, charcoal burning and construction timber. The tree sheds its leaves to retain moisture and mulches and add abundance of humus to the soil. The matured wood is used for making luxury furniture.

Alder trees are grown in most parts of Nagaland. However, the antiquity of the alder-based jhum system is attributed to the Angami farmers of Khonoma village, who have perfected this practice into a fine art. The alder tree has root nodules which improve soil fertility by fixing atmospheric nitrogen into the soil. It also enhances crop yields and reduces soil erosion. Normally, a jhum farmer cultivates the fields for two years within a nine-year cycle (1:4 ratio of cropping to fallow). But the alder system allows two harvests in two out of every four to five years (1:1 ratio of cropping to fallow).



Nitrogen-fixing modules in alder roots

How to Establish the Alder System

If the jhum field is located in the hills above 1000 m:

- Plant alder saplings collected from the nursery or seedlings from the wild.
- Maintain a spacing of 3-4 m between plants and 5-6 m between rows.
- Let the trees grow for 10 years or until they attain rough fissures on the bark after which you can execute the initial pollarding.

If the jhum field is located at an altitude of less than 1000 m:

- Plant gogra with some nitrogen-fixing plants (koroi, mandani and gomari) and follow the same operation described.

BENEFITS FROM THE ALDER SYSTEM

This sustainable and productive system has the potential to be adopted on a wider scale. For example, villages in land-scarce areas suitable to the alder could increase food production. In addition to more productive agriculture, this system also provides good quantities of timber and firewood.

ALDER-BASED JHUM CULTIVATION

Four steps are involved:

1. In the first year in a jhum plot, alder trees are pollarded (cut off from the main trunk) at a height of 2 m from the ground before or after the slash and burn operation. (Pollarded branches are sold or used as fuelwood).
2. Primary food grain crops and secondary crops such as vegetables are grown as mixed crops in the burned fields.
3. The cropping operation is repeated in the second year.
4. The field is left fallow for two to four years to allow the alder trees to grow for pollarding and cropping in the subsequent cycle.

POLLARDING OF ALDER TREES

The practice is done in two phases: (1) initial pollarding; and (2) cyclical/subsequent pollarding. Young trees are pollarded for the first time when the bole circumference reaches 50 to 80 cm and the bark develops rough fissures, usually at the age of seven to 10 years. The next pollarding is after four to six years (i.e., two years of cropping and two to four years of fallow period).

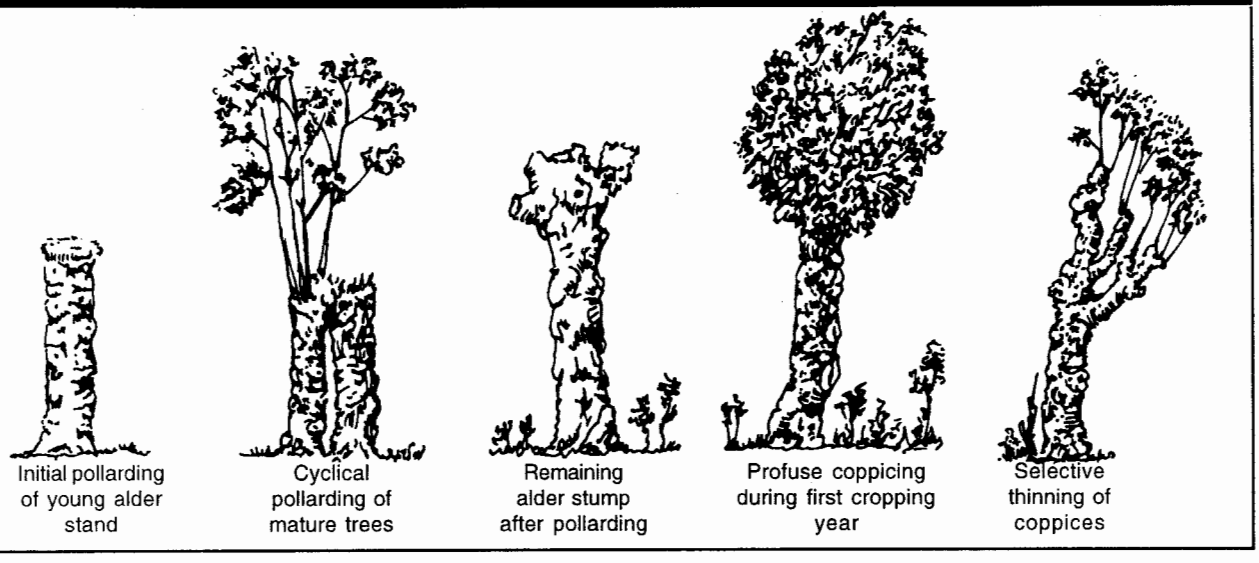
INITIAL POLLARDING

In this process, the main trunk is cut horizontally at the height of 2 m from the ground. Sprout growth decreases with the increase in sprout density and stump diameter, while it increases with the height of the stump. It is very important that the height of the stump is kept at about 2 m in order to obtain good sprouts and, at the same time, to avoid cattle damage. The flush of coppice shoots should not interfere with the light-demanding agricultural crops.

What is Pollarding?

Some species, such as alder, have the ability to coppice or sprout again when cut or injured. Pollarding is an operation whereby the main trunk is cut off, usually at about 2m above the ground. This permits coppicing of shoots on the stump which may be subsequently harvested.

Pollarding of An Alder Tree



The main trunk should be horizontally cut using a sharp *dao* (utility knife) to ensure that the stool head is not split. After pollarding, the fresh cut is then plastered with mud to prevent it from drying and cracking. The stone slab is then placed at the top to protect the fresh stool head from frost damage and ensure that new coppices will sprout from all sides resulting in a more horizontally spread canopy formation. Some farmers cover the fresh cut with hay and stone slab to protect the stool head from the desiccating effects of winter winds and accumulation of frosts at night.

Cyclical pollarding (Re-opening the fallow)

Cyclical or subsequent pollarding is repeated every four to six years. Normally, an alder jhum field is cropped for two years after which, it is abandoned. The coppice shoots, if not removed at this time, are usually kept for less than six years on the stump. Otherwise, the growth of the coppice shoots is so fast that these are unable to withstand strong winds that cause the old stump to split and ultimately decay.

Flush of coppice shoots in second (selective) pollarding

A pollarded stump (whether initially or cyclically pollarded) coppices profusely. Sometimes, about 200 shoots per stump are produced. All the shoots are allowed to grow on the stump until the agricultural crops are harvested.

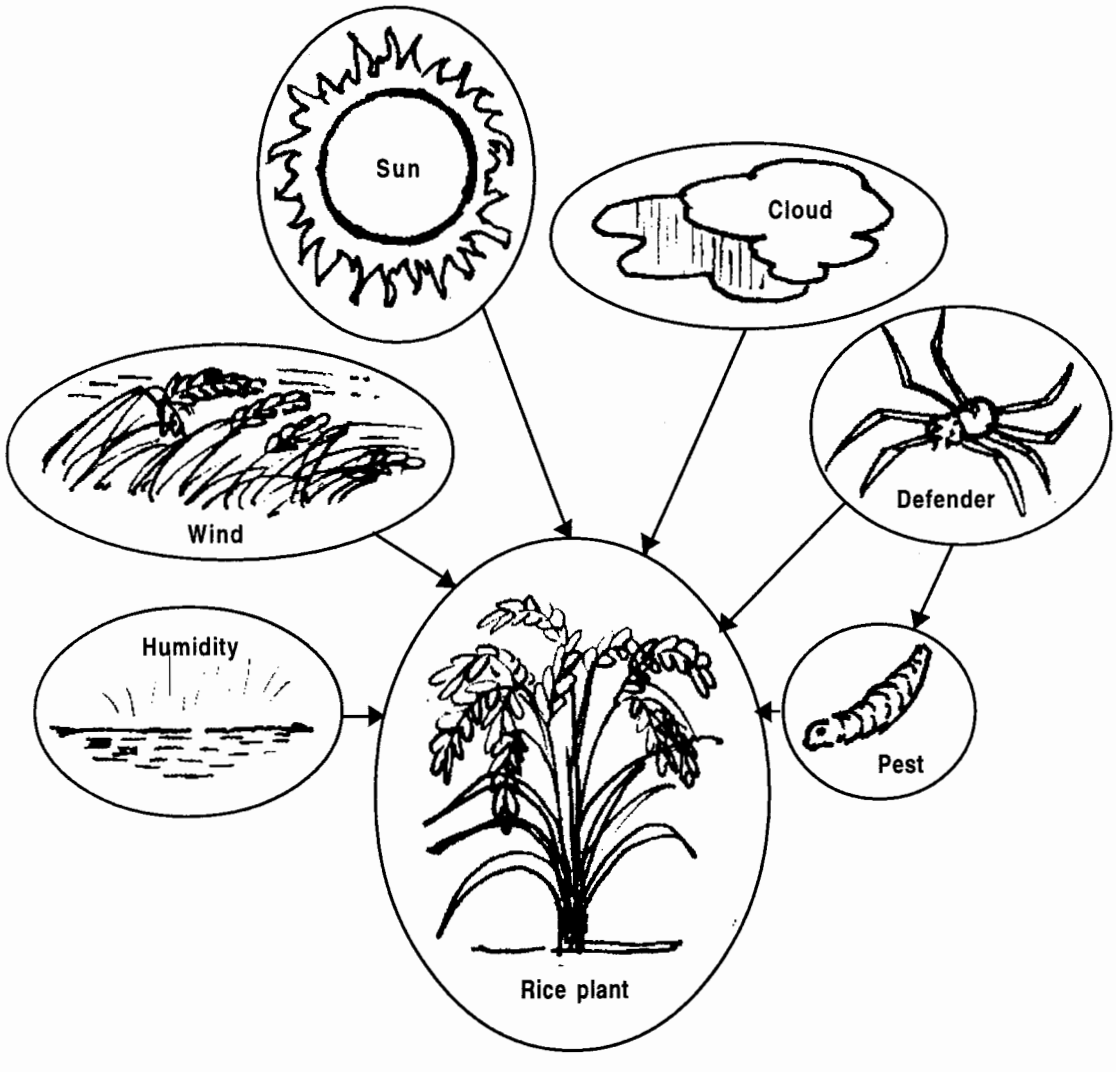
After the harvest of annual crops, the field is prepared for the second year of cropping (i.e., cropping of the same field during the second year within the same jhum cycle). The second pollarding is then carried out; i.e., selective thinning of the coppice shoots of the stumps. Of the 100 to 200 shoots, only four to six shoots are selected and retained; the rest are flushed down with a sharp *dao*. The farmer executes this operation judiciously to ensure that the selectively-retained shoots are properly distributed around the top of the stool head to avoid congestion. The second pollarding operation is also done during winter when the physiological activities of the plant are minimal.

The Angami farmers of Khonoma village have developed the alder-based jhum system to a high level of sophistication. Interestingly, after hundreds of years of pollarding, the yields of crops are still sustained. Other parts of Nagaland could benefit from this farmer-developed and proven approach. Exchange visits could be maximised to promote this practice widely.

Prepared by:
Amenba Yaden

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Rice Ecosystems in Nagaland



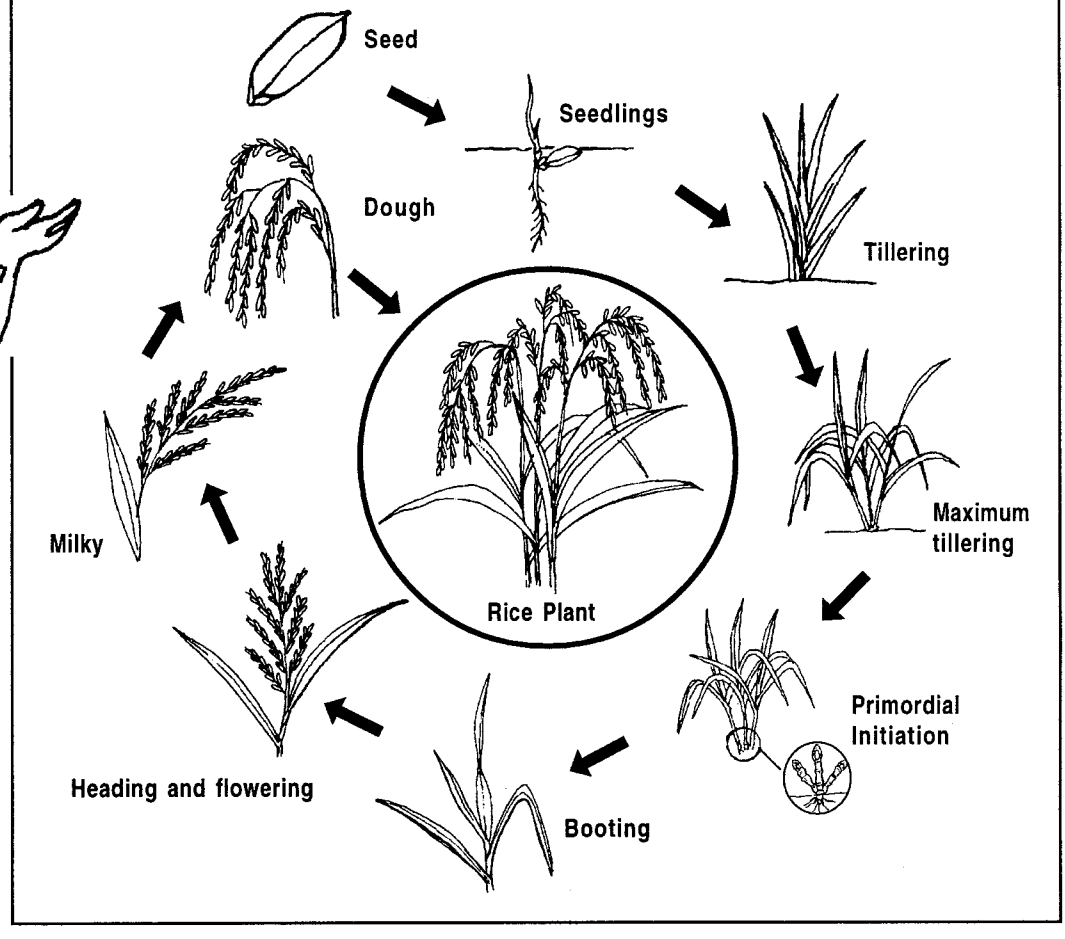
FACTORS INFLUENCING RICE ECOSYSTEM

An ecosystem is the combination of naturally-prevailing biotic and abiotic environments interacting at tropic levels, exchanging materials for energy flow.

Nagas cultivate about 360 different varieties of rice. Out of which, 50 have been identified and found to be economically viable. Of the total area under rice cultivation, jhum rice occupies 70%, rainfed terrace rice 20% and low lying wet rice, 10%.

Biotic factors	Abiotic factors
■ Host plant ■ Pests ■ Defenders ■ Weeds ■ Soil	■ Sunlight ■ Humidity ■ Wind ■ Water ■ Weather

Different Stages of Rice Plant

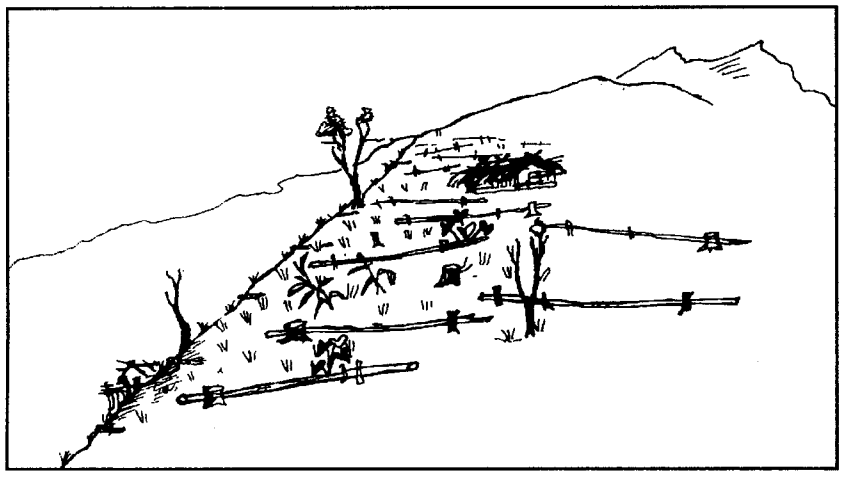


RICE ECOSYSTEMS IN NAGALAND

There are three types of rice ecosystem in Nagaland.

JHUM RICE ECOSYSTEM

This system is generally practised in high altitude mountain terrain ranging from 500-2000 m (asl) with moderate to steep slopes.



Jhum Rice Varieties

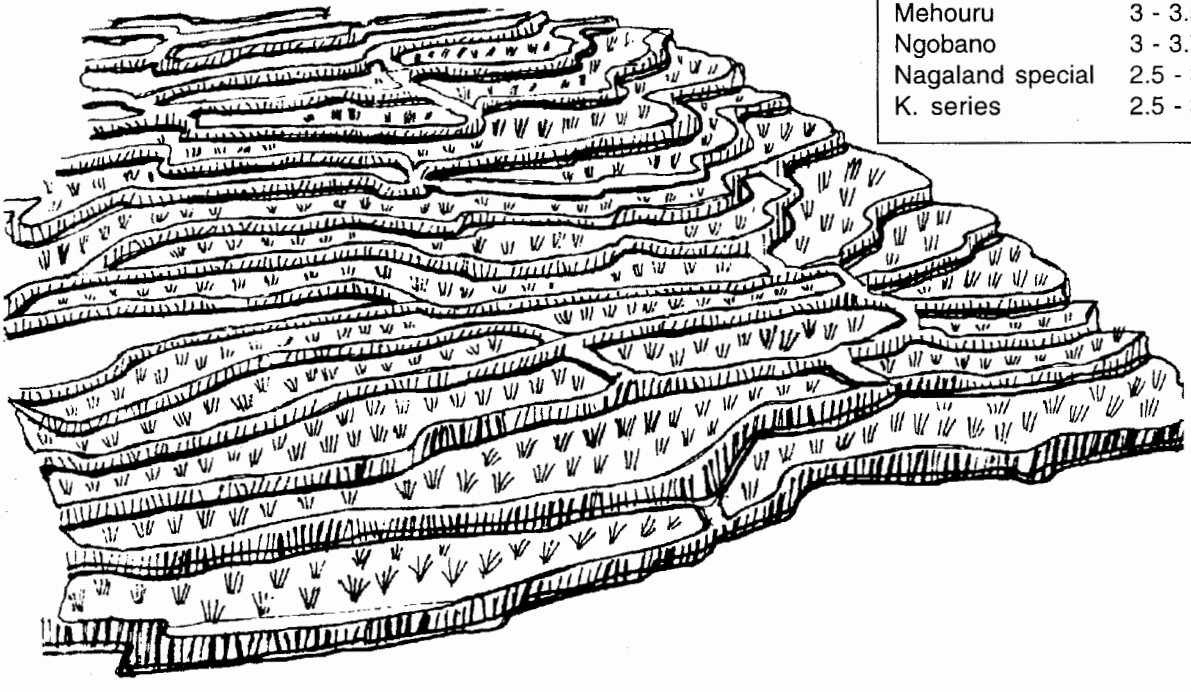
Name/code	Yield/ha
Sars-1	3 - 4 MT
Sars-2	2.5 - 3 MT
Sars-3	2.5 - 3 MT
Sars-4	2.4 - 3 MT
Sars-5	2 - 2.5 MT

Rainfed Rice Ecosystem

This system is adopted at altitudes ranging from 500-1000 m (asl) In this system, both terraced and unterraced cultivations are practised.

Rainfed Rice Varieties

Name	Yield/ha
Mehouru	3 - 3.5 MT
Ngobano	3 - 3.7 MT
Nagaland special	2.5 - 3 MT
K. series	2.5 - 3 MT



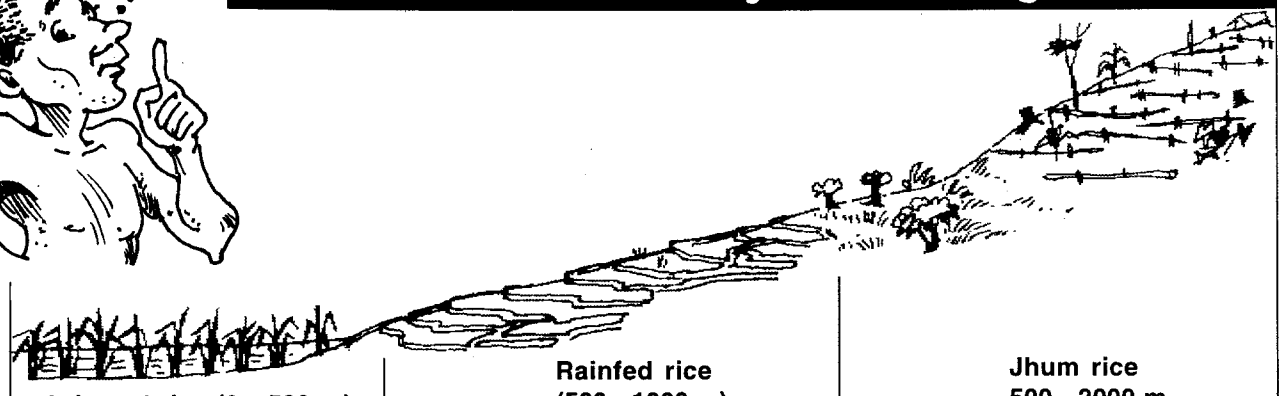
Wet Rice Ecosystem

This system of rice cultivation is done in low-lying valleys along rivers with an altitude ranging up to 500 m (asl).

Irrigated Rice Varieties

Name	Yield/ha
Bedkoti	2 - 3.5 MT
Pankaj	2.5 - 3 MT
IR-8	2 - 3 MT
IR-21	2 - 3.5 MT

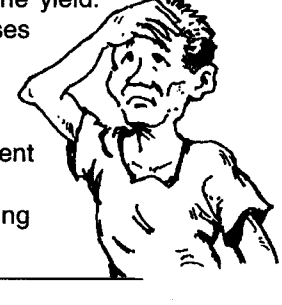
Limiting Factors and Possible Solutions for Different Rice Ecosystems in Nagaland



	Irrigated rice (0 - 500 m)	Rainfed rice (500 - 1000 m)	Jhum rice 500 - 2000 m
	Wet Rice Cultivation	**Wet Terrace Rice**	**Upland Jhum Rice**
PROBLEMS	■ Flood prone ■ Limited area ■ Normally one crop per year ■ Nutrient deficiency ■ Labour intensive	■ Soil acidity ■ Nutrient loss ■ No cold tolerant high yielding varieties ■ Elements like Ca, Mg are deficienct ■ Drought-prone ■ Insects and disease prone	■ Soil erosion ■ Soil acidity ■ No cold tolerant high yielding varieties ■ Resurgence of pests ■ Damage to natural biodiversity ■ Low yield ■ Labour intensive ■ Year round activities
SOLUTIONS	■ Integrated nutrient management ■ Selection of suitable high-yielding varieties ■ Innovative irrigation methods ■ Addition of required fertilisers/ ammendment by correct method ■ Adopt relay cropping ■ Integrated pest management	■ Innovative methodology for integrated nutrient management ■ Suitable soil moisture conservation measures ■ Selection of suitable cold tolerant variety ■ Innovative methods for puddling and transplanting ■ Introduction of integrated pest management practices	■ Suitable soil conservation methods ■ Addition of required fertiliser by correct method ■ Improve traditional varieties for higher yield ■ Introduce integrated pest management ■ Addition of organic matters and biofertilisers

Constraints to Rice Production

- Rice is cultivated in varied types of soils and climatic conditions.
- Prolonged cloudy weather results in low light intensity which ultimately reduces the yield.
- Incidence of insect-pest and diseases (endemic epidemic).
- Lack of adoptable high-yielding varieties for different ecosystems.
- Lack of adoptable varieties for different types of soil.
- Lack of cold-tolerant and high-yielding varieties.



Prepared by:
Temsu Yanger Phom

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Intensification of Jhum Fields with Annual Leguminous Cover Crops

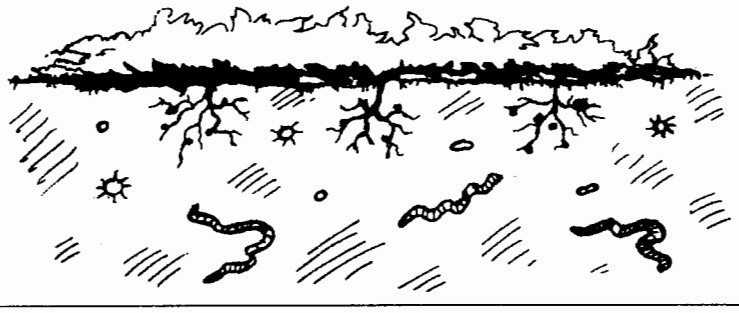
Jhum fields in Nagaland are usually cropped for two years and left fallow for seven years in a nine-year jhum cycle. In recent years, there has been an increase in population and demand for food. Land use has increased and fallow periods have been reduced. Farmers are now growing more food crops during the fallow period. However, productivity of land and crops has declined drastically. Land productivity and crop yields can be enhanced by including an annual leguminous cover crop during the cropping year.

Cover Crops

Leguminous cover crops (e.g., velvet bean, rice bean and soybean) have dense foliage and are grown mainly to:

- cover and protect the soil;
- fix atmospheric nitrogen in the soil;
- stimulate microorganisms to loosen compaction of soil;
- add biomass to the soil and improve soil fertility;
- create well-aerated and well-drained soil structure; and
- maintain soil temperature and conserve microorganisms and earthworms.

Velvet bean

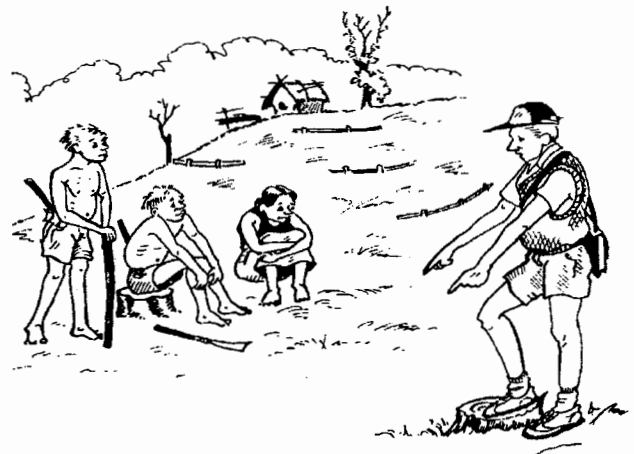


ON-FARM TRIALS

On-farm trials were initiated by the NEPED research team in three villages of Mokokchung district in 1997-1998. Five farmers from each village, each having 1 ha of land, were involved. In the traditional practice, rice was grown as the main crop during the first two years of the jhum cycle, followed by fallow.

CROP SELECTION

In the third year, farmers were asked to select one cover crop from three options: rice bean, velvet bean and soybean. These crops are traditionally grown in jhum fields as secondary crops. All the farmers chose velvet bean as the seeds were easily available. They considered velvet bean as an important food crop that had good market value.



CROP VARIETY

The high-yielding rice variety SARS-I (*Sungmangtsuk*) was planted in the first, second and fourth jhum years at 30 kg/ha. A local black variety of velvet bean was planted in the third year at 40 kg/ha. The crop was sown in April and was harvested after five to six months.

Velvet bean

ADVANTAGES OF THE IMPROVED SYSTEM

- Improvement of soil fertility due to biomass addition and nitrogen fixation.
- By raising a cover crop in the third year, the land productivity is increased.
- The farmer can cultivate rice in the fourth year and obtain additional income by selling the grain in the third and fourth years.
- The seeds of cover crops are consumed as pulses which, an important component in the diet of Nagas.
- Leaves of cover crops are used as fodder and as green manure.
- Cost of farm production is reduced as the same jhum field is used for four years.
- The extent of jhum land is also reduced and, thus, may reduce deforestation.

Jhum year	Crop	Yield (t/ha)	Income[1] (Rs)
1	Rice	2.5	10,000
2	Rice	1.7	6,800
3	Velvet bean	1.2	6,000
4	Rice	2.0	8,000

[1] Market value: rice = Rs. 4 per kg grain; velvet bean = Rs. per 5 kg grain.

WHAT HAPPENED AFTER THE FOURTH JHUM YEAR?

The farmers had two options:

1. Leave the jhum field as fallow until the next jhum cycle (i.e., for about seven to eight years).
2. Introduce fallow management practices and cultivate crops that grow under shade; e.g., ginger, turmeric, cardamom, coffee, betel vine, passion fruit and pepper.

OPTION: WITHOUT COVER CROP

Year	1	2	3	4	5	6	7	8	9	10	11
Practice	Jhum (rice) with trees	Jhum (rice)	Fallow/Fallow								

OPTION: WITH COVER CROP

Year	1	2	3	4	5	6	7	8	9	10	11
Practice	Jhum (rice) with trees	Jhum (rice)	Cover crop	Jhum (rice)	Fallow/Fallow crop						

Prepared by:
Supong Keitzar, Temsu Yanger Phom and Imliakum

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Some Measures for Sustaining Agroforestry

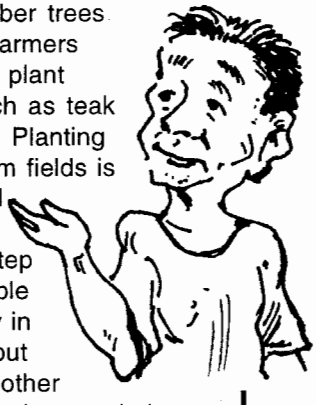
Integration of agroforestry and fallow management into jhum cultivation is one pathway to an improved jhum system. It is well suited to the ecology of the region, fits in with Naga traditions and is a source of income for the villages while ensuring food needs.

Extensive study based on empirical evaluation and field observations in the region suggests 10 practical steps to improve the jhum system through agroforestry.

- Support the transfer of farmer-tested technologies and best practices across and between the different tribes in Nagaland.
- Need for special strategies where jhum cycles are below 10 years in length.
- Build upon traditional knowledge on the local ecology to make sure that tree plantation is patterned after natural tree architecture.
- Introduce nitrogen-fixing species into the system, like alder (*Alnus nepalensis*).
- Maintain important bamboo species to conserve nutrients and serve as windbreaks.
- Introduce fast-growing native shrubs and trees, while avoiding monoculture.
- Shorten the time span of forest succession and accelerate recovery by adjusting species mix in time and space.
- Improve animal husbandry.
- Re-develop village ecosystems through the use of appropriate technology.
- Strengthen conservation measures based upon the traditional knowledge and value system. It is especially important to protect existing natural forests.

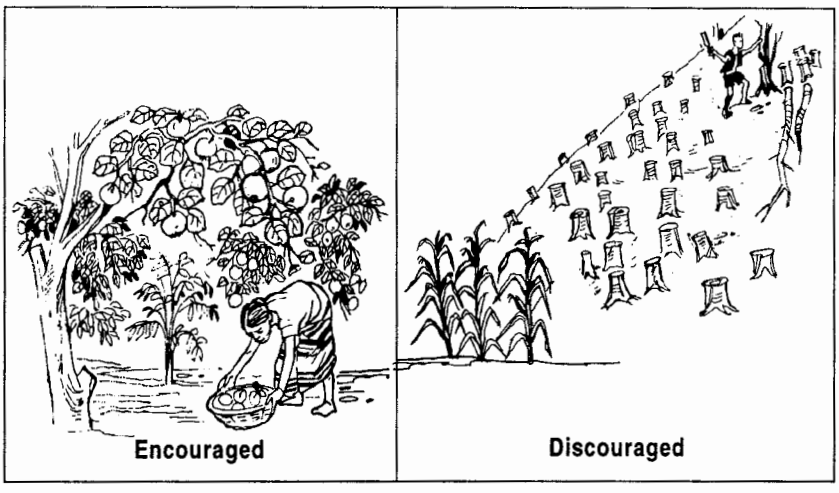
Agroforesty in NEPED

NEPED was designed and implemented to assist in the development and adoption of new agroforestry technologies and production systems. Emphasis was placed on planting timber trees with many farmers choosing to plant species such as teak and gomari. Planting trees in jhum fields is the first and most important step to sustainable agroforestry in Nagaland, but adoption of other practices is also needed.

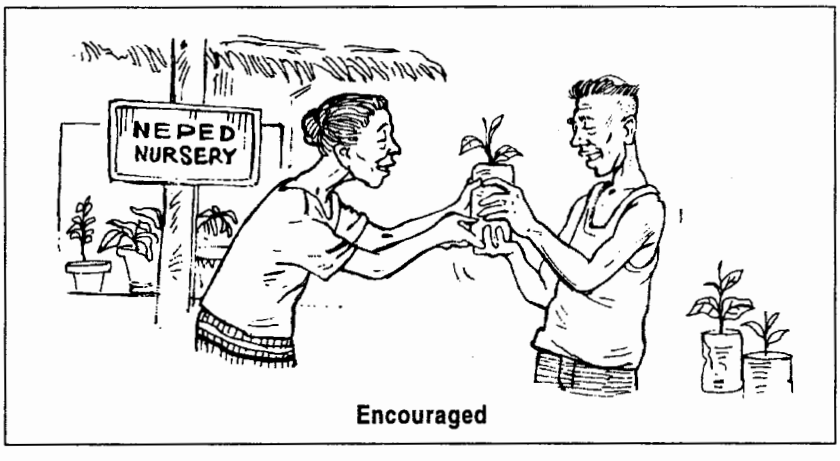


MAINTAINING AGROFORESTRY

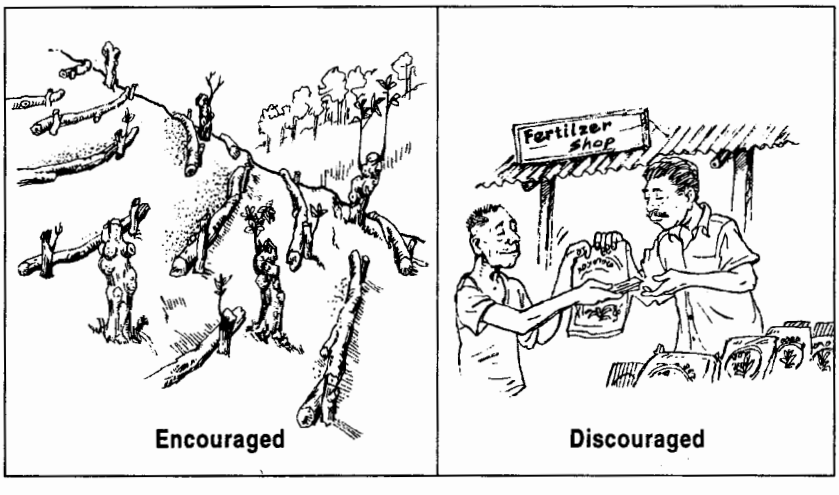
- Minimise encroachment on natural forest for jhum cultivation, in the short- and long-term.
- Discourage clearance of old-growth forest for establishing tree plantations.
- Work with villagers to find viable agricultural alternatives in land-scarce areas.
- Transform jhum into profitable agroforestry.



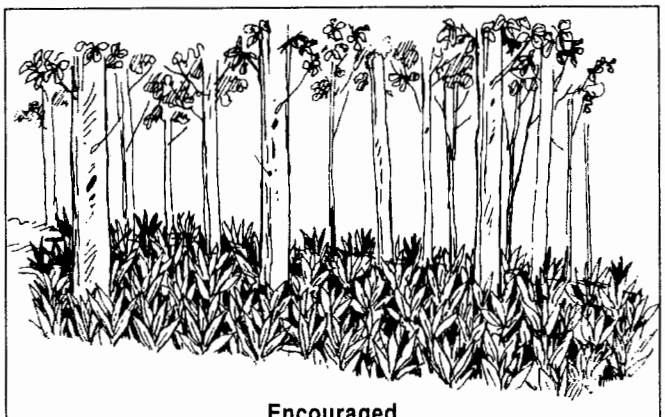
- Encourage self-sustaining agroforestry without dependency on free planting materials.
- Encourage farmers to buy seedlings from local-based nurseries established under NEPED.
- Encourage low-cost ways of self-reliance through replanting wild seedlings and planting seeds directly.



- Reduce soil erosion and improve fertility.
- Avoid costly soil fertility solutions that small farmers cannot afford.

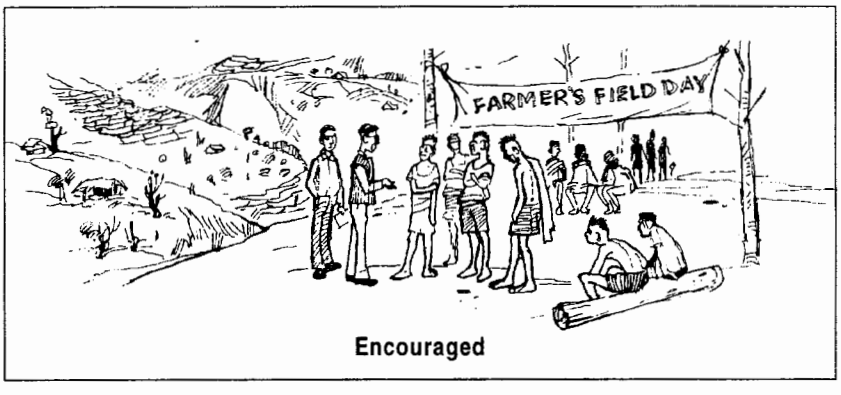


- Plant crops with potential higher return as cash and food crops in agroforestry.
- Add other crops that are of high value, shade tolerant and easy to store and transport.

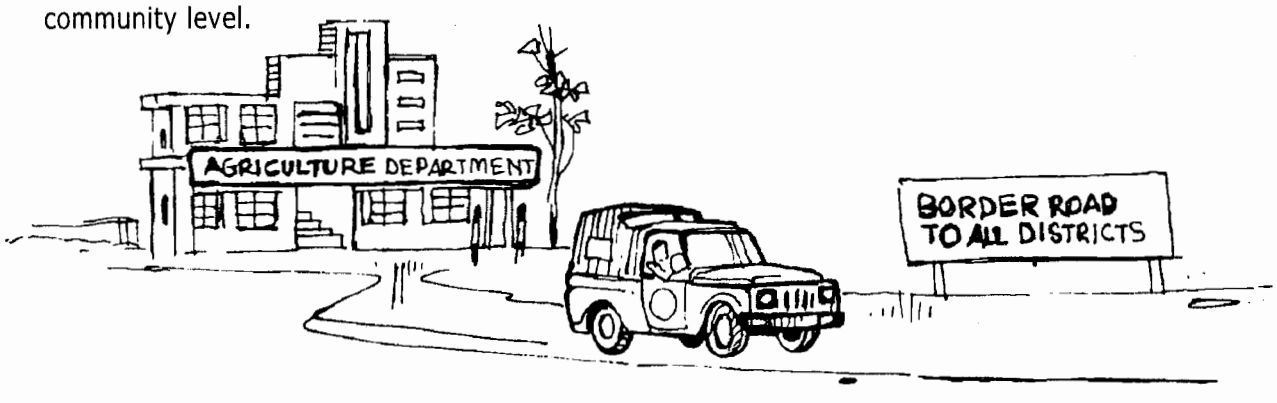


Encouraged

- Help villagers find access to lucrative markets, first emphasising on poles available from thinning operations.
- Facilitate local value-addition processing.
- Mount effective programs for improved farming practices.
- Develop a program for use of this resource book at the community level.



Encouraged



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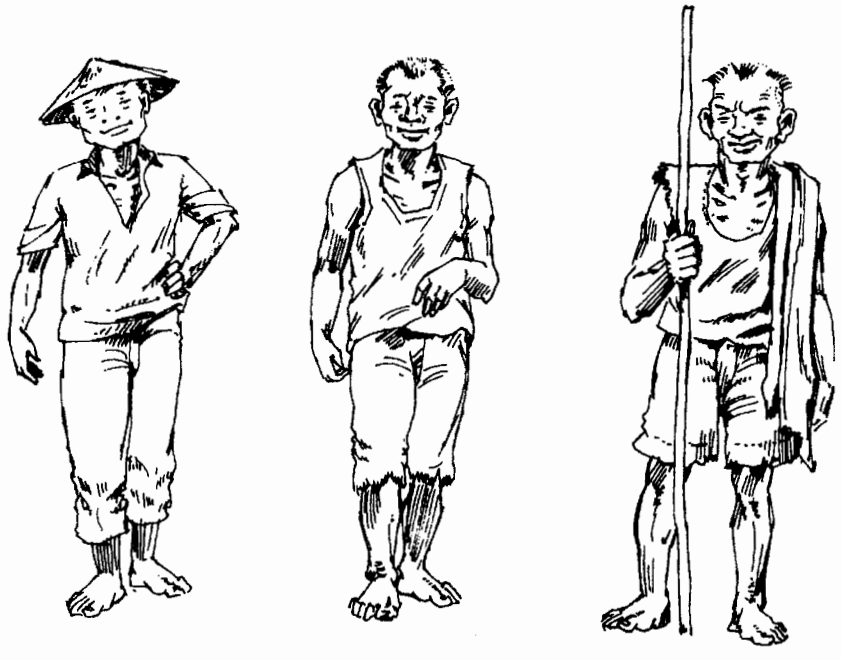
Prepared by:
Merle D. Faminow

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Comparative Agroforestry Systems of Vietnam, Laos and Nagaland



The purpose this paper, which is a result of a trip, is to study the transition from subsistence shifting cultivation to market-oriented agriculture in Yen Bai district in Vietnam and Xiengguen, Pak Xeng, Ban Kachet, and Ngoi districts in Laos. Several international agencies are trying to accelerate this transition through the introduction of modern technology, especially in agroforestry.

VIETNAM

In Vietnam, shifting cultivation is widespread in the hills in the northern part of the country. The primary crop is rice, which is inter-cultured with trees during the first year. The dominant species of trees are bamboo, eucalyptus, cinnamon and styrax. In the second year, cassava is planted to establish food security and to provide shade for the trees that were planted in the previous year. Rice production in the plains of the southern part of Vietnam is sufficient to meet the country's domestic requirement. Efforts are being made to introduce agroforestry in the hills in northern Vietnam in the areas under shifting cultivation. Since 1993, the government has been allocating land to individual households.

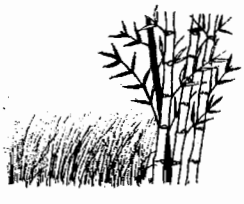
LAOS

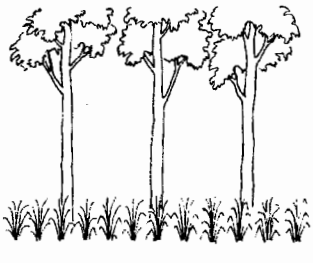
In Laos, the practice of shifting cultivation is more basic. One aspect where Naga farmers can contribute is in the improvement of soil conservation measures and mixed cropping with legumes. Production of rice is foremost in the minds of the farmers. In visits to several villages and farms, rice was observed to be grown without soil conservation measures. In several places, signs of severe erosion were visible and the crops were unhealthy. International agencies are now working to shift the focus from rice to other cash crops. Many important tree crops like teak and styrax are now being grown. Paper mulberry too has become an important crop for fallow management.

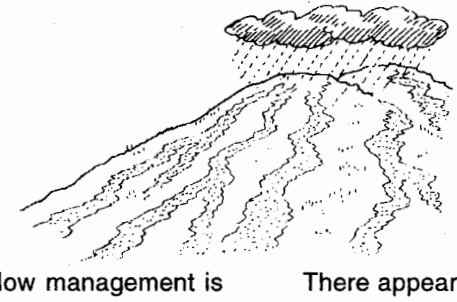
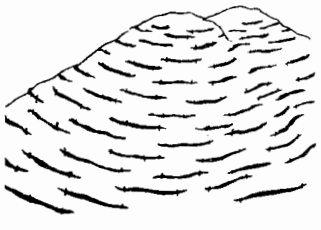
Observations

- Farmers in Vietnam and Laos could benefit from soil conservation measures and cropping methods practised by the Naga farmers. On the other hand, Naga farmers could learn about marketing strategies, packaging and processing of food items.
- A study should be made to select only a few species of trees that are of commercial importance and encourage the growing of these species as the dominant crop in tree plantations.
- Local farming methods in Nagaland should be properly documented.
- Efforts should be made to encourage villagers to plant trees by the roadside in Nagaland as is being done in Vietnam and Laos. While Naga farmers may be better in subsistence cropping, they could follow the practice of adopting more use of export-oriented agroforestry crops like cinnamon to generate income.

Comparative Statement of Agroforestry System of Vietnam, Laos and Nagaland

Terms of Reference	Vietnam	Laos	Nagaland
A. Physiography			
1. Slope	Gentle to steep slope	Medium to steep slopes wherever land is available for shifting cultivation	Gentle to steep slope wherever land is available for shifting cultivation
2. Soil	Red, sandy clay and gravel	Red, sandy clay and gravel	Clay loamy, mostly black
3. Vegetation	Scrub forest and sometimes bamboo forests 	Thicker forests than Vietnam 	Grassland to thick forests 
4. Climate	Hot and humid	Hot and humid	Colder, less humid
5. Extent of shifting cultivation	Not very extensive 	Extensive, sometimes covering the whole mountain 	Extensive, sometimes covering the whole mountain.
6. Size of individual holdings	Allocated by the state according to labour available to each household.	Allocated by the state according to labour available to each household.	A farmer normally has as many plots as the number of jhum cycles. The size of the plots may vary.

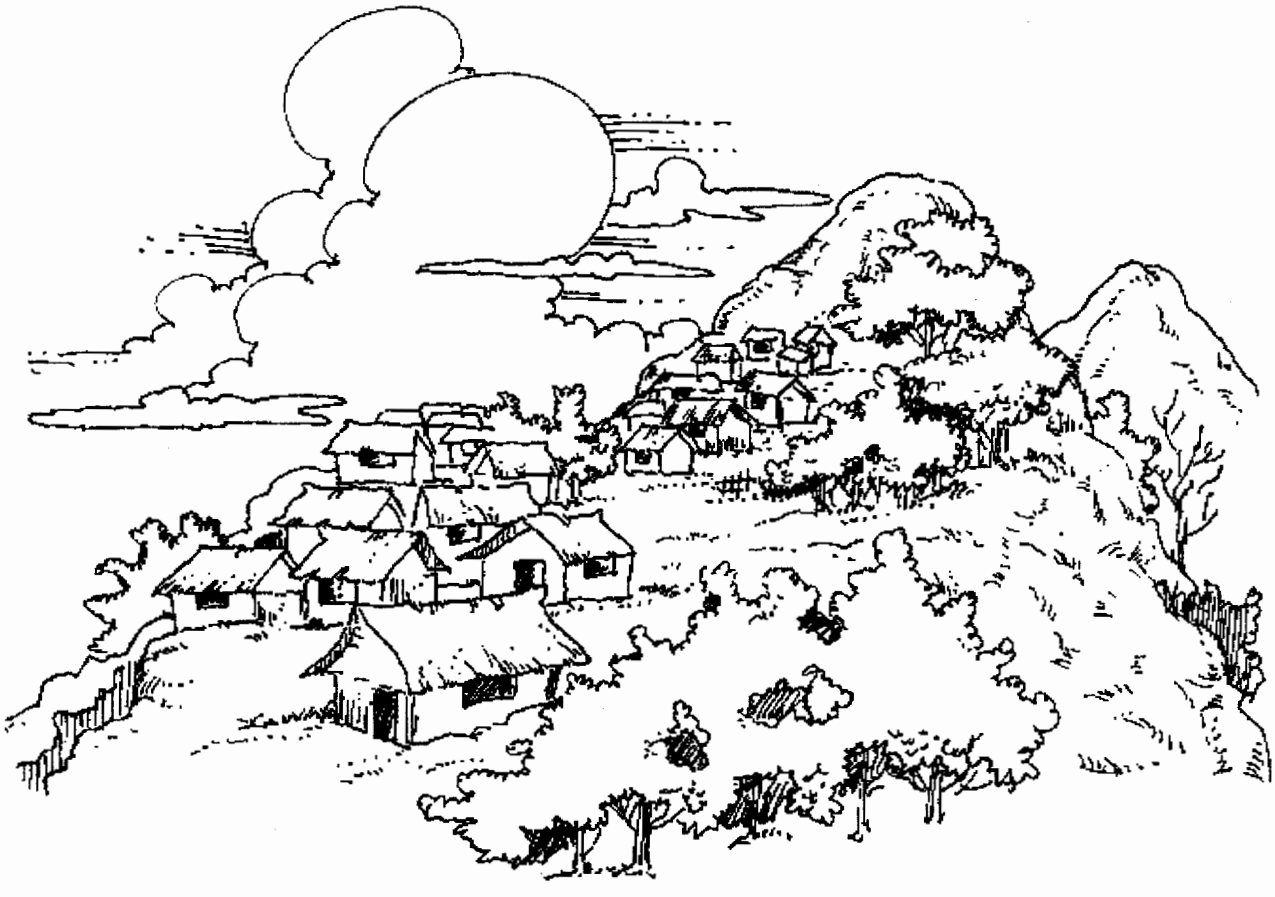
Terms of Reference	Vietnam	Laos	Nagaland
A. Cropping system			
1. Slashing	Entire land is cleared of vegetation by slashing. Tree stumps are cut very close to the ground 	Entire land is cleared of vegetation by slashing. Tree stumps are cut very close to the ground	Some trees are cut at chest height while some trees are left to stand. In other cases, poles are topped and left on site to provide support to climbing varieties of plants 
2. Burning	Well burned, residue is not visible	Well burned, residue is not visible	Well burned. The unburned residue is used as contour bunds to prevent soil erosion
3. Tillage operation	None	None	Minimum tillage
4. Sowing	An upright hollow stick is used for sowing 	An upright hollow stick is used for sowing. Eight to ten seeds are put into each pit. 	Seeds are broadcasted or dibbled in a staggered manner with a hoe. About three to five seeds are put into each pit. 
5. Crop mix	Mixed crop of rice and cinnamon 	Monoculture of rice 	Mixed crop of cereal, pulses, oilseeds, vegetables, root crops, etc. 
6. Crop density	Thin	Thin	Dense
7. Cropping time per jhumming cycle	2 years	Indefinite	2 years
8. Dominant crop	First year is rice Second year is cassava	Rice is grown until *Agoratum conyzoides* weeds appear in the field.	Rice/maize in the first year and millets in the second year

Terms of Reference	Vietnam	Laos	Nagaland
9. Why shifting cultivation?	To grow cinnamon, styrax, tea and raw materials for paper mills	For subsistence	For subsistence
10. Weeding	Weeds are removed from the fields to the margins four to five times a year	Weeds are removed from the fields to the margins four to five times a year	Only stolonite rooted weeds removed to margins of the fields or raised places. The rest are used for mulching.
11. Harvesting	Approximately 3.0 ton/ha of rice is harvested.	Approximately 3.0 ton/ha of rice is harvested.	Approximately 2.0 ton/ ha of rice is harvested. Other crops are also harvested.
12. Land ownership system	Land belongs to the State. The farmer has tenancy rights only.	Land belongs to the State. The farmer has tenancy rights only.	Individual or community has both ownership and tenancy rights.
13. Soil conservation measures	Few except for zero tillage	Few except for zero tillage	Elaborate
14. Erosion rate	Massive top soil erosion 	Massive top soil erosion	Less erosion 
15. Fallow management	Fallow management is aimed at converting abadoned jhumlands into a permanent source of income by growing cash-crops like styrax, bamboo, eucalyptus and tea.	There appears to be no specific objective for fallow management except planting teak for timber. Efforts are being made to promote paper mulberry and styrax.	The objective of fallow management is aimed at making the soil fertile in the next cycle which generates income for farmers. Crops like ginger and colocossia are also grown. Tree planting for fallow management is also being done.
17. Jhum cycle	No fixed jhum cycle	No fixed jhum cycle	Approximately 9 years

Prepared by:
Vengota Nakro and
Vizonyu Liezie

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Rainwater Harvesting: A Case Study of Kikruma Village

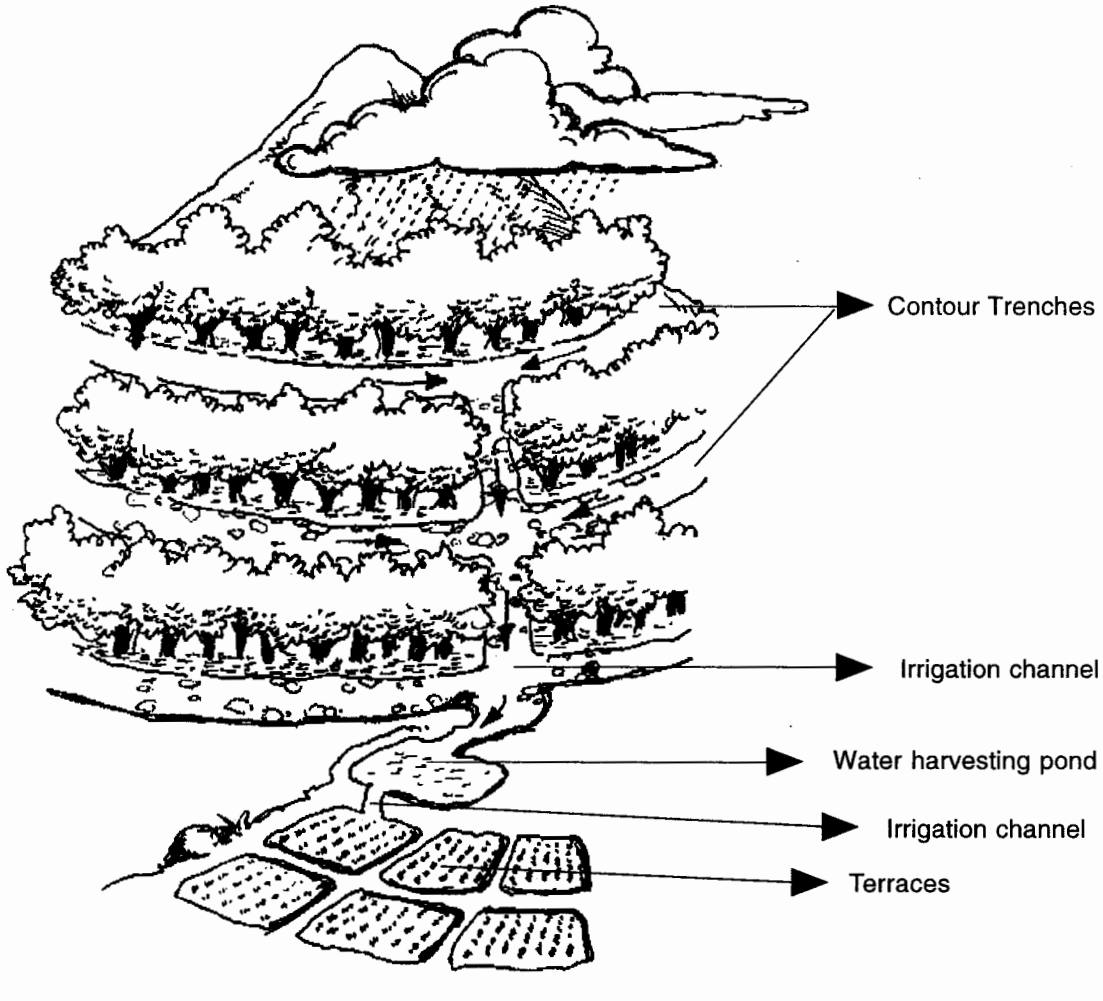


Some villages in Nagaland practice rainwater harvesting methods. Kikruma village in Phek district is one of the largest villages of Nagaland and has one of the best examples of this. The village is located about 50 km east of Kohima. It is situated on a hilltop where perennial water sources are scant. The people are from the Chakhesang community and their staple food is rice. They are experts in constructing Wet Terrace Rice Cultivation (WTRC).

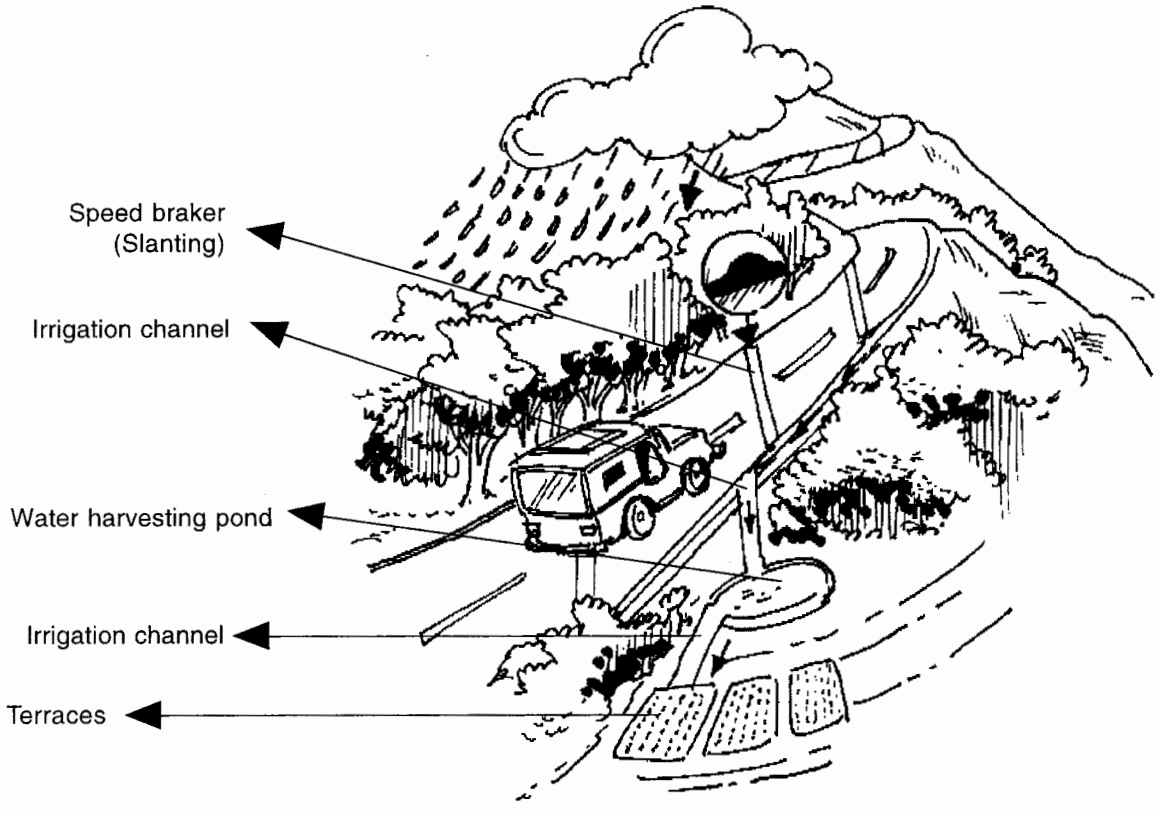
Because of few perennial sources of water, the people have evolved an ingenuous way of harvesting rainwater to irrigate their rice fields. They have constructed water harvesting ponds and trapped runoff rainwater through contour trenches. This method is simple and effective and reported to be as old as the village itself.

TECHNIQUE

- A channel is constructed almost parallel to the slope and stones are carefully laid at the bed of the channel to prevent gully erosion.
- Several parallel, gradual sloping contour trenches are constructed in series on both sides of the channel. These trenches collect runoff water from the catchment area and drain into the channel that leads to an irrigation channel below.
- The irrigation channel, in turn, conducts water to a water-harvesting pond. A water-harvesting pond is a dugout farm pond that collects rainwater from the catchment area. This water is used to irrigate the rice in the terraces.
- Another irrigation channel is constructed from the water harvesting pond that leads to the topmost terrace field.
- During the rice planting season, water is released from the pond by cutting open a small section of the bund of the pond according to the water requirement. Subsequent cuts are made until all water is drained or the need for water is met. The cut portion is then plugged again with soil to trap water during the next rain.
- With every shower, some rainwater finds its way to the pond; thus the bottom is always wet and stagnant and this prevents cracking and seepage.
- A pond of 3 x 2 x 2 m size is able to irrigate terraces that yield 600 kg of rice.
- The water harvesting pond not only serves as a water reservoir for irrigation, but is also a source of drinking water for cattle and other animals.



The villagers have even used of the State Highway (from Kohima to Phek) as the catchment area. They have constructed speed breakers shaped like slanting risers, thereby, diverting runoff water to the pond.



ADDITIONAL BENEFITS

- In some of the terraces irrigated by this technique, the farmers are able to produce not only rice but also fish and tomato.
- Fish fingerlings are introduced into the terraces in June and July right after transplanting of rice. The fishes are harvested in September/October when water is drained from the terrace.
- Tomato seeds are sown immediately before water is drained from the terrace. The seeds begin to germinate in November as soon as the rice straws are removed.
- The plants bear fruit by April and are harvested and sold in Kohima and Dimapur markets for good prices.
- Very few weeding operations are needed.
- A side benefit is that speed brakers slow down vehicles on the highway, helping control the traffic.

Prepared by:
Vengota Nakro

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility and the International Institute of Rural Reconstruction.

Traditional Erosion Control Measures in Jhum

Converting slopes into flat lands require heavy labour, technical know-how and many other inputs.

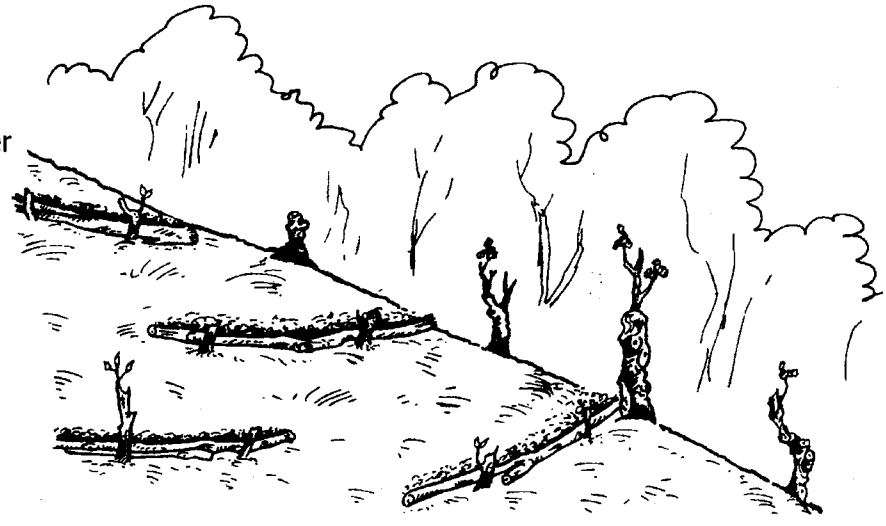
1. Hill slopes, when cultivated, are prone to soil erosion through rain and wind.
2. The farmers of Nagaland, in spite of the difficult terrain, have adapted well to the conditions and practise jhum cultivation.
3. These farmers have developed a number of mechanical and vegetative barriers to sustain cultivations in these conditions.

MECHANICAL BARRIERS

BOULDERS AND ROCKFILL

- The Angami and the Chakhesang tribes construct boulder and stone barriers to check soil erosion. They also plant nitrogen-fixing alder trees (*Alnus* spp.) in the fields for checking soil erosion, and for fuelwood and biomass.

LOGS AND POLES



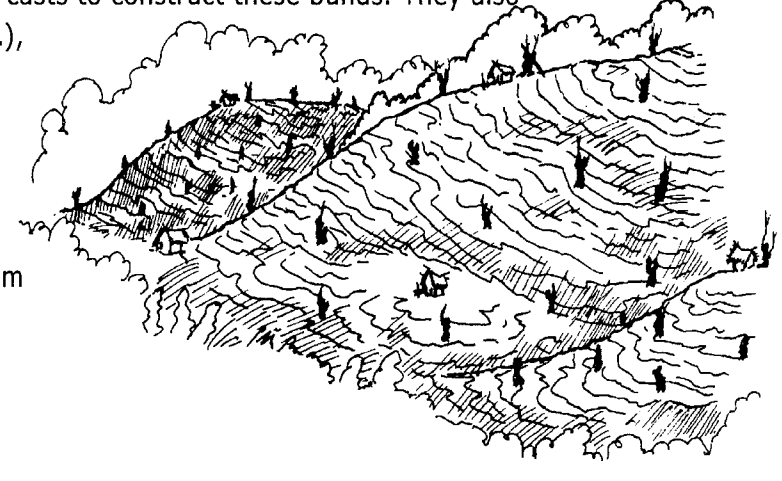
- The Ao, Lotha, Sema and Rengma tribes lay logs and stones in a staggered manner across the slopes to check soil erosion from the field. Tree stumps and poles are left standing even after the slash and burn operation. These are used as support for the barriers laid.
- Although intensive planting of trees is not widespread, weeds, twigs and stones are piled along the barriers to check erosion. High-value shade-loving crops like ginger, chillies, perilla and cucumber are planted along the contours.

BAMBOOS AND TRASH

- Coarse mat-like split bamboo barriers are laid across slopes to prevent soil erosion. Trash and remnants of burned trees and plants are then piled on the barriers to check further erosion.
- These barriers are used by tribes like the Sangtams, Lothas, Aos and Semas who inhabit regions where bamboos are cheap and abundantly available.

EARTHEN BUNDS

- The Konyak, Khiamungan, Phom and Chang tribes of some parts of Mon and Tuensang districts commonly adopt this erosion control measure. A mixture of soil and clay is used with earthworm casts to construct these bunds. They also plant crops like ginger (*Zingiber* spp.), taro (*Colocasia* spp.) and yam (*Dioscorea* spp.) on the bunds to further strengthen it.
- Farmers also broadcast seeds of trees like *Macaranga* spp., *Litsea* spp., *Alnus* spp. and *Trema* spp. in the jhum fields for fuelwood, biomass and soil conservation measures.



VEGETATIVE BARRIERS

Jhum farmers in Nagaland grow about 15 to 60 different crops. They normally plant crops and vegetables in rows across the slopes of the jhum fields to check sheet erosion.

Farmers of the Chang, Sangtam, Khiamnungan and Yimchunger tribes specially practise this method by growing maize (*Zea* spp.), taro (*Colocasia* spp.), yam (*Dioscorea* spp.), millet and varieties of local beans.

MAIZE, MILLET, JOB'S TEAR BARRIERS

- Farmers grow these crops in rows across the slopes to check soil erosion. These are the stable food crops for farmers in higher altitudes having an elevation of at least 1500 m.
- Farmers also plant these crops along the boundaries of their jhum fields.

SOYBEANS AND VELVET BEANS

- Soybeans are generally grown in rows along the contours to check soil erosion.
- On the other hand, velvet beans, which spread over vast areas, are grown as cover crops to prevent the loss of top soil from rain action.

OBSERVATIONS

- Farmers can best use physical barriers if they ensure that poles and other barriers follow the contour line. The use of an A-frame helps find the proper placement.
- Farmers usually do not go for labour-intensive methods but are sometimes willing to adopt modifications like shallow trenches.
- The use of farmer-to-farmer training encourages farmers to adopt alternate methods. This is the most effective way to introduce improvements.

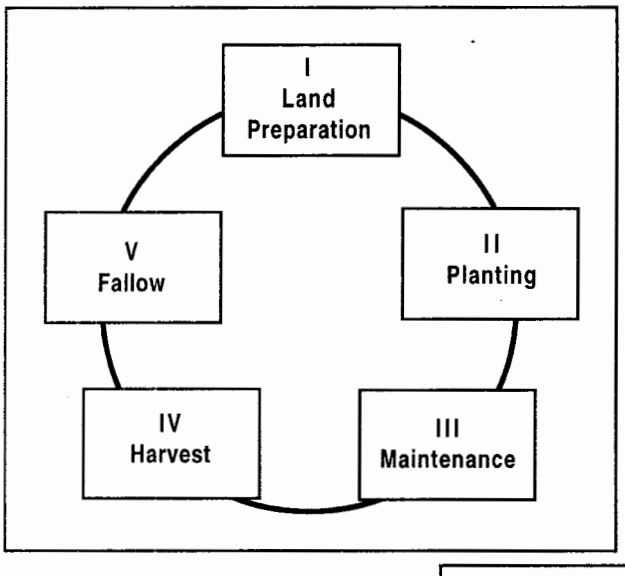
Prepared by:
Sanchothung Odyuo

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Nutrient Management in Jhum

Plants require a wide range of nutrients for growth, including macro-nutrients (e.g; carbon, nitrogen, potassium) and micro-nutrients or trace elements (e.g; zinc, molybdenum, manganese). Most of these nutrients are held in the soil. Jhum farming practices seek to maximise the production, recycling and retention of soil nutrients for optimum plant uptake and growth.

Jhum, as practiced by a Naga farming family, has the following phases:



LAND PREPARATION

1. SLASHING

There are two steps involved in slashing:

a) The understorey bushes, herbs and grasses are slashed first. This operation begins in September to November, depending on various factors such as altitude and vegetation. It is timed to expose the slashed vegetation to dew and rain and as a result, the slash begins to rot adding humus to the soil.

b) After a gap of about two months, the trees are cut down. The leaf litter from trees rots and further adds humus to the soil. Tree slash also presses previously-cut vegetation nearer the soil which activates micro-organisms and hastens decomposition. Tree stumps of various heights (depending on the species) are normally left to coppice and the stumps and root systems serve as mechanical barriers for soil erosion. Later, desuckering and dressing of the stumps adds humus to the soil.

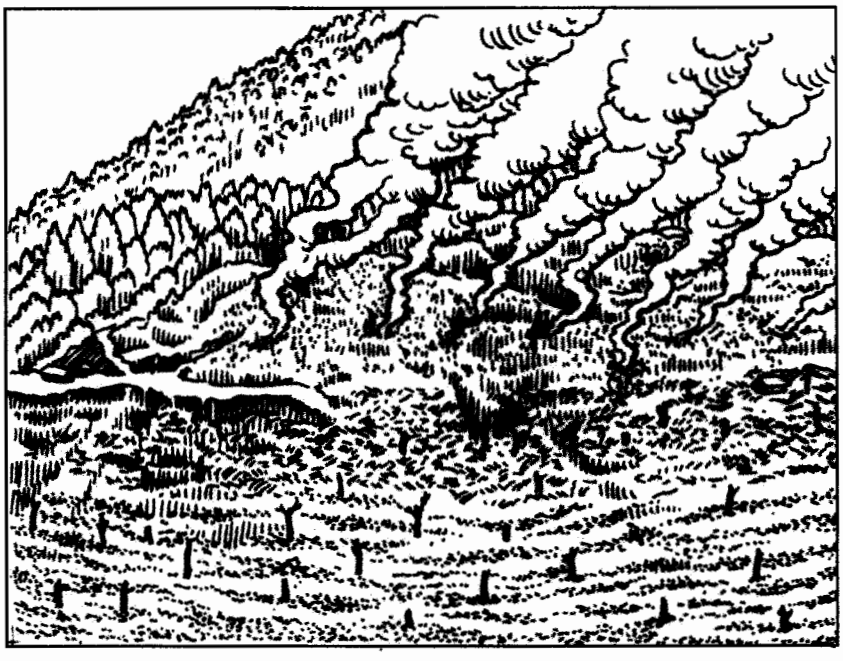
2. Burning

a) The first burning is the most important. The dried vegetation is burned in the months of February and March. Soil nutrient status is affected in the following ways:

- Adding nutrients, e.g; potassium, directly to the soil in the form of ashes. This is especially done when the farming activity is taking place in bamboo forest. A subsequent increase in soil pH may further facilitate the release of soil-bound phosphorous, making it available to plants.

- The high temperatures during burning enhance the release of other native soil nutrient elements. Burning activates dormant soil micro-organisms to accelerate the process of nutrient release to the plants.

Farmers are also aware that if burning takes place during the windy season, wind erosion of topsoil and ashes may contribute to soil nutrient loss.



Jhum burning at the right time ensures a good harvest

b) Often, a second burning of "soil heaps" is undertaken: plant residues, twigs, branches and roots collected from the first burning are cut into short pieces and set on fire. Soil is then heaped upon the fire and burning continues slowly until all twigs and branches are burned out, sometimes overnight. The longer it takes, the better. Burned soil is then spread uniformly through the field so nutrients are evenly distributed.

What Does Burning Do?

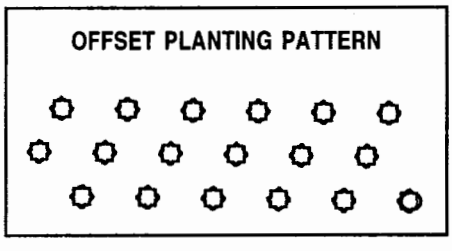
- It releases fixed nutrients, such as potassium and phosphorous from the soil to the crops.
- It kills weed seeds in the soil and saves time and money.

3. LAYING OF POLES AND RAKING OF SOIL
Unburned poles are laid along the contour and then soil clods and vegetative debris are raked alongside the poles to bind them, check soil erosion and retain nutrients. This operation is carried out before the pre-monsoon rains because farmers are aware that since crops are absent, soil is exposed to rain.

Minimum tillage operations are practiced to prevent soil erosion during the first plough. Tilling along the contour may be practiced but tilling up and down the slope is avoided.

PLANTING

Offset sowing: While sowing, farmers are aware that if crops are sown in an offset manner, erosion is reduced and nutrient cycling is more regular.



Crop mix: Jhum farmers always grow legume crops along with their cereal crops (rice, maize, millet and Job's tears) observing that the cereals typically grow better in this fashion. They are often unaware of the symbiotic relationship whereby micro-organisms "fix" nitrogen in root nodules of leguminous species making it available for uptake by the cereals.

Trees: Planting and managing naturally-growing trees improves soil fertility. The tree roots grow deep into the subsoil and absorb nutrients that other crops would not have drawn upon. Trees serve to recycle these nutrients to the surface where, upon decomposition, they become available to growing crops.

MAINTENANCE

- Hoeing uproots and buries weeds, helping the decomposition process and the formation of humus.
- Weeding is preferably done on sunny days. Obnoxious weeds are placed on top of tree stumps and rocks to avoid regrowth while succulent weeds are placed along the contour or used as mulch by spreading over the field. During the next round of weeding, those obnoxious weeds (now thoroughly dry) that were previously placed on stumps and rocks are retrieved and used as mulch.

HARVEST

- In harvesting, the barest minimum vegetation is removed from the site. This is for two reasons: the first is to minimise transportation and the second is to contribute organic matter and humus.
- Legume crop residues are left to stand *in situ* (even though it might have been more convenient to remove the whole plant to another site to retrieve the pods) because of the value of this plant residue in enhancing soil fertility.
- When harvesting cereal crops, only panicles are collected and straw is left behind.
- Farmers are aware of the need to spread nutrients uniformly throughout the field and not to concentrate all nutrients onto few places.

FALLOW

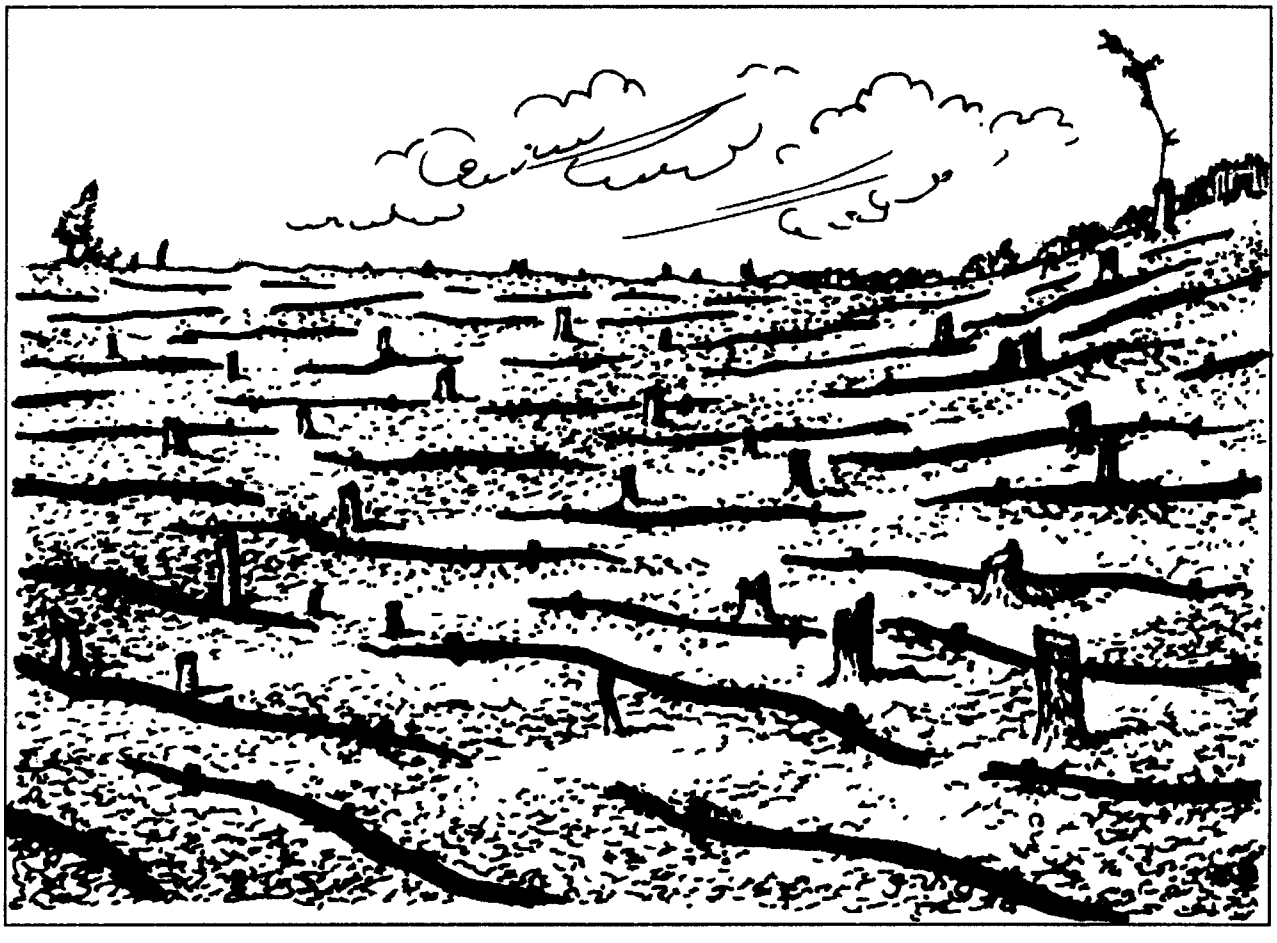
- In longer fallow periods, increased vegetative cover and biomass helps improve soil fertility substantially. Shortening jhum cycles have contributed to declining soil fertility in jhum fields.
- Farmers know that earthworm casts are indicators of soil fertility. They observe more earthworm droppings around some tree species (e.g., alder). These "soil building" tree species are thus favoured before entering the fallow period.

Beneficial Effects of Trees on Soil

Nature of processes	Processes	Main effect on soil
Inputs (augment natural additions to soil)	Biomass production (litter and root decay) Nitrogen fixation Effect on rainfall (quantity and distribution)	■ Improvement or maintenance of organic matter ■ N-enhancement ■ Influence on nutrient addition through rain/dust
Outputs (reduce losses from soil)	Protection against water and wind erosion	■ Reduced loss of soil and nutrients
Turn-over	Nutrient retrieval/recycling/release	■ Uptake from deeper layers and deposition on surface ■ Witholding nutrients that can be lost by leaching ■ Timing of nutrient release
Catalytic (indirect influences)	Physical Chemical Microclimatic Biological	■ Improvement of soil structure, porosity and water-holding capacity ■ Moderating effect on acidity, salinity and alkalinity ■ Ameliorative effects on extreme conditions ■ Positive effect on soil micro-organisms; improvement in litter quality through biodiversity

Adverse Effects of Trees on Soil

1. Competition for moisture and nutrients
2. Production of growth-inhibiting substances
3. Loss of nutrients through tree harvesting
4. Possible adverse effect on soil erosion



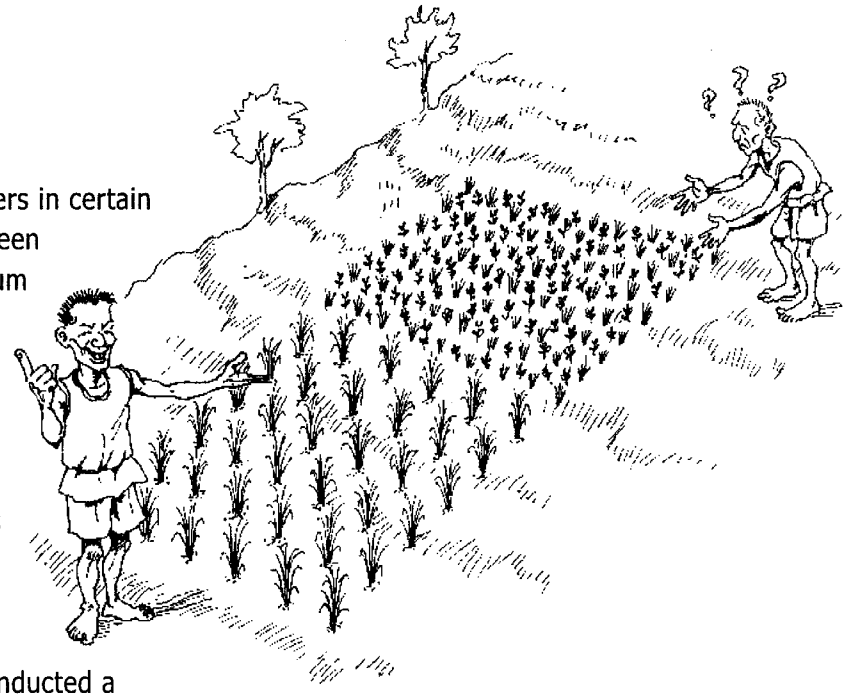
Reference

Nair, P.K. and R.G. Muschler. 1993. Springer-Verlag Tropical Forestry Handbook, Pancel (Ed.). pp 1029.

Prepared by:
Vengota Nakro

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Common Salt for Weed Suppression in the Jhum Fields

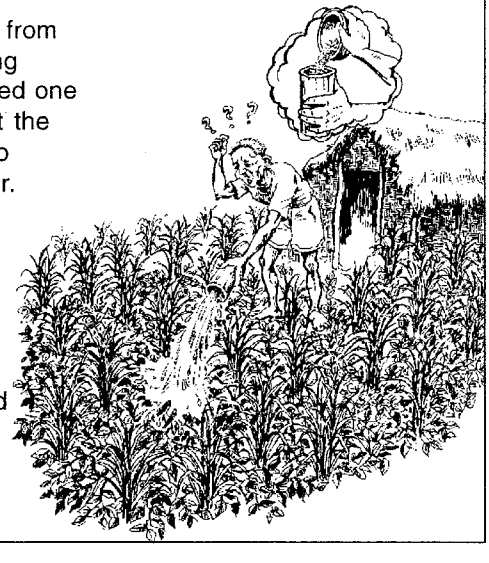


For quite some time, farmers in certain areas of Nagaland have been using common salt (sodium chloride) in controlling the growth of broad-leaf weeds in their jhum fields. Common salt is probably the most effective weedicide (for broad-leaf weeds) being used in some of the districts where jhum cultivation is practiced.

The research team from NEPED conducted a participatory evaluation programme with farmers on the effectiveness of using common salt for weed control. This programme covered six villages of Mokokchung district during 1998 and 1999. However, intensive testing was already being done since 1997 at the research station as well as on the farms.

Background

The story goes that a farmer from Ungma village in Mokokchung district of Nagaland discovered one day, to his utter dismay, that the salt he had kept in a bamboo container had turned to water. He threw away the liquid, incidentally, on the weeds growing near his hut. The next morning he found that the weeds had perished. After that, the farmer began using common salt dissolved in water for controlling weeds and this is how the practice started.



RESULTS OF THE TESTS

- **Salt should not be used in alkaline soils and permanent farmlands.** As the soil in Nagaland is acidic (pH 4.5 to 6.5), this method can safely be used in the jhum fields.
- It was found that common salt is very effective only in controlling the broad-leaf weeds. There was no significant impact on the narrow-leaf weeds.
- The optimum dose for effective weed-control is 1 kg of salt dissolved in 12 litres of water. The higher the dose, the more effective is the weed control. But large quantities of salt were found to affect the yield of rice, probably due to the extension of the vegetative stage of the rice plant.
- A significant reduction in the number of field operations carried out per year was highly visible (from five times in one cropping season in the untreated fields to about two times for treated fields).
- A dramatic increase in the yield was noticed in the jhum fields where salt was used. The reason for this could be explained by the presence of sodium and chloride in the common salt, elements that are essential for better plant growth.
- Tests in Northern Thailand show that since salt is rapidly leached out from the soil, low to moderate quantities (150 to 200 kg/ha) have no adverse effects on the soil.

What the Farmers Say

- Very effective and reliable
- Safe and easy to use
- Improves plant growth
- Reduces the number of field operations
- Drives away the leeches in the jhum fields

What the Researchers Recommend

- Combine the application of common salt with agronomic practices like soil conservation measures.
- Salt should not be applied more than once in a single cropping season.
- Apply salt within 45 to 70 days after germination of the rice plant.
- Use the optimum dose – 1 kg of salt dissolved in 12 litres of water.
- Hot sunny days and rainy days should be avoided.
- Adding a small quantity of washing powder in the salt solution is helpful as this will act as a sticking agent.
- Good quality sprayers enable better coverage. Knapsack sprayers are preferred.
- After application of the salt, field operations should be immediately carried out.

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Prepared by:
Supong Keitzar and Imliakum

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Controlling Thatch Grass Through Cassava

Thatch grass (*Imperata*) grows extensively in the hills of Nagaland. This troublesome weed makes it difficult for the farmers to cultivate land as weeding operations become very intensive and therefore costly. Based on tests, the research team at the State Agricultural Research Station, Nagaland, determined that planting cassava is very helpful in suppressing the growth of thatch in the jhum fields.

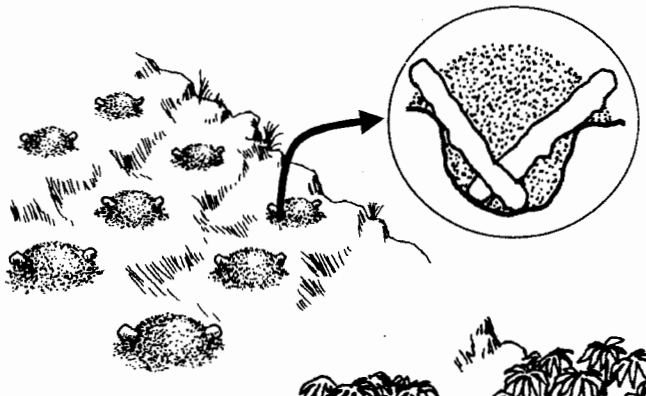
The tests at the research station showed that the growth of thatch could be checked to a very large extent by planting cassava in the first cropping season. Complete control may possibly be achieved by the end of the second cropping season. All varieties of cassava found in Nagaland serve equally well for thatch control.

HOW CASSAVA IS PLANTED

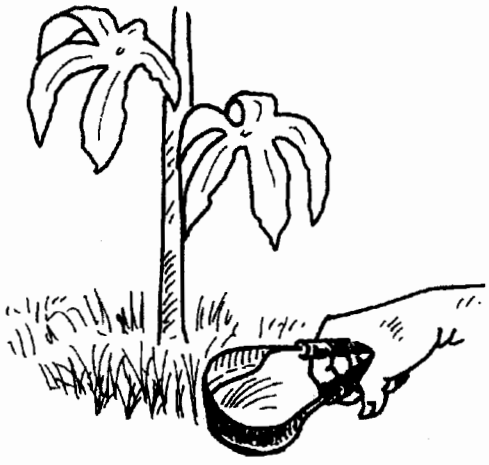
- Slash and burn the thatched patches. The area where cassava is to be planted should be completely free from weeds as this would hamper the growth of the young plants in the initial stages.

- Dig pits of 1 m x 1 m spacing between plants and rows in the cleared area. The cassava plants will go into these pits.

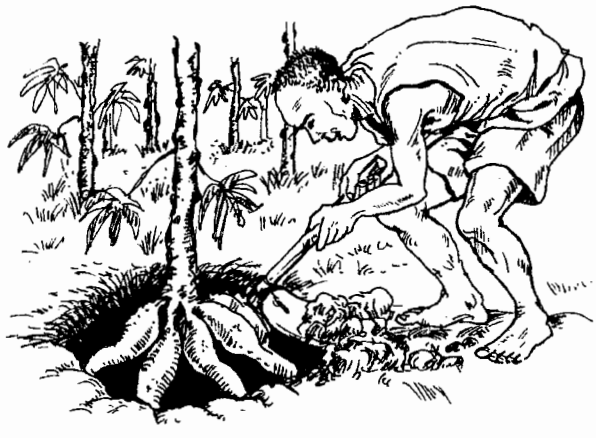
- Plant the cassava sets, each with 15 to 20 cm length, in the dug pits. Two sets should be planted on each pit, one facing north and one facing south. Planting is normally done in the months of March and April on the days of the new moon and full moon.



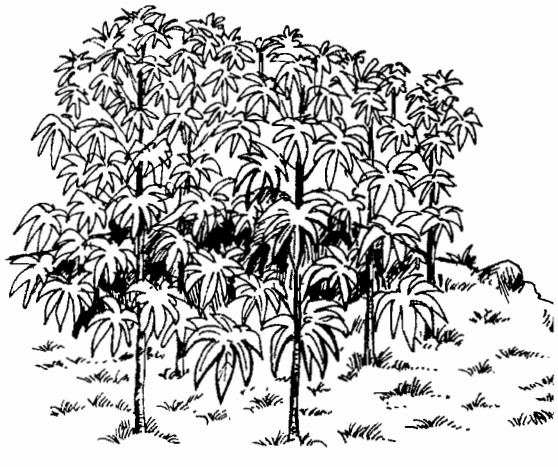
- Carry out frequent field operations using ring weeder to keep the cassava plants free from thatch during the early stages.



- Harvest cassava approximately ten months after planting when the plant is fully mature.



- Raise the second year's cassava crop for more effective control of the thatch.



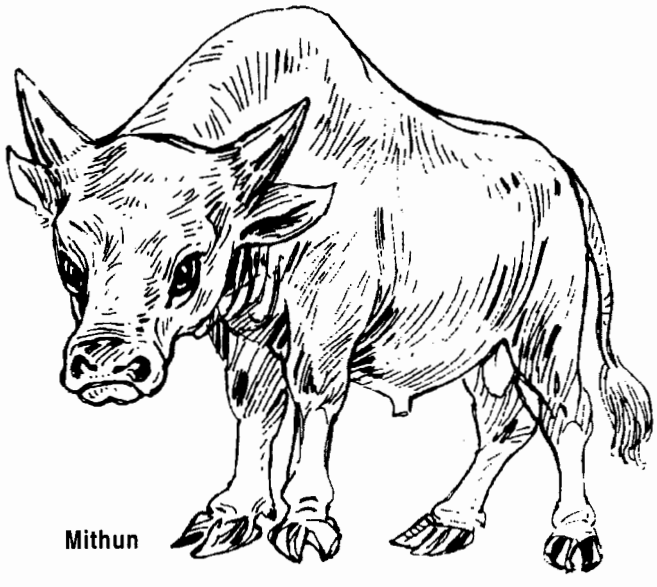
Other Uses of Cassava

- Produces a large volume of food
- Flour-making
- Preparing animal feed from the leaves and tubers of the plant
- Starch-making

Prepared by:
Supong Keitzar and Temsu Yanger Phom

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Protection from Livestock



Mithun

In Nagaland, protection from livestock is an important issue especially in Phek, Kohima and Dimapur districts. Animals are often allowed to graze freely in the village lands where the villagers have grazing rights approved by the Village Council.

Uncontrolled grazing by cattle and pigs has become a major problem for farmers, as these animals stray into the gardens, paddy fields and plantations. Cattle trample and eat the foliage while pigs uproot and eat the crops. In many areas of Nagaland, the *mithun*, a sturdy semi-domesticated bison, is a cause for concern as it tramples the plants while grazing.

Farmers in Nagaland have adopted various innovative measures to prevent cattle, pigs and goats from straying into their fields. These include physical and social barriers.

PHYSICAL FENCING

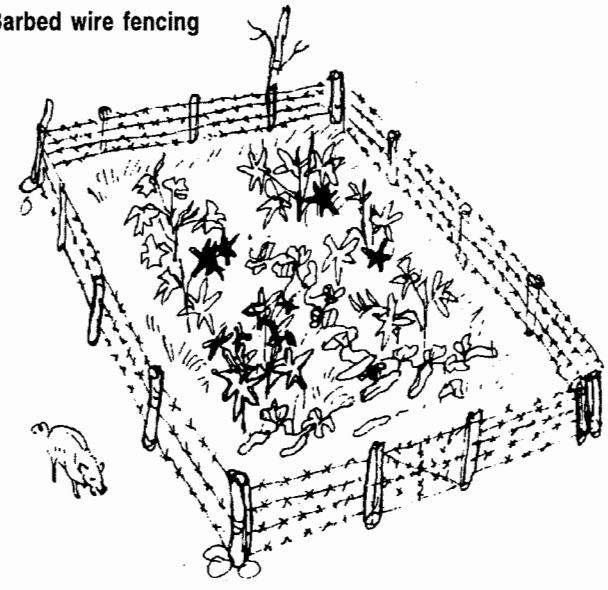
- Barbed wire fences
- Bamboo fences
- Stone walls
- Live fencing — by planting plants like aloe, madar and hedgerows around fields and gardens.

Besides physical barriers, cattle are tethered, restricting their movement while grazing. Wooden or bamboo gates are also made across the roads bordering the villages, so that cattle from one village do not stray into another.

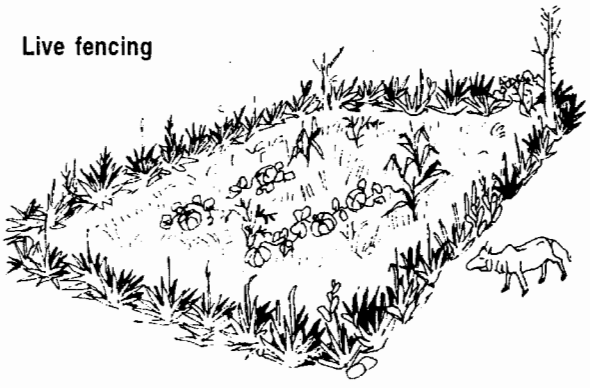
Physical Fencing Pros and Cons

Material used	Pros	Cons
Barbed wire	■ Strong ■ Durable	■ Expensive ■ Not easily affordable
Bamboo/ poles	■ Easily available ■ Cheap ■ Versatile	■ Temporary ■ Weak
Stone walls	■ Permanent ■ Strong	■ Labour - intensive ■ Not easily available
Live fencing	■ Versatile ■ Cheap ■ Permanent	■ Takes time to grow

Barbed wire fencing



Live fencing



Bamboo fencing

SOCIAL FENCING

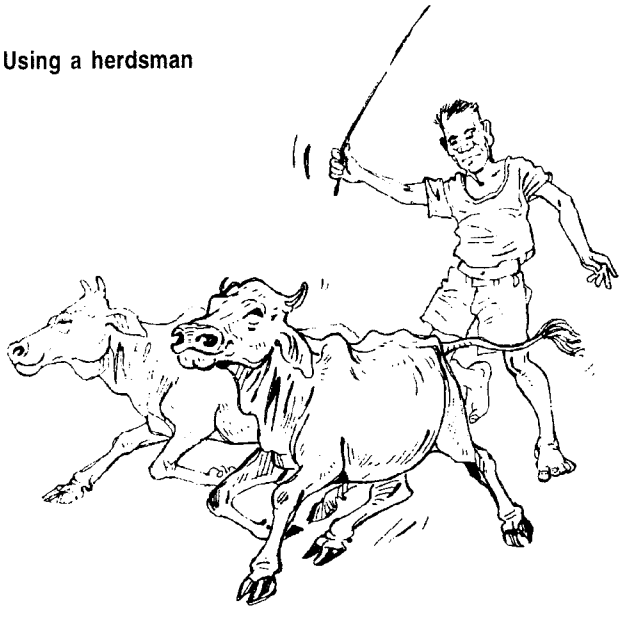
Post-harvest grazing in fields, lopping off of trees and grazing in the forests are also practiced. In the past, this was well regulated by traditional practices, particularly when livestock numbers were lower and forests could sustain this silvi-pastoral system. But now, many forests are severely degraded due to over-grazing, over-lopping and over-exploitation.

In Nagaland, the Village Council frequently passes resolutions restricting free grazing of cattle and free movement of goats and pigs in villages having large numbers of livestock. A fine is fixed and imposed for violation of the resolution.

The resolutions of Village Councils take the following points into consideration:

- Since free-grazing cattle may stray into fields and plantations belonging to neighbouring villages, Village Councils cooperate in levying fines to avoid social conflicts and misunderstandings.
- Owners of cattle are required to collectively or individually hire a herdsman to tend their cattle while grazing.

Using a herdsman



- Free grazing of cattle is sometimes restricted only to specific areas, away from the jhum fields.
- Free grazing of cattle is allowed only for specific months during the post-harvest period, usually between November and February. After harvest, the cattle herds are permitted to graze freely on agricultural residues in the fields so that the animal droppings will add fertility to the soil.
- Some seedlings planted in jhum fields, like gomari, are relished by cattle. In some villages, Village Councils have determined that tree plantations should be protected by banning unrestricted grazing.
- Unrestricted grazing of pigs within the village area is prohibited, forcing owners to confine them in sties. Pigs usually intrude into home gardens and eat all root crops after digging up the soil, thereby leaving deep craters and damaging most young plants.

Besides the Village Council resolutions, the Government of Nagaland has, from time to time, issued orders restricting the movement of stray animals within town limits, the latest one is the "Nagaland Cattle Trespasses Act, 1985."

Prepared by:
Pfukrulhou Koza and Michael Zaren

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Trees and their Management

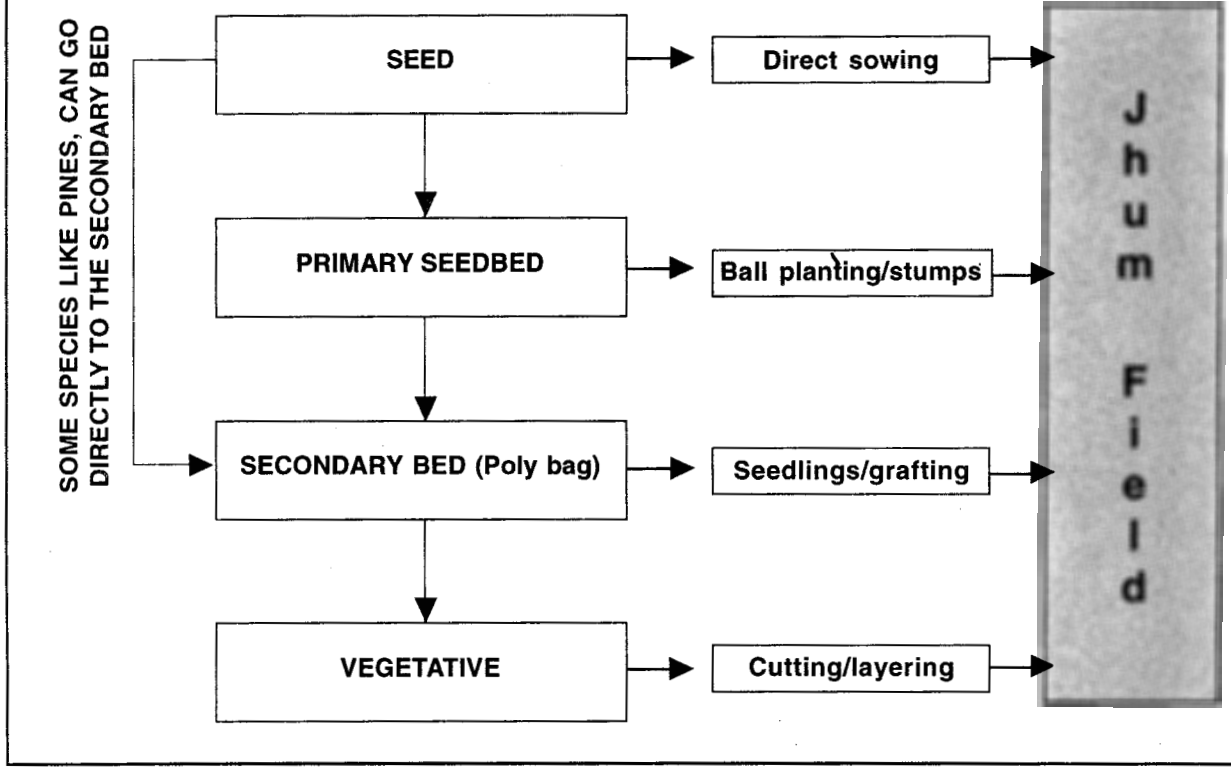
Tree Nurseries and Their Management

The success of tree plantation efforts depends, to a large extent, on vigorous disease-free saplings that are usually available from well-managed nurseries. In Nagaland, the use of quality saplings is very important because of the deforestration problems associated with short fallow cycles in the widely-practiced jhum-based agriculture.

FACTORS TO CONSIDER IN NURSERY MANAGEMENT

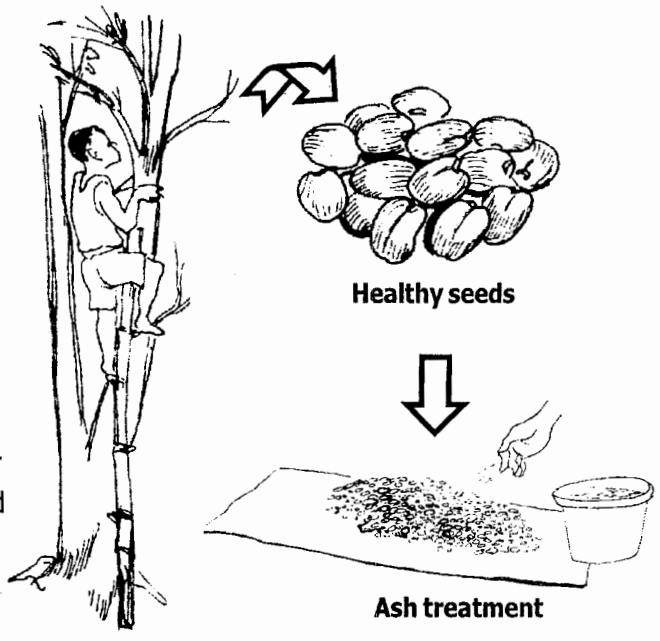
- Nursery sites should be centrally-located for accessibility and should be close to water source.
- There should be no trees near the nursery site.
- Nurseries must be fenced.
- Site should have access to cheap labour.

Nursery Management in Nagaland



COLLECTION OF SEED

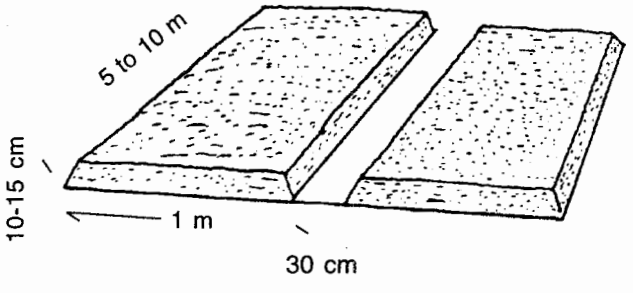
- Take note of the maturity of seeds before collection.
- Identify good mother plants for use as seed bearers.
- To ensure viability, some seeds require chemical treatment against fungal infection, whereas some can be treated manually with certain measures (e.g., hot water, ashes).
- It is difficult to determine the viability of small seeds. One method to test seed viability is to throw a very small quantity of seeds over a fire, if they crackle, the seeds are considered viable.



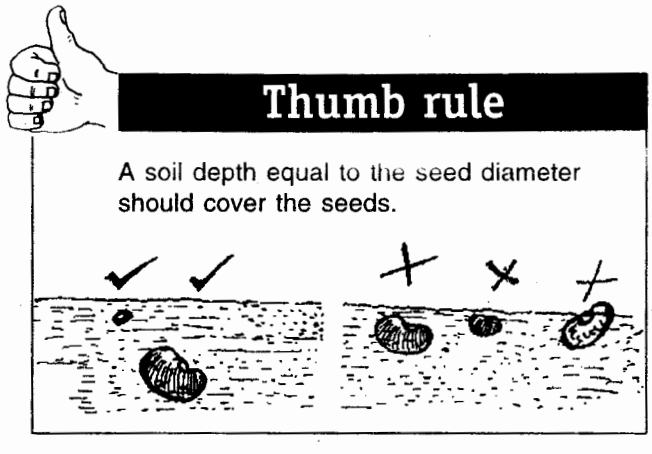
Collection of seeds

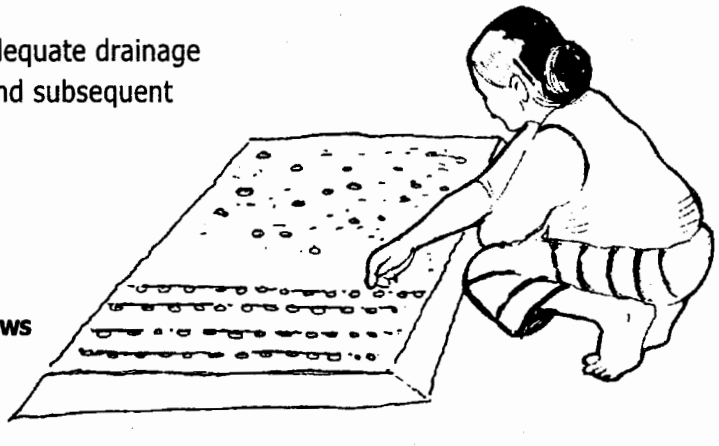
PREPARATION OF PRIMARY SEEDBED

1. Prepare the nursery site by burning the weeds and grasses and go for deep hoeing. Turn over the soil to expose insect-pests, bacteria, nematodes and parasites.
   - The soil should be deep, well-drained and rich in organic matter content.
   - The bed should be about 10-15-cm high and 1 m wide and of convenient length.
2. Level the seedbed.
3. Sow the seeds immediately to retain viability.
4. Sow the seed either in rows or broadcast.
5. Once the seeds are sown, cover with thin layer of fine soil and mulch (dry straw or thatch) to conserve the moisture and maintain the temperature of soil.
6. Remove the materials when the seeds germinate. In case of some species like agar and hollock, use polythylene sheets to enhance germination.
7. Water the bed depending upon the moisture content of the soil.
   - The bed should have adequate drainage for good germination and subsequent growth of saplings.



Seedbed size



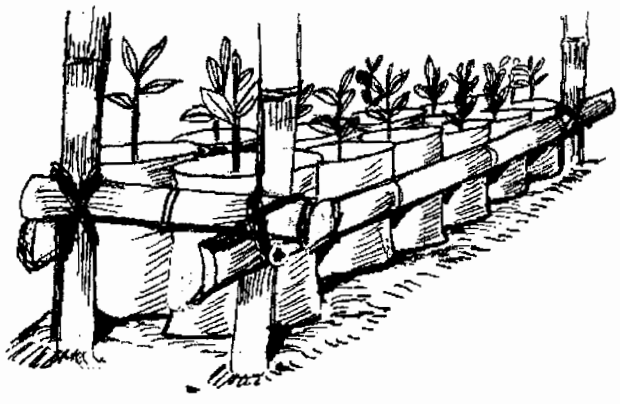


Sowing in rows

PREPARATION OF SECONDARY BED

Some species like hollock and pines require nurturing in secondary beds. Prepare the secondary bed with the following steps:

1. Mix topsoil with compost and sand in the ratio of 6:2:1.
2. Sieve with 5-mm gauge netting wires and slightly dampen it.
3. Pack the soil preparation in perforated polybags for proper drainage and aeration.
4. Arrange the bags on the surface of a raised bed, with a sand base of 1cm thick.
5. Water regularly for a week so that the soil is properly settled.
6. Prick out the seedlings and then transplant into the perforated polybags (preferably in the morning or evening hours).

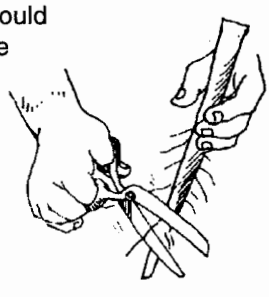


TIPS in TRANSPLANTING

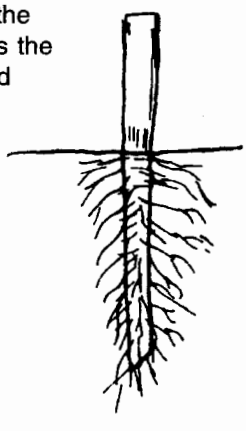
Make finger size holes of approximately 3-6 cm deep in the center of a polythene bag. Insert the seedlings, pull upwards a little bit and press the soil gently so as to facilitate a better root system.

TIPS in BED PREPARATION

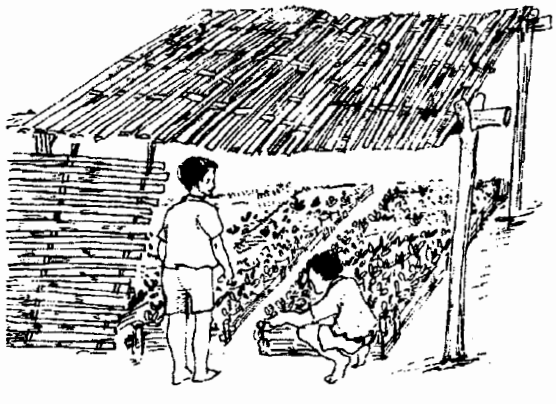
- Except for some pine species, some roots should be nipped off to enhance the rooting system.



- The level maintained for the collar region of seedling is the same for both primary and secondary beds.



- Provide overhead pandal for shade-loving species to protect the seedlings from frost and hailstorms and to check excessive moisture loss.



MAINTENANCE

- Water the beds depending on the soil moisture content.
- Keep the nursery pest-free. Spray a solution of neem, garlic and chilli as an insect repellent.
- Apply cow-dung slurry (mixture of fresh cow-dung and water kept overnight) for proper growth of the seedlings.
- Avoid using chemicals like copper fungicides and other fertilisers in the nursery. They adversely affect the growth of radicals and cause scorching.
- Fungicides (e.g., bavistin, arrestin) can be used to avoid damping-off of seedlings.
- Plant the samplings in the main field after 6-12 months.

Propagation Methods for Selected Species in Nagaland

Species	Seed	Naked	Stump	Polybags	Cuttings
Gomari	✓	✓	✓	.....	✓
Alder	✓	✓	✓	.....	X
Teak	X	✓	✓	.....	X
Ghora neem	✓	✓	✓	.....	X
Hollock	X	✓	✓	✓	X
Poma	X	✓	X	.....	X
Agar	X	✓	✓	✓	X
Khokon	X	X	X	✓	X
Kadam	X	X	✓	✓	X
Bonsum	✓	✓	X	✓	X

Prepared by:
Purakhu Angami and Vizonyu Liezie

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Tree Establishment by Direct Sowing of Seeds

Tree planting in jhum fields is an idea which has generated much enthusiasm among the people of Nagaland. Planting trees, however, requires quite substantial investments which poor villagers can ill afford. A low cost, yet effective, alternative available to them is the direct sowing of tree seeds.

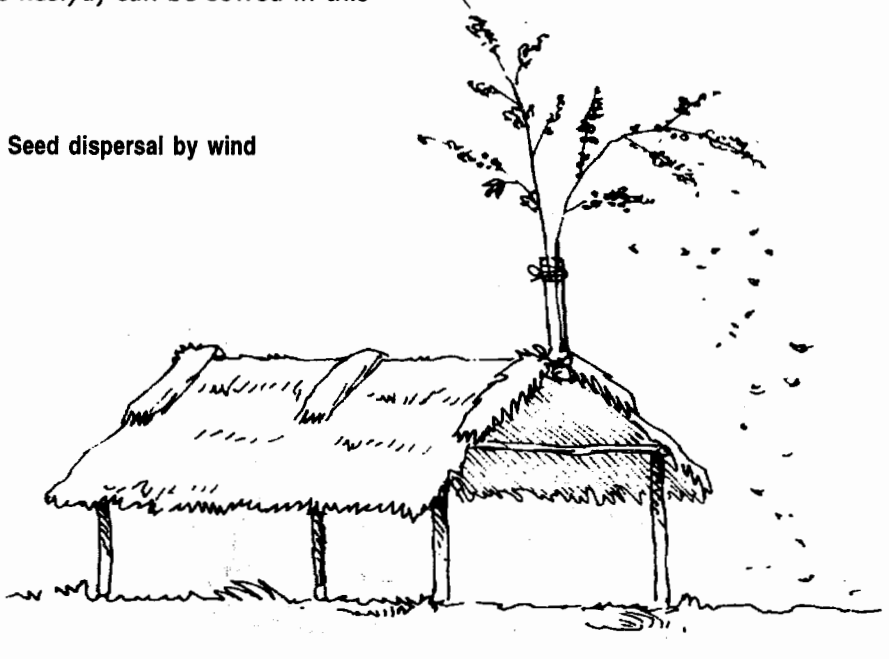
Direct sowing is a method of tree planting where seeds are sown in the field without having to go through the process of raising the saplings in the nursery. There are several ways of direct sowing that are successfully practiced by farmers of Nagaland:

Wind dispersal
Winged and pod-like seeds are hung at the tip of a pole, tree stump or farm hut and nature is allowed to take its own course in dispersing the seed. An example of a wind-dispersed seed is toona (*Cedrela serrata*).

Ball sowing
Tiny seeds are mixed with moist mud and rolled into a ball the size of a fingertip and this is sown. Pine (*Pinus kesiya*) can be sowed in this manner.

Broadcasting
Tree seeds are scattered all over the field by hand simultaneously with crop seeds. Koroi (*Albizzia procera*) is broadcasted in Nagaland.

Dibbling
Tree seeds that are easy to handle are sown at the same time as crop seeds using a spade or a hoe. By far, this is the most reliable method of direct sowing.



Seed dispersal by wind

Advantages of Direct Sowing

1. It is easy to do and costs little, requiring only the farmer's time.
2. More areas can be planted in less time and all family members can take part in planting.
3. Seeds are locally collected, stored and are available for sowing at the right time in the right place.
4. Transport cost is almost nil.

Disadvantages of Direct Sowing

1. Mortality rate is higher than planting with saplings.
2. One cannot be certain what proportion of seeds will fail to germinate.
3. Often, sprouting seedlings are mistaken for weeds and removed along with weeds, so extra care is required while weeding.

Some species suited to direct sowing are as follows:

Naga Neem
(Spondias axillaris)

Seed collection

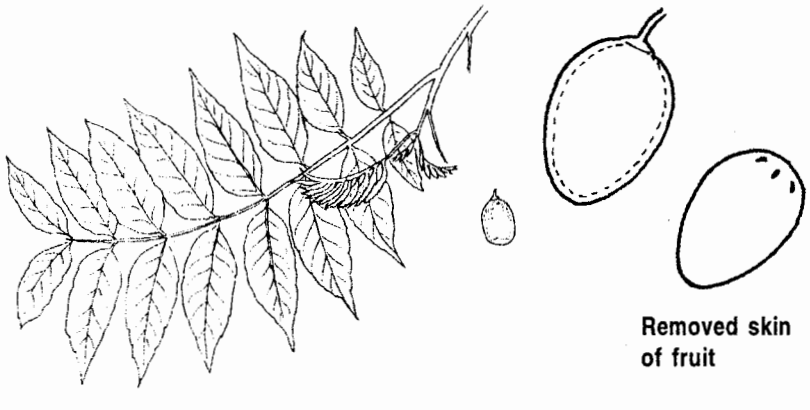
- Season: November to February
- Ensure that skin of the fruits has turned yellow.
- Make sure that they are from the current year's seed fall and are fresh. Better still if they are collected while still attached to the tree.

Seed preparation

- Clean the skin and pulp thoroughly by mixing fruit with ash or sand and then squeeze or pack in a gunny bag along with ash or sand and trample. Wash and dry the stones. Dry weight is about 280 to 350 stones per kg.
- Check to make sure that the five "eyes" of the stones are white and discard these stones having "eyes" that are dull or brownish.

Characteristics

- Viability period is only six months.
- About three to five shoots will sprout from one stone but only the fittest two to three will survive. Extra sprouts can be used in gap filling in the second year.
- Germination will take place 20 to 25 days after sowing.
- It is suited to high altitudes.



Removed skin of fruit

Ghora Neem
(Melia composita)

Seed collection

- Season: seed fall is from October to December
- Germination is faster and the rate is better when seeds are ruminated by cattle and regurgitated before collection.

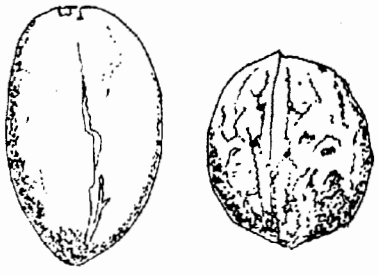
Seed preparation

- Remove the skin and expose to sunlight until the seeds begin to show signs of cracking in the suture.
- Alternate soaking and drying of seed results to better germination rate and time.
- One kg contains about 400 to 450 dry seeds.

Characteristics

- Some seeds germinate only in the year following sowing.
- Prolific germination has been observed in the jhum fields where there are mother trees whose fruits are lying on the ground and are burned along with jhum burning.
- Germination begins one month after sowing. It can be grown both in low and high altitudes.

WALNUT (*Juglans regia*)



Seed collection

- Season: November to January

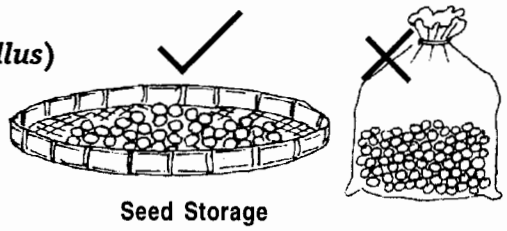
Seed preparation

- Remove the skin of the fruit and dry.
- Smoke-dried nuts (e.g., on mantle piece) have better germination rate.
- Discard those nuts that have turned black, they are likely to have expired embryo.

Characteristics

- Seeds germinate about 40-50 days after dibbling.
- Children like to eat the kernel so precautions are necessary.
- It is suited to high altitudes.

JACKFRUIT (*Artocarpus heterophyllus*)



Seed Storage

Seed collection

- Season: July to September
- Collect seed from ripe fruit only. This is important because unripe fruits are also harvested for use as vegetables and seeds from such fruits will not germinate.

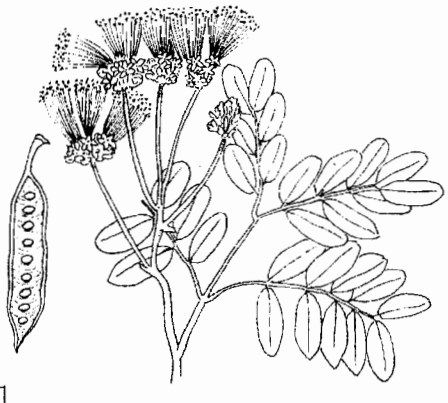
Seed preparation

- Fruits are 30–60 cm long, containing a large number of seeds, each enclosed in a yellowish juicy sheath. Remove fleshy pulp and the sheath covering the seed and dry them.
- Seeds are soft and so likely to "heat-up" if stored in large numbers in a closed container. It is recommended to store seeds in an open space.

Characteristics

- The tree is suited to lower altitude.
- Sow immediately after preparation.

SIRIS (*Albizzia lebbek*)



Seed collection

- Season: February to April
- Collect matured pods while these are still attached to the tree and are closed (if pods are open it is most likely that seeds have fallen out).

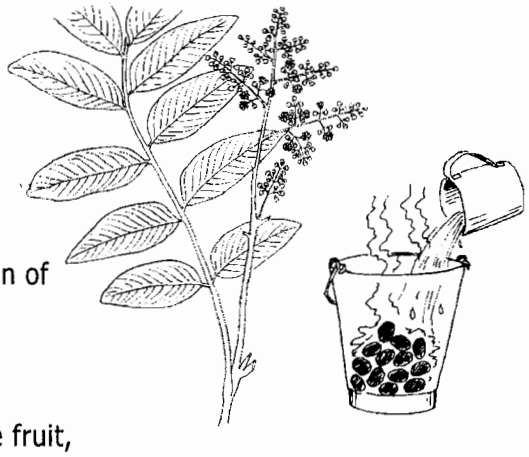
Seed preparation

- Expose collected pods to sunlight until the pods are completely dry. After thrashing, the pods and seeds can be separated by sieving.

Characteristics

- It will germinate along with crops if sown simultaneously.
- Suited to low to medium altitude and has medium growth rate.

SOAPNUT (*Sapindus mukorossi*)



Seed collection

- Season: January and February
- Make sure that the skin of the fruit is yellow.

Seed preparation

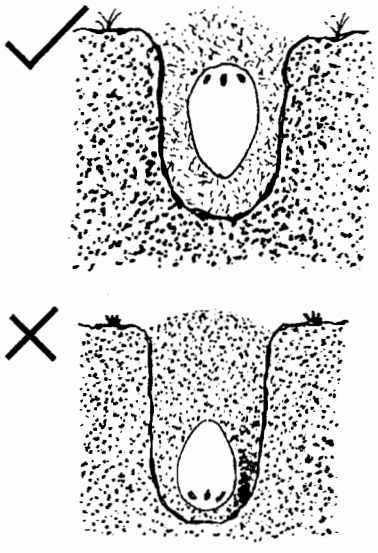
- Peel the skin from the fruit, pour boiling water and soak over night.
- Expose to sunlight for two days until a crack appears in the "eye" of the seed.

Characteristics

- Seeds germinate in 30 to 40 days with fast growth rate.
- It is suited to medium and low altitudes.

BONSUM *(Phoebe sp.)*

Sowing Position



Seed collection

- Season: collect the fruit during January to February for one of the species and the other during June
- Collection of fruits can be done only when the fruits drop on the ground as the trees are large and tall.

Seed preparation

- Remove the skin of the fruit immediately on collection and dry them.
- Do not keep a large quantity of fruit in a container as the fruit will 'heat-up' and kill the embryo.
- Store them in an open space.

Characteristics

- The seed must be sown immediately on preparation.
- The tree is suited for higher altitudes.
- The growth rate is slow.
- It thrives best under shade.

TITACHAP *(Michelia sp.)*

Seed collection

- Season: June and July
- Experience has shown that seed collection is not easy. On one hand, as soon as the fruit ripens, birds begin to eat them not allowing the fruit to drop to the ground; on the other hand, the trees are usually large and tall requiring an expert climber to collect the fruit.

Seed preparation

- Remove the skin of the fruit immediately on collection and dry them.
- Do not keep a large quantity of fruit in a container as the fruit will "heat-up" and kill the embryo.
- Store them in open space.

Characteristics

- The seed must be sown immediately on preparation.
- The tree is suited for higher altitudes.
- The growth rate is slow.

OAK *(Quercus serrata)*

Seed collection

- Season: acorns begin to fall by the month of April to June, however, seed collection can continue until January the following year and still be viable.

Characteristics

- Squirrels like to eat the kernel.
- Germination takes place about two to three weeks after sowing.

Prepared by:
Vengota Nakro

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Management of Trees in Jhum Fields

Shifting cultivation (jhum) is a practice in which forests are cyclically slashed, burned, cropped and fallowed. This is a traditional practice where a vast diversity of plants and animals co-exist and depend on each other, thereby maintaining an ecological balance. Although trees are a part and parcel of jhum cultivation, the concept of maintaining a large scale tree plantation in jhum fields of Nagaland has taken a new turn with the advent of the NEPED project.

MANAGEMENT OF TREES

Establishing tree plants and managing them in jhum fields involves a number of management techniques. Some important factors range from spacing to nutrient management. Inter-plantation with different species of trees in alternate rows is also advocated rather than going for monoculture. This helps in reducing soil erosion and weeding cost.

SPACING

Before the planting of trees, construct contour bunds across the land slopes. The bunds are spaced about 5 m from each other. However, spacing should be done according to the nature of topography and slope. In Nagaland, NEPED recommends a spacing standard of 5 m from row to row and 2 m from plant to plant. Close spacing also helps the plants in their subsequent competition for sunlight which encourages the trees to grow straight and tall.

Pruning

One important care and maintenance activity of tree plantation is pruning which is undertaken to remove unwanted branches or crooked trees. Pruning operations should be done during the winter months while the trees are still growing but dormant. To minimise injuries to the tree, tender branches should not be pruned. Maintain single stems in order to have proportionate height and girth.

Plant protection measures

White grubs (larvae of beetles) cause heavy damage to young trees. These stem borers must be checked by proper plant protection measures. The commonly adopted remedial measures are as follows.

- **Mechanical**
  Removal of grubs can be adopted by cutting affected trees if there is widespread infestation of borers. A fire path of 3-5 m wide should be built along the border line of jhum fields.
- **Chemical**
  Chemical methods can also be taken by swabbing the main stems of trees with solutions of malathion.

Stabilisation of Soil pH

Some plants can grow in acidic soil, but high-quality trees having timber values thrive best in saline soil. Most soils in Nagaland are strongly acidic in nature having pH below 7. Soil acidity can be brought to optimum range by application of agri-lime for neutralisation of acidity.

Nutritional requirements

Deficiency of nutrients may stunt the growth of plants. Fertilisers or nitrogen, phospate and potasium (NPK) in the ratio of 30:40:30 may be applied in drip circle during the dormant stage for remedial measures. Fertilisers are not widely used in Nagaland, especially with jhum farmers, but it increases yield if applied correctly. However, the best long-term solution is the preservation of soil nutrients by bunding.

Leaving cut leaves and branches and uprooted weeds to decompost also acts as a catalyst for providing green manure to the crops.

Weeding and Mulching

Depending upon the nature of weeds and their intensity, weeding operations should be done at least thrice a year. This process should be continued for two to three years until the young trees are well established.

Farmers often leave the weeds to die on bare rocks and tree stumps. The more succulent ones are left along with dry leaves and agricultural wastes that decompose and fertilise the soil.

Planting Time

Planting trees in the wrong season adversely affects the survival rate of the trees. Farmers must check the right time of planting depending on whether they are seeds, saplings or scions.

Prepared by:
Purakhu Angami

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

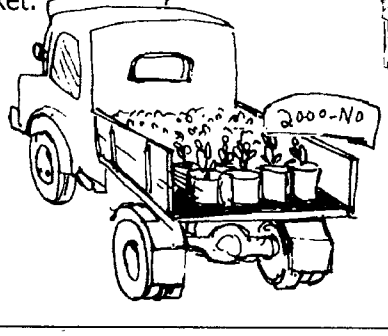
Pure Vs. Mixed Tree Plantations

Globally, the need to increase the area under tree cover has become a cause for concern due to large-scale deforestation and soil erosion that have resulted in significant changes in the ecological systems. Though tree plantations cannot satisfactorily substitute for natural forests, they definitely alleviate the pressure caused by deforestation. In Nagaland, there has been a dramatic increase in the area under tree plantation, most being established for economic benefit.

The major cause for concern, however, is that more and more people are planting only pure crops like teak and gomari. These species potentially have good markets but planting pure crops on such a scale might upset the ecological balance and pose a threat to their survival.

WHY MONOCULTURE

- **Very economical**
  The saplings are cheaper as compared to most other commercial species.
- **Easy to transport**
  Saplings are not kept in polythene packs, which make them easy to transport.
- **Easy to manage**
  These varieties do not require much nurturing.
- **Easy to restock**
  Restocking is very simple.
- **High market value**
  Teak and gomari are highly-valued for their timber quality and have better prices in the market.

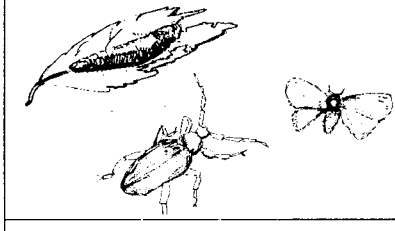
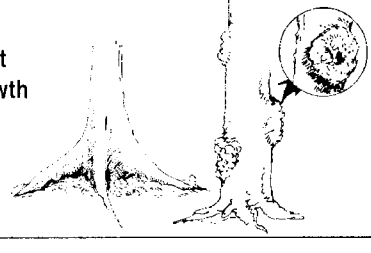
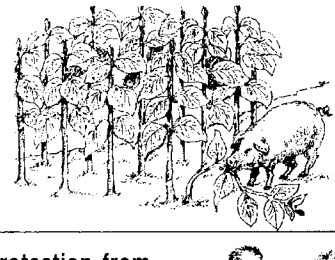


Teak and Gomari Monoculture

Some farmers in Nagaland are planting teak and gomari on a large scale without being aware of the implications. This has brought about changes in the ecological system in certain areas.

WHY NOT MONOCULTURE TEAK AND GOMARI

Although teak and gomari may appear to give better economic benefits, they are prone to pests and diseases and also bring about degradation in the quality of the soil by using up essential nutrients. These are problems typical of plantation monocultures.

PROBLEMS WITH PLANTATION MONOCULTURES	
Pests and Diseases 	Entire plantations of one species are sometimes totally wiped out when attacked by pests or diseases as these outbreaks quickly assume epidemic proportions moving from tree to tree.
Space Utilisation and Yield 	Optimum utilisation of space for different soil conditions is not always possible in the case of pure crops. The soil is rendered infertile due to identical rooting depths of the crops, especially if they belong to a light demanding species. The total yield of timber is higher in mixed plantations.
Crop Management and Marketing Issues 	Pure crop cultivation can sometimes be risky as higher cash returns are directly dependent on good market prices. It is difficult to profit from a limited product range in an unstable market.
Plant Growth 	Pure teak crops often suffer from defects like fluting, epicormic branching and bad bole formation. (Certain species of trees attain better form in a mixed plantation.)
Damage by Wild Animals 	Animals sometimes cause extensive damage to pure crops. This occurs if the particular crop happens to be the favourite food of some animals.
Protection from Wind and Fire 	The scale of damage from winds and wildfire is typically higher in monocultures.

ADVANTAGES OF MIXED CROPS

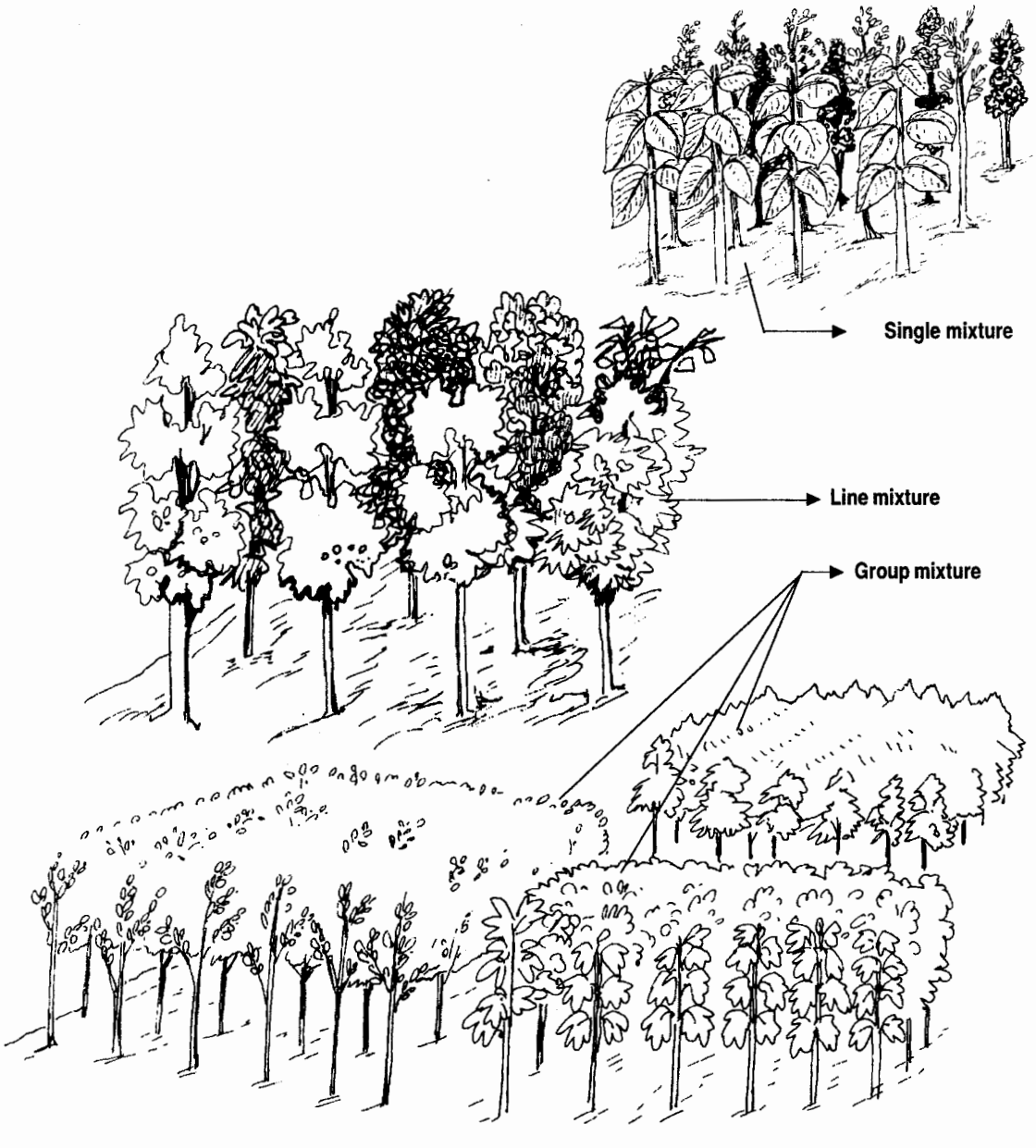
Mixed cropping ensures better coverage and optimum use of the soil. Different plants have different rooting depths and therefore the plants make better use of nutrients. A judicious selection of plant species will ensure that the soil is not rendered infertile and multi-storeyed tiers of canopy optimise available sunlight. Mixed crops are also less susceptible to dangers posed by fire, disease, wind, etc. The mixtures can be planted singly, in lines or in groups.

"Nature almost always produces mixed crops. Other matters being equal, it is best to follow nature."

– Howard

It is generally a good idea to group the mixtures. For example, light-demanding trees that grow quickly could be combined with shade-loving plants. The light-demanding trees would soon tower over the slower and shade-loving plants and provide them with the essential shade.

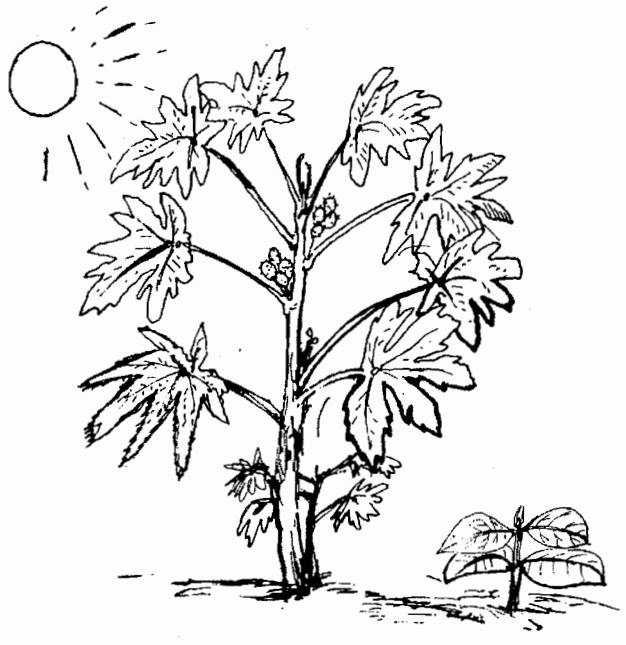
Perhaps the major advantage of mixed cropping is the spread of the owner's financial risk. Low prices for one species may be offset by better prices for the remainder.



TEMPORARY MIXTURE

Temporary mixture is the mixing of secondary species with the main species for only a part of the cropping period. This is done to:

- Provide protection to the main crop against browsing, frost or insulation. For example, the main crops hollong (*Dipterocarpus spp.*) and bonsum (*Phoebe spp.*) could be grown under gomari (*Gmelina*) which will provide them with protection from the sun.
- To obtain better bole form, for example, gomari could be grown with ghora neem (*Melia composita*).
- Provide additional short-term revenue.
- Provide vegetative cover to the exposed soil and suppress the weeds – e.g., tree plantation in jhum fields. The species in temporary mixtures can be removed when it has served its purpose.

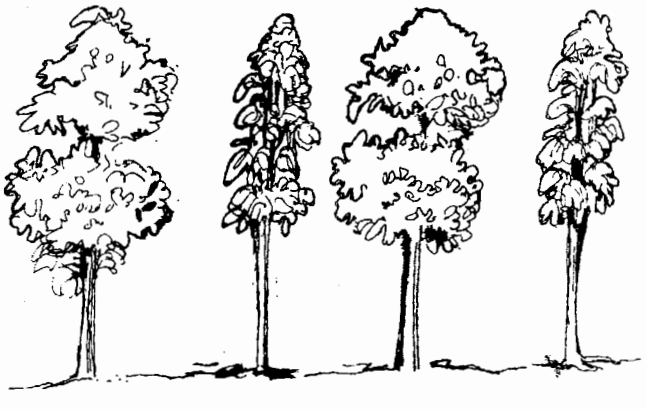


PERMANENT MIXTURE

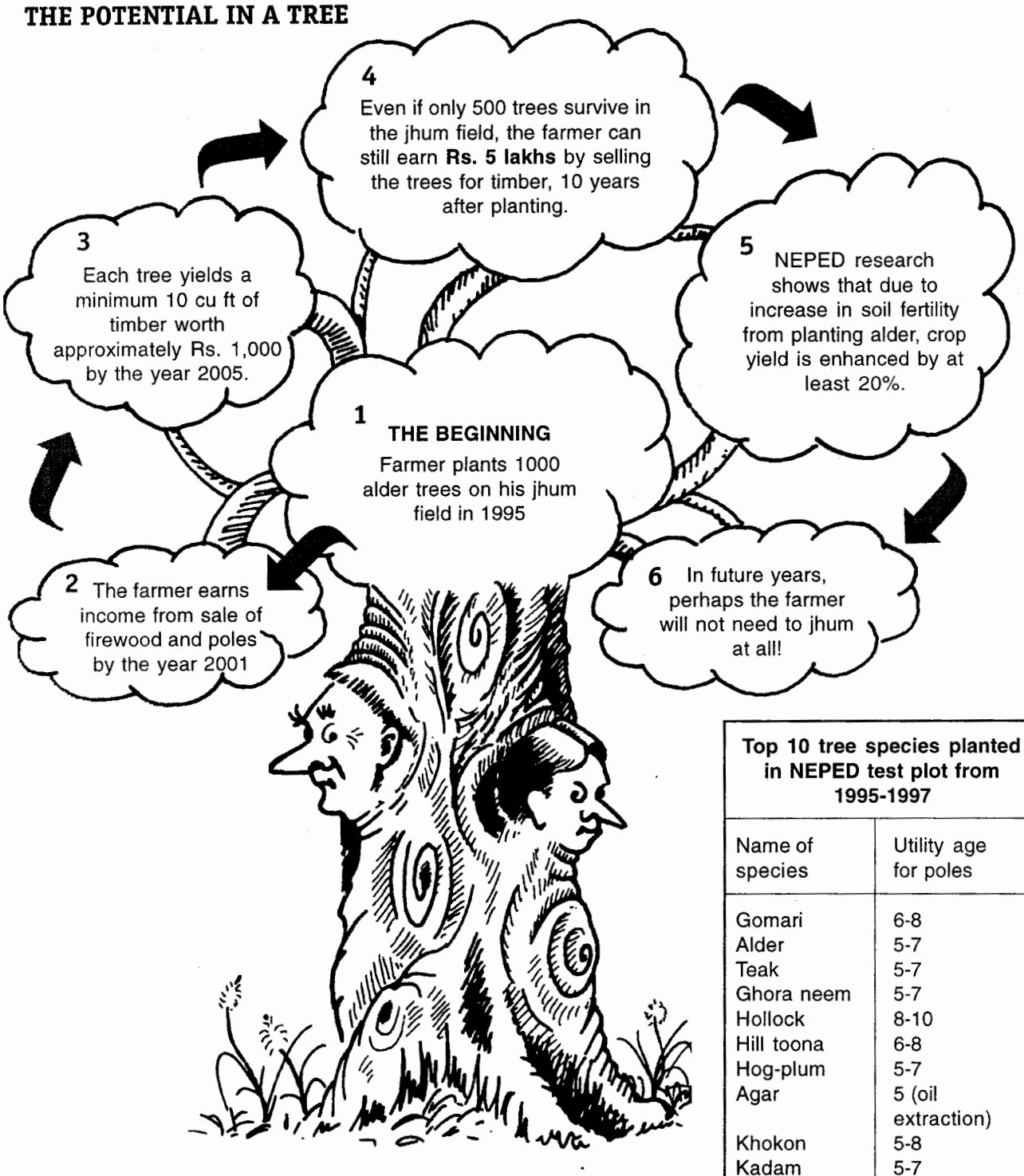
With permanent mixture, the supplementary species remain with the main species throughout the rotation period. Such mixtures are generally done in order to avoid the risks to which pure crops are exposed. Below are the two kinds of permanent mixtures.

1. HORIZONTAL OR EVEN-AGED MIXTURE

The species mixed are generally of the same height. Examples of such mixtures are gomari, titachap and bonsum. These mixtures are difficult to manage, especially when the mixed species have different silvicultural requirements, rates of growth and exploitable ages.



THE POTENTIAL IN A TREE



Top 10 tree species planted in NEPED test plot from 1995-1997

Name of species	Utility age for poles
Gomari	6-8
Alder	5-7
Teak	5-7
Ghora neem	5-7
Hollock	8-10
Hill toona	6-8
Hog-plum	5-7
Agar	5 (oil extraction)
Khokon	5-8
Kadam	5-7

The Nagaland Environmental Protection and Economic Development (NEPED) project encourages farmers to plant economically-viable and fast-growing trees in the jhum fields along with the normal food crops. The project's impressive success in popularising the concept is reflected by the widespread adaptations of NEPED test plots.

Do you know that . . .

- The research wing of NEPED has so far collected 222 samples of different tree species in Nagaland.
- More than 90 species have been identified to be of good timber and construction value.
- Many other species have medicinal, fuel, art and handicraft values.

Importance must, therefore, be given to raising farmers' awareness regarding the marketing aspect for the profitable sale of trees or fallow crops recommended by NEPED. They should be aware of:

- the right age for harvesting their "fallow crops" so that they get the right price;
- the need to explore and identify the best available market prices;
- market requirements in terms of species, size, quantity and quality
- the risk factors that are governed by:
  - prevailing market prices;
  - access to market;
  - seasonal changes in market demand; and
  - physical risks from fire, pests, calamities, etc.

Minimum Harvestable Age of Selected Tree Species for Sawlogs

	Harvestable age
Alder *(Alnus nepalensis)*	10
Teak *(Tectona grandis)*	10
Gomari *(Gmelina arborea)*	15
Ghora neem *(Melia composita)*	8
Hollock *(Terminalia myriocarpa)*	20
Hill toona *(Cedrela serrata)*	15
Hog-plum *(Spondias axillaris)*	10
Khokon *(Duabanga grandiflora)*	10
Kadam *(Anthocephalus cadamba)*	10
Tita chapa (*Michelia champaca*)	20
Mundani (*Acrocarpus fraxinifolius*)	10
Walnut (*Juglans regia*)	25
Koroi (*Albizzia procera*)	10
Sam (*Artocarpus chaplasha*)	15
Bola (*Morus laevigata*)	25
Bonsum (*Phoebe goalparensis*)	20
Simul (*Bombax ceiba*)	10
Urium (*Bischofia javanica*)	20
Pine (*Pinus khasya*)	20
Birch (*Betula alnoides*)	15

THE MARKET FOR POLES

A recent survey on Nagaland timber markets shows that:

- There is a shortage of poles and fuelwood in the country.
- Pole prices are substantial.
- Industries, particularly coal mining and construction, need large quantities of poles.
- Pole traders at Siliguri, Chandrakona Road and Jhargram are potential buyers in bulk from Nagaland. Poles may also be bought by traders from Guwahati and Calcutta.
- If the quantity of poles collected reaches 100,000 cu ft or approximately above 50,000 poles, they can be auctioned.
- For small quantities, the sale is based on the number and quality of poles.

Pole prices at Siliguri (1999)

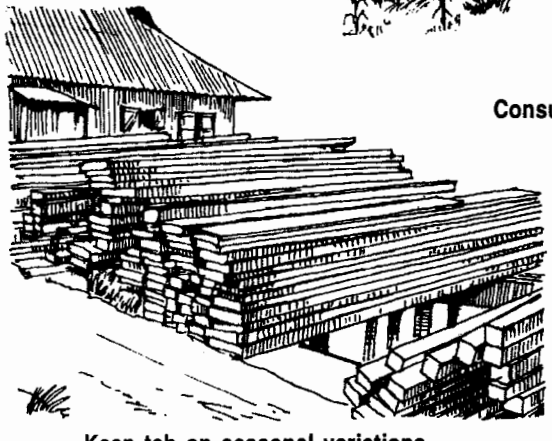
Species	Girth	Rs/cu. ft.
Teak	55 cm	135
Gomari	90 cm	250
Sal	60 cm	100
Hollock	90 cm	270
Kokhon	45 cm	80
Kawala	90 cm	200

Specification for Poles

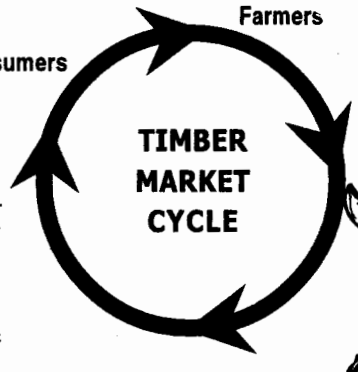
- The base should measure at least six inches in diameter.
- It is best to have full length debarked poles of eucalyptus, gomari and alnus species.
- The pole length should be at least 16 ft. However, it is safer to keep the full length trees as the pole length requirements may vary from costumer to costumer.

Establish fast-growing and economically-viable trees

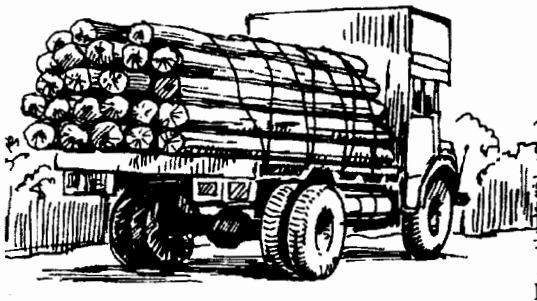
Assess demand and check prevailing market price



Keep tab on seasonal variations of demand and price.



Avoid damage to poles and remaining trees when cutting



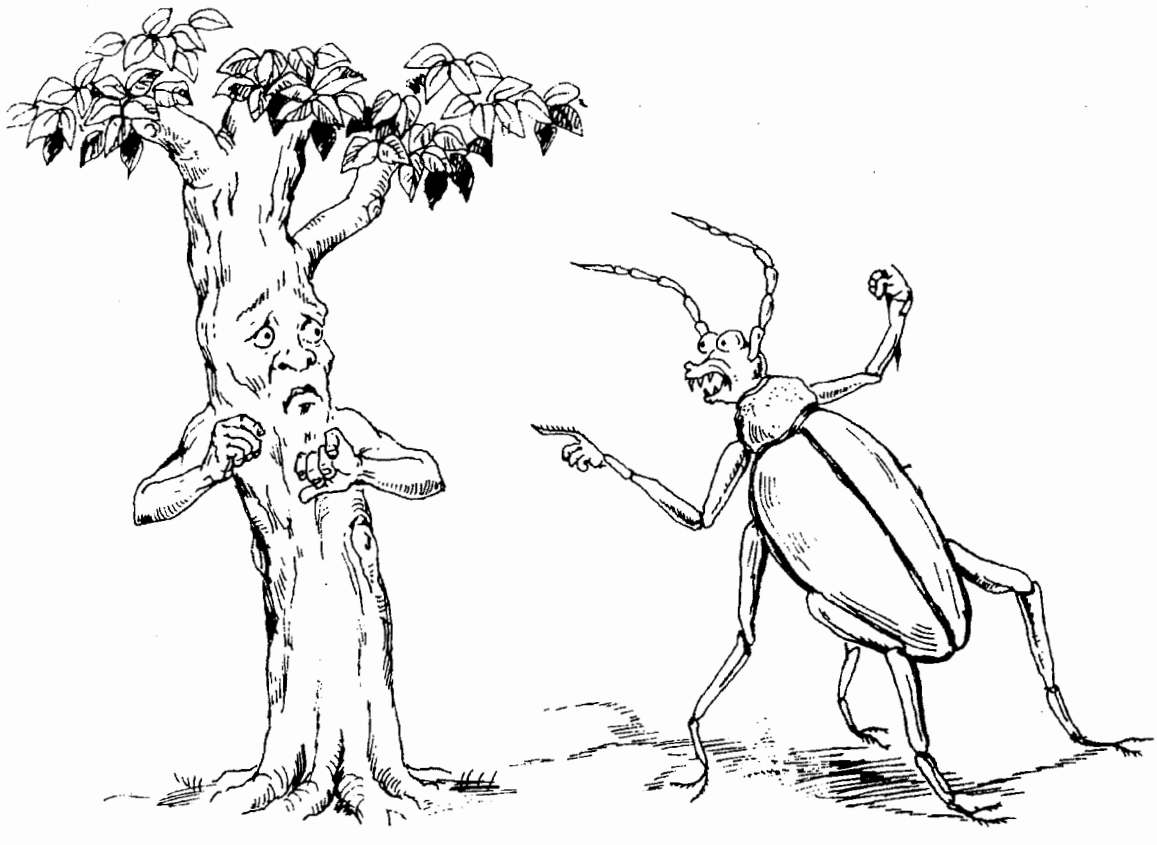
Check access to market cost and availability of transport

Market through reliable organisations and cooperate with other farmers

Prepared by:
N. Ari Jamir and Raj Verma

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Pests and Diseases in Tree Plantations of Nagaland



Like other plants, trees too are susceptible to injuries caused by pests and diseases. Insect infestation of trees has been one of the most serious causes of tree mortality in plantations of Nagaland. As such, it is important to identify the different types of insects and diseases and the measures to protect the trees.

INSECT PESTS

Pests fall into three categories:

1. Leaf eaters – feed directly on the leaves, buds and shoots
2. Sap suckers – extract sap by sucking from leaves and branches
3. Borers – enter the sapwood and sometimes heartwood.

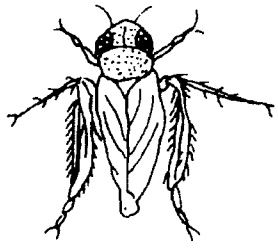
Some of the common pests found in the tree plantations of Nagaland are:

- **Tea mosquito bug** (*Helopeltis antonii and Helopeltis theivora*)
  The nymphs suck the sap from the tender shoots and leaves of the tea plants, neem trees (*Azadirachta indica*), mahogany (*Swietenia macrophylla*) and cashew plants (*Anacardium occidentale*).

Nymph

Adult

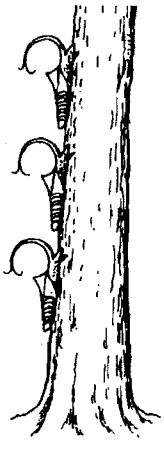
- **Tree-hopper** (*Tricentrus bicolor*)
  The acacia and cassia trees are commonly infested by the tree-hopper. The nymphs can be especially devastating as they extract the sap from the trees by sucking on the leaves.



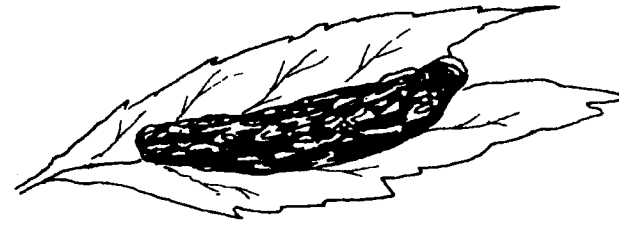
- **Leaf defoliator of gomari** (*Calopepla leayana*)
  This beetle feeds on the leaves, buds and shoots of gomari trees. The bodies of the adults have a metallic shine. The leaf defoliator can be controlled, to a large extent, with the help of light snares. Building artificial pupation sites that would be destroyed later on is useful in killing the pupae.

- **Lace bug of gomari** (*Tingis bessoni*)
  This insect feeds at the base of the leaves of the gomari trees. The ravaged leaves appear to be patched. This insect can be controlled using insecticides.

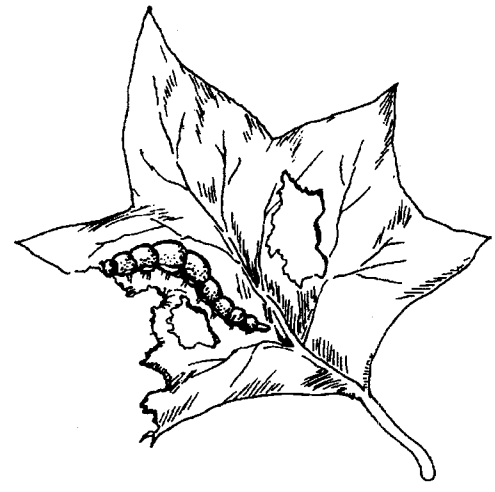
- **Sap-sucking pest of albizzia** (*Heteropsylla species*)
  Normally, this insect does not pose serious problems in Nagaland due to the climatic conditions. But if tree plantations are infested, they could be badly damaged. The nymphs attack the shoots and suck the sap from the young leaves and tender stems.



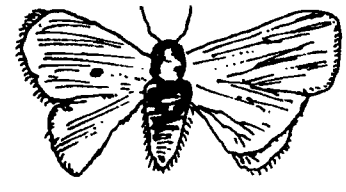
- **Leaf-eating caterpillar** (*Eurema blanda silhetana*)
  The larvae generally feed on the leaves of albizzia trees but sometimes, larger trees are also infested.



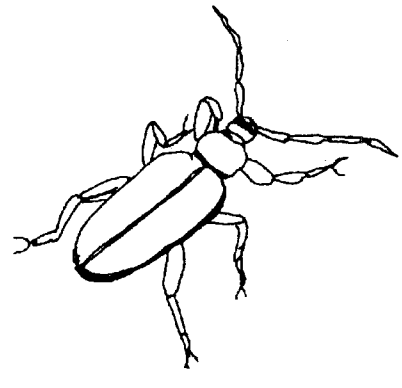
- **Defoliator of gomari and agar** (*Heortia vitessoides*)
  This pest is commonly found in agar wood (*Aquilaria agallocha*). It can cause serious damage to the tree and in extreme cases, may even strip the bark of the young tree.



- **Teak defoliator** (*Hyblaen puera*)
  The caterpillars feed on the leaves of trees causing extreme defoliation. In certain cases, the leaves of the teak trees are totally stripped.



- **Teak canker grub** (*Dihammus cervinus*)
  The larvae bore into the sapwood and injure the cambium. The infested plant should be cut below the affected area to facilitate the growth of a new stem.



Pest Control Measures

Some levels of insect activity can always be expected in tree plantations and treatment is only required for serious outbreaks. Chemical solutions for pest-control are generally not advisable as they may lead to environmental problems. More eco-friendly measures should be adopted:

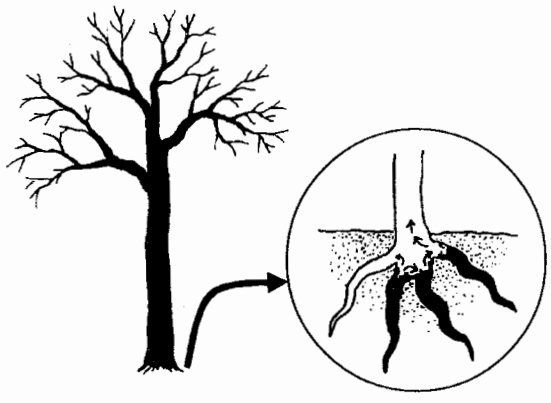
- Avoid monocultures.
- Select the appropriate species for the site.
- Weed at regular intervals (if applicable).
- Set up light traps to attract insects.
- Apply lime to the tree trunks to discourage infestation.
- Naga folk wisdom holds that the planting time should be determined by the phases of the moon. The days of the full moon and the seventh and ninth days of the new moon are regarded to be the best times for planting trees.
- Through controlled burning, set on fire the areas near the plantations to attract and burn the insects.

In extreme conditions, when non-chemical measures prove ineffective, chemical pesticides like Rogor, Nuvacron, Sevin and Carbanyl may be used.

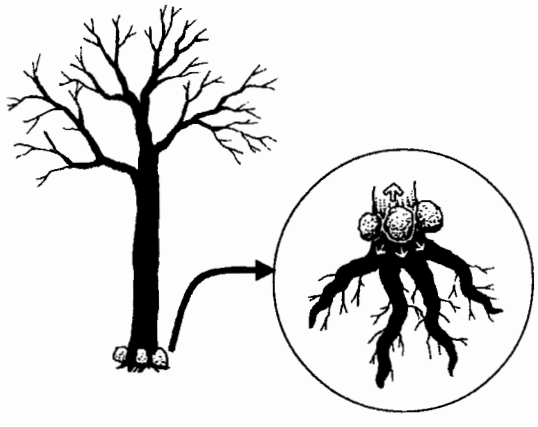
TREE DISEASES

Most tree diseases are of fungal origin. Some of the common ones are:

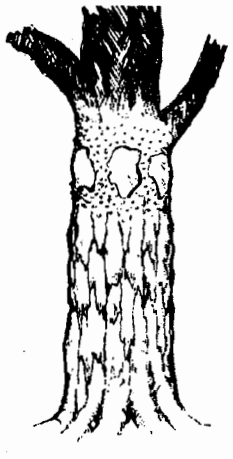
- **Root-rot** (*Ganoderma lucidum*)
  Trees like albizzia, dalbergia sissoo, acacia and eucalyptus are attacked. The pathogen remains in the soil and attacks the root system first and gradually spreads through the entire tree.



- **Root-rot** (*Cylindrocarpon lucidum*)
  This disease normally attacks the roots of the eucalyptus trees. In severe cases, the roots die and eventually the tree also dies.



- **Pink disease of stem** (*Corticium salmonicolor*)
  The pathogen affects the bark and gradually spreads to the cambium. *Azadirachta indica*, *Bombax ceiba*, *Cassia siama*, *Gmelina arborea* and *Tectona grandis* are some of the trees which are affected by this disease.



- Other common tree pathogens are leaf-spot disease, leaf-blotch, anthracnose and powdery mildew.

In general, leaf diseases do not kill the trees and can be controlled by proper maintenance and management practices.

Prepared by:
Supong Keitzar, Temsu Yanger Phom and Imliakum

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Trees and their Uses

Commonly Planted Tree Species in Nagaland

Naga farmers plant many tree species in their fields. But some are more commonly grown than others. In a NEPED evaluation, the most popular four species accounted for 61% of all trees planted and the top ten species accounted for more than 80%. The ten most commonly planted trees in Nagaland (in descending order) are described below.

GOMARI (*Gmelina arborea*)

Distribution and habitat

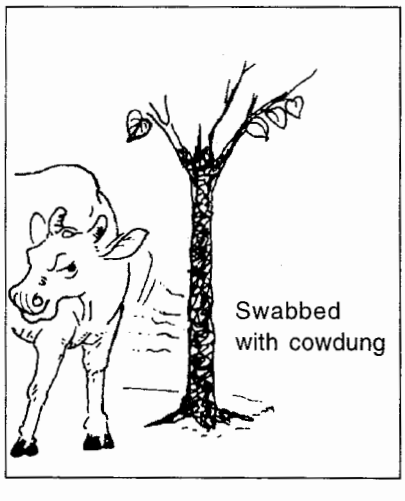
Grows on various types of soils, scattered in deciduous forests throughout the Indian subcontinent.

Characteristics

Moderate to large deciduous tree, with numerous spreading branches; 20-30 m tall and a girth of 2.4-4.5 m. The leaves fall in January-February. New leaves appear in March-April and panicles of flowers appear in February-March. The fruit ripens in May-July. It is a succulent, oblong drupe and turns yellow when ripe. The hard, bony stone is usually 2-celled and 2-seeded.

Propagation

Seedlings are raised in the nursery in June-September and root-shoot stumps are prepared in March-April for plantation.



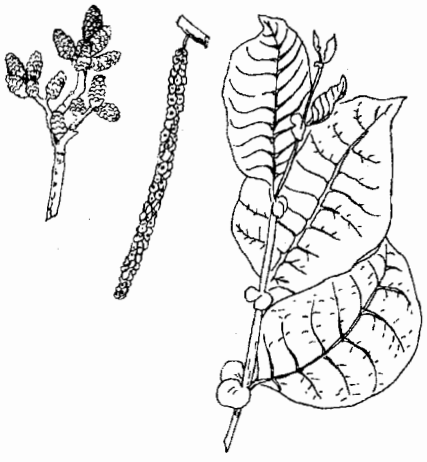
Uses

Wood is used for furniture, planks, carriages, printing blocks, carving, musical instruments and artificial limbs. Fruits, flowers, roots and bark are used as medicine. Leaves are used as fodder.

Experience of NEPED farmers

Cattle relish the leaves; so the stem can be swabbed with cowdung, which acts as a repellent. Stem borer is controlled and killed by plugging with fumigants. Defoliators (*Calopepla* sp.) also cause damage. They are collected by hand in the initial stage of infestation and crushed or burned.

ALDER (*Alnus nepalensis*)



Distribution and habitat

One of the most widely distributed trees in South Asia. It spreads from Pakistan to Northwest India, Nepal, Bhutan, Northeast India, Myanmar and China. It grows well at altitudes of 1000-2000 m above sea level (asl). In Nagaland, it is mostly found in the hills. It thrives well in shady ravines and landslides.

Characteristics

A sparsely branched, deciduous tree which grows up to a height of 24-30 m; it grows in clusters. The bark becomes fissured and brown in colour when the plant is 4-6 years old. The leaf is simple with two small, rounded leaflet-like structures, at the base of the slender petioles. The male flower thickens into chain-like structures called catkins. Wood is light and hardens by seasoning.

Propagation

Cones mature in December and seeds are dispersed by wind. The seeds remain viable for 4-8 months. Seedlings can also be raised in nurseries. The optimum time of sowing is February and the saplings can be planted in the same year.

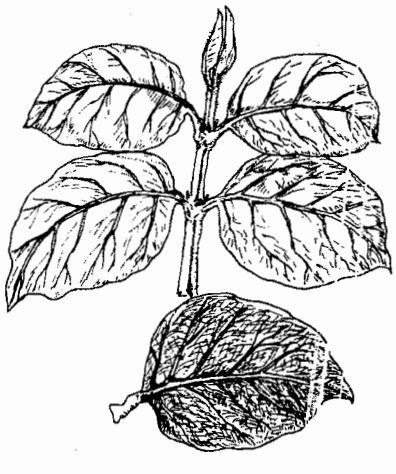
Uses

Wood is used for construction work and furniture. Profuse leaf fall and decomposition improves soil fertility. Wood provides a good source of fuel. The roots have nodules which fix atmospheric nitrogen in the soil. Bark contains tannin used for dyeing. Roots spread laterally; this helps binding the soil and prevents soil erosion. Leaf sap has coagulant properties and is used for acute dysentery and external injuries.

Experience of NEPED farmers

Farmers are aware of the beneficial effects, particularly the use of wood as fuel. Many farmers are unaware that the wood can be used as sawn timber.

TEAK (*Tectona grandis*)



Distribution and habitat

Common in Myanmar, Central and South India and Thailand.

Characteristics

Teak grows on various soils but requires good soil and a suitable climate. It has exceedingly rapid growth while young and coppices well. It needs bright sunlight and is resistant to fire.

Propagation

Stumps are planted during April to May. The stumps are 1-2 cm in diameter with 15-30 cm long roots.

Uses

The wood is one of the best timbers for furniture and cabinet making, wagons and railway carriages. It can also be used for poles, beams, columns, roofs, doors, window frames, flooring, planks, panelling, straircases and other construction work.

Experience of NEPED farmers

Cattle do not browse the leaves. Some farmers in Nagaland obtain pieces of cuttings from a single root and these have successfully sprouted. Growth is optimum in the first four years. Hoeing around the base and scratching the lateral roots after 5-9 years enhance the growth.

GHORA NEEM (*Melia composita*)

Distribution and habitat
In sub-Himalayan tracts of India; also common in Myanmar, China and Persia.

Characteristics
Medium size, 20-30 m tall; fast-growing tree. Leaves are beautiful and fern-like, compound, bearing 5-7 leaflets. Each fruit contains five seeds having natural percolation through the centre. Seeds are collected in October-January.

Propagation
By direct sowing. It is difficult to grow the plant in the first year unless the seed is first eaten by cattle and ruminated; or the seed is burned to remove the seed coat for easy germination.

Uses
The tree yields valuable timber. Wood is used for making toys, cigar boxes, tea-boxes and packing cases. It is also used for agricultural implements, sports ware, musical instruments, furniture, and plywood. Seeds yield a drying oil used for making soap and hair oil. A gum collected from the tree is used in the control of spleen enlargement. Leaves, bark, and fruits have insect-repellent properties. The seeds of fruits are used as beads in necklaces and rosaries.

Experience of NEPED farmers
The tree is affected by few insect pests and diseases. Termites and borers do not easily attack the timber. Cattle relish the shoots; so the stem should be swabbed with cowdung (repellent). Wood requires proper seasoning to avoid warping and twisting. Some farmers break the nut, collect the seeds and sow during the first year.

HOLLOCK (*Terminalia myriocarpa*)

Distribution and habitat
Grows at altitudes ranging from sea-level to 1500 m above sea level (asl).

Characteristics
A tall, evergreen tree. The trunk is bent and grows in one direction. However, it is not advisable to lop the lower branches to straighten the bole.

Propagation
By saplings in polythene bags.

Uses
Wood is used for house building, transmission poles, heavy packing cases and furniture. It is also used for plywood, matchboxes, jute mill rollers, trucks, dugouts, oars and cart-shafts. Wood yields pulp used in manufacture of paper.

Experience of NEPED farmers
It is easy to maintain a hollock plantation. But occasionally, insects attack the terminal shoots. Some farmers have successfully raised plantations from stumps.

HILL TOONA (*Cedrela serrata*)

Distribution and habitat

Grows in the sub-Himalayan tracts and in India (Assam, West Bengal and Nagaland). It is found at higher altitudes up to 2500 m.

Characteristics

A large tree which usually can attain a height of 30 m and a girth of 3 m. Flowers are white and dangle in clusters of panicles (1 m long).

Propagation

The seeds are dispersed by wind during mid-summer. It is normally planted bare-rooted. The saplings can also be stump planted; even the root-shoot cuttings are planted.

Uses

The wood is used for furniture, bridges, poles, packing cases and plywood manufacture. Bark is used for treating chronic dysentery. Fruits are used as decoration. Flowers are used as a dye for cotton and woolen clothes.

Experience of NEPED farmers

The tree is resistant to termites and other insects. It grows rapidly in the first 6-8 years and attains maximum size in about 15-20 years.

HOG-PLUM (*Spondias axillaris*)

Distribution and habitat

Commonly found in Nepal and northeastern India (Assam and Nagaland) up to an altitude of 1700 m.

Characteristics

A tall and fast-growing tree. It can remain submerged in the soil for a long period.

Propagation

Seed is collected in October-January. Fresh fruits are collected and the pulp is removed by rubbing with ash or sand. The eyes of the seed are placed upright while dibbling. The seeds germinate in three weeks. About five shoots sprout from each seed; of these the best one is retained and allowed to grow.

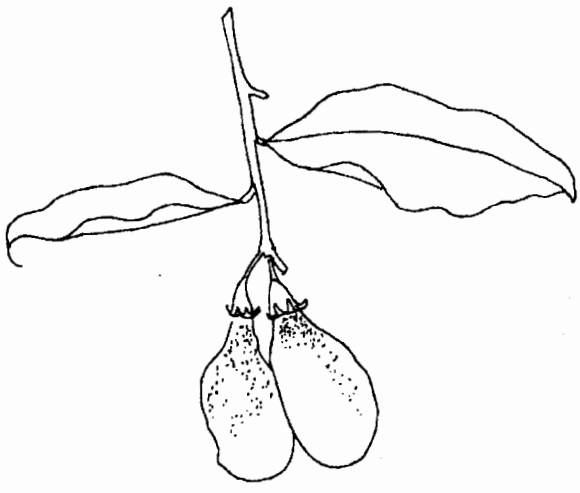
Uses

Wood is easy to split and is used as light constructional timber.

Experience of NEPED farmers

Easy to propagate and cost effective. Villagers use split timber for construction of farm houses because the wood can withstand moisture and remain in the soil for a long period.

AGAR-WOOD (*Aquilaria agallocha*)



Distribution and habitat

In Nagaland, it is mostly found in warmer places below 1000 m.

Characteristics

A medium-sized evergreen tree, 18-21 m tall with 1.5-1.8 m girth; moderately straight. The wood is soft, light and elastic. It requires shade in early stages of growth. If the wood is infected by a fungus, dark, resinous, fragrant masses called "agar" are formed in the centre of the bole.

Propagation

The tree regenerates freely. It is propagated through seeds raised in nurseries. Seeds are collected in August and sown immediately due to their short viability.

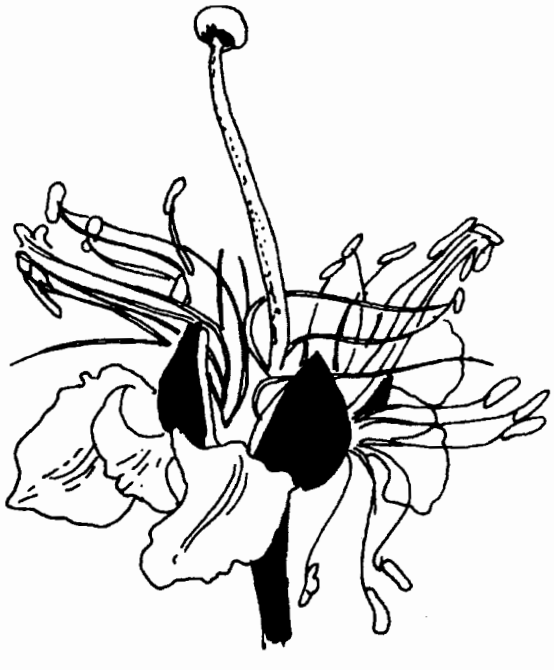
Uses

Wood yields "agar" oil used as fixative in perfumes. "Agar" oil is used in treatment of asthma, diarrhoea, dysentery and paralysis; and as an aphrodisiac. It is also used to prevent fleas and lice.

Experience of NEPED farmers

Healthy trees are infected by the fungus when infected pegs are driven into them. Wood from four- to five-year-old trees is also sold as grade IV category for extraction of "agar" oil.

KHOKON (*Duabanga grandiflora*)



Distribution and habitat

In India, it is widely distributed in the Himalayan foothills, West Bengal, Sikkim and Andaman Islands, up to 1200 m. However, the best density is observed up to 500 m.

Characteristics

Elegant, tall tree with horizontal and long drooping branches; 30-40 m tall and with girth of 2.5 m.

Propagation

Seeds are minute and should be sown carefully. Germination is 80% if proper conditions are provided in the nursery. It also regenerates naturally in cleared areas of the first year jhum fields.

Uses

Wood is suitable for planks, light rafters, match splints, canoes, boats, tea-boxes and house construction. Fruits are acidic and edible.

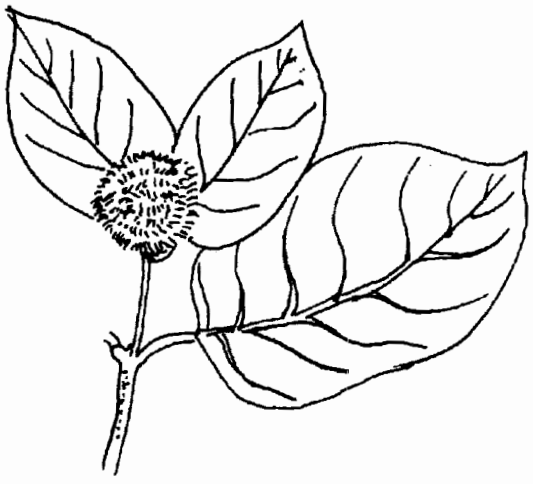
Experience of NEPED farmers

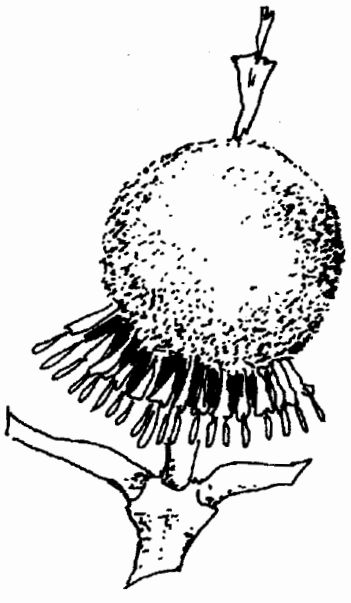
Timber houses in many parts of Nagaland are attacked by wood-borers. Khokon wood is preferred for house construction as it is not attacked by insects.

KADAM (*Anthocephalus chinensis*)

Distribution and habitat

Common in moist deciduous and semi-evergreen forests in Northeast India and Western Ghats. It occurs in the tropical semi-evergreen and evergreen forests up to an elevation of 1000 m. The tree thrives in well-drained alluvial soil. It occurs naturally in the fresh clearings of jhum fields after burning.





Characteristics

Large, graceful deciduous tree with a straight bole of about 20 m in height and girth of 1.5-2 m. The spreading crown bears drooping branches and ball-like flowers. Fruits are large, orange in colour, fleshy, 5-7 cm in diameter.

Propagation

Seeds are collected in August-November. Prior to sowing, seeds are soaked in water for 36 hours to enhance germination. Germination is maximum during 18th-20th day. Small seedlings are transferred into polythene bags. Frequent watering is required. The saplings are ready for transplanting after three months.

Uses

Wood is generally used for boards, packing cases, tea-boxes, match splints and manufacture of cheap paper. It is also used for beams and rafters.

Experience of NEPED farmers

The wood has a peculiar smell. To ensure its durability, the bark is kept intact in the portion of the pole that is imbedded into the ground.

Prepared by:
Amenba Yaden and
Vizonyu Liezie

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Shade-loving Economic Plants for Agroforestry

Although all green plants require sunlight for synthesis of food (i.e., photosynthesis), their degree of requirement, exposure and tolerance to sunshine hours varies from one species to another. Shade-loving plants grow and develop better when planted in shade. For their photosynthesis, a defused sunlight is enough.

Some important shade-loving plants, known to local farmers and which can be used for agroforestry, are described below.

Agroforestry

Agroforestry seeks to maximise production from mixed cropping by including tree species. Shade-tolerant species may be interplanted beneath these trees and shrubs for food, medicine or cash.

TURMERIC *(Cucurma aromatica L.)*
The plant is a herbaceous perennial tropical crop with thick underground rhizomes.

Cultivation:

- Cultivated up to 1400 meters.
- Grown in varieties of soil but grows best in loamy soil rich in organic matter.
- Cultivated from April to July.
- Seed rate: 1000 kg/ha.
- Spacing: 45 x 15 cm and deeper than 7.5 cm.
- Yield: 14,000 to 32,000 kg/ha (Rhizomes).

Uses:

- Cosmetic preparations
- Spices
- Dyes
- Medicinal uses: It has antimicrobia and antiseptic properties and is also used as a stomach tonic and blood purifier.

GINGER
(Zingiber officinale)
A herbaceous perennial plant having underground rhizomes. It is a leafy herb.

Cultivation:
- A tropical crop, it is cultivated from low to 1600 m.
- Grows best in sandy soil with high organic matter content.
- Planting is done from March to April before the onset of monsoon.
- Seed rate: 800 to 1200 kg/ha
- Spacing: 45 x 18 cm
- Yield: 10,000 kg/ha

Uses:
- Spice
- Medicine
- Flavouring agent in confectionery and also for making ginger beers, etc.

CARDAMOM *(Elettaria cardamomum L.)*
It is a herbaceous perennial plant. It has underground rhizomes which give rise to aerial leafy shoots and panicles.

Cultivation:
- Thrives best in tropical forests
- Grows in altitudes ranging from 600 to 1600 m
- Propagated through rhizomes and suckers
- Planted from April to May
- Seed rate: 800 to 1000 kg/ha (Rhizomes)

Uses:
- Medicine
- Flavouring agent in confectionery
- Spices and curry powder preparations

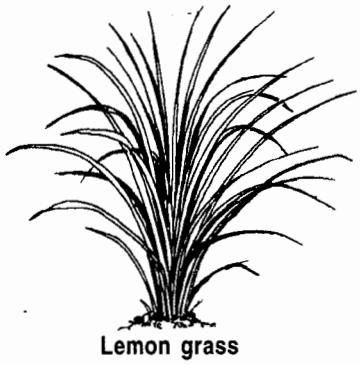
PEPPER *(Piper nigrum)*
Pepper is an evergreen climber with jointed stems. Its leaves are dark green and the stems grow on support. The fruits are normally green and reddish when ripe.

Cultivation:
- It requires humid tropical climate with good rain.
- Thrives best in well-drained clay to loam soil.
- The plant is propagated through cuttings of runner shoots.
- Planted from May to June
- The number of planting materials required depends on the system of farming or type of garden.
- Yield: 2000 to 2500 kg/ha

Uses:
- Spice
- Stomach trouble, lowering blood sugar, etc.

LEMON GRASS AND CITRONELLA *(Cymbopogon citratus* and *Cymbopogon spp.)*

Both the plants are stemless perennial grasses. Their leaves yield an aromatic oil containing a high percentage of citral oil.



Lemon grass

Cultivation:

- Both plants can be grown in most types of soils.
- They are largely grown in sub-tropical areas.
- Lemon grass is propagated through seed raised in nursery.
- Citronella grass, on the other hand, is propagated by rooted slips.

Uses:

- The oil is used in soaps, cosmetics, deodorants and perfumery formulation.

COFFEE *(Coffea arabica, Coffee robusta)*

Description:

Coffee plant is an evergreen shrub or a small tree. The leaves are opposite and simple. The fruit is commercially known as cherry or berry.

Cultivation:

- *Coffee arabica* grows best at elevations ranging from 500 to 2000 m.
- *Coffee robusta* grows best between 150 to 500 m.
- Coffee plant is directly propagated from seeds and seedlings which are raised and transplanted from nurseries.
- Spacing: 1.75 x 2.75 m for *Coffea arabica* and 3 x 4 m for *Coffee robusta*
- Yield about 600 to 700 kg dried beans per/ha

Uses:

- Coffee is used as a non-alcoholic beverage.
- It helps in stimulation and diuretic action.

TEA *(Camellia sinensis)*

Description:

Tea plant is an evergreen tree under natural conditions. The leaves are alternate and simple and the stem is profusely branched.

Cultivation:

- Tea plants can be grown under a wide range of environmental conditions. It grows well from sea level to 2400 m.
- It is best grown in well drained fertile soils with high organic matters.
- Tea plants are propagated from seed, through cuttings, grafting and layering.
- About 20 kg of seed is enough for one hectare while 8000 to 10000 saplings are required for the same area.
- Pits should have at least 45 cm diameter and 60 cm depth.
- Spacing: 1 x 1 m

Uses:

- Non-alcoholic beverage
- It has diuretic property and is useful in cardiac therapy.

TARO *(Colocasia spp.)*

Taro is a tuberous root crop. It is a herbaceous annual plant.

Cultivation:

- Taro is grown in many Asian countries in the tropics and sub-tropics.
- Taro thrives well in soil rich in organic matter.
- Planting is done through tubers/rhizomes.
- About 1000 to 1500 kg of tuber is needed for one hectare
- Yield: About 12,000 kg per hectare

Uses:

- Food crop

YAM *(Dioscorea spp.)*

It is a tuberous root crop. The plant is a tuberiferous species with the vines twining up on trees and other supports.

Cultivation:

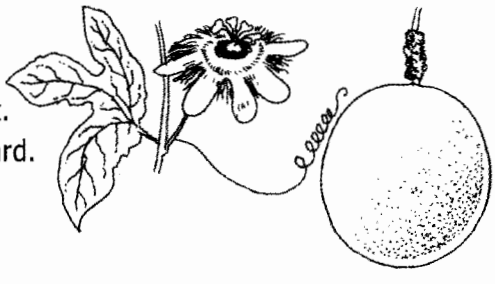
- Yam is cultivated in most parts of Nagaland during the rainy season.
- It thrives best in well-drained sandy loam soil rich in organic matters.
- Pre-sprouted tubers are used for planting.
- Yams are normally grown in jhum fields mixed with rice.

Uses:

- Food crop

PASSION FRUIT *(Passiflora edulis)*

Passion fruit is a climber cultivated for its edible fruit. The vines are woody and hard.



Cultivation:

- The crop is cultivated all over Nagaland.
- There are two types of passion fruit – one bears purple fruits and the other bears yellow fruits.
- The plant is propagated from seeds, and through vegetative cuttings in April and May.
- The plant profusely bears fruits even up to two times a year.

Uses:

- Fruits are edible.
- The juice extract is used for squash making.

Prepared by:
Supong Keitzar

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

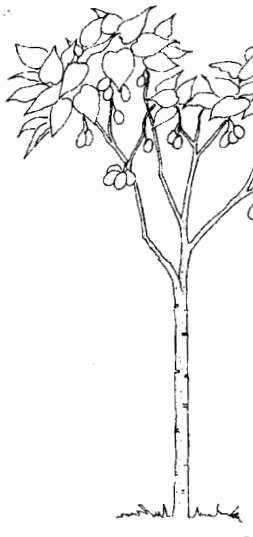
Some Backyard Horticultural Crops of Nagaland

Growing horticultural crops in backyards is a common practice amongst the Naga farming community, primarily for family consumption. In recent years, certain local fruits have been identified according to market potential, better adaptability to the region and high nutritional value. The crops are consumed locally and fetch good prices in the local markets, as well as outside the state. Some of the backyard horticultural crops of Nagaland are described below.

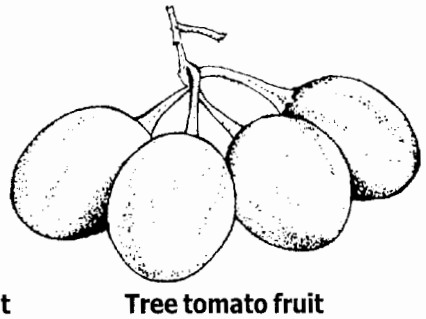
TREE TOMATO

(Cyphomandra betacea)

An evergreen semi-woody shrub or small tree normally found in the hilly regions of Nagaland. In low-lying tropical areas, the growth is poor and the tree does not bear fruits. The plant propagates easily from seeds and cuttings. Within two to three years of planting, it bears reddish egg-shaped fruits with smooth skin, hanging in clusters on the branches. Although the tree bears fruits throughout the year, the peak season is from November to March.



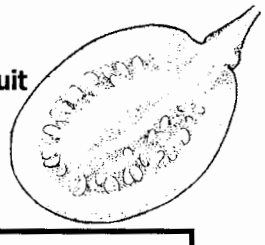
Tree tomato plant



Tree tomato fruit

MARKET POTENTIAL

- Tree tomato is used as a substitute for tomato and has a longer shelf life.
- A single tree can bear more than 100 fruits at a time.
- In local markets, the fruit has a good price.



Cut section of fruit

USES

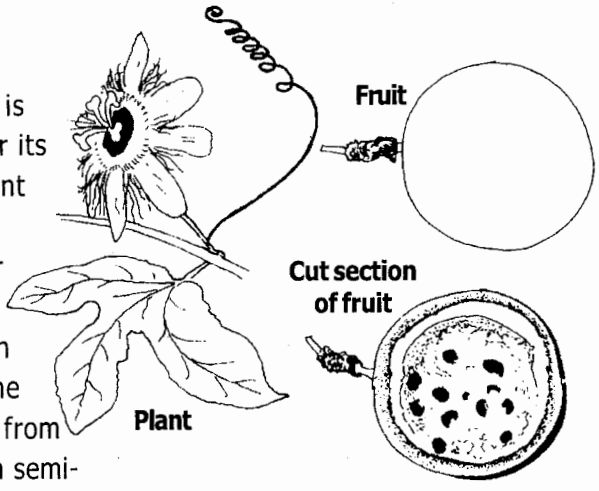
- The fruit can be eaten raw or cooked as a vegetable.
- It is used for making jams and jelly.
- It is a good source of protein, fat, carbohydrates, minerals and vitamin A.
- The woody stem yields fiber.

Tribe		Local names
Angami	:	*Seibengenuo*
Konyak	:	*Pe hoishi*
Rengma	:	*Akati kesiwa*
Sumi	:	*Asubeguna*
Lotha	:	*Khondi ethem*
Chakhesang	:	*Suhbanga*

PASSION FRUIT

(Passiflora edulis)

This woody climber is chiefly cultivated for its edible fruit. The plant bears two types of fruits: purple colour in higher elevations and yellow colour in lower elevations. The plant is propagated from seed as well as from semi-hardwood cutting.



MARKET POTENTIAL

- A kilogram of passion fruit (about 30 fruits) sells for Rs. 15 in the local market.
- The fruits have a long shelf-life and can be transported in long distances without damage.
- A kilogram of passion fruit yields 300 ml of pure juice extracts which is normally used to prepare squash.
- A liter of squash costs Rs. 60 to Rs. 70 in the local market.

USES

- Ripe fruits are edible.
- The juice is used for the preparation of squash, syrups, jellies, etc.
- The fruit is used for flavouring candy, ice creams, cake fillings and frostings.
- Peels and seed cake are used as feed for livestock.
- Seeds yield oil used in paints and varnishes.
- The leaves are bitter and eaten as a vegetable. It possesses medicinal qualities and is used for high blood pressure problems and diarrhoea.

Tribe	Local names
Ao	: *Entsulashe*
Angami	: *Bel*
Konyak	: *Lungha vulick*
Rengma	: *Ajukekupi*
Sumi	: *Bell xathi*
Lotha	: *Bellthi*
Chakhesang	: *Bel*

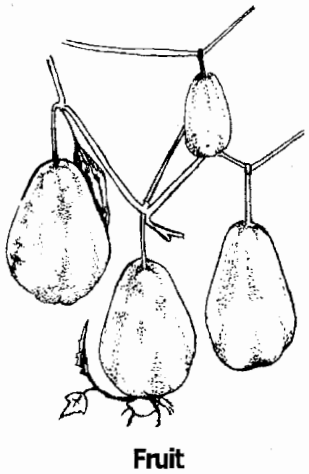
CHOW-CHOW

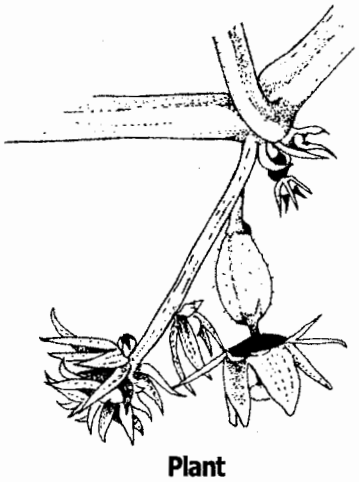
(Sechium edule)

A climbing herb with tuberous roots. Chow-chow is cultivated on a large scale and is grown throughout the hilly regions of Nagaland. Sprouted fruits are used to propagate the plant. The seed begins to sprout inside the fruit while still on the parent vine. The plant requires a large quantity of water for its growth and the fruit matures in about 30 days after flowering.

USES

- The fruits are eaten as vegetable.
- Roots are a source of starch and can be used as substitute for arrowroot starch.
- Seeds are cooked or roasted before eaten.
- Tender shoots, leaves and tubers are eaten as vegetables.
- Fruits, stems and tubers are used as fodder.
- The woody stem yields fibre.


Fruit

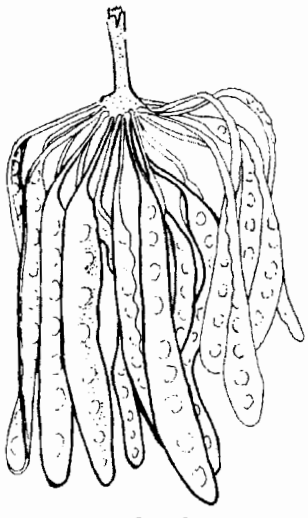

Plant

Tribe	Local names
Ao	: *Squash*
Angami	: *Bisuku*
Konyak	: *Wolick*
Rengma	: *Sukusu*
Sumi	: *Sukosu*
Lotha	: *Sukosu*
Chakhesang	: *Kusu*

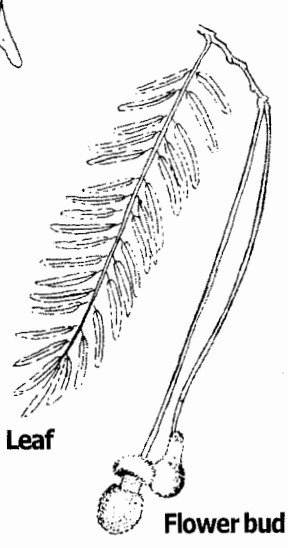
YONGCHAK

(Parkia roxburghii)

A medium-sized tree, grown for its pods and used as a park tree for shade. It flowers in December and yellow and white in colour. The plant propagates from seeds. The fruits or pods are borne in clusters, each measuring as long as 50 cm.



Cluster of pods



Leaf

Flower bud

MARKET POTENTIAL

A cluster of pods sell for Rs. 10 in the local market.

USES:

- Tender shoots and pods are eaten as vegetables.
- Pods and seeds are used for stomach disorders.
- Lotion from the bark and leaves is used to treat sores and skin infections.
- Wood is used for fuelwood, temporary constructions, boxes, shoe heels, etc.

Prepared by:
Qhutovi Wotsa and Sanchothung Odyuo

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

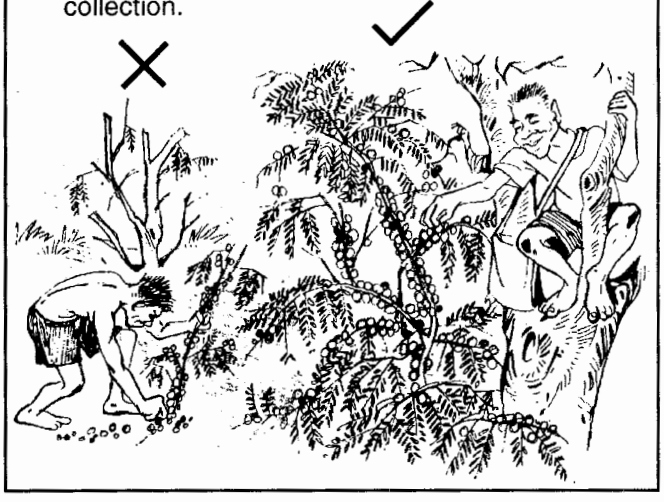
Some Important Wild Fruits of Nagaland

Wild fruits make an important contribution to the nutrition of the rural people in Nagaland. They also play a significant role in income and survival strategies for jhum cultivators, small landholders and landless families living near forests. They are a food supplement especially during times of shortage. Some wild fruits, e.g., gooseberry and crab apple, are processed into different forms and are sold in local markets.

Wild fruits are common in tropical and subtropical rain forests of Nagaland and have enriched the biodiversity. But many species are vanishing due to deforestation and wild fire. For example, when wild fig varieties get burned by wild fire, the plant may survive, but the fruits become non-edible. Efforts are needed to reintroduce wild fruits and conserve biodiversity in Nagaland.

Ways to Conserve Wild Fruit Trees

- Sustainable agroforestry systems with wild fruit trees.
- Controlling wild fire in forest.
- Domestication and marketing of wild fruits.
- Distributing propagation materials (seed and cuttings) widely to encourage multiplication at farm and community levels.
- Controlling slashing of trees at the time of fruit collection.



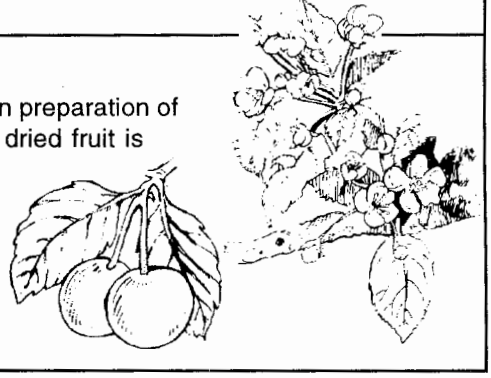
Some of the important wild fruits of Nagaland are described below:

Crab apple (*Malus* sp.)

Local name
Angami: *Ciepho*
Chakhesang: *Chiphoshe*
Konyak: *Shangphai*
Lotha: *Malanthi*
Sumi: *Phukhothi*

Habit and description
Medium-size tree. It bears clusters of white, long-stalked flowers in April to May. Fruits are pear-shaped with 3-5 seeds. Propagation is by seed.

Uses
Fruits: In preparation of squash; dried fruit is eaten.



Gooseberry (*aonla*) (*Emblica officinalis*)

Local names
Ao: *Luzujang*
Angami: *Ciehu*
Chakhesang: *Koloche*
Konyak: *Phang*
Lotha: *Jekhethi*
Rengma: *Ahuli*
Sumi: *Kholethi*

Habit and description
Small or medium-sized deciduous tree; sensitive to frost. Fruit, bark and leaves are rich in tannin. Wood is red and hard. Flowering occurs in summer. Fruits ripen during winter; green when tender and become yellow or brick red when mature.

Uses
Fruit: Richest source of vitamin C; eaten raw as well as pickled; also used as fodder.
Dried fruit: Edible, used in the treatment of diarrhoea and dysentery; and as detergent and shampoo.
Leaves: As fodder and manure.
Wood: For agricultural implements and poles.

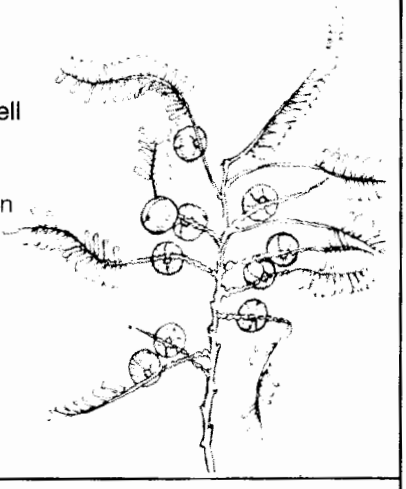


Fig (*Ficus cunia*)

Local names
Ao: *Akho*
Angami: *Thotsenuo*
Chakhesang: *Thüzo chüdü*
Konyak: *Phatnyu*
Lotha: *Khyingothi*
Rengma: *Khaghapfu*
Sumi: *Khughuthi*

Habit and description
Common in the banks of streams or in ravines. A tree, moderate in size; usually evergreen. Fruits are borne underground, on the scaly, long, leafless branches and from the trunk near the base. Fruits are globose or pyriform, in pairs or in clusters; and ripen during May to September.

Uses
Fruit: Edible; and used in preparation of jams.
Leaves: As fodder.
Bark: Yields fibre used for making ropes.
Wood: As fuel.
Root: Juice used in bladder ailments.

Fig (*Ficus auriculata*)

Local names
Ao: *Mongozuno*
Angami: *Chiede*
Chakhesang: *Makaduche*
Konyak: *Phok*
Lotha: *Zuvothi*
Rengma: *Amba*
Sumi: *Mbuthi*

Habit and description
Found abundantly along streams and damp valleys. Low-spreading tree with large leaves. Secondary branches are hollow; young shoots and stipules are spongy. A milky juice oozes when petioles and branches are plucked. Fruits are borne on the trunk and leafless branches, often in clusters and ripen during April to June. Fruits are large, brown or purple when ripe.

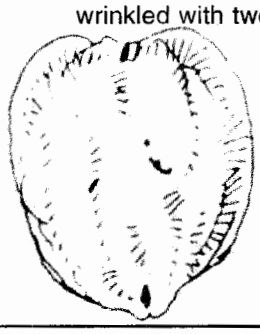
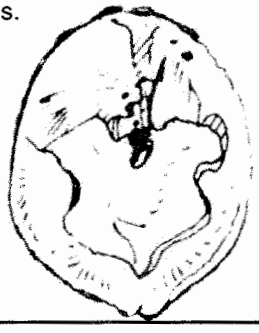
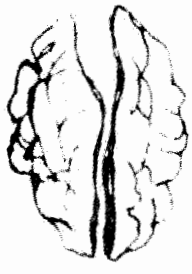
Uses
Fruit: Eaten raw; used in preparation of jams.
Leaves: As fodder and for wrapping vegetables. Young leaves are eaten as vegetables.

Walnut (*Juglans regia*)

Local names
Ao: *Akojang*
Angami: *Pfhu*
Chakhesang: *Lepfuchechi*
Konyak: *Vuh*
Lotha: *Akorthi*
Rengma: *Ajukha*
Sumi: *Ghakuthi*

Habit and description
A large deciduous tree. The tree starts bearing fruit after 8-10 years. Flowers are yellowish-green, forming a long, chain-like structure called 'catkin', which hangs down from the branches. Male flowers are borne on the old branch (i.e., developed during the previous year) while female flowers are borne on the new branch. Fruit is green with leathery nutshell. Seed is indehiscent, corrugated, oily and edible. The endocarp is hard, woody and wrinkled with two valves.

Uses
Seed: Edible.
Green hull: In fishing, used to intoxicate fish.
Bark, leaves and fruits: In medicines.
Wood: For furniture, carving gunstocks, veneers, plywood, cabinets, musical instruments, and handloom shafts and frames.

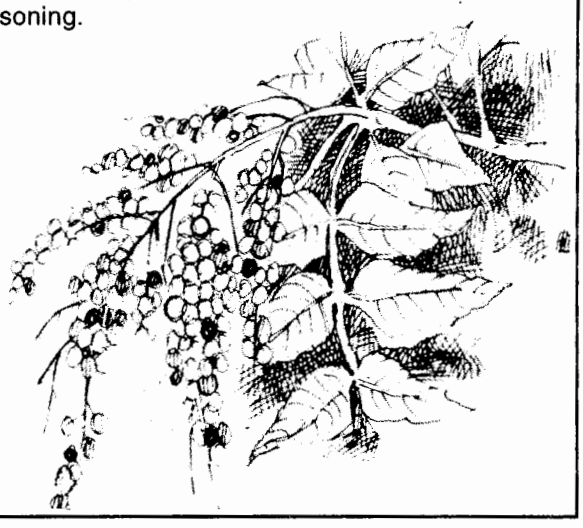




Naga tenga (*Rhus semialata*)

Local names
Ao: *Tangmoh*
Angami: *Zomhou*
Chakhesang: *Mvuchi*
Konyak: *Aomah*
Lotha: *Thumpak*
Rengma: *Athama*
Sumi: *Athum*

Habit and description
Small (or medium sized) deciduous tree. Secondary branches, petioles, undersurface of leaves and inflorescence are covered with short, soft, brownish hair. Bark is grey and rough with deep vertical furrows; also has resin canals filled with sticky milk. Leaves turn red before they fall. Profuse flowering occurs during April to September. Flowers are white or pale yellow, produced in large, terminal panicles. Fruits are small and reddish brown.

Uses
Fruit: Edible, acidic in taste; used for treatment of dysentery, diarrhoea and food poisoning.

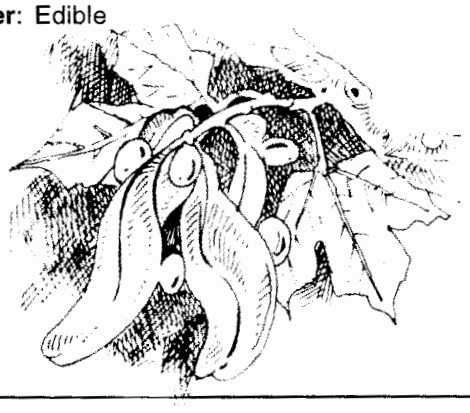


Naga peanut (*Fermiana colorata*)

Local names
Ao: *Metangtong*
Konyak: *Penwang*
Sumi: *Kughothi*

Habit and description
A medium or large deciduous tree; mostly grows wild but sometimes grown in gardens. The stem often has vertical grooves. Young shoots are pubescent. Bark is ash-grey. Profuse flowering occurs in spring (March-April). Leaves are large, often lobed and crowded at the end of branches. Leaves fall during winter and new leaves develop after flowering. Flowers are bright orange. Fruits are formed on leaf-like structures and ripen during June to July.

Uses
Fruit: Eaten raw or after roasting
Leaves and twigs: As fodder
Bark: Yields fibre used for making ropes
Wood: For timber
Root tuber: Edible

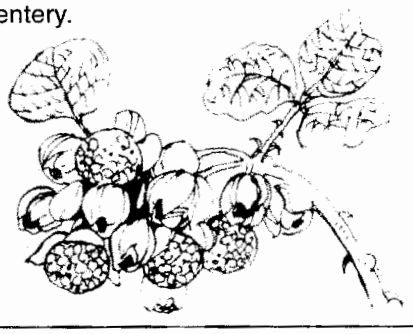


Raspberry (*Rubus ellipticus*)

Local names
Angami: *Ruomvu*
Chakhesang: *Runushe*
Konyak: *Aovei*
Rengma: *Akhughu pfuzawa*
Sumi: *Sulithi*

Habit and description
Large shrub with long, trailing branches. Branches and petioles are covered with dense, long, soft, brown bristles. Stout thorns are also present in branches, petioles and midrib of leaves. Flowering occurs during March to May. Flowers are white. Fruits are yellow and in clusters.

Uses
Fruit: Edible and has a good flavour and taste.
Root and young shoot: In treatment of colic pains and dysentery.

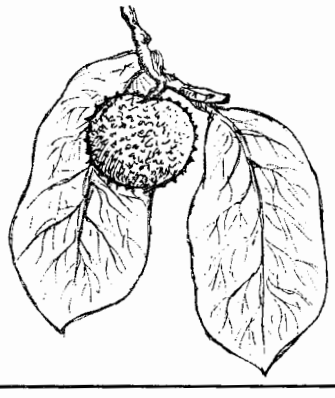


Wild jackfruit (*sam*) (*Artocarpus chaplasha*)

Local names
Ao: *Tsumertong*
Angami: *Chierie*
Konyak: *Vivoi*
Lotha: *Etothi*
Rengma: *Agwenten*
Sema: *Khaghathi*

Habit and description
The tree grows well in partial shade; hence recommended for under planting in timber plantations. Fruiting occurs during May to June. Fruit is 7-10 cm in diameter; fleshy, globose and pubescent.

Uses
Fruit: Eaten raw
Leaves: Fodder
Wood: Timber and plywood



Prepared by:
Qhutovi Wotsa, Raj Verma and Ellen Konyak

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Useful Indigenous Plants of Nagaland

Many indigenous plants that grow in Nagaland have multiple uses: medicine, food, fodder, manure, fuel, timber, handicrafts and fibre. Some of these uses are confined to Nagaland while others occurring widely outside Nagaland. As Nagaland is a hilly state, only the upper limit of the altitude for optimal distribution of plants is mentioned.

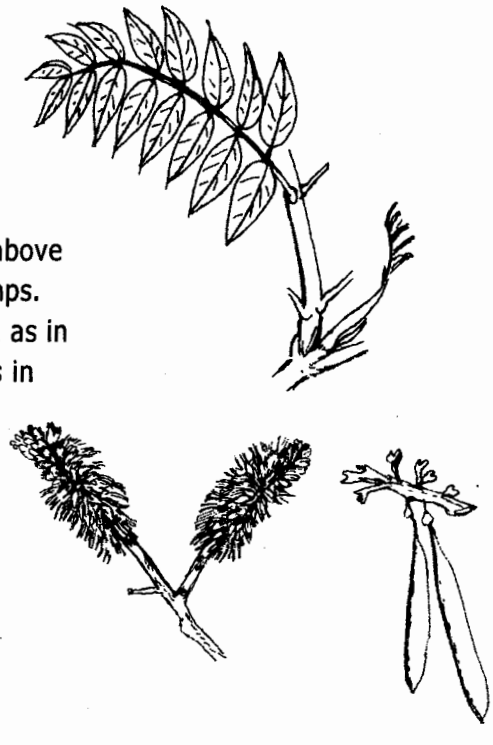
> Local names in Naga languages are mentioned where known. The NEPED team invites contributions of other local names.

MUNDANI (*Acrocarpus fraxinifolius*)

Local names

Angami: *Cietha*

Sumi: *Amiyibo*



Description

A fast-growing timber tree found in Nagaland up to 1500 m above sea level (asl). Propagated by seeds, naked saplings and stumps. Saplings can be transplanted in partially-shaded fields as well as in jhum fields. Cattle do not browse the plant. Flowering occurs in January-February. Seeds are collected in May - July.

Uses

- Wood is used for timber, veneers and plywood.
- It is also suitable for packing cases of heavy machinery.

BLACK SIRIS (*Albizia lebbeck*)

Local names

Ao: *Moang*
Angami: *Ze*
Chakhesang: *Azhochi*
Rengma: *Azugho*
Sumi: *Azuyisu*

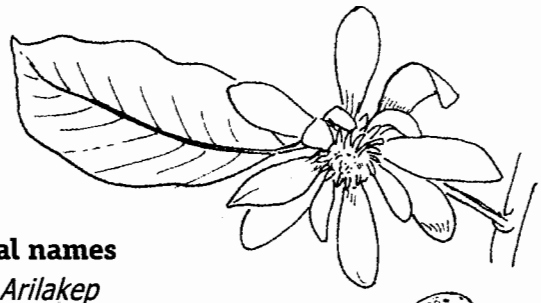
Description

A large deciduous tree that grows on various soils in areas up to 1200 m asl. The sap wood is white or yellow and the heartwood is dark brown. Propagation is by seeds and saplings.

Uses

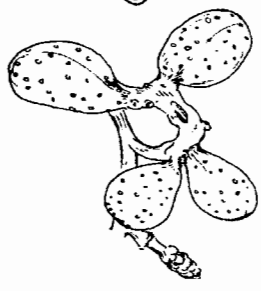
- Wood is used for high-quality furniture, internal decoration, paneling, flooring, construction and carving.
- In Nagaland, it is used as a joint post placed in the soil as it withstands moisture and termite attacks for long periods.

TITA CHAPA (*Michelia champaca*)



Local names

Ao: *Arilakep*
Angami: *Seirei*
Chakhesang: *Chachi*
Konyak: *Lahkhong*
Rengma: *Achughu*
Sumi: *Achighisu*



Description

A tall evergreen timber tree; grows best in damp climates with deep moist soil. It is sensitive to frost. Flowering occurs during summer and rainy seasons. The wood is somewhat lustrous, medium texture, and takes good polish. Propagation is by seed. Seed viability is low.

Uses

- Wood is used for posts, boards, veneers, furniture, decorative fittings and carriages.
- Flowers are used in the preparation of perfumes and hair oils.
- The flower also yields a yellow dye for textiles.

CORAL TREE (*Hovenia dulcis*)

Local names

Angami: *Ciepie*
Chakhesang: *Lalochi*
Konyak: *Jei*
Rengma: *Awughu chu*
Sumi: *Aghau pukhusu, awulokosu*

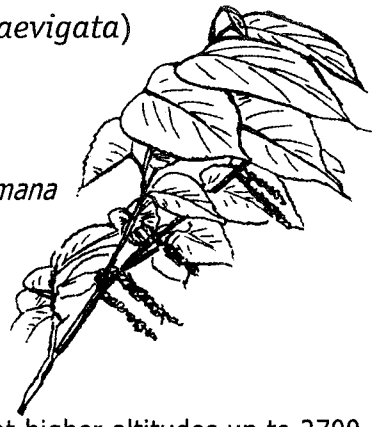
Description

A medium to large-sized tree; grows well up to an altitude of 2000 m asl. It usually occurs in moist, shady places. It flowers from May to June. Propagation is by seed.

Uses

- Wood is used as timber and fuel.
- Fleshy peduncles (fruits) are eaten.

BHOLA (*Morus laevigata*)



Local names

Ao: *Hatsuh*
Angami: *Meu*
Chakhesang: *Zuchemana*
Konyak: *Lihman*
Rengma: *Achu*
Sumi: *Milisu*

Description

A large tree found at higher altitudes up to 2700 m asl. The tree yields tough timber which is heavy and durable under cover. The wood seasons well and gives a good finish. Propagation is by seed and cuttings. Flowers in February-March.

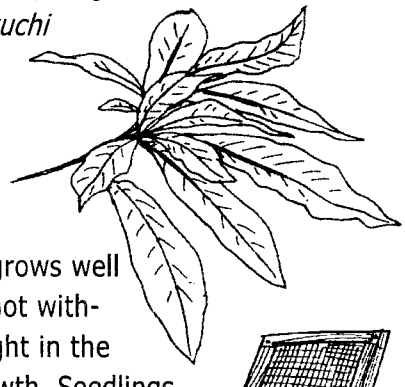
Uses

- Wood is used for furniture, sports equipment, agricultural implements, ornamental paneling.
- Lopped branches are used as fodder.

BONSUM (*Phoebe goalparensis*)

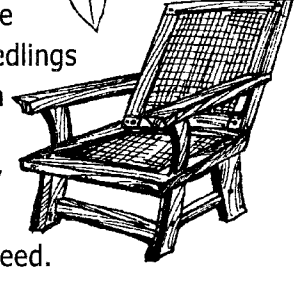
Local names

Angami: *Tekhravozhu; megu*
Chakhesang: *Muwuchi*
Konyak: *Kaang*
Sumi: *Atunasu*



Description

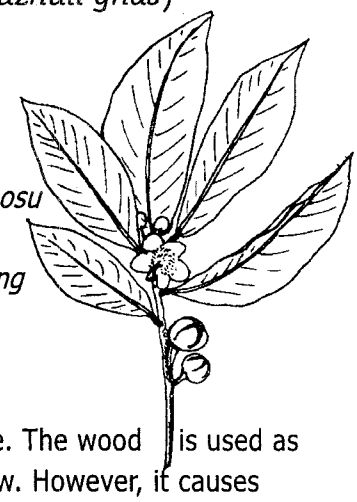
A large tree that grows well in shade and cannot withstand direct sunlight in the early stage of growth. Seedlings can be raised artificially in shaded beds. The wood is light, easy to season, easy to work and gives a good finish. Propagation is by seed.



Uses

- Wood is used for house construction, planks, furniture, cabinets, tea-chests, plywood, bobbins and occasionally for pattern-making.

NEEDLE TREE (*Khuzhuli ghas*) (*Schima wallichii*)



Local names:

Ao: *Mesang sung*
Angami: *Mecho*
Chakhesang: *Mechochosu*
Konyak: *Lak*
Rengma: *Ameshu chang*
Sumi: *Michhisu*

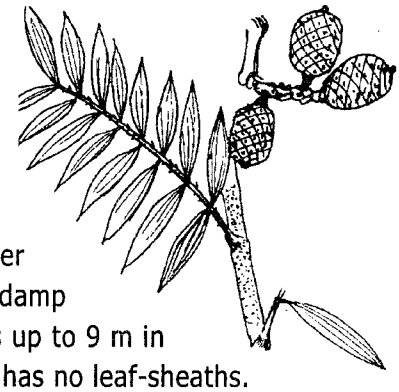
Description

A large evergreen tree. The wood is used as timber and easy to saw. However, it causes irritation of the hands when handled and is difficult to season. Propagation is by seed.

Uses

- Wood is used for construction of buildings, planks, canoes, agricultural implements and poles.
- It is a good source of fuel.
- Bark is used for dyeing and processing of leather.
- The bark is also mixed in feed and used to expel tapeworms in livestock.

RATTAN CANE (*Calamus tenius*)

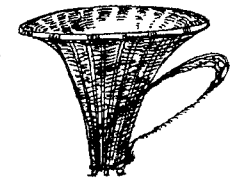


Local names

Konyak: *Veiyong*
Rengma: *Aghawi*
Sumi: *Aqhebo*

Description

A very long slender climber found in damp places and grows up to 9 m in height. The stem has no leaf-sheaths. Fruits are straw-coloured and sour in taste. Propagation is by seed and suckers.



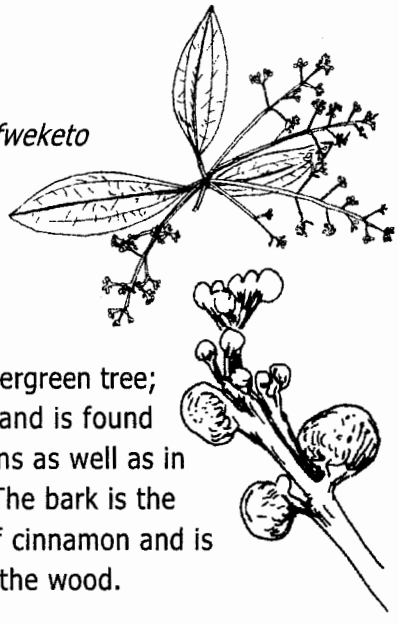
Uses

- Fruits are eaten raw.
- Cane is used for baskets, furniture frames, walking sticks and polo sticks.
- It is also used as substitute for ropes and cables for suspension bridges.

DALCHINI *(Cinnamomum zeylanicum)*

Local names

Ao: *Sungshe*
Angami: *Seicho*
Chakhesang: *Chipfweketo*
Konyak: *Pong-mo*
Rengma: *Achansa*
Sumi: *Akusa*



Description

A medium-sized evergreen tree; grows in the wild and is found abundantly in plains as well as in the hilly regions. The bark is the principal source of cinnamon and is more valued than the wood.

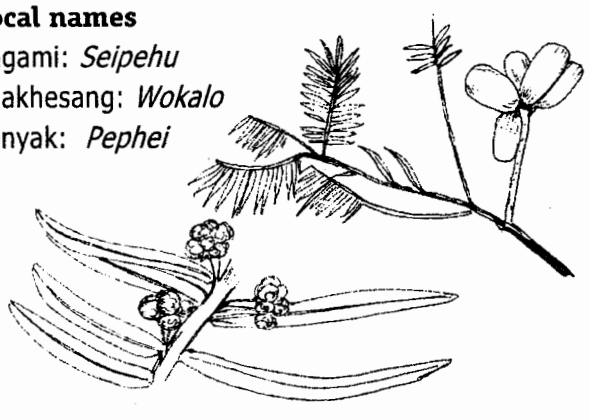
Uses

- Bark is used as spice; in preparation of chocolates, candy, gum, incense and perfumes; and to check nausea and vomiting.
- It yields an essential oil used in flavouring confectionery, pharmaceuticals and soaps; and for gastric disorders.

YEW *(Cephalotaxus griffithii)*

Local names

Angami: *Seipehu*
Chakhesang: *Wokalo*
Konyak: *Pephei*



Description

A small to medium-sized tree found in the hills. Propagation is by seed and cuttings.

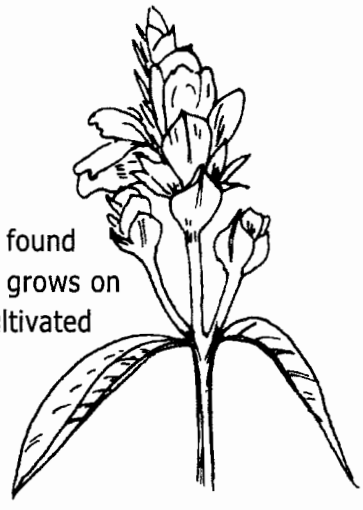
Uses

- Grown as an ornamental plant.
- Leaf extract contains 'cephalotaxine' which has anti-tumour properties.

ADHATODA *(Adhatoda vasica)*

Local names

Angami: *Tsiesenyu*
Rengma: *Akhashe*
Sumi: *Awupiyebo*



Description

An evergreen shrub, found up to 1500 m asl. It grows on various soils; also cultivated as hedge plant. Propagation is by seed and cuttings.

Uses

- The extracts of both fresh and dried leaves are used in treatment of bronchitis, diarrhoea, dysentery and glandular tumours.
- Leaves, flowers, fruits and roots are used in treatment of cold, cough, chronic bronchitis and asthma.
- The plant is a rich source of nitrogen and is used as green manure. Also used in rituals.

BAUHINIA *(Bauhinia variegata)*

Local names

Ao: *Biangnok*
Angami: *Tegou-w*
Chakhesang: *Mowochi*
Konyak: *Phum*
Rengma: *Amu-o*
Sumi: *Qopupu, apa-abo*

Description

A medium-sized tree; grows well up to 1800 m asl. It can withstand frost. Propagation is by seed.

Uses

- Leaves are used as fodder.
- Flowers and pods are eaten as vegetables.
- Bark is used for dyeing.
- Wood is used for various agricultural implements.

MEJANKORI *(Litsea citrata)*

Local names

Ao: *Anget*
Angami: *Cie*
Chakhesang: *Lebvuchechi*
Konyak: *Voting*
Rengma: *Atazi*
Sumi: *Khamthi*

Description

A deciduous and aromatic small or medium tree found up to 2700 m asl. The tree has a delightful fragrance of lemon. Most parts of the plant yield aromatic, volatile oils. Propagation is by seed.

Uses

- Oil from the flowers and fruits is used in perfumes.
- Fruit is eaten raw or mixed in pickle after roasting.
- Fruit extract is used for treating dizziness, headache, hysteria, paralysis and amnesia.
- It is also used as insect repellent.
- Seeds yield fat used as an illuminant.

DEVIL NETTLE *(Laportea crenulata)*

Local names

Konyak: *Ching shakphe*
Rengma: *Akusho*
Sumi: *Apughu*

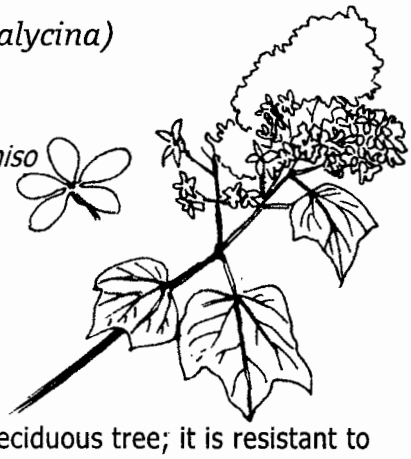
Description

A large, stout shrub found growing wild in evergreen forests. The plant is covered with small, highly irritant hair. The sting of the hair causes dermatitis and acute burning pain. The effect of the sting lasts for several days and is aggravated when water is applied to the affected area. It is particularly powerful during the flowering season. Propagation is by seed.

Uses

- Bark yields a strong fiber used for making cordage and coarse cloth.
- Flowers are used in curries.
- Seeds are used as medicine.
- Root extract is used in chronic fevers.

PULA *(Kydia calycina)*



Local names

Angami: *Kerunyu*
Chakhesang: *Kininiso*
Konyak: *Vivota*
Rengma: *Ameli*
Sumi: *Khunisu*

Description

A medium-sized deciduous tree; it is resistant to frost and drought. Propagation is by seed.

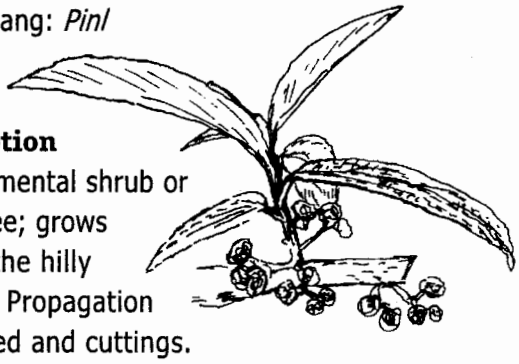
Uses

- Leaves are used as fodder.
- Paste made from leaves is used for treating body ache and skin diseases.
- Bark is used as shampoo and it yields fibre used for making ropes.
- Wood is used for handles of implements and it yields pulp which is used with bamboo pulp to manufacture paper.

WILD RHEA *(Debregesia longifolia)*

Local names

Konyak: *Visha*
Sumi: *Awukhunabo*
Angami: *Melu, Tsunyu*
Chakhesang: *Pinl*



Description

An ornamental shrub or small tree; grows wild in the hilly regions. Propagation is by seed and cuttings.

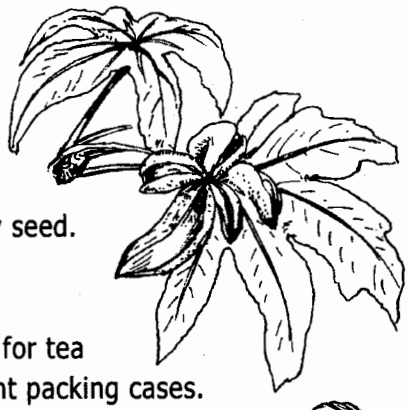
Uses

- Fruit is edible.
- Wood is used for making charcoal.
- Fiber is valued for making ropes and cordage.
- Bark is used to make a local shampoo.

UDAL *(Sterculia villosa)*

Local names

Ao: *Ajunem*
Angami: *Ketsho*
Chakhesang: *Mechachi*
Konyak: *Zimzao*
Rengma: *Aghazi*
Sumi: *Qhechobo, akuchhobo*

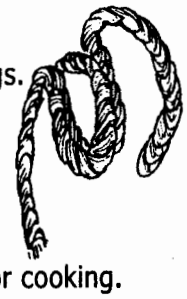


Description

A moderate-sized tree found up to 1000 m asl. Propagation is by seed.

Uses

- Wood is used for tea boxes and light packing cases.
- Bark yields coarse, strong fiber used for cordage and rough bags.
- Fiber is specially valued for breast bands of elephants for dragging timber and for tying cattle.



- Seeds are eaten after roasting or cooking.
- Pericarp yields a dye and the bark yields a gum used in veterinary medicine.

NETTLE TREE *(Trema orientalis)*

Local names

Ao: *Tosu*
Angami: *Thedie*
Sumi: *Atughusu*
Chakhesang: *Thudzu*

Description

A fast-growing but short-lived evergreen tree found up to 2400 m asl. It grows fast in forest clearings and fallow lands. The plant is propagated from seed.

Uses

- Wood is used for tea-chests, matchboxes and splints, shoe heels and fishing floats.
- Wood yields pulp which is used with bamboo pulp to manufacture paper.
- Extract of bark is used for tanning and toughening fishing nets.
- Bark yields fiber used for ropes, twine and coarse cloth.
- Extract of roots is used to treat diarrhoea and presence of blood in urine.
- Fruit is edible.
- Leaves are used as fodder.
- Extracts of root, bark and leaves are used to treat epilepsy.

DUDHI (*Wrightia tomentosa*)

Local names

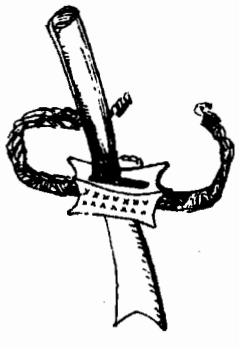
Angami: *Gasiasei*
Chakhesang: *Neichi*
Konyak: *Jatvong*
Rengma: *Ajoku chang*
Sumi: *Khachesu*

Description

A small tree up to 12 m in height found up to an altitude of 1200 m asl. It grows wild but is also planted as an ornamental tree. The wood is uniformly white and lustrous but turns yellow with age. It is straight, even-textured and easy to saw and can be easily worked. Propagation is by seed.

Uses

- Wood is used in making cups, plates, combs and frames and in carving.
- Bark yields latex from which a yellow dye is obtained and is used for cotton fabrics.
- Fruit yields floss used for stuffing.
- Seed yields thick, red, medicinal oil.



MECHINGA *(Zanthoxylum acanthopodium)*

Local names

Angami: *Ganyasei*
Konyak: *Matkat*
Rengma: *Amezo*
Sumi: *Nakiniye*
Chakhesang: *Laango*

Description

A thorny, small tree or shrub with dense leaves and prickly trunk and branches. It is found in higher altitudes up to 1800 m asl. The plant has pungent taste and smell. Propagation is by seed.

Uses

- The plant is used as spice and also in medicine for stomach disorders.
- Young leaves, shoots and seeds are eaten as vegetables.
- Dried flowers yield an essential oil which is used in perfumes.
- Wood is used for making walking sticks and clubs.

Prepared by:
Qhutovi Wotsa

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Some Local Medicinal Plants: Uses and Domestication

Thousands of plant species growing throughout the world are used in both herbal and pharmaceutical medicine. Herbal medicines sometimes offer benefits that conventional medicines lack. Often, the two complement each other, providing safe and well-tolerated remedies. Despite dramatic advances in modern medical science, people continue to seek herbal medical remedies as they are easily available and cheaper than allopathic medicines.

The use of herbal medicines has always been a way of life for the Nagas. A wide variety of these medicinal plants are grown as crops in the jhum fields and the home gardens of Nagaland but, many are also collected in the wild.

CAUTION !!

Remember that even though most of the commonly-used herbal medicines are safe and with no known side effects, they should not be taken without the guidance of a trained practitioner.

The Decoction and Infusion Process

Decoction process

1. Boil the herbs for 15-20 minutes.

2. Strain using a tea strainer.

Infusion process

1. Pour boiling water into the container with the herbs.

2. Allow it to cool.
3. Strain using a tea strainer.

SOME LOCAL MEDICINAL PLANTS

The following medicinal plants were chosen as these are:

- easily available;
- easy to administer with no known residual effects; and
- commonly used as food.

Botanical name: *Butea minor*

Family: Leguminaceae

Description:

Herbaceous perennial plant with thick pith and hairy stem; which grows to a height of about 5 ft. Flower is red, terminal; podded fruit is pubescent.

- Abundant in altitudes between 1000-1400 m asl.

Parts used and time of collection:

Mature pods are generally collected between December-January.

Used for:

- antidote to food poisoning
- deworming

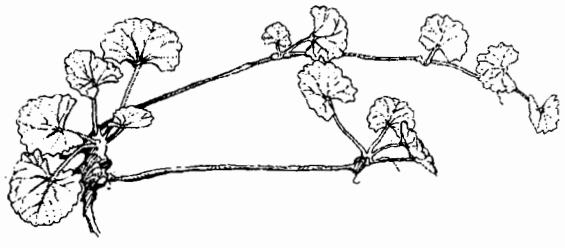
How used:

The beans are taken out from the pod and burned in hot ash. The ones that burst with a crackle are given to the patient. This induces vomiting thereby expelling the poisons. **Care should be taken that this medicine is not given to weak patients.**

Botanical name: *Centella asiatica*

Family: Umbellifereae

Common name: Indian Pennywort



Description:

Creeping stolons rooting at every node; leaves are orbicular, reniform, serrate and basal nerved.

- Found in clayey soils in open spaces.

Parts used and time of collection:

Whole plant can be collected throughout the year.

Used for:

- cholera
- tuberculosis
- dysentery
- high blood pressure

How used:

Decoction is taken. Regular use has a restorative effect.

Botanical name: *Curculigo capitulata*

Family: Amaryllidaceae

Description:

Herbaceous perennial plant with tuberous, fleshy, rhizome-bearing lateral roots. Leaves are folded and curvy; flowers are near the ground on a short stalk.

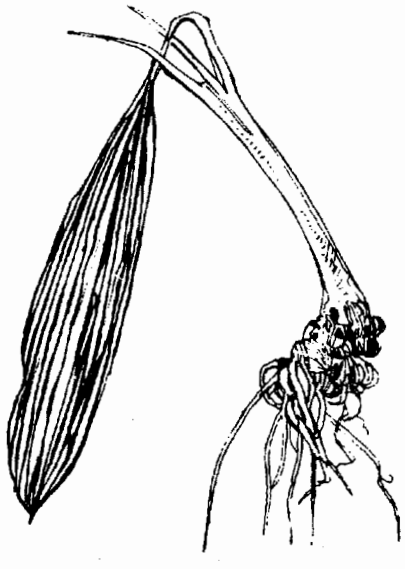
- Widely available in open spaces or in the undergrowth at high altitudes.

Parts used and time of collection:

Rhizomes can be collected throughout the year.

Used for:

- stomach disorders
- gastritis



How used:

The rhizome is first cleaned and sliced then soaked overnight in water. The slimy jelly that forms is scooped out and eaten.

Botanical name:
Fagopyrum esculentum

Family:
Polygonaceae

Common name:
Common Buckwheat

Description:
Erect herb with triangular leaves having acute cordate and red nerve base. It has long petiole that is often red. Flowers are white in colour.
- Found abundantly in cultivated land.

Parts used and time of collection:
Roots can be collected throughout the year. Roots of plants that are about a year old are preferred.

Used for:
- deworming

How used:
Decoction of the root is taken.

Botanical name:
Houttuynia cordata

Family: Saururaceae

Description:
Perennial herb bearing a pungent smell. The undersides of the leaves turn bright red in autumn. Flowers have no petals.
- Commonly found in open fields and exposed sub-soil.

Parts used and time of collection:
Whole plant can be collected throughout the year.

Used for:
- stomach ache

- cholera
- dysentery
- arthritis
- body ache

How used:
Decoction is taken by the patient.

Botanical name: *Litsea citrata*

Family: Lauraceae

Common name: Mejanker

Description:
Tall shrub with a green bark which turns black when dried. The surface of the leaves is bright green. Bears green berries which turn black when dried.
- Abundant in cultivated areas after the cultivation period when no crops are growing.

Parts used and time of collection:
Fruit can be collected during May and June.

Used for:
- cholera
- diarrhea
- constipation
- headache
- fever
- vomiting
- food poisoning
- suppressing effects of alcohol

How used:
The fruit may be eaten raw or in a dried powdery form. Decoction is also taken.

Botanical name:
Rhus semialata

Family: Anacardiaceae

Common name: Naga-tenga

Description:
A small tree; leaves are alternate and compound. Leaflet has 4-6 pairs, is sessile toothed, pale reddish beneath, acuminate; panicle is large with stout peduncle; flower is pale, yellowish green; drupe orbicular, red. Panicles are coated with white crystals during winter.
- Abundant in open fields.

Parts used and time of collection:
Fruit is collected from November to January

Used for:
- fever
- headache
- indigestion
- stomach ache
- allergy
- antidote to poisoning

How used:
Decoction or curry of the powdered fruit is taken. In case of snakebite, the crystals coating the fruit are applied over the bitten area.

Botanical name:
Swertia Chirayita

Family: Gentianaceae

Common name: Lhinetta

Description:
Calyx and corolla are both with very short tubes and with 4-5 lobes free almost to the base; corolla lobes are each with one or two usually fringed nectaries at their base, stigma bilobed; capsules are oblong.
- Found in exposed soils in open spaces.

Parts used and time of collection:
Whole plant is collected during summer.

Used for:
- fever
- tuberculosis
- gastritis
- high blood pressure

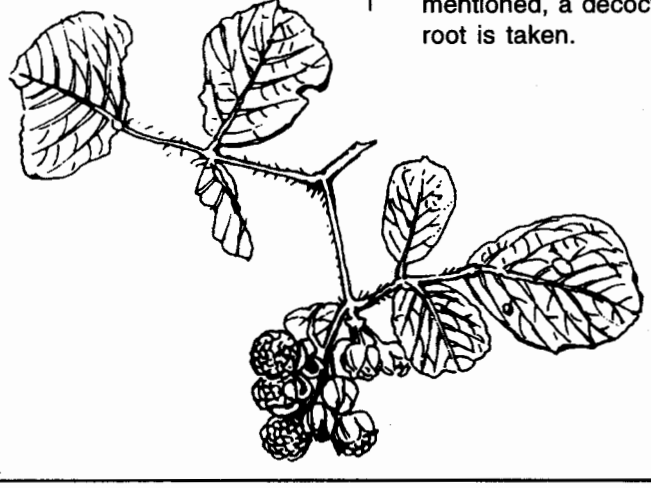
How used:
Decoction is taken.

Botanical name:
Rubus ellipticus

Family: Rosaceae

Common name: Raspberry

Description:
Evergreen shrub covered with rufous bristles and recurved spines. Leaves trifoliate; leaflets are leathery, elliptic, toothed gray wooly beneath. Flower is white and in clusters. Fruit is red or yellow and globular.
- Abundant in scrub forests.



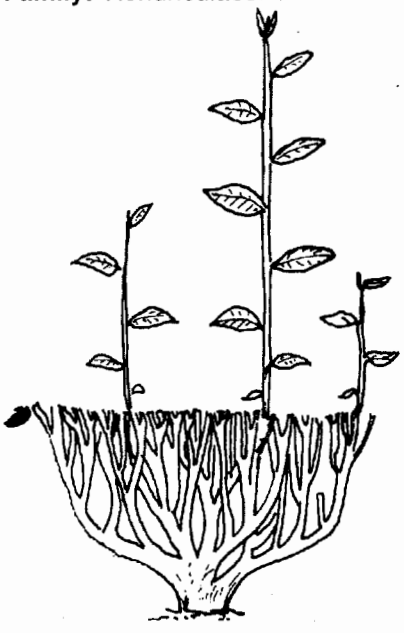
Parts used and time of collection:
Root, bark and young shoots are collected throughout the year.

Used for:
- stomach ache
- loose motion
- deworming
- malaria
- fever

How used:
Decoction of any part of the plant is taken for stomach ache. For other ailments mentioned, a decoction of the root is taken.

Botanical name: *Thalictrum* sp.

Family: Renunculaceae



Description:
Large herb with yellow roots that resemble a tuber.
- Commonly found in the undergrowth.

Parts used and time of collection:
Roots are collected throughout the year.

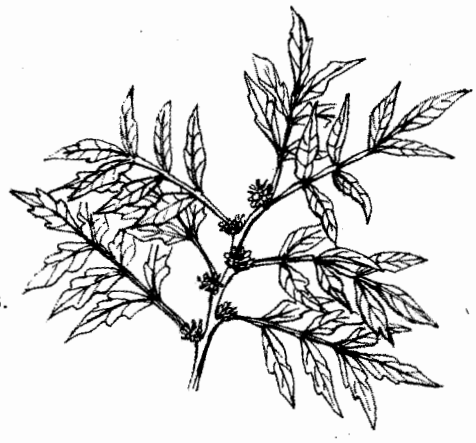
Used for:
- gastritis
- stomach ache
- fever
- malaria
- dysentery
- diarrhea
- chest pains

How used:
Decoction is taken. The doses, duration of treatment and degree of concentration are determined by the seriousness of the ailment.

Botanical name:
Zanthoxylum alatum

Family: Rutaceae

Common name: Darmar



Description:
Shrub with prickly branches.
- Commonly found in the forests.

Parts used and time of collection:
Leaves and roots are collected throughout the year.

Used for:
- cholera
- stomach ache
- fever
- deworming

How used:
Decoction of leaves and roots is taken for treating cholera;
Infusion of leaves is taken for expelling worms.
In all other cases, decoction of leaves is taken.

DOMESTICATION OF MEDICINAL PLANTS

Collection of wild plants is rampant in Nagaland. Plants that are known to have commercial importance are fast disappearing, requiring efforts to domesticate them. Initial steps for domestication are as follows:

- Collect planting materials from matured mother plants.
- Observe the microclimate at the original location where the plant was collected and simulate it on the farm. If the plant grows well in rock crevices, plant it in rock crevices. If it grows facing the north, then plant it facing that direction.
- On site conservation is the best way to domesticate certain species.
- Do not store seeds in polythene bags.
- In general, sowing seeds in the month of March was found to be ideal.

Prepared by:
Vengota Nakro

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Biodiversity Conservation

Agro-biodiversity in Jhum

Jhum takes place in different locations under a wide range of conditions (soil, microclimate, altitude, slope, natural vegetation and biotic interference). Fortunately, the farming family has a large number of crop options.

Agro-biodiversity in jhum under Nagaland conditions constitutes agricultural crops sown by farming families amidst naturally regenerated plants preserved in a jhum cycle. Agro-biodiversity in jhum-based cropping systems has been the basis of subsistence for Naga farming families. It has been a key factor in sustaining village life over several millennia providing jhum communities with an enormous range of food, medicine, construction materials and other products.

What is Agro-biodiversity?

Biodiversity is the variety of life expressed in genetic, species and ecosystem dimensions. Naga farmers maintain and enhance the agro-biodiversity of their fields through cycles of jhum or shifting cultivation.

DIMENSIONS OF BIODIVERSITY

Altitudinal Zones

A transect walk in the jhum of a village reveals a broad diversity of cultivated crops in four regions, based loosely on altitude.

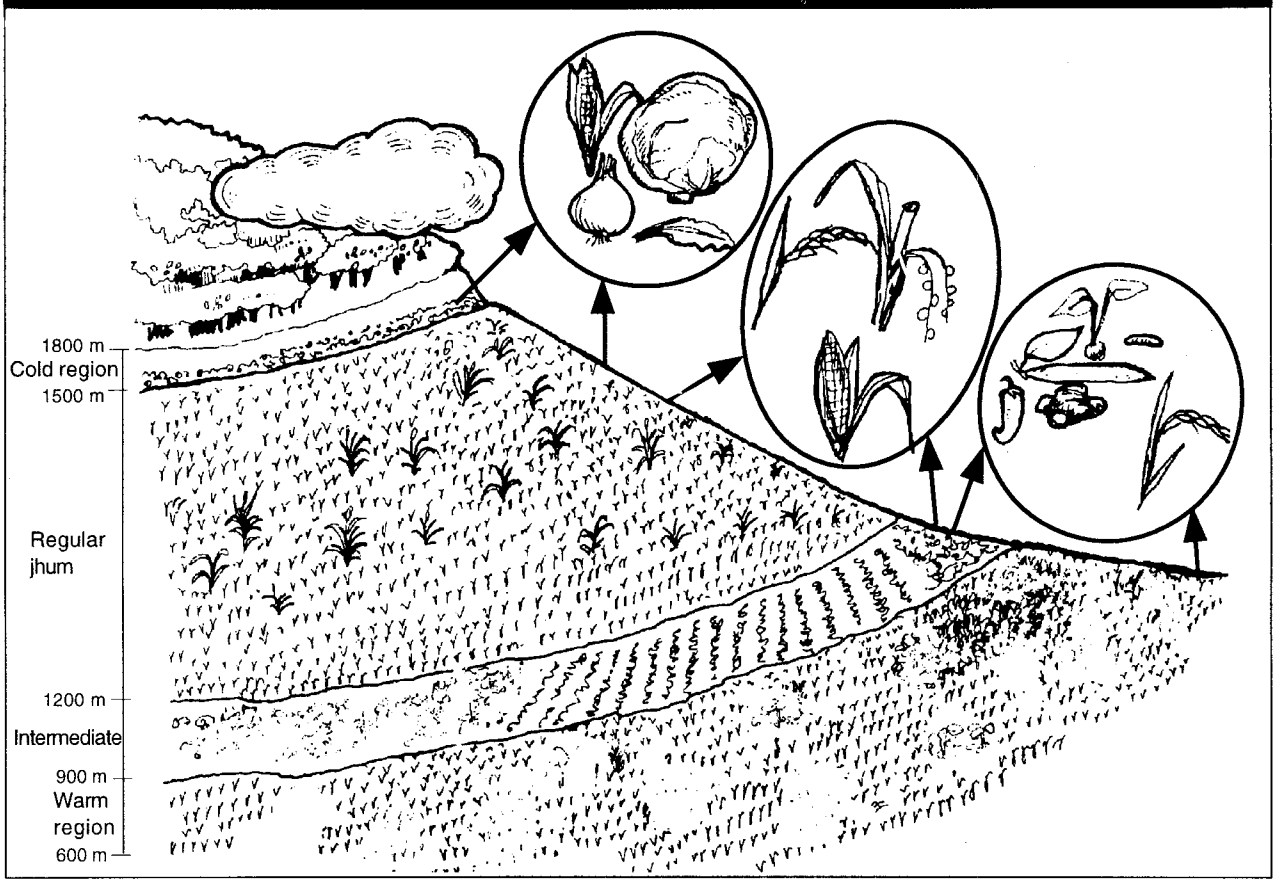
Cold region, near cloud-line

- The field adjacent to forest area or new area of primary forest is brought under jhum.
- Cold region crops are commonly cultivated [e.g., green leafy vegetables (cabbage and mustard), beans, onion, garlic, leek, maize and job's tears]. Rice is usually not grown, but the Sema tribe grows a black variety called *Ailachi.*

Regular jhum area

- Cropping activity is high in this region which is warmer. The main crop is rice or maize, while spices and other crops are also grown as mixed crops.

Altitudinal Zones for Crop Biodiversity



Intermediate

- The region is warmer than regular jhum area.
- Some crops of the regular jhum area are grown.
- Rice is the main crop with maize, field pea, pigeonpea, soybean, ginger and chilli grown in intercrops.
- Some green leafy vegetables (e.g., cabbage and mustard) are not grown; instead, *Hibiscus* sp. and spices are grown.
- This is the zone of highest agro-biodiversity.

Warm region

- Crops of the region above (excluding those of the regular jhum area) are cultivated.
- Rice is the main crop grown with maize, soybean, pigeonpea, ginger and chilli in intercrops.

Survey of Crops

- Crops grown in Chetheba area of Phek district in Nagaland were surveyed by the author and Mr. Zachunu (a local expert), in October 1998.
  - The study revealed that at least **167 crops** (including **12 rice varieties**) are cultivated in a typical jhum field.
  - The number of **species** cultivated in each jhum field varies from 18 to 60.
- In another study in January 1999 in Wokha village, 18 residual crops were being grown even **after** the main crops were harvested.

Crops used in jhum fields

Contour bund crops

Crops are planted on the contour bunds where wooden poles are laid along the contour for soil conservation. They are usually:

- short-duration crops grown to provide food for immediate needs (e.g., beans and mustard); and
- biennial root crops (e.g., yam and ginger) that serve as vegetative barriers for soil conservation in the second year of cropping.

Main crops

- Main crops are rice and/or maize depending on the availability of terraced rice cultivation fields. Perilla, soybean, foxtail millet and job's tears are grown as mixed crops.
- Monocropping of main crops (rice and maize) is not practised.

Special crops

- Crops that need some specific management practices are grown in a particular plot in the jhum field.
- These are crops that inhibit the growth of the main crop or those that cannot thrive well as companion crops (e.g., garlic, chilli, bringal, tomato, basil, onion, spices and cabbage).

Margin crops

- Usually, creepers are grown to demarcate field boundaries.
- These crops inhibit growth of the main crop; e.g., cucumber, pumpkin, gourds and beans.

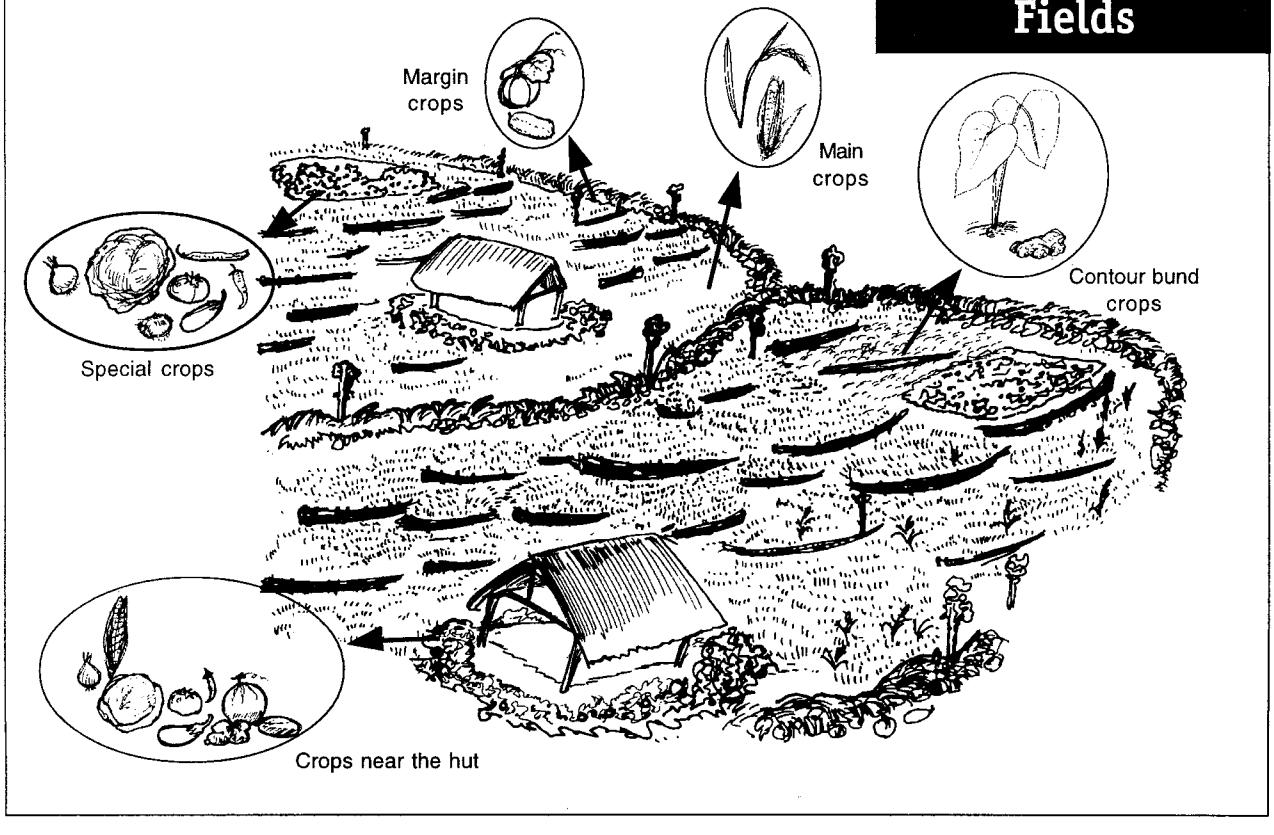
Crops near the hut

- Almost all the crops that are planted in the field are also found in the vicinity of the field hut. They serve as a storehouse of vegetables for the preparation of mid-day meals in the field or for immediate collection for home consumption when farmers return home. *Hibiscus* sp., chilli, spices, leafy vegetables and fruits are grown.
- Trials of new crops are carried out in the vicinity of the hut.
- Rice and job's tears are not grown near the farm hut.

Crop Durations

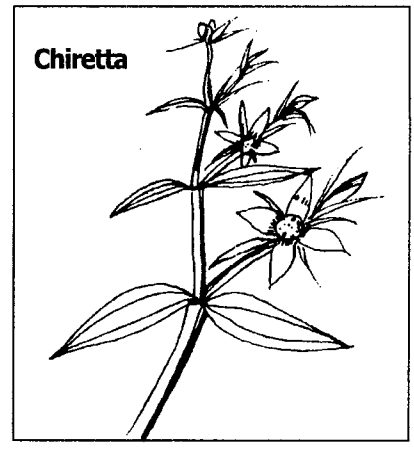
- Major crops are typically of good storage quality and provide food for the family throughout the year. They are normally the annual, staple food crops (e.g., rice, maize and foxtail millet).
- Foxtail millet is the major cereal crop that is harvested before rice and is used as the main food until rice is harvested.
- Long-duration crops (e.g., job's tears) and late-sown crops (e.g., soybean) continue to stand in the field even after the main crops are harvested.
- Biennial and perennial crops (e.g., *Hibiscus* sp., chilli, brinjal, ginger and yam) are grown for sale and also for food security during the lean period.

Crop Biodiversity in the Jhum Fields



ADVANTAGES OF AGRO-BIODIVERSITY

- A wide range of food products is obtained from the different crops grown. This contributes to food security, nutritionally balanced food and good health.
- Promotes maintenance of traditional and site-specific varieties.
- Provides firewood which is very important for a Naga family. When the jhum field is being prepared, especially during the slashing operations, the family collects sufficient firewood for the year.
- The family continues to harvest its food needs almost all year round making the household reasonably self-reliant in food needs.
- The special crops serve as supplementary income or as the sole source of cash income.
- Medicinal plants that are grown as jhum crops serve as a "drug store" for home remedies.



DOMESTICATION OF WILD VEGETABLES AND MEDICINAL PLANTS

- Domestication of some erstwhile wild vegetables (e.g., *Zanthoxylum acanthopodium, Clerodendron* sp. and *naga tenga*) has become common. Farmers now preserve wild edible plants that grow in the jhum fields. In the past, these plants were weeded out.
- Awareness of medicinal value of some wild plants [e.g., mint (*Mentha arvensis*), chiretta (*Swertia chirayita*) and *mejanker* (*Litsea citrata*)] has increased crop diversity in the farmer's field and home garden.

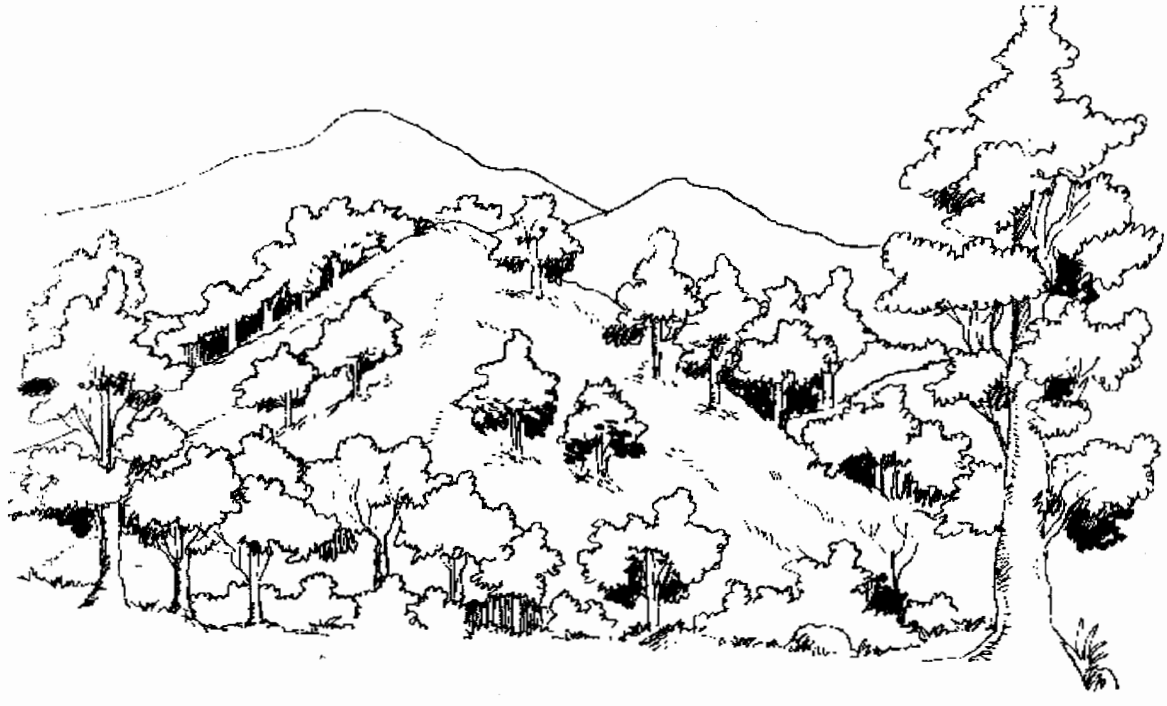
SEED EXCHANGE AND IMPORT OF EXOTIC SEEDS

- The farm serves as a seed bank for farmers so that even if a particular family does not have seed for some locations, there are other families who can provide the seed.
- Travellers have played an important role in introduction of new crops and varieties into the village. Chow-chow and passion fruit may not have originated in Nagaland. It is presumed that exotic seeds of these crops were brought by travellers.
- Visiting relatives in other villages are sources of new crops and varieties. This form of seed exchange has been practised for many years among the Nagas.
- Government programmes also play an important role in bringing new crops into the jhum field.

Prepared by:
Vengota Nakro

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Community Initiatives to Conserve Biodiversity



Nagaland, India is an area of high biological and cultural diversity. This has resulted from mountainous terrain and high rainfall, averaging 2500 mm.

Complex community-based processes and traditional laws for managing village land and water resources have evolved through the years. These traditions guide allocation of land to various agricultural uses (including jhum), use of community forest reserves, extraction of trees and plants, raising of animals and management of free-flowing water. Different ethnic groups have evolved management practices for:

- private, family and clan farmland;
- chieftain-owned agricultural and forest land; and
- community-controlled forest land.

Action by Communities

Villagers in Nagaland have begun adopting innovative approaches that use more broadly- based measures to check the forces responsible for the degradation of biodiversity. Stronger institutional support from village administrations and cooperation across communities can provide immense benefits for biodiversity conservation.

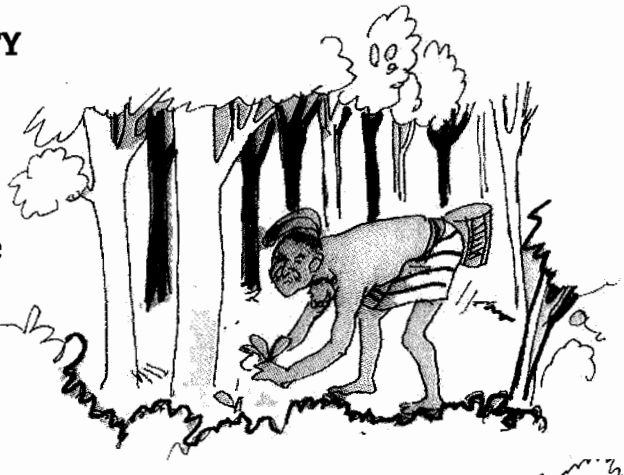
Traditional Systems are Dynamic

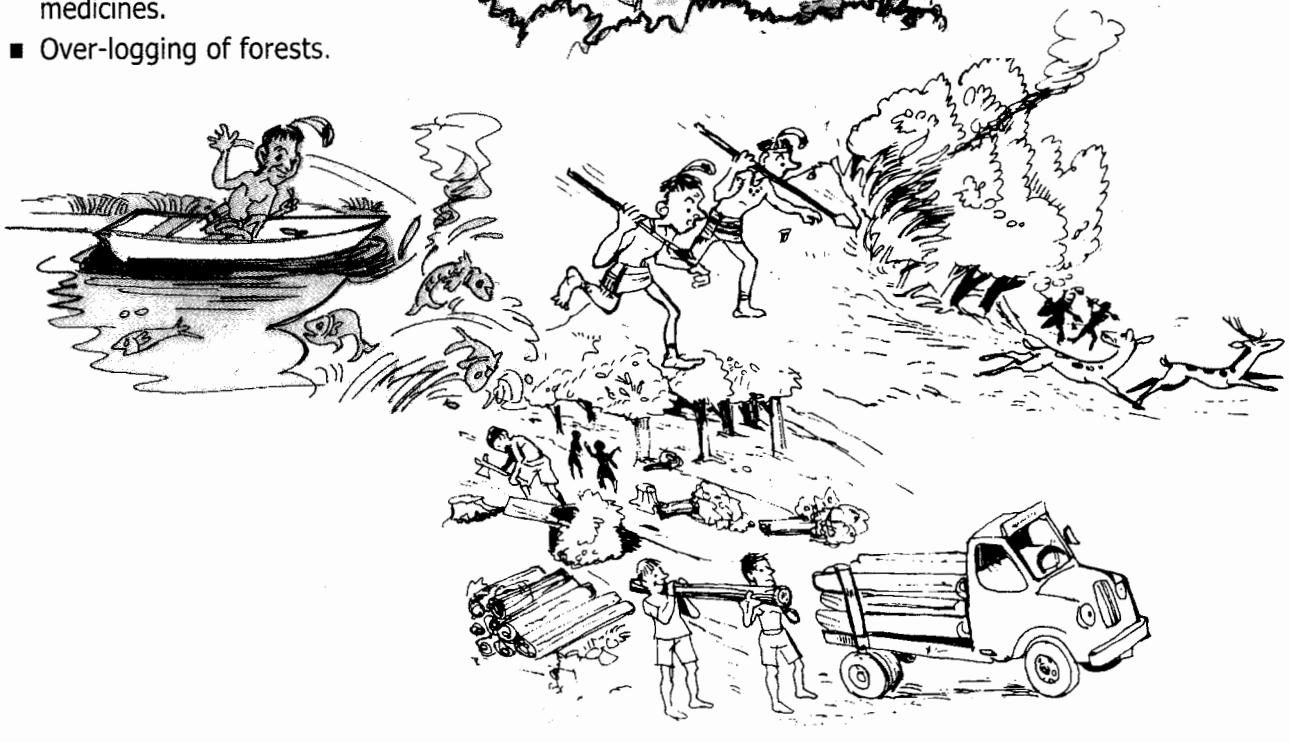
High rates of population growth have placed a heavy burden on traditional Naga practices. Villagers have learned that not everything from the past is effective today. Thus, in response to these new pressures, traditional resource management systems in Nagaland have continued to evolve, as they always have done through the generations.

Individual communities in Nagaland have begun adopting new measures designed to deal with pressure on resources caused by population, while preserving the parts of their community-based management systems that they feel are important.

THREATS TO BIODIVERSITY

- Over-hunting that reduces wildlife populations.
- Forest burning in hunting activities.
- Over-fishing, use of dynamite and poison.
- Over-extraction of naturally-growing foods, herbs and medicines.
- Over-logging of forests.





CHECK LIST FOR COMMUNITY INITIATIVES TO CONSERVE BIODIVERSITY

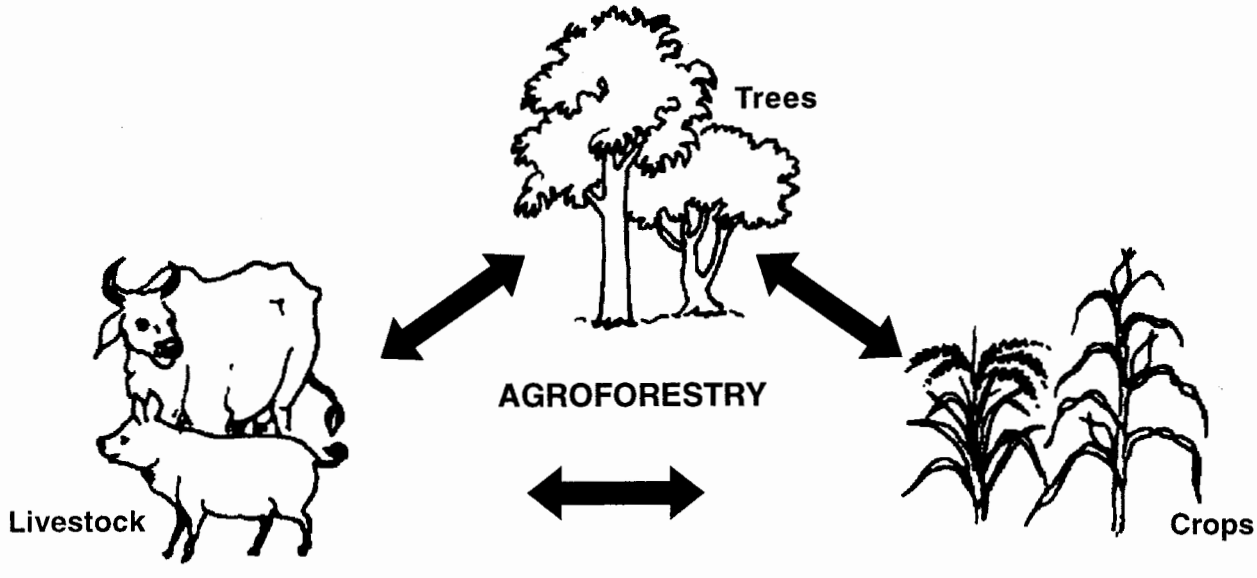
- ✓ Measures that are community-based and broadly accepted by villagers are often the most successful.
- ✓ Different parts of the community might have different stakes in preserving biodiversity, so initiatives that will benefit some at the expense of others need careful discussion.
- ✓ Rigid measures for preservation threaten people's livelihoods.
- ✓ Villagers best recognise the value of important areas, like remaining natural forests and hill tops.
- ✓ Measures that are enforceable work best.
- ✓ Taking special measures to protect plants and animals when they are reproducing is an effective approach.
- ✓ Cooperation between villages, especially when sharing a watershed or preserving animals that are mobile, can pay big dividends.
- ✓ Some extraction and use of plants and animals will often be better for conservation in the long run, because people are more open to conserving valuable species.
- ✓ Actions that respect the traditions and laws of different communities tend to be more acceptable.

Prepared by:
Vengota Nakro

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Agroforestry-related Livelihoods

Agroforestry: The Basis for Better Land Use System

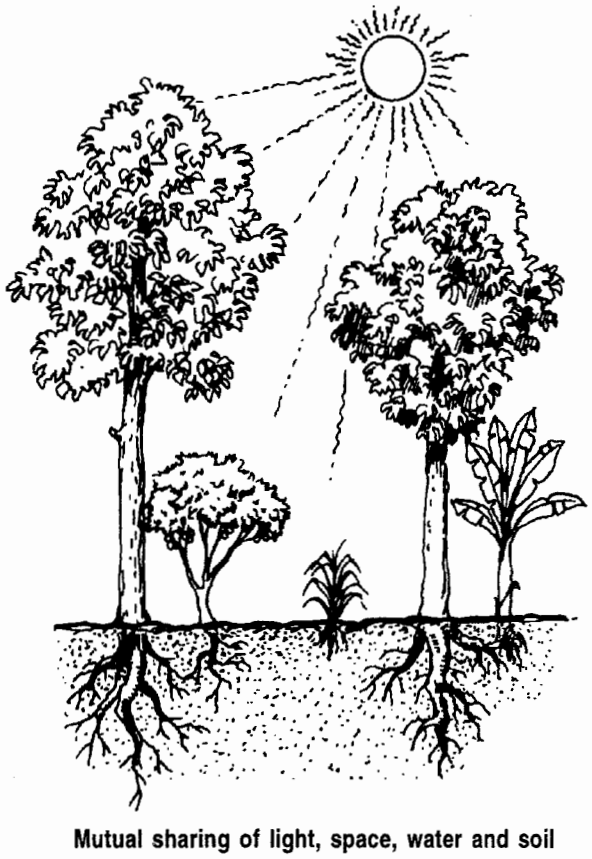


Agroforestry is the deliberate growth and management of trees along with agricultural crops and/or livestock in systems that are ecologically, socially and economically acceptable. The production of basic necessities is possible through an integrated agroforestry system of crops, trees and animals.

INTERACTION OF COMPONENTS

The long-term sustenance of any agroforestry practice requires a basic knowledge of tree-crop interaction. The interaction among trees and crops, with respect to light, space, rooting patterns, soil fertility, competition for plant nutrients and moisture, shade and species has to be well understood. For example, the leaf canopies of the components are usually arranged so as to occupy different vertical layers from the tall, light-demanding species (e.g., koroi) to the shade-tolerant species (e.g., tree tomato).

Agroforestry, as a concept, has evolved recently, although Nagas (e.g., Khonoma village) have practiced a traditional form of agroforestry on the hills. The system is successful and can be easily adopted on the existing jhum fields of Nagaland.



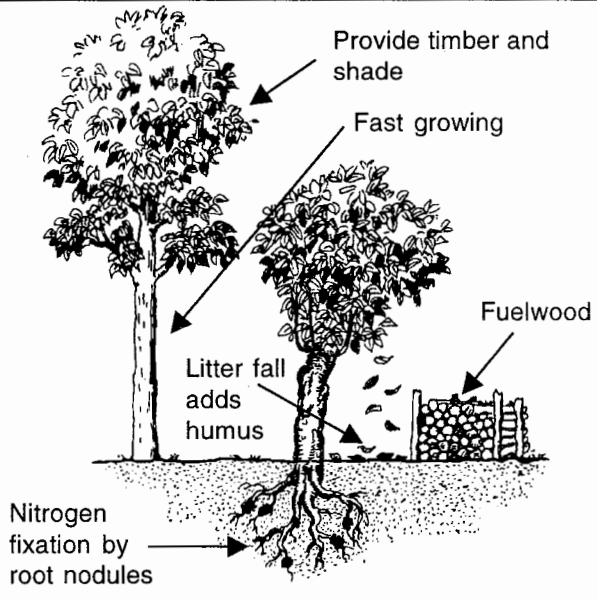
Mutual sharing of light, space, water and soil requirements

FALLOW MANAGEMENT

With just one to two hectares being cultivated per household each year and with the ever rising population, the fallow period of jhum is currently about nine years. This adversely affects the productivity of the land. Subsistence farmers, once almost totally self-sufficient in food, are now barely able to produce food for eight to nine months. Better fallow management systems are, therefore, needed for production systems that are biologically and economically sustainable and compatible with the local socio-economic conditions.

- Jhum fields are normally cultivated for two years in succession then left fallow until the next jhum. Fallow is the period between two jhum cycles.
- Local shade-loving crops, such as ginger, yam, turmeric, cardamom and pepper, are usually grown among trees, increasing the income of the farmers during the trees' gestation period.
- Cover crops like velvet bean, rice-bean or rubber bean can be used to smother weeds, improve soil fertility, control soil erosion and conserve moisture.
- Deep-rooted trees access a lot of other nutrients that cannot be reached by crops and thereby increasing soil fertility.
- Improved fallow management in jhum fields will protect the environment and increase economic development in a sustainable way.

Growing local shade-loving crops with trees during fallow.



***Alnus* sp. is a multi-purpose tree**

SELECTION OF SPECIES

Proper selection of tree species is extremely important for any agroforestry system. Farmer's knowledge of local species and their compatibility with associated crops is necessary for good selection. The species selected for agroforestry must, therefore, fulfill the following conditions:

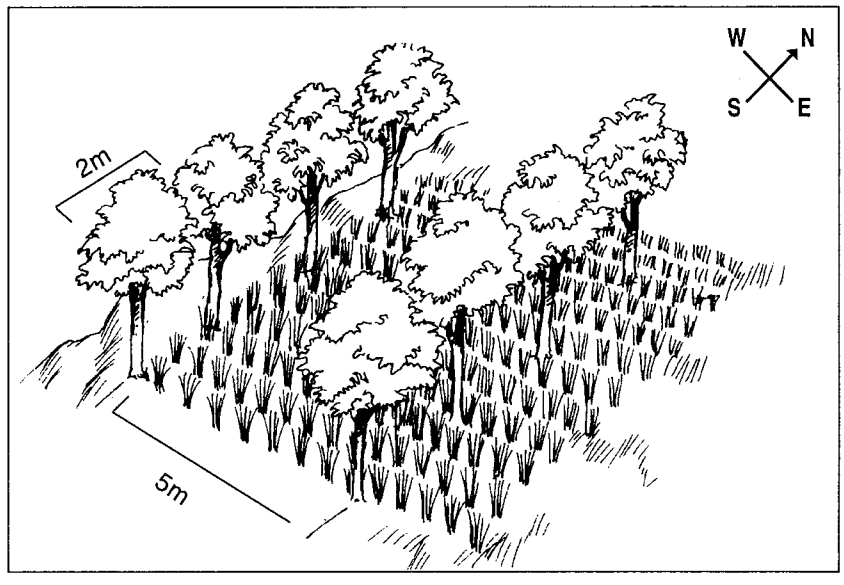
- Farmers must find the trees easy to propagate, e.g., *Spondias* sp.
- The trees must be adaptable to local conditions, e.g., *Melia* sp.
- The trees should be fast-growing having multi-purpose uses, e.g., alder (*Alnus* sp.) to supplement the farmers' needs.
- Like *Albizzia* sp., the trees should be compatible with and/or complementary to underlying/adjacent crops to ensure healthier crops.
- The tree should be able to sustain the environment without lowering its productivity, e.g., nitrogen fixation by alder (*Alnus* sp.).
- The tree should be easy to maintain and cost effective, e.g., hollock (*Terminalia* sp.).

MODELS FOR AGROFORESTRY

Based on the nature of components, agroforestry practices in the fields can be designed according to the preference and need of the farmers.

AGROSILVICULTURE (TREES + CROPS)

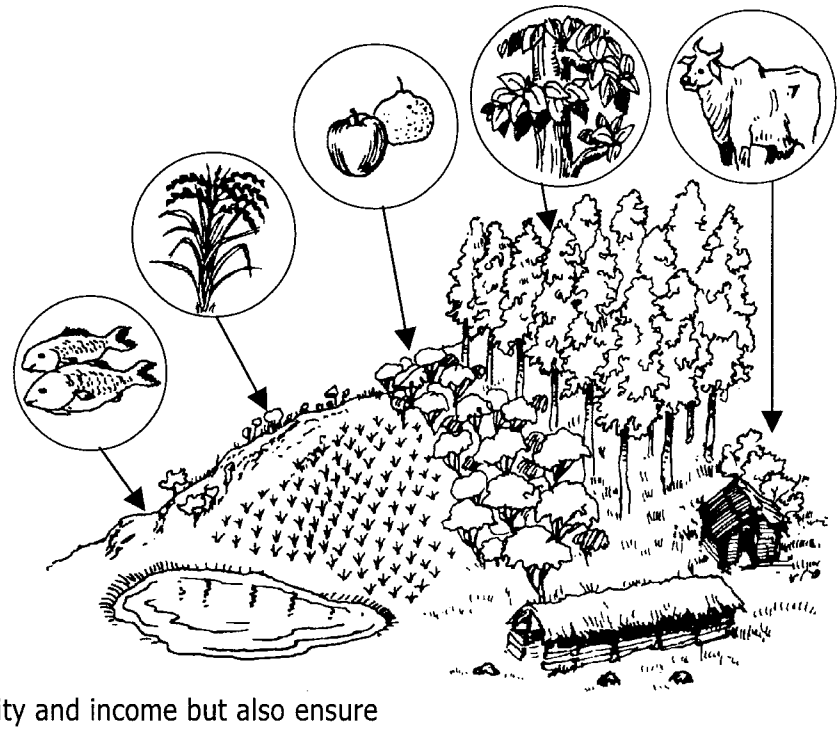
This is a system of establishing forest plantation in which agricultural crops are grown on a temporary basis in between regularly-arranged rows of forest tree species. Trees are planted in north-south direction to avoid wind effect on crops while ensuring sufficient light.



In Nagaland, the NEPED project has recommended a standard spacing; i.e., 2 m x 5 m between plants and rows respectively.

AGRO-HORTI-SILVI-PASTURE (CROPS + FRUITS + TREES + PASTURE)

This is a practice that has four major components of agriculture, horticulture, silviculture and pastures. Farmers may also adopt an integrated livestock, poultry and fishery culture, designed according to their needs and requirements.



Agroforestry is one of the best options to break away from unsustainable, resource degrading forms of farming. It will not only increase productivity and income but also ensure sustainable nutrient management systems.

Livestock options for agroforestry are under utilised in Nagaland. In food-secure regions, considerable potential exists for integrating food grains and cassava production with trees. This would provide feed for livestock production and better nutrient cycling. For example, manure from animals can be recycled to fields for better plant nutrition.

Also, greater animal production is good for the environment as a substitute for hunting wild animals.

Prepared by:
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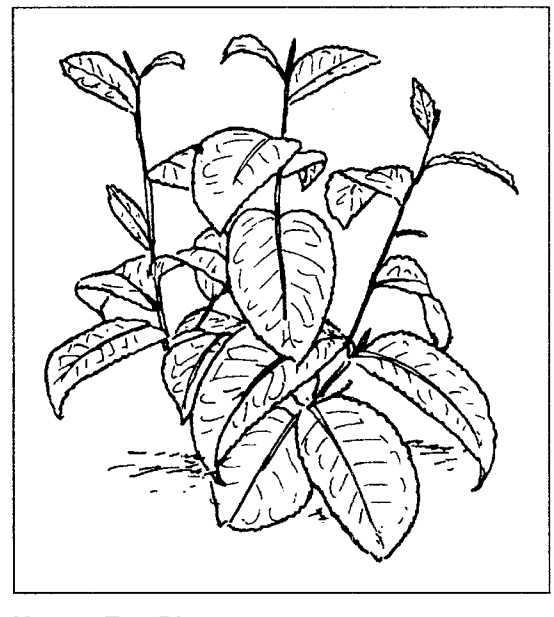
Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Small-scale Tea Cultivation – An Option for Naga Farmers

Tea is the most popular beverage in Nagaland. However, it is not grown on a large scale in the area even though the climate, altitude and soil are conducive to its growth. This is largely because most of the land is under jhum cultivation, which is traditionally practiced by the farmers. It is also partly due to the fact that the cultivation of tea is not widely publicised in Nagaland and not much is known about the method of cultivation.



Young Tea Plant

DESCRIPTION

The tea plant is an evergreen shrub. The stem is profusely branched and the leaves elliptical with serrated margins that are alternately arranged. The tea plant flourishes at altitudes up to 2400 meters, however, at higher elevations, growth is significantly slower. Tea grows well in fertile, slightly acidic, loamy soils with good drainage facilities.

METHOD OF CULTIVATION

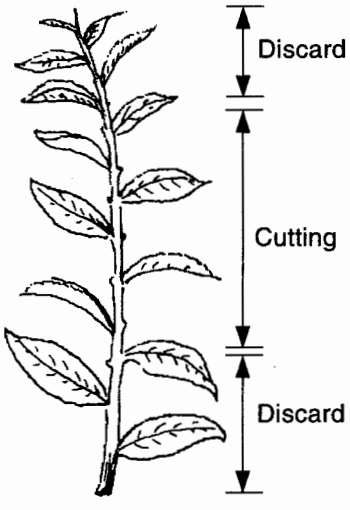
A. PROPAGATION

Raising in Nurseries

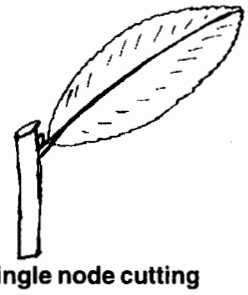
The planting materials are generally obtained from seeds and cuttings although grafting, budding and layering are also possible. Cuttings are preferred because of low tree mortality, less maintenance and better growth. The cuttings can be raised directly in sleeves or transplanted from the nursery beds to sleeves after the formation of calluses. After a year, they are ready to be transplanted into the fields.

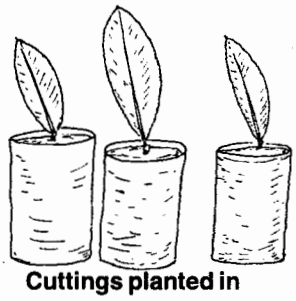
Node cutting

- Primary shoots with active or near-active terminal and axilliary buds are selected.
- Fully mature or reddish parts of the shoots are avoided.
- Single node cuttings from green and semi-hard shoots should be taken. The cuts should be slanted and as close to the axilliary bud as possible.
- The cuttings should be immediately dipped in water after being cut.
- They are planted at a slight angle to prevent overlapping of branches.
- The node and petiole should be above the ground.



Node cuttings


Single node cutting

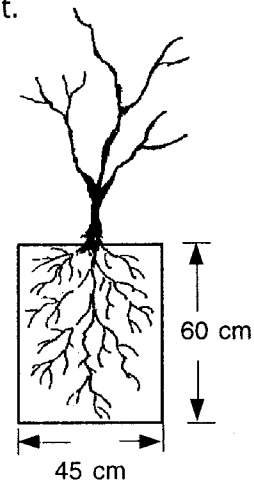

Cuttings planted in polythene sleeves

State Agricultural Research Station

The State Agricultural Research Station (SARS) is located at Yisemyong in Mokokchung district. It has a tea demonstration plot and a nursery for training and extension services. Formal training in tea-growing was first imparted to some farmers from Phek district. Few women from the same district were also trained. During the last two years, SARS has been distributing tea saplings free of cost to the trainees to encourage tea growing. Currently, SARS is working on the identification of elite clones suitable to Nagaland's conditions.

B. Planting

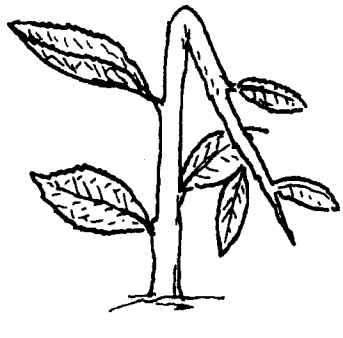
The pits should be 45 cm in diameter and 60 cm in depth. Care should be taken to place the root system vertically into the pit without twisting the roots. The saplings should be robust and between 45-50 cm in height.



Pit size

C. Breaking Up

The young plants should be broken up to encourage bushy growth once they are well established. It is necessary to train and modify the bush structures, to restrict them to a convenient height for plucking. The idea is to have a good frame and better coverage of ground. This process is called breaking up.

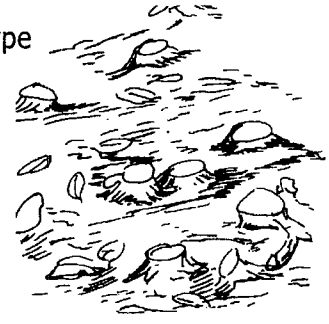


Breaking up

D. Pruning

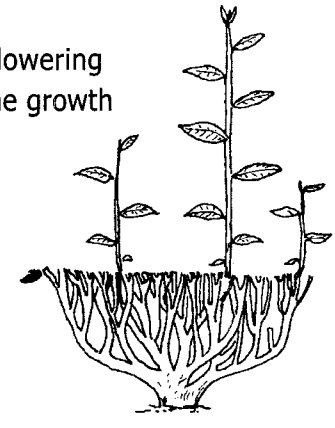
Pruning is the process of cutting off the vegetative parts of the plant in order to restrict its height and to encourage bushy growth. There are several types of pruning which are as follows:

- **Collar Pruning** is the most severe type of pruning in which the bole of the bush is cut close to the ground. This is usually done in the case of diseased tea bushes.



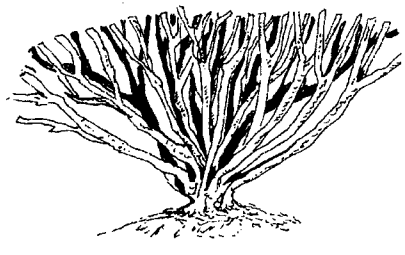
Collar Pruning

- **Heavy Pruning** is done 15-45 cm above the ground and is necessary for frame renewal.
- **Medium Pruning** is carried out for lowering the plucking table and to stimulate the growth of new branches.
- **Height Reduction Pruning** is done 70-80 cm above the ground and is required to facilitate the plucking of tea leaves by restricting the tea plant to a convenient height.



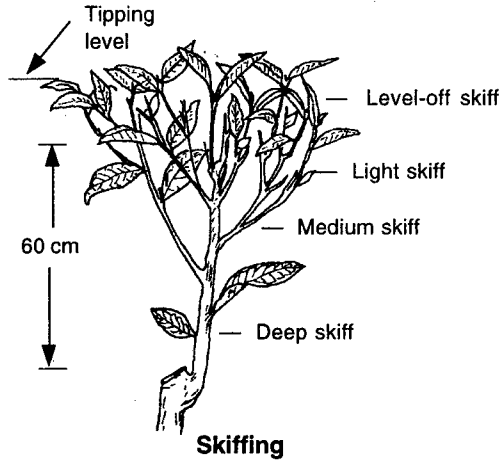
Pruned Frame

- **Light Pruning** is done 2-3 cm above the height at which it was last pruned in order to renew the growth of leaf-bearing branches.



Light Pruning

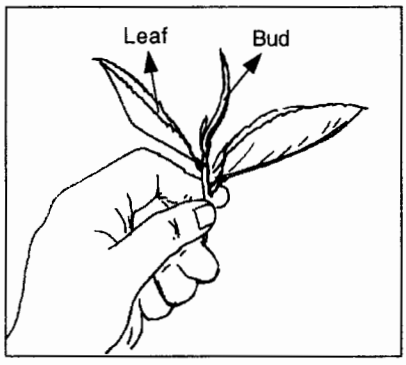
- **Skiffing** involves removal of a little of the upper part of the tea bushes in order to achieve a level plucking table. The different types of skiffing are deep, medium, light and level-off skiffing and tipping.



Skiffing

E. Plucking

Two leaves and the bud are plucked from the tea plants and processed for marketing.



SHADE TREES

Trees are essential to provide shade to the tea plants under tropical conditions. Trees stimulate growth by enabling the plants to retain the moisture. Normally, trees like siris, silver oak and alder are grown in the tea plantations. At higher altitudes, tea can grow without the help of shade trees but a few trees like albizzia and alnus may be planted for biomass addition and nitrogen fixation.

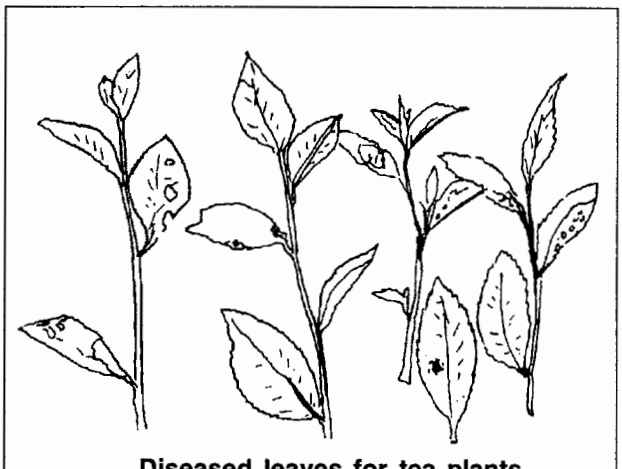
WEED CONTROL

Weeds compete with plants for moisture, nutrients and sunlight. The weed growth is more intense during the early stages of development of the tea plants. Physical, biological and chemical methods may be used to check weed growth among the young plants. Weedicides like Glycel (Glyphosate), Simazine (Tafazine), Paraquat (Gromoxone) and 2,4-D (Fernoxone) are very effective in controlling weeds and do not leave residue in the soil.

PESTS AND DISEASES

Pests

Some of the common pests found in tea plantations are termites, scales, aphids, mites and borers. These may be checked by regular weeding, pruning and in certain cases, removal of the whole plant. Sometimes, chemical spraying also becomes necessary.



Diseased leaves for tea plants

Diseases

Root-rot, stem-rot, pink disease, blister blight, black rot and brown blight are the most common diseases occurring in tea plants. The same measures that are used for pest control may be adopted.

PROCESSING

The processing of tea in the factory involves the following steps:

- Withering
- Rolling
- Fermenting
- Drying and firing
- Sorting and grading

Approximately 5 kg of green leaves are required to produce 1 kg of tea.

In Nagaland, tea is grown on a backyard scale. The domestic demand is very high, since tea is the most popular beverage consumed within the state. Mostly, it is grown in home gardens for household consumption. The manufacturing of tea involves well-defined processes which are possible only in a factory. However, as such facilities are non-existent in Nagaland, tea growers have devised their own methods of processing tea manually. The significance of tea cultivation lies in the fact that it provides an economically-viable alternative to jhum. Farmers in Mokokchung, Wokha, Phek and Mon districts have already taken up tea cultivation for commercial purposes.

Social Implications

Growing of tea can have serious implications unless social issues are also considered. Large-scale cultivation will result in a substantial increase in the labour requirement. Importing labour from outside the state to meet the local demand may be a drastic step to take, as this is likely to lead to social and cultural problems. The alternative is to manage tea cultivation in a collective manner in small holdings where every member of the community contributes to the upkeep and management of the plantations, thus minimising the need for imported labour. A very good example of this kind of management can be found in Chuchung Tea Estate in Longsa village of Mokokchung district, where the entire community is involved in every aspect of tea growing.

Tea

- Generates income
- Increases employment opportunities
- Provides an option for jhum farmers

For further information about tea cultivation in Nagaland, please contact:

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Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Cultivation of Oyster Mushroom in Nagaland

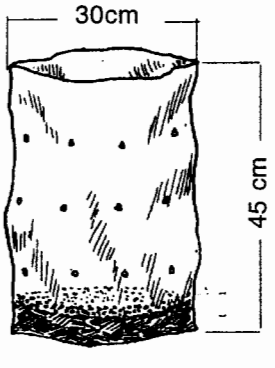
Mushrooms have been widely accepted in the Naga culture especially for their taste, nutritional value and economic benefits. People collect wild mushroom species not only for food but also as a source of income. Since wild varieties are highly seasonal, there exists an opportunity for the cultivation of mushrooms in Nagaland.

Oyster mushroom

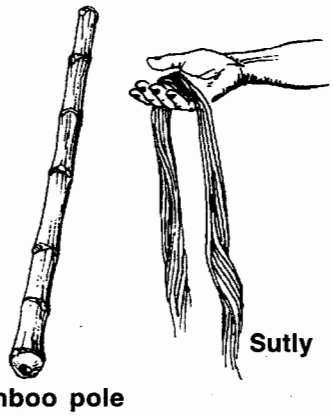
Oyster mushroom (*Pleurotus sajorcaju*) has potential for cultivation and a new technique has been developed for its cultivation which is simple, easy to practice and is rather cheap. Oyster mushroom cultivation requires minimum space and no sunshine. The process of cultivation includes the following steps:

MATERIAL REQUIREMENT

- A perforated polybag of preferably 45 cm x 30 m size
- Miscellaneous materials like sutly (jute ropes), bamboo poles to support the hanging polybags



Perforated polybag

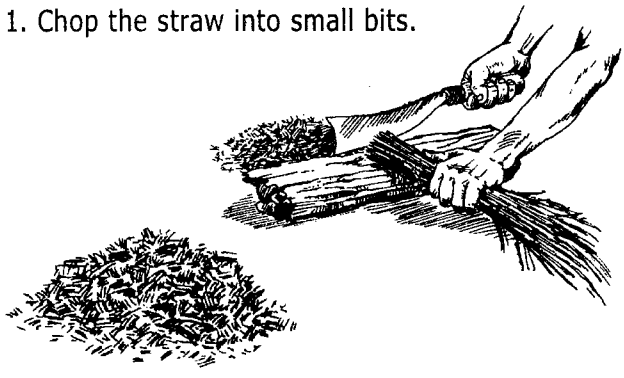


Bamboo pole

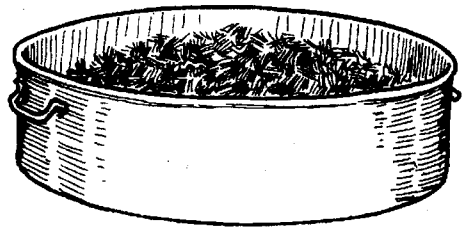
MATERIAL PREPARATION

Oyster mushroom is grown in media of rice/wheat straw. Straw collected should be free from moulds and insect pests.

1. Chop the straw into small bits.



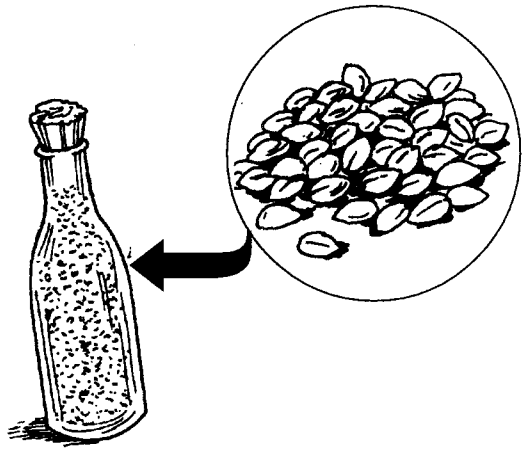
2. Soak the chopped straw in cold water for 24 hours.



3. Boil the straw bits in hot water for 15 minutes.

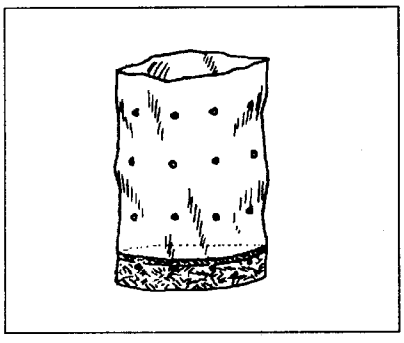
4. After boiling, thoroughly drain the excess water from the straw.

5. Collect viable mushroom spawn from support organisations/institutions. One bottle of spawn is adequate for three polybags.

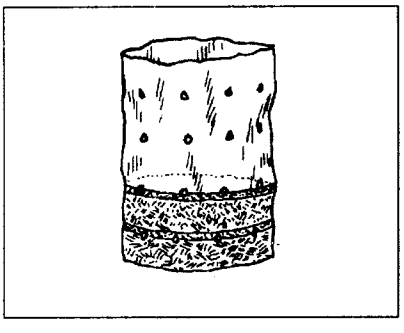


6. Mix spawn with bason (powdered black gram) for better growth.

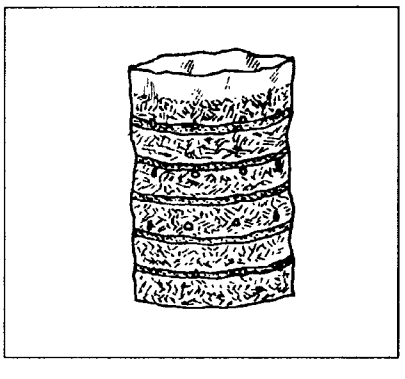
1. Fill 1/6 of a perforated poly bag with the prepared straw.



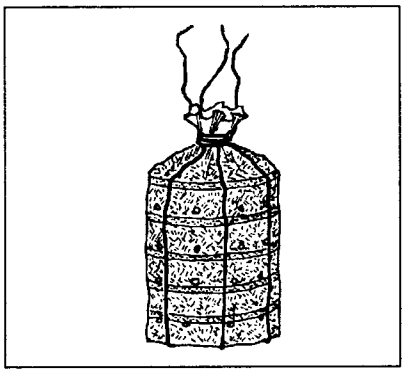
2. Spread about 5-6 g of bason over the straw. Uniformly broadcast spawn over the straw layer.



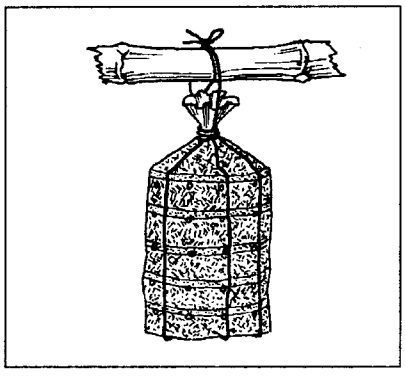
3. Cover the spawn with the second lot of prepared straw and repeat this process until the remaining portion of the bag is filled up.



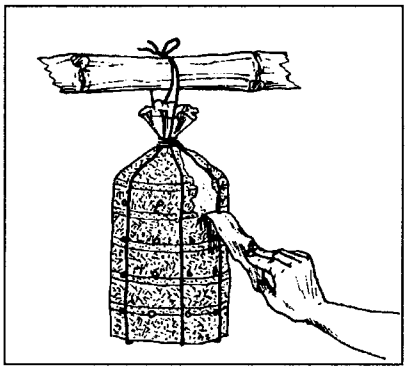
4. Tie the open end of the polybag then restrain with the jute rope around the four sides.



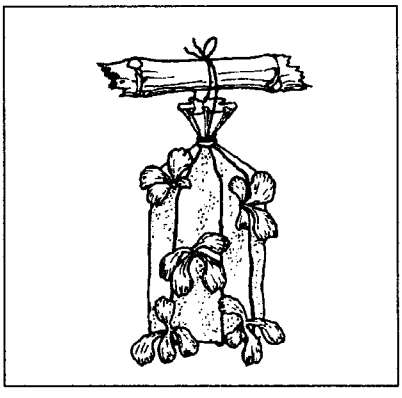
5. Hang the bag in a dark room, vertically along a bamboo pole. "Pin-head" formation takes place in about three weeks time.



6. Tear the polybag when the pin-heads first emerge.



7. The first crop of mushroom is ready to harvest within three to four days after the pin-head formation. The next flush crop appears ten days after the first flush, followed by the third flush.



The yield per bag in three harvests is about 800-1000 g.

TIPS

- Oyster mushrooms can be economically grown within a temperature range of 20-30ºC. In colder regions of the hills, the growing season is from March to October while in the warmer plains, it can be grown between October to March.
- Excess water should be removed, to avoid the growth of unwanted moulds.
- Hang the polybags in a well-aerated dark room. Avoid exposure to sunlight.

AFTER CARE

- Watering is not necessary until the pin-head formation.
- White cottony root (mycillium) will develop slowly, binding the paddy straw.
- Watering is done twice a day by spraying or sprinkling.

SUPPORT ORGANISATIONS/ INSTITUTIONS (SOURCES OF SPAWN)

- State Horticulture Farm
  4th Miles, Dimapur, Nagaland, India
- ICAR
  Complex, Jharnapani, Nagaland, India
- Regional Rearch Laboratory
  Jorhat, Assam, India
- Assam Agriculture University
  Department of Plant Pathology
  Jorhat, Assam, India
- Mushroom Laboratory
  Chambaghat, Solan, H. P., India
- Directorate of Agriculture
  Shillong, Meghalaya, India

Cost of Cultivation (10 bag unit)

Cost of 10 kg of paddy straw (dry weight)	=	Rs. 10
Cost of polythene bag (10 pcs at 50 paise)	=	Rs. 5
Cost of firewood, sutly rope, bason, spawn etc.	=	Rs. 50
Maintanance cost	=	Rs. 100
Total	=	Rs. 165

A yield of 800 g of fresh mushroom is harvested from one bag. Therefore, 8 kg of mushroom can be harvested from 10 bags.

A kilogram of mushroom is retailed at Rs. 40.
Therefore, the total value for 8 kg at Rs. 40 = Rs. 320

Total sale	=	Rs. 320
Cultivation cost (-)	=	Rs. 165
Cash return	=	Rs. 155

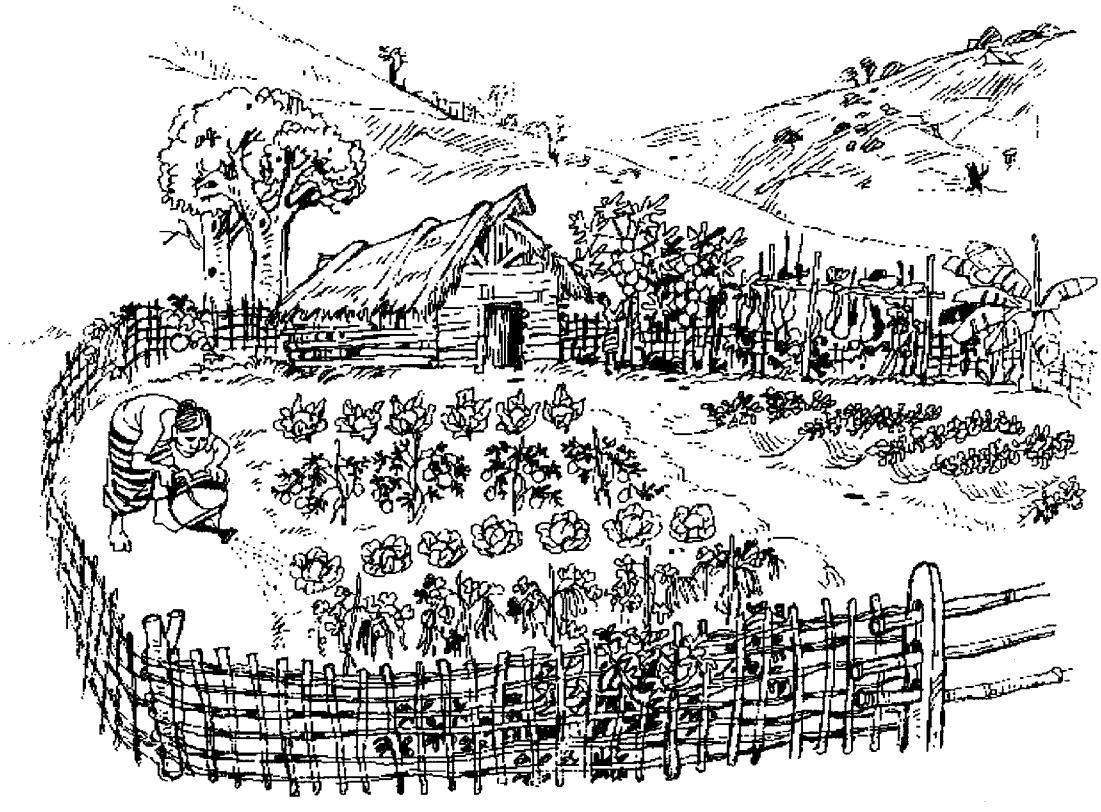
The above rate is based on existing market price. The rates are subject to change depending on the market rate.

Some other costs may also accrued that will affect actual net profit.

Prepared by:
Zuchamo Kikon

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Home Gardens



The home garden is the land adjacent to a house on which a mixture of annual and perennial crops are grown. It is the patch of earth in the yard that is developed by the members of a household to grow varieties of vegetables, spices, fruits and other items to supplement the immediate needs of the kitchen.

The home gardens in Nagaland have impressive crop diversity and help maintain the biodiversity in the region. Recent studies in northern Nagaland revealed that more than 120 species of plants are found in the Konyak home gardens.

WHY HOME GARDEN

- Growing fruits and vegetables for home consumption can cut down on living expenses.
- The excess produce can be sold in the market thereby supplementing the family income.
- Vegetables are an important source of vitamins, calcium, minerals, protein, etc. Home gardens can, therefore, ensure a healthy diet for the family.
- Home gardens can help recycle household and kitchen scraps especially when a compost pit is developed.

Crop Diversity

A survey of Kohima and Mon town markets showed that of the total produce recorded, 40 are found in home gardens. These include:

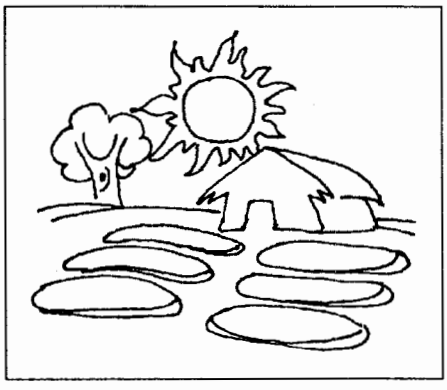
- Potato
- Chilli
- Cabbage
- Tomato
- Pumpkin
- Bean
- Pea
- Brinjal
- Garlic
- Ginger
- Mustard
- Leek
- Lady's finger
- Cauliflower
- Cucumber
- Carrot
- Onion
- Turnip
- Lettuce
- Yam
- Radish
- Passion fruit
- Maize
- Bitter gourd

HOME GARDEN MANAGEMENT

The following steps should be kept in mind when establishing a home garden:

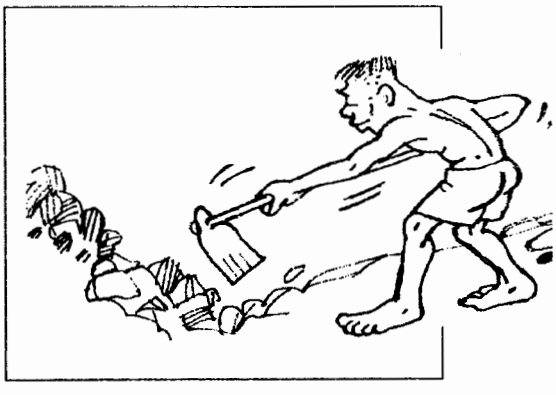
1. Location and Size

Choose an open sunny area, away from trees or large shrubs, which not only shade and stunt the growth, but also compete with vegetables for moisture and nutrients. The size of the plot depends on the availability of the land, the number of family members and the time and labour that can be spared for its care. Keep it to a manageable size and properly fenced.



2. Bed Preparation

The soil should be worked well at least 2-3 weeks before the planting and the beds prepared after reworking the soil. This allows good development and penetration of roots into the soil and retention of moisture and nutrients. Apply farmyard manure to the soil or use home-made compost, made of well-decomposed kitchen waste, paper and garden debris.

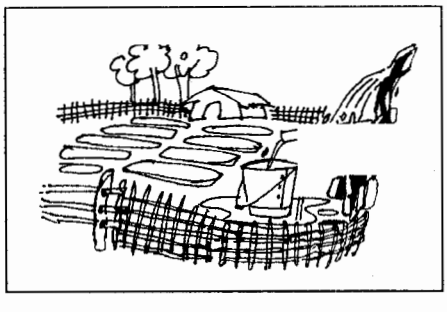


3. Sowing and Planting

Some crops like carrot, beet, pea and bean can be sown directly into the plot while others like cabbage, cauliflower, tomato, brinjal and chilli should first be sown in nursery beds and the young seedlings transplanted after 4-6 weeks. Short and tall plants can be mixed to optimise sunlight. Trellis and stakes can also be used.

4. Watering and Drainage

An adequate supply of water should be available and plants should be watered at regular intervals. Care should be taken to see that the young plants are not over-watered. Proper drainage should also be provided to prevent water-logging.



5. Mulching

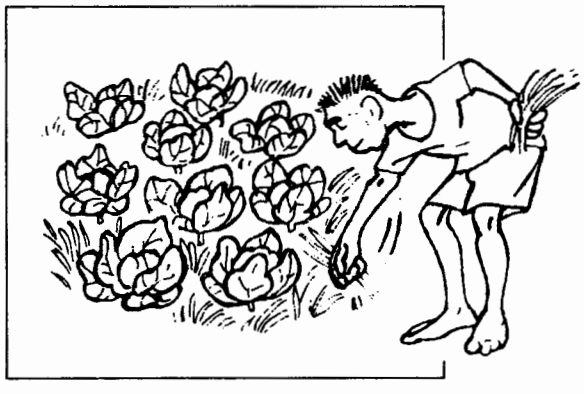
Surplus organic materials like leaves, cut straw, etc. are key components of mulch. Mulch is used to cover the soil around the plants.

Mulching:

- supresses weeds around plants;
- prevents soil compaction;
- conserves soil moisture;
- maintains the soil temperature; and
- encourages decomposers (e.g., worms) to aerate the soil and also releases nutrients from the mulch for plant uptake.

Organic mulches have the advantage of being dug into the soil at the end of the season, thus improving soil structure and fertility.

6. Weeding



Weeds should be removed in time as they compete with crops for light, water and nutrients which affect the growth of crops. Weeds also act as hosts for pests and plant diseases so it is important that they are disposed off by burning or burying in trenches. A warm sunny day is ideal for weeding as the weeds will wilt and die quickly after being uprooted.

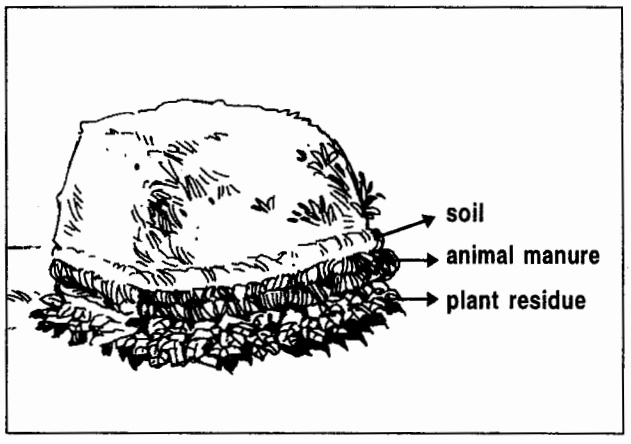
7. Harvesting

Vegetables should normally be harvested after they attain full maturity. However, root and leafy vegetables are harvested at their most tender or succulent stage; fruits and pod vegetables on attaining their proper size while still remaining succulent. Some vegetables like chilli and pumpkin can be harvested ripe or immature.

COMPOSTING

Composting is the process of decomposing various waste organic materials and refuse to a quickly utilisable condition as manure. For most gardeners, good compost making is the key to maintaining the fertility of the soil.

A good compost is prepared from a heterogenous mass of vegetable and animal waste – rather than from a single material – piled in layers and well mixed.



ESSENTIALS OF GOOD COMPOSTING

- Moisture is essential for the activity of microorganisms to bring about decay of the raw materials. Water the heap regularly.
- Proper aeration is essential during the initial stage of composting. Turn over the heap regularly.
- For rapid decomposting, add raw materials like cow dung, cattle urine, soil, etc.
- Acidity in compost pile can be corrected by adding lime or wood-ash.
- Do not add meat scraps to the compost heap as this encourages ants and discourages worms.

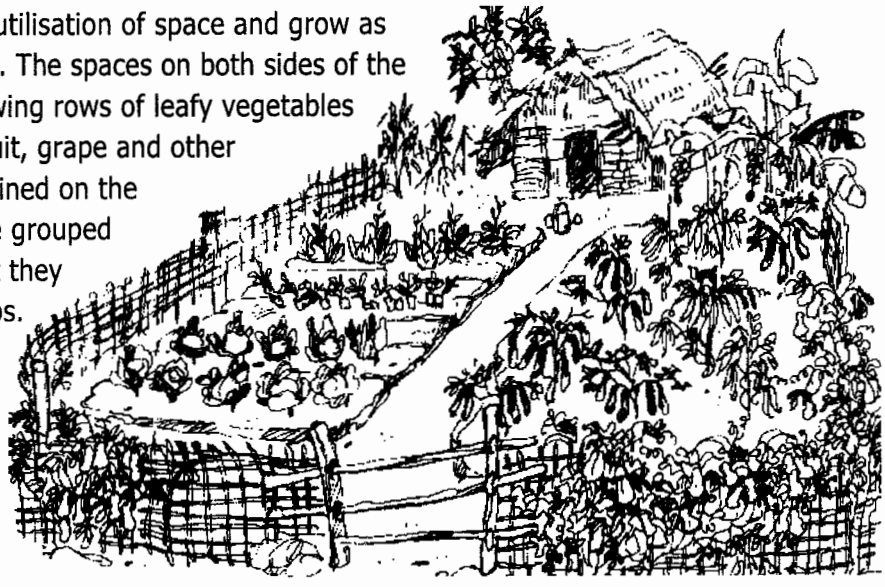
CROPPING PATTERN

- The cropping pattern should be aimed at obtaining optimum harvests, keeping in mind the family's food preferences, yield, diversification and the prices fetched in the local market.
- Consider growing crops throughout the year rather than having a flush of vegetables in one season; think in terms of quick maturing varieties sown in succession.
- Avoid growing the same crop on the same bed each year. Different plants have varying rooting depths and therefore extract nutrients and moisture from different levels in the soil. Crop rotation enables the land to "rest" while crops are still being grown. It will also help reduce and control soil-borne pests and diseases.

Crop Rotation

	Year 1	Year 2	Year 3	Year 4
Bed 1	Cabbage	Tomato	Carrot	Pea
Bed 2	Tomato	Cabbage	Pea	Carrot
Bed 3	Carrot	Pea	Cabbage	Tomato
Bed 4	Pea	Carrot	Tomato	Cabbage

- Aim for the most economic utilisation of space and grow as many vegetables as possible. The spaces on both sides of the path can be utilised for growing rows of leafy vegetables and beans, while passion fruit, grape and other climbing varieties can be trained on the fences. Tall plants should be grouped together on one side so that they do not shade the dwarf crops.



In many villages of Nagaland, home gardens have proved to be a profitable venture not only in terms of an assured supply of fresh, nutritious vegetables for home consumption, but also as a means of supplementing income. Vegetables from home gardens in the villages are increasingly finding their way to markets in towns and road-side stalls as the people prefer locally-grown vegetables and fruits which remain fresh and nutritious.

Cropping Seasons

Kharif (Summer)	Rabi (Winter)
■ Lady's finger ■ Bean ■ Pumpkin ■ Cucumber ■ Tomato ■ Chilli ■ Gourds ■ Brinjal ■ Leek	■ Carrot ■ Garlic ■ Turnip ■ Peas ■ Radish ■ Mustard leaf ■ Cabbage ■ Cauliflower

Prepared by:
Michael Zaren

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Bamboo Propagation and Processing in Nagaland

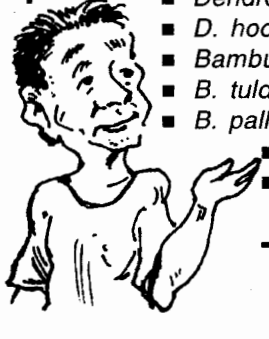
Bamboo is the tallest perennial grass of the *Poaceae* (Graminae) family. Due to its long cylindrical woody stem, strength and ease of workability, bamboo is considered a versatile material of countless uses. It is grown by almost all the Naga farmers while wild varieties are also readily available and utilised.

Bamboo has ecological benefits as it minimises soil erosion and stablises stream banks. It can be grown in a wide range of sites and is suitable for reforestation in degraded lands.

Demand for bamboo is steadily increasing in Nagaland and measures should be taken to grow it on a commercial scale to meet the growing demand. Bamboo propagation is, therefore, a potential source of income for the Naga farmers.

There are many species of bamboo available in Nagaland. A few of the common species are:

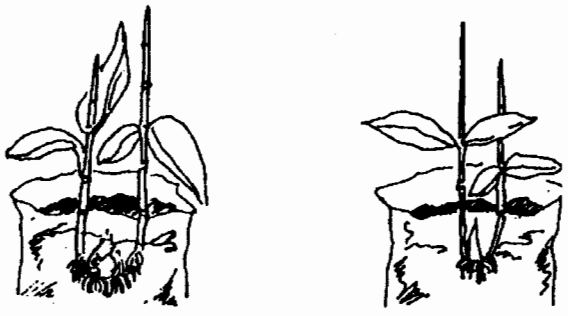
- *Dendrocalamus hamiltonii*
- *D. hookerii*
- *Bambusa balcoa*
- *B. tulda*
- *B. pallida*
- *B. nutans*
- *Melocana baccifera*



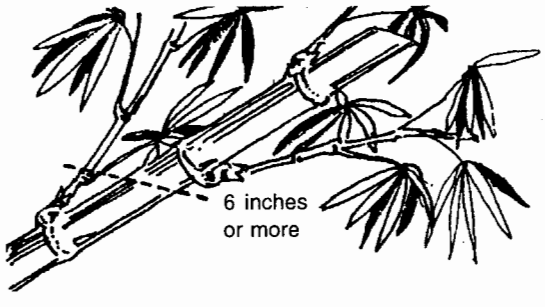
PROPAGATION

The main means of propagating bamboo are illustrated below:

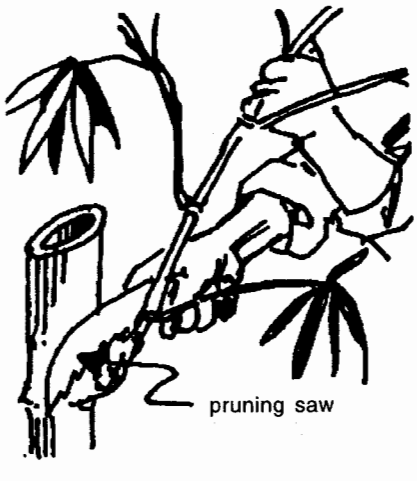
Seedlings



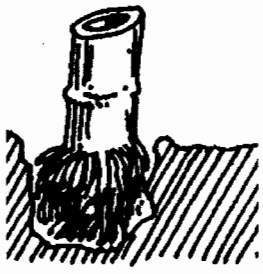
Culm cutting



Branch cutting

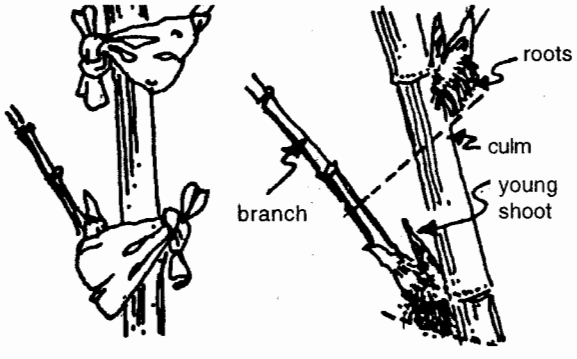


Offset



directly planted in fields

Marcotting



USES OF BAMBOO SHOOTS

- Fleshy tender shoots of some species are edible.
- Bamboo shoots are also cooked and eaten as vegetables.
- Shoots are preserved in brine solution (salt water) for common dish preparation.
- Bamboo shoots are processed and preserved for various purposes.

BAMBOO SHOOTS PROCESSING

RHÜCHAK/RHÜCHÜ

Description:

Rhüchak – processed form of bamboo shoot, sour in taste, used in preparation of Naga cuisine.

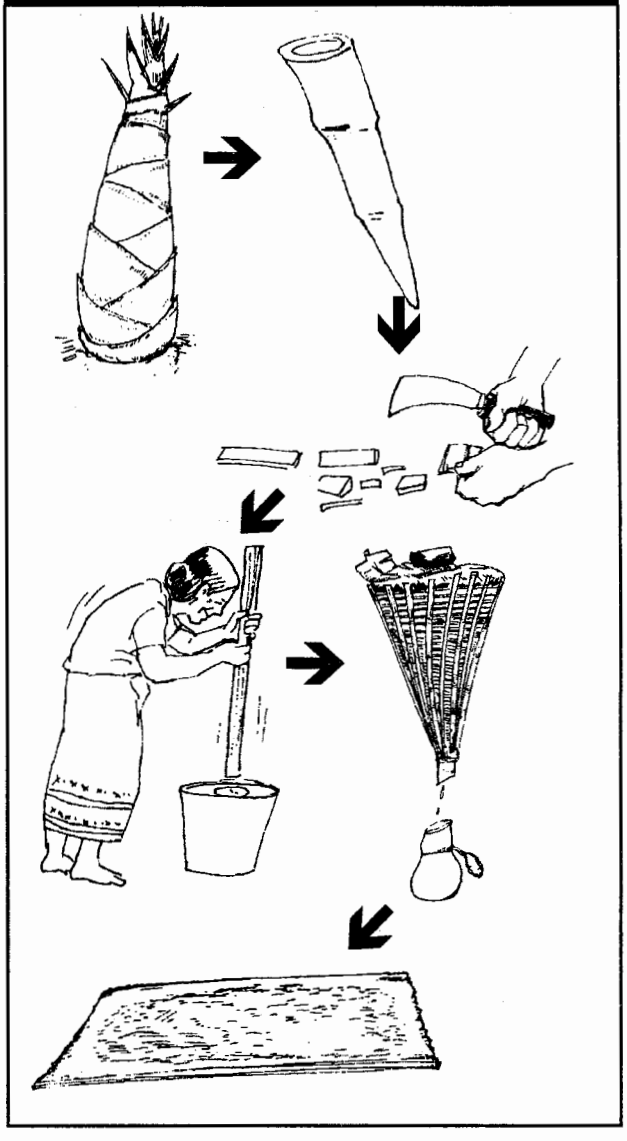
Rhüchü – sour liquid of the bamboo shoot is used as taste maker and preservative.

Process:

- Collect tender bamboo shoots from the forest during June to August.
- Remove the outer layer of the skin and wash.
- Slice into small bits.
- Pound into pulp form and place in a bamboo basket, internally lined with banana leaves.
- Cover the top of the basket with a banana leaf and place a weight on it.

Within two to three weeks, the fermentation process for *Rhüchü* makes the bamboo shoot sour and acidic. Simultaneously, the liquid starts dripping and is collected in a wodden or bamboo container. The liquid collected is then drained out. The bamboo shoots inside the basket are used for cooking this processed bamboo shoot.

The *Rhüchu* Process



Bamboo Basket

Inter-woven, broad at one end, tapering at the other end with small hole on the node for dripping the liquid.

RHÜCHON

Description:

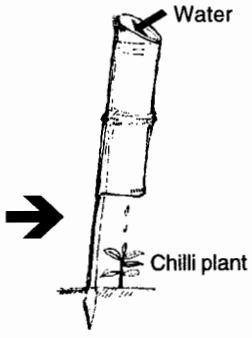
Rhüchon - dried bamboo shoot, sour in taste, used in various dish preparation and can be stored for a longer period of time

Process:

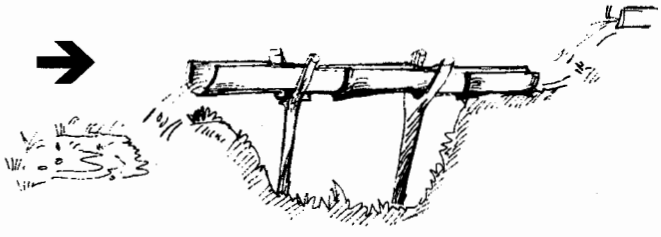
- Take out the processed bamboo pulp from the basket and spread over a bamboo mat.
- Dry under the sun. Within two to three days, this will turn cripsy brown.
- Pack in a banana leaf and store close to the fireplace in the kitchen.

SPECIAL USE OF BAMBOO - IRRIGATION

1. When water is scarce, the Lotha Naga farmers use an indigenous innovation of `bamboo drip irrigation system' for chillies and other fruit crops as shown in the illustration.



2. In the hills, where an irrigation channel passes through a ravine, gorge, depression and landslide area, farmers use split bamboo as a means of traversing.



Other Uses of Bamboo

- construction of houses
- graineries
- furnitures
- handicrafts
- agricultural tools, implements and field operations
- various ethno-religious purposes
- fishing gears/ hunting gears
- musical instruments
- pulp and paper

Prepared by:
Zuchamo Kikon and Sanchothung Odyuo

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Participation, Extension and Implementation Issues

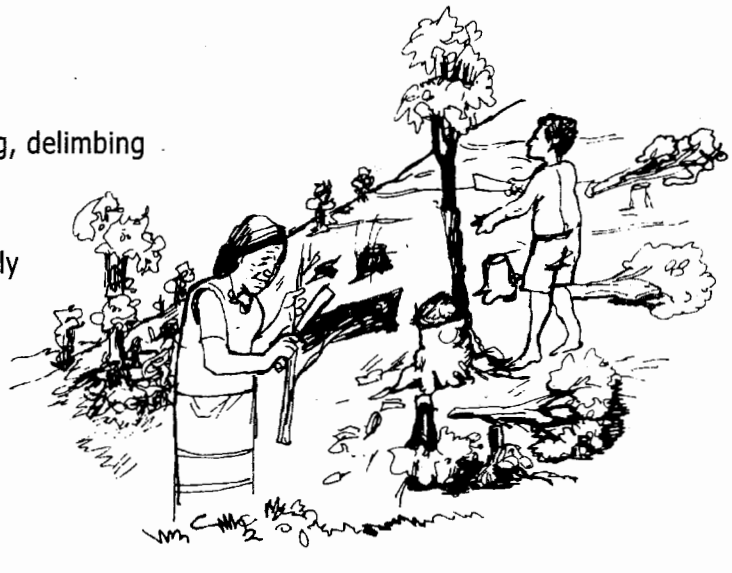
Role of Women in Naga Jhum Cultivation

In jhum, diverse crops are produced though rice has been the primary crop for generations. Both men and women play an active role in agricultural operations. But the labour input from women is not less than 70% of the total labour used. This is in addition to the women's household responsibilities (i.e., raising the children, preparing food, etc.).

SEQUENCE OF JHUM ACTIVITIES

SLASH

Slashing is one of the toughest tasks. Felling, delimbing and lopping of the big trees require human strength, sharp *daos* (utility knife of the Nagas) and axes. While the slashing is usually done by men, preparatory work of cleaning and cutting of undergrowth and brushwood is undertaken primarily by women.



BURNING

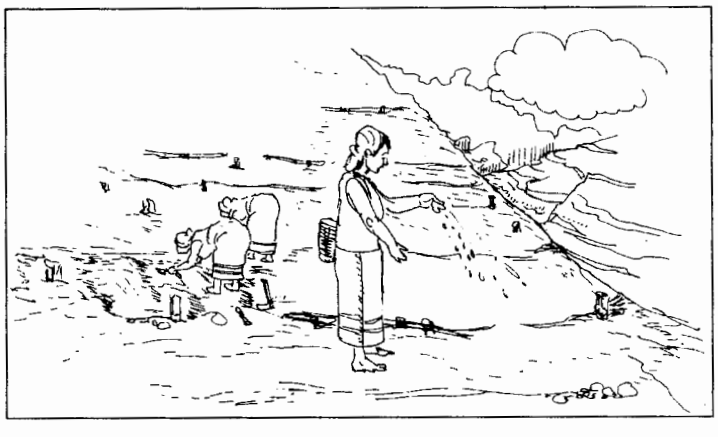
Once the slashed biomass has dried, farmers set it on fire and the slashed material is brought down to ashes. The collection of burned debris and reburning of the unburned materials are done by women.

HOEING

Women take part in the hoeing of the field. They till the field with locally-made tools. This is a difficult task in which women equally participate with men.

SOWING

Women sow and dibble seeds of different crops along with the main paddy crop.

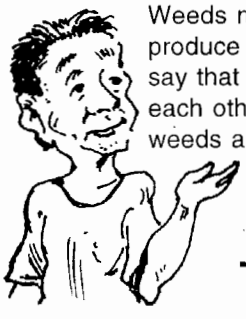


SEED COVERING

After sowing, the seeds are covered with soil and this is usually done by women.

WEEDING

Jhum fields require about three rounds of weeding during a cropping period. Weeding is usually done by women.



Weeds may be considered as a menace to crops but they also produce a lot of biomass that enriches the soil. Konyak women say that "paddy and weeds" are best friends as they depend on each other for biomass production and healthy growth. Uprooted weeds are usually dried and returned to the paddy as mulch. Paddy straw is also used as mulch to conserve soil moisture and increase soil fertility. Women generally undertake this operation.

PRE-HARVEST

Besides manual operations, it is the responsibility of the women to protect the crops from birds, rodents and wild animals. During this period, the women also collect food plants from the jhum fields and nearby forests.

HARVEST AND SEED SELECTION

Harvesting is done by both men and women. The harvested crops have to go through various processes like drying, pounding and cleaning that are usually done by women.

The selection of panicles for future use is also done by women. They take care of all seeds that are meant for the next year's plantation and select the most matured and developed seeds. Seed selection is normally carried out just before and during the harvest.

Storing and Post Harvest Management

Once the harvested products are hauled to the homes, women store them in appropriate bushels/baskets. The selected seeds are dried well in the sun and then stored in appropriate containers. Care is also taken to ensure that the seeds are well aerated and protected from insects and rodents.

Storing of seeds in bamboo baskets

Cooking

Though men occasionally help, it is the responsibility of the wife and the daughters to cook for the family.

After a day's work in the fields, women carry minor forest products or vegetables and firewood to their homes. They also take the surplus products to the local markets and sell them.

The role played by women in agricultural production is highly significant but often less valued. Women often work tirelessly both at home and in the fields and at times, at the cost of their own health.

An Example of a Daily Routine of a Naga Woman

4:00 a.m.	Wake up, wash and pray.
4:15 a.m.	Make fire and set kettle on the fire.
4:20 a.m.	Sweep the kitchen.
4:30 a.m.	Prepare tea
4:45 a.m.	Water the garden.
4:55 a.m.	Feed livestock.
5:00 a.m.	Prepare food for lunch to be taken to the field.
5:30 a.m.	Household work
6:00 a.m.	Cook food for breakfast
6:30 a.m.	Eat and clean the utensil, etc.
7:00 a.m.	Set for the field.
8:00 a.m.	Make fire and fetch water.
8:10 a.m.	Boil the water for tea and serve.
8:20 a.m.	Start field work.
10:00 a.m.	Prepare day food.
11:30 a.m.	Day lunch.
12:00 noon	Continue field work.
3:00 p.m.	Collect green vegetables for home use.
4:00 p.m.	Start for home.
5:00 p.m.	Make fire and wash up.
5:40 p.m.	Feed livestock.
6:00 p.m.	Prepare food.
7:00 p.m.	Spend time with the family.
8:00 p.m.	Prepare tea.
8:20 p.m.	Family fellowship prayer
9:00 p.m.	Sleep

Prepared by:
Ellen Konyak

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Women's Participation in Forestry

Naga women have a very close relationship with the environment they live in. The food security and the welfare of their families depend on preserving this environment. Changes in the environment can affect the availability of water, fuelwood, fodder, medicinal plants, food and other materials for their daily domestic use. Women in Nagaland have a very strong appreciation of the value of forests and farm biodiversity.

In Nagaland, each community manages a range of forests and agroforest resources as described below:

1. Primary natural forest
Largely undisturbed for various physical or socio-cultural purposes; or for the conservation of biodiversity and other resources (e.g., water).

2. Secondary natural forest
In various stages of fallow in the jhum cycle and more or less managed for the collection of food, medicine and other non-timber forest products.

3. Agroforestry
More intensive and deliberate mixed cropping with trees in the recent jhum areas.

Gender Equity Factor

- Most of the Naga women spend as much time in the fields as the men. Their work ranges from tending the home garden, to cultivating the agriculture fields and foraging in the neighbouring forests.
- In countries like India, many women are farmers, fuel-wood collectors, users and sellers of minor forest products.
- Women spend as much time in the forests as men.
- Women and their children would be the first ones to feel the impact of any shortage of forest produce.

Women form a distinct group within the forest sector. Their role in managing forest and agroforest resources has been proven and recognised internationally. Efforts must be made to ensure that this resource group is actively involved in the decision-making and benefit sharing of forest produce and resources in Nagaland.

Sometimes, women's role in forestry and agro-forestry has been limited to providing labour. This has resulted in negative impact and exploitation of women. Increasing their level of participation beyond merely providing labour must be accompanied by increased recognition of their decision-making power. Due acknowledgement must be given to their unique knowledge, their contributions and the need for equitable sharing of benefits.

NEPED and Gender

NEPED aims to:

- inform and convince the people of Nagaland, India that women have an important role to play in forestry projects;
- increase the people's knowledge of the role of women in social development and agroforestry;
- ensure that Naga women get to play a decisive role in forest management; and
- train and increase the capacity of women so that they can become partners in project implementation.

Naga women can be called the "guardians of their biodiversity" and caretakers of most agricultural and livestock resources. Rural Naga women are best equipped (in some ways) and least equipped (in other ways) to manage this environment.

Women have a unique opportunity to conserve biodiversity because they have:

- an orientation towards the need to preserve biodiversity for their children;
- practical indigenous knowledge of biodiversity; and
- specialised technical knowledge for sustainable resource use and pest management issues.

Unfortunately, women are often in a disadvantaged position because:

- they have little say in the decision-making process;
- their views are often overlooked;
- their social standing does not provide them the means to voice their concerns; and
- their daily household burdens are too heavy for them to get organised.

KEY ELEMENTS FOR GENDER-SENSITIVE APPROACHES IN NEPED AGROFORESTRY

1. Recognise women's participation in agroforestry, not only at the rural but at the higher professional and technical levels as well.
2. Fully involve women when establishing objectives, workplans, indicators and strategies for women.
3. Define their role with regard to environmental policies, traditional social structures, land tenure systems, control over means of production and other such issues.
4. Segregate data. Identify baseline studies and gender analysis for specific women's issues. These should be practical, participatory and timely.
5. Encourage and allow women to participate in decision-making bodies and become part of the process. This helps ensure that specific funds, opportunities and targets include women.
6. Adopt approaches that facilitate active participation of women.
7. Train project staff to be sensitive to and be able to address gender issues.
8. Acknowledge the fact that women are direct users and preservers of their environment and hence, have a major role to play in biodiversity conservation.
9. Most importantly, accept the fact that women are partners and not mere labourers.

Prepared by:
Raj Verma

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Women Empowerment: Concept and Training Module

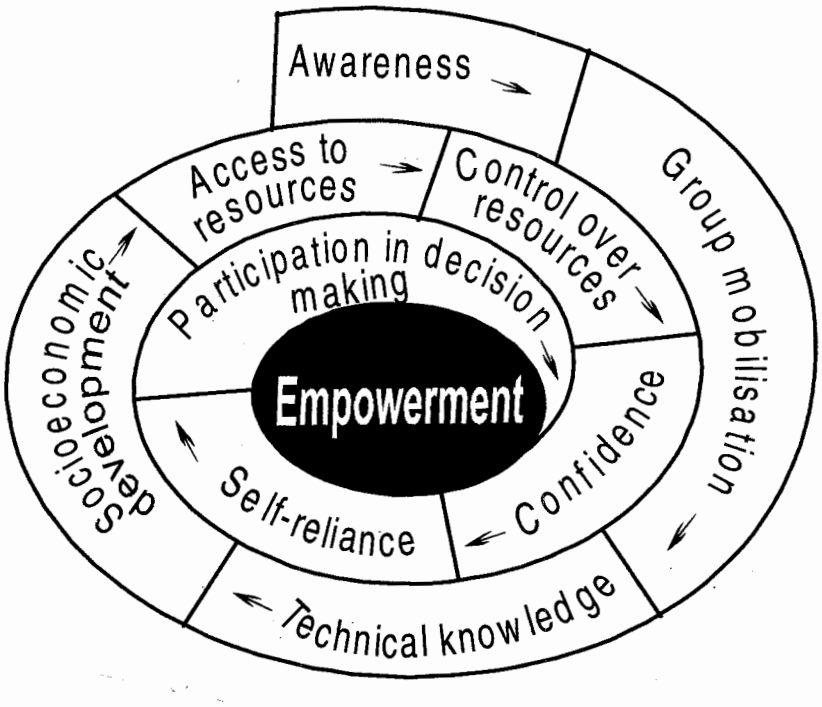
Nagaland has a patriachial society and women have many roles: looking after the home, children and elders, and farm. But they have little power or control over productive resources. In Nagaland, a common strategy to address land or land-related resource issues in relation to women cannot be developed because customary laws are binding and vary from tribe to tribe or even from village to village.

The Women Empowerment Training Programme was initiated by NEPED in 1996 to improve the socio-economic status and develop the abilities of women in Nagaland. Although women have access to resources, such as land, by establishing a nursery or test plot as part of the development programme, they lack control and their involvement in land use is restricted.

METHODOLOGY OF THE BASIC TRAINING MODULE

- The training (one example below conducted in Nagamese) is participatory in nature and adopts a learning-based approach, which minimises lecturing.
- Each participant learns from the experiences of others.
- Activities such as brainstorming, group discussions, group exercises, games and lectures are used.
- Each participant gets an opportunity to present her views and local wisdom and is able to see the views and wisdom of others when they are articulated.

EMPOWERMENT PROCESS



The following sessions are included in the training programme.

Ice-breaker exercise

1. Ice-breaker exercises

The exercise is used to introduce participants to each other and help the group to mingle. Each participant is asked to choose a friend and introduce her. Later, one woman closes her eyes and the other leads her and vice versa. Finally, their feelings are written down on a flip chart and then summarized.

Articulation of expectations and fears

Expectations and fears

Each participant is asked to write down her expectations and fears. This helps in identifying the needs of the group and to modify the content of the training programme. The most commonly expressed fear was "failure of the plant nursery".

Women's strengths and weaknesses

Participants are divided into groups and group leaders are selected. Each group writes their strengths and weaknesses. Each group leader presents the group's views which are later summarized by the facilitator.

Sample Expectations

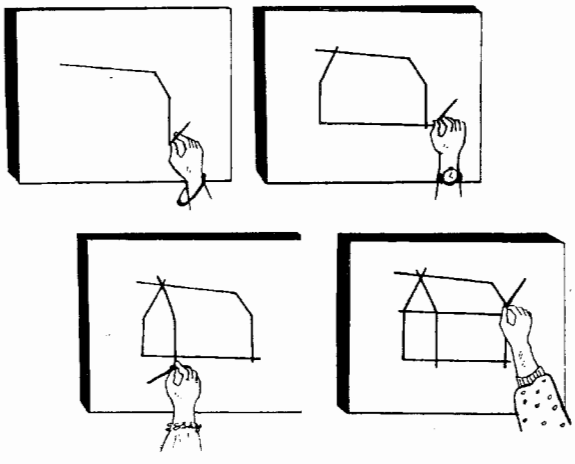
- To gain new experiences.
- To get training materials.
- Field visits to nurseries.
- Successful nursery raising.
- To see women from other districts.
- Project expansion.
- Exchange of views, ideas and knowledge.
- Tree management.

Sample Output

Strengths	Weaknesses
Guiding and teaching children	Inferiority complex
Handicrafts	Suspicious
Flower nursery work	Gossiping
Care of farm and house	Restricted property rights
Care of livestock	Impatience
Care of husband, aged and children	Shyness
More patience and tolerance	Cannot build houses
Sincere and hospitable	Poor in budget management
Family health care	Physically weaker than men
Kitchen gardening	

HOUSE BUILDING GAME EXERCISE

Each participant is asked to contribute one line to make a house on a flip chart. The lessons learned from this are summarized by the facilitator emphasising group action. Participants could employ the same methods in the village using locally-available materials in the absence of pen and paper.



Lessons Learned

- Unity is strength.
- Women should be mobilised and formed into groups.
- Different materials are required to make a house. Likewise, different ideas and talents should be merged together to make the State stronger.
- A single line cannot make a house.
- Like windows and doors for in and out movement, we have to exchange our ideas and knowledge for improvement.
- As the house needs a strong foundation, we also need good leaders.

GENDER ANALYSIS: EXERCISES

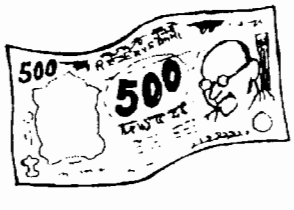
Access to and control over resources

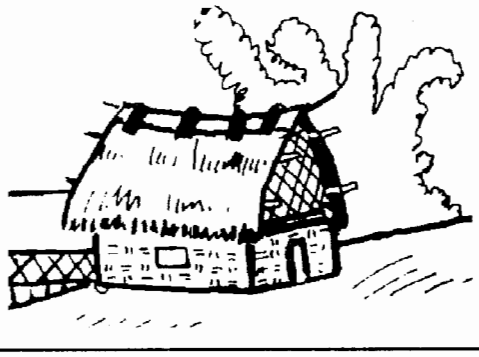
All resources available in the village are identified and written down on cards. Participants are asked to place the cards under three categories (man, woman and couple) depending on who has access and control.

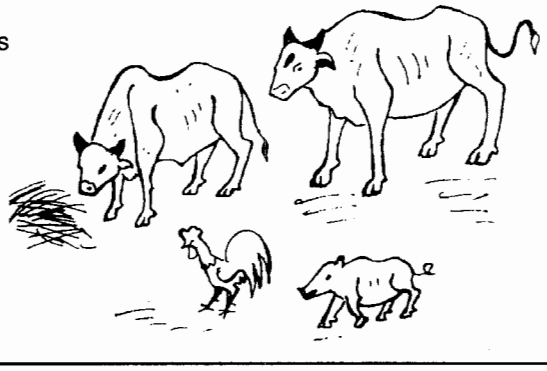
Sample Output

Access to and control over resources

Man	Woman	Couple
House	Money	Livestock
Vehicle	Jewelry	Farm
Land	Fruits and vegetables	Utensils
Furniture	Water (use)	Agricultural tools
	Clothes	Timber/wood
		Rice
		Handicrafts







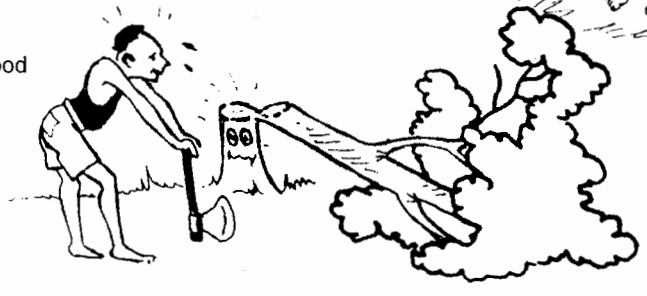
Task analysis

The tasks undertaken in a village are identified and written down on cards. Participants are asked to place these cards under three categories (man, woman and couple) according to who does the task.

Sample Output

Task analysis

Man	Woman	Couple
House construction	Washing clothes	Teaching
Furniture making	Cleaning the house	Praying
Cutting trees	Weaving and knitting	Recreation
Ploughing	Cooking	Travelling
Tree plantation	Child care	Church service
	Weeding	Meeting
	Sowing	Gardening
	Care of flowers	
	Cleaning	
	Marketing	
	Care of livestock	
	Collecting fuelwood	
	Seed selection	



Decision-making

Key decision makers in the village are identified. Issues for which decisions have to be made are also identified. Participants are asked to place the cards according to who makes the decisions. After these decision-making exercises, the actual status of women becomes very transparent.

Sample Output

Decision-making process

Man	Woman	Others
House purchase	Money use	**Village Development Board**
Sale of land	Crop selection	Development Planning
Sale of animals	What to cook	
Purchase of animals	Purchase of jewelry	**Village Council**
Sale of trees	Purchase of utensils	Boundary dispute
	Child education	Search for jhum land
	Selection of seeds to be planted	

EVALUATION OF SELF-CONFIDENCE

An exercise is conducted to evaluate the degree of self-confidence of women. The participants are asked to vote whether they are timid, shy or bold to participate, discuss and challenge in meetings.

Sample Output

Three categories of women were identified:

1. A woman who is too timid to attend the meeting.
2. A woman attends the meeting but too shy to participate.
3. A woman attends the meeting, participates actively in the discussion and challenges ideas in meetings.

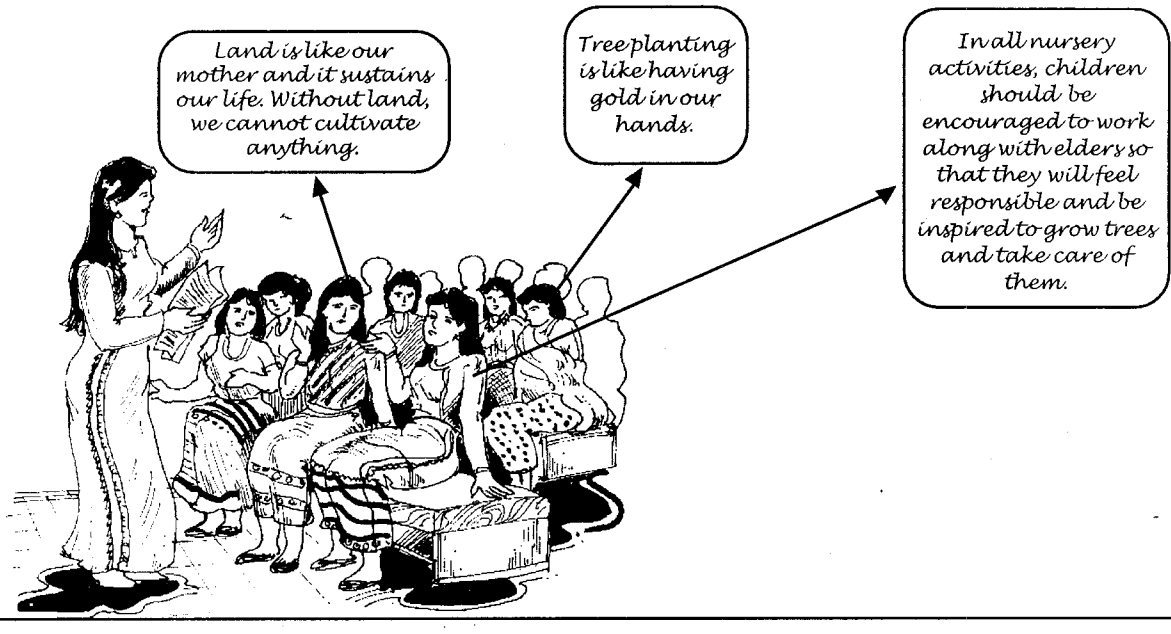
Participants' Ranking

Categories	1	2	3
Responses	0	10	13

BRAINSTORMING

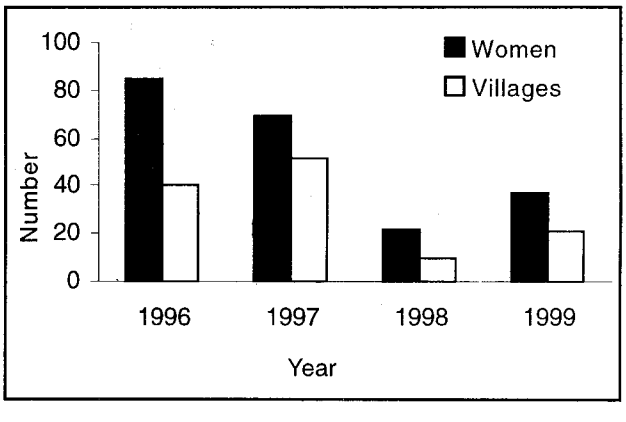
Brainstorming sessions are conducted to collect views of participants on specific topics such as land and trees.

Sample Output



IMPACT

- During 1996 to 1999, a total of 213 women from 123 villages received Basic Empowerment Training.
- After the programme, the participants were confident, self-reliant and learned to take part in decision-making.
- Women have learned to take action to ensure their legal rights. In Peren, three women won a case related to field destruction by stray cattle. A compensation of Rs. 500 each per cattle was paid to the women. Also, cattle owners were warned to keep a close watch on their cattle to prevent from further straying.



Basic Women Empowerment Training

The fine (Rs. 1,500) collected was used in the construction of a fence.

- Women's groups have established Women's Credit Programmes with support from NEPED. The proceeds from the sale of saplings are used to help each other during financial crises.
- So far, government and non-government organisations have given minimal support to bringing women at grassroot levels in Nagaland to have in-depth discussions on gender issues or sensitisation. NEPED is the first organization to address gender-sensitive issues in Nagaland and has already contributed to the gradual improvement of the socio-economic development of women.

What some women said after the training programme!

"From now on, I will treat both my sons and daughters equally for property inheritance".

"In our family, we only have daughters. We have never thought of what will happen to our father's land and landed properties after he dies. Now, I am fully aware on what I should do."

"To protect our environment, all women should plant at least one tree each."

"Although I am a Village Development Board (VDB) member, I never participated in the meetings and decision-making exercise. I always make tea during the meeting. But from now on, I will attend the VDB meetings and participate in the decision-making."

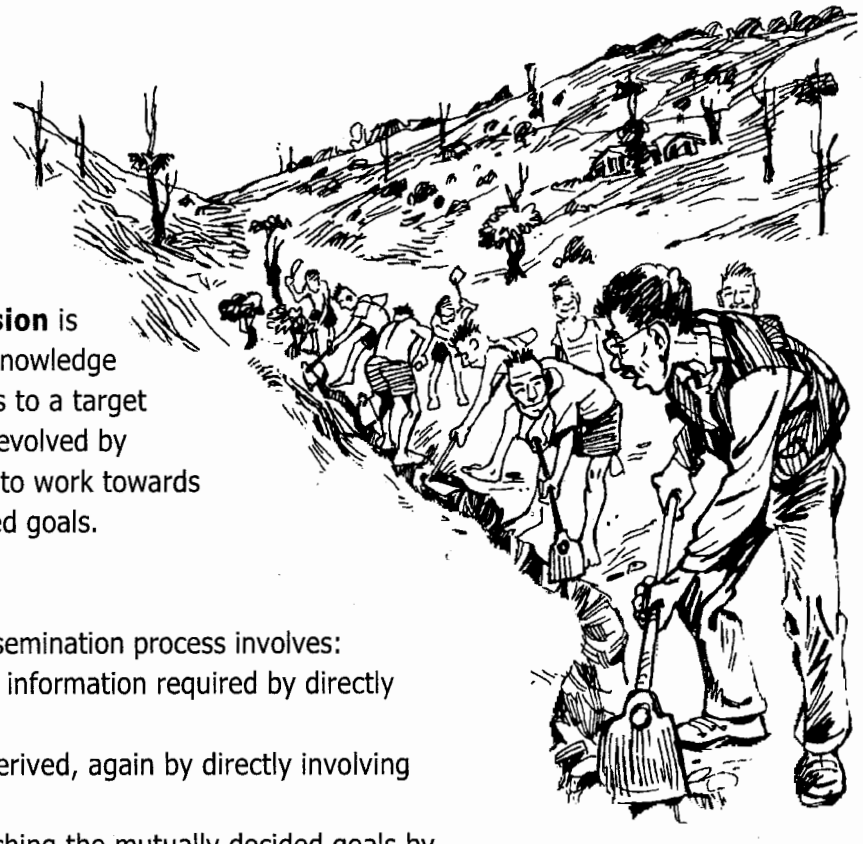
"Empowerment training is like the lid of the pot being opened."

"I have realised how much women work and have little control and decision-making power, and that too, only on small things."

Prepared by:
Chozhüle Kikhi

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

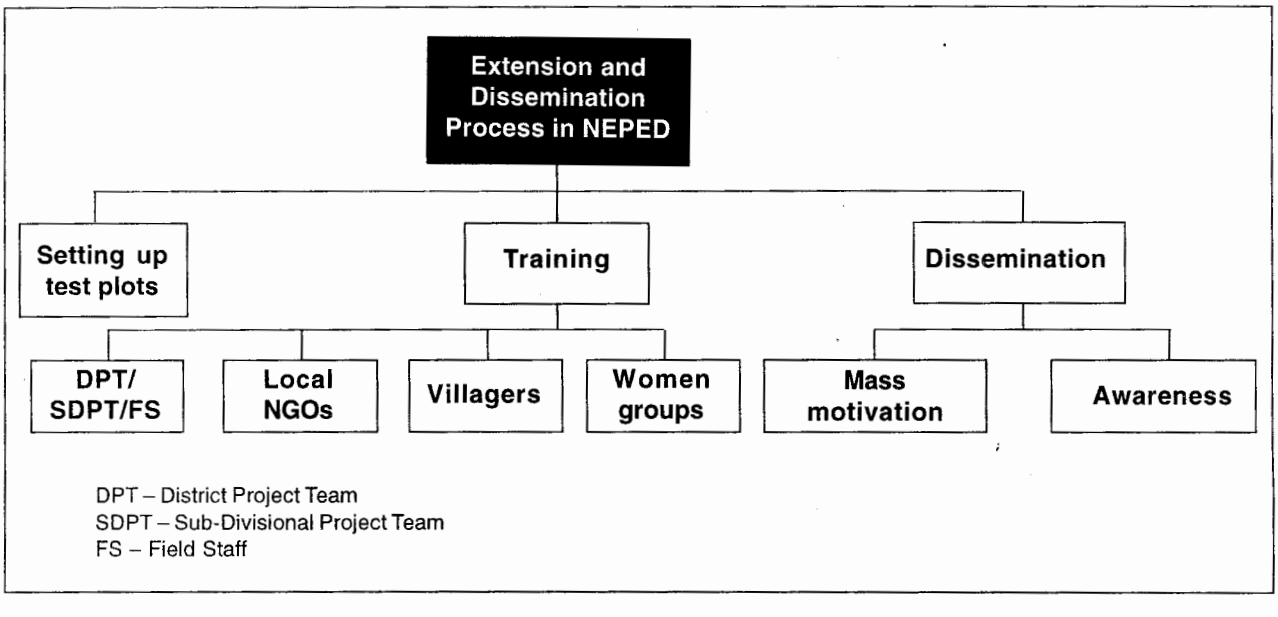
Participatory Extension and Dissemination



Participatory extension is the dissemination of knowledge and working principles to a target group. This has been evolved by involving and motivating them to work towards achieving the commonly-realised goals.

Participatory extension and dissemination process involves:

- generating and sharing the information required by directly involving the people;
- analyzing the information derived, again by directly involving the people;
- initiating steps towards reaching the mutually decided goals by planning;
- implementation and execution of the action planned; and
- management of the activities initiated through the process.



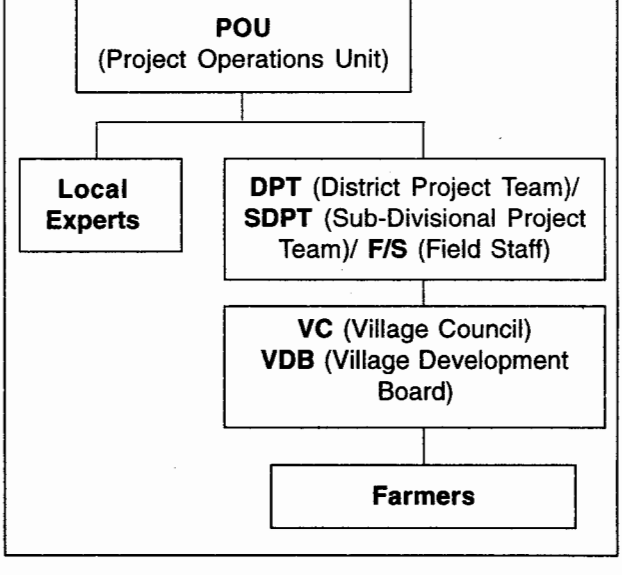
HOW PARTICIPATORY EXTENSION HAS BEEN USED IN NEPED

In Setting Up Test Plots

- All Project Operation Unit (POU) members meet every Tuesday to collate and share their experiences. Problems regarding the project are discussed and resolved, as each member contributes to the solution using his or her past experiences as the basis.
- Each district in Nagaland has two POU members assigned to implement the project. Strategies relating to the NEPED activities are evolved, by first evaluating the pros and cons among the POU members, and then consulting with the Chairman of District Project Team (DPT). These strategies and recommendations are discussed in the DPT meeting, where it decides as to whether these plans can be implemented in their district, after taking into account the prevailing situation.

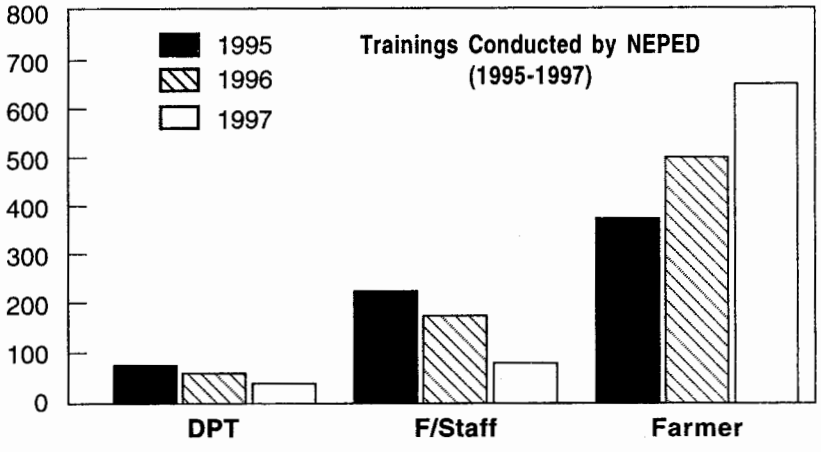
- NEPED collaborates with the traditional authorities in the village like the Village Council (VC), Village Development Board (VDB), *Gaon Burra's* (traditional village chieftains) and other elders. This is done through the DPT and field staff (FS).
- As per the NEPED guidelines, the VC and VDB have been given the power to survey and select the community group or individuals who shall establish the test plots.
- In keeping with the project requirements, the targeted farmers are left free to select the tree species, although planting local species is encouraged. Being a farmer-led project, the villagers execute the work under the supervision of the VC and VDB. POU provides the technical support and intervenes through the DPT, only when the farmer diverges away from the project guidelines.

Structure for Setting Test Plots



TRAINING

- While training farmers, villagers are encouraged to discuss the issues, problems and approaches that are needed to incorporate tree plantation with the traditional system of jhum cultivation.
- Women groups in villages are identified and training is conducted with emphasis on nursery management. The training also focuses on presenting a conceptual as well as operational understanding of the project to women and other groups in the villages.



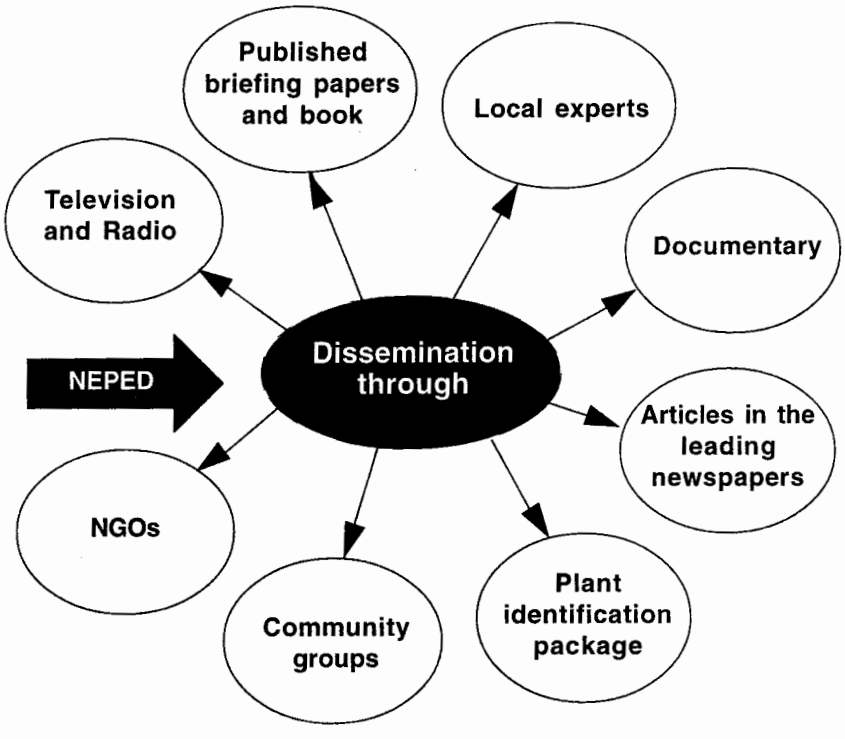
- Training using participatory methods has also been conducted in the empowerment and capacity building of rural folk. The idea behind this is to encourage these people to act as catalysts for other farmers.
- Most DPT/SDPT/FS were trained in the early years of the project and farmers training expanded overtime.
- The "core group" consisting around 150 officers drawn from various departments were given computer training.
- Most of the POU members had training, workshops, seminars in different fields at the state and national levels. Some of them went on study tours overseas, i.e., Indonesia, Vietnam, Laos, Thailand, Nepal, Costa Rica, Japan, China and Canada.

DISSEMINATION

NEPED has encouraged participation as a tool to reach out to student groups, churches, NGOs, women groups, tribal apex bodies *(hohos)*, etc., apprising them of the role of agroforestry in jhum. Efforts have been made to inculcate a sense of work culture, and NEPED has succeeded in creating awareness of the need to preserve and protect their natural resources.

Audio-visual and the print media have been used to create awareness among the general public. This has generated a lot of interest in the general populace to take up tree plantation, for commercial as well as domestic purposes.

Information Dissemination Strategies of NEPED



Suggestions for Effective Extension and Dissemination

- Projects should be watershed wise and not village wise.
- Agroforestry is an option with broad applicability in Nagaland.
- Training of project staff should be completed early in the project implementation.
- Project management staff should be empowered to take initiative and be responsible for accounts and records.
- Travelling allowances must be sufficient for the project's extensive field work.
- District level officers should be detached from normal department assignments.
- Exposure trips from district to district are necessary.

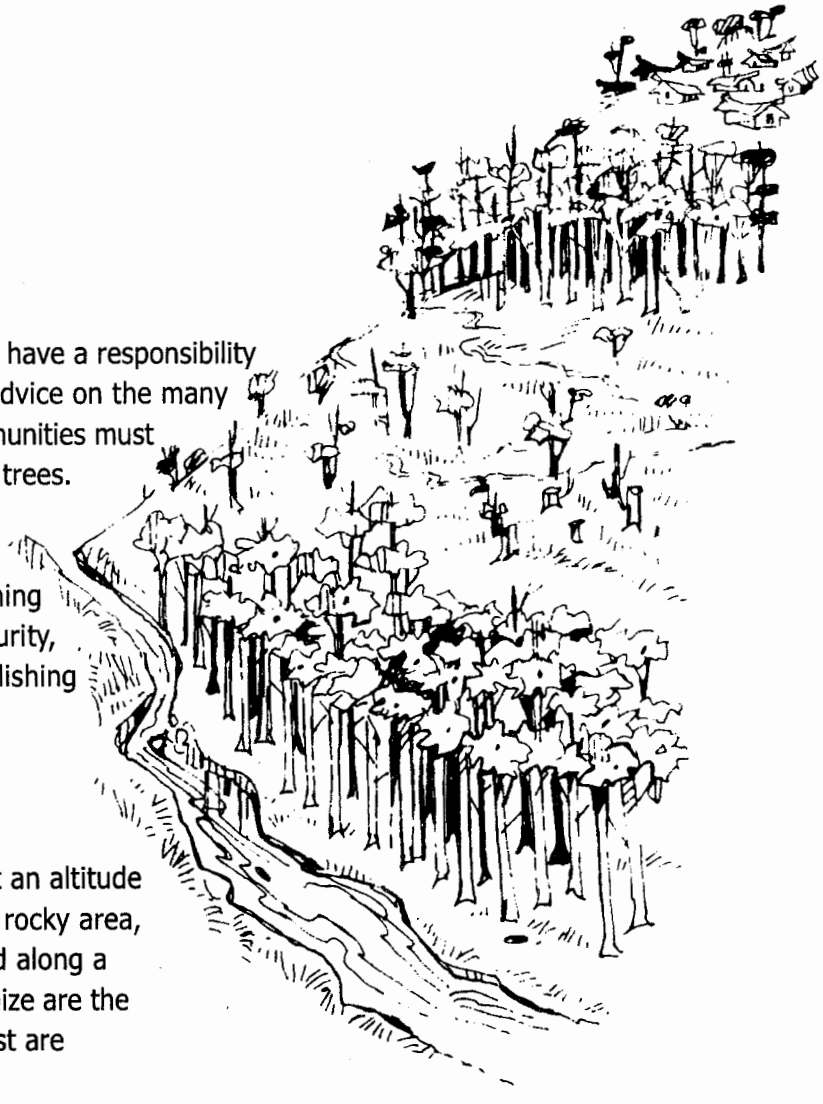
OUTCOMES

- Most villages in Nagaland have resolved to plant trees in their jhum fields.
- NEPED and other NGOs have organised workshops, seminars on environment protection and economic development at the grassroot level.
- Tree planting has been organised around the town and at the community land.
- A resolution on biodiversity conservation was also passed at the tribal level.
- Some government departments have incorporated tree plantation programmes.
- The year 1999 has been declared as the tree planting year by the Government of Nagaland.
- Recognition that village community funds can be used for income-generating activities has grown.
- Active communication between the project team and the farm owners has occurred.
- Sharing of knowledge between officers and farmers has accelerated the developmental activities.The clear proof are the test plots used for replication/adaptation.
- The importance of native species has come into focus.

Prepared by:
Ghukhui Zhimoni

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Extension: A Case Study in Balancing Community Needs



Agroforestry extensionists have a responsibility to provide high quality advice on the many things farmers and communities must consider before planting trees. The following case study, based on an actual village, illustrates a need for thorough and participatory planning and analysis of community food security, livelihood and culture prior to establishing tree plantations.

CASE STUDY

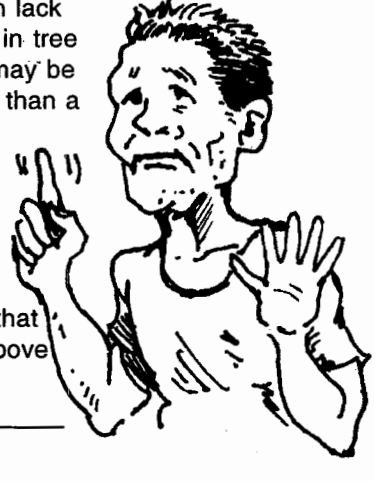
The village is located in Nagaland at an altitude of 1150 m. While the village is on a rocky area, it is endowed with ample fertile land along a river some 11 km away. Rice and maize are the staple foods of the villagers and most are dependent on jhum cultivation.

TREE PLANTING

In the early 1990s, the village began planting trees such as teak (*Tectona Grandis*) and gomari (*Gmelina arborea*) inter-cropped with rice and mustard along the river valley. The objective was to improve the economic conditions of the villagers through planting these high-value timber species on the fertile land available to the village.

Lesson 1

Village leaders and other local elites can be important initiators and supporters of tree growing but they often lack technical background in tree management. They may be more inspired by zeal than a full consideration of community needs, wants and expectations. People in the village are always enthusiastic to implement schemes that promise to lift them above subsistence.

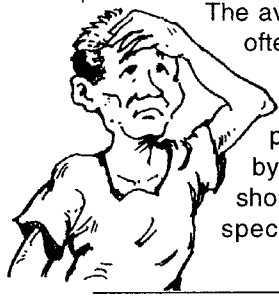


Lesson 2

A comprehensive resource assessment may have revealed additional potential for higher altitude species (e.g. hollock, alder, poma, mandani) in jhum fields above 750m.

The villagers took up the scheme with keen interest in the hope of huge potential income. Each and every household began planting teak along the river at an altitude of 400m and gomari on the higher altitudes up to 750m. Few trees were planted above this.

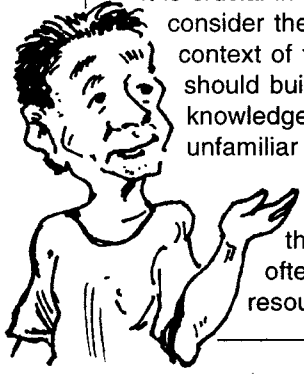
Lesson 3



The availability of planting materials is often a constraint to farmers planting trees. Some species, such as teak and gomari, are easily propagated at the community level by stumps and cuttings. Villagers should not neglect other useful species.

In the initial stages, planting materials were provided free of cost. Later on, the villagers continued their plantation programme by procuring planting materials from their own resources. Villagers estimate that they planted altogether not less than 2.0 million teak seedlings – in 1999 there were about 1.8 million trees standing in the river valley covering about 250 hectares of land. The plant spacing on these lands was quite close to reduce the need for weeding and other maintenance.

Lesson 4



It is crucial in the promotion of tree planting to consider the existing livelihood and cultural context of the communities. Tree planting should build upon existing economies and knowledge rather than introducing unfamiliar technologies demanding precious time and resources. Extensionist should be aware that subsidising new activities will often shift labour and other resources from other farm activities.

Neglected Orange Orchard

Prior to planting teak and gomari, the villagers had been subsidised to plant some citrus, mainly orange saplings in the area. Plantings ranged from 100 to 600 trees for each family. The soil was suitable for citrus cultivation and some villagers also planted saplings in their home gardens. During 1995-97, the villagers could sell a good quantity of the fruit in the local market.

In their hot pursuit of high-valued timber species, the villagers did not maintain their citrus and production of oranges fell drastically. Substantial cash investment was required to rebuild their gardens. The citrus orchards are still below potential.

When asked why they did not utilise Village Development Board (VDB) funds for citrus maintenance, they said that the schemes do not fit into the model schemes of the Rural Development Department.

Lesson 5

Extensionists should be fully aware of the various government and non-government programmes accessible to communities. VDB funds are now available for certain tree planting activities although this was not an option for the villages until recently.

Mustard as an Inter-crop

While the teak and gomari trees were small, mustard was intercropped along with trees until 1995. During these years, the villagers could produce and sell bulk quantities of mustard seeds in the local market. The villagers even processed mustard oil to sell. From 1995, the trees (particularly the teak) attained canopy closure and cultivation of mustard became unproductive. The villagers complained that nothing grew under teak trees. According to them, teak not only smothers the plants beneath but also damages soil fertility. The villagers finally abandoned mustard cultivation.

Lesson 6

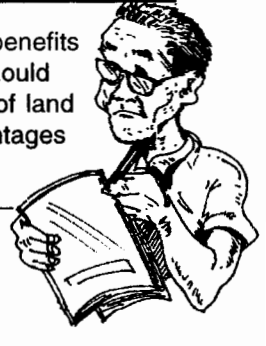
Short-term benefits are important in establishing long-term tree crops. While tree plantations are growing, shade tolerant cash crops can be interplanted and livestock grazed to provide ready cash. Canopy closure often occurs two to three years after establishment and intercrops are no longer possible.

Land allotment

Land tenure systems in Nagaland vary from tribe to tribe and even among the same tribe these may differ from village to village. In the village, the land generally belongs to the community. For the tree plantations, however, the Village Council decided to allot ownership to each family based on the extent of the area planted by the family. This allowed the more wealthy villagers to plant widely and so claim much larger areas than poorer villagers. It also encouraged the use of tree plantation as a means of claiming the most fertile land.

Lesson 7

Land tenure is crucial to maximise benefits from tree cropping. Extensionists should become familiar with local systems of land ownership and recognise their advantages and drawbacks.



Present Situation

Most of the fertile lands are now occupied by teak plantations with few areas left for cultivation. This has caused large numbers of villagers without secured government jobs to seek alternative employment such as labouring or petty contract jobs to make ends meet. Despite people migrating from the area, the jhum cycle has still decreased from 15 to 10 years as a result of less fertile land being available for crop cultivation.

Lesson 8

Participatory planning can assist in rationalising and optimising community resources. Planning prior to tree planting should consider food security, livelihood and other community needs. In this case, intercropping trees into the jhum fields may have provided more sustainable and flexible food production. Fertile land should generally be retained for food crops.

The villagers are convinced that they will reap a fortune once the trees are harvested after 15 years but are also concerned about their food security until then. Food security should be protected by reserving fertile land for food crop cultivation and developing agro-forestry in a way that permits mixed feud-free crops whenever possible.

Prepared by:
Mukul Chandra Acharyya and Vizonyu Liezie

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Use of Indigenous Knowledge in NEPED

Indigenous knowledge is a valuable resource that exists within a society. Any development initiated in that society should combine conventional know-how and modern techniques with local wisdom. Such development should build upon the indigenous customs and practices of the local populace, and not simply substitute them with modern methods. Incorporating indigenous knowledge into a project also facilitates the empowerment and participation of the local people. In order to do this, a clearer understanding of their background and culture is vital.

INDIGENOUS KNOWLEDGE OF THE NAGAS

The cultural diversity of Nagaland makes it important to be aware of the local customs and practices, as different tribes have different ways of doing things. One thing though that they have in common, is the close relationship they share with nature, and their cultures are deeply rooted to the biodiversity of the land.

Cultural Diversity

- There are 16 officially recognised tribes and numerous sub-tribes in Nagaland. Each tribe and sub-tribe has its own unique set of customs, practices and beliefs. This diversity is reflected in the different designs and motifs on their shawls, baskets, machetes (*daos*), etc; the design distinctly identifies the tribe.
- More than 25 language groups co-exist within the state in over 1000 villages under different geographical and climatic conditions.

DECLINE OF TRADITIONAL KNOWLEDGE

Over the last 20 or 30 years, traditional knowledge is gradually being forgotten due to a number of reasons, some of which are as follows:

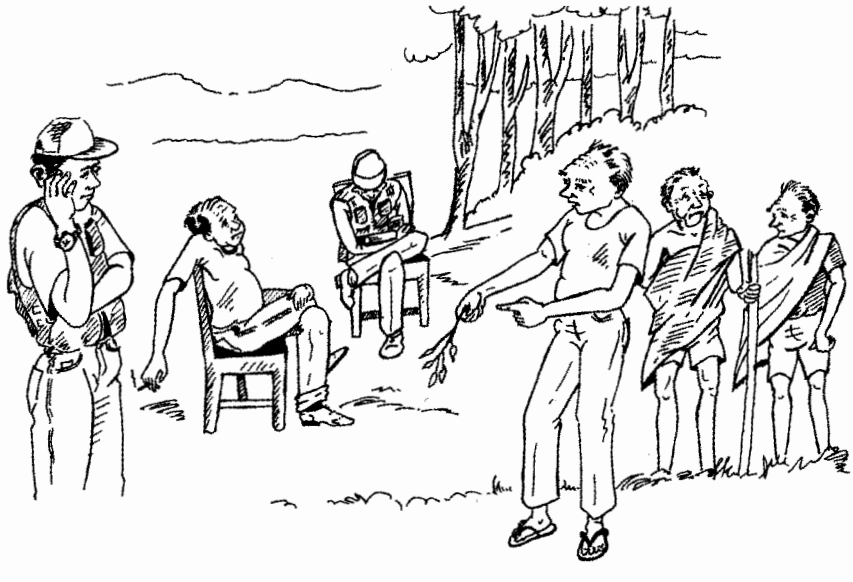
- Lack of written history or any other form of documentation.
- Introduction of modern technology in the rural areas.
- Increase in the educational level has resulted in more people looking for jobs in the towns.
- Increase in the population has lowered the 'carrying capacity' of the land. More people have become dependent on the land that they possess. This has prompted the introduction of "modern" methods, often at the expense of traditional knowledge.

"LOCAL EXPERTS" IN NEPED

Based on this rationale, NEPED introduced the concept of having 'local experts' assist in project activities. These experts share their wide range of indigenous knowledge with NEPED officers in implementing project activities and facilitating interaction between the communities. This is a unique strategy where indigenous knowledge is being used to complement scientific facts and facilitate NEPED's operations. The "local experts" are a group of knowledgeable and respected men, drawn from various tribes, and are representative of the cultural diversity of Nagaland. There are thirteen local experts in NEPED and they are often referred to as NEPED's "human data bank".

Question Posed by NEPED to Local Experts

"HOW DOES NATURE INDICATE THAT IT IS TIME TO START PLANTING TREES?"



Local customs may differ but these are based on the same environmental observations, e.g., the time for spring plantation.

Taku	:	When new shoots are emerging from trees that have no latex.
Pusazo	:	When the Cuckoo bird begins to sing.
T. Lotha	:	When the Bauhinia's flowers begin to fall, there will be rain. That is the best time to plant trees.
Zachini	:	When new leaves start to emerge on plants that shed leaves in winter.

A Problem Faced by NEPED

"How to prevent alder saplings from dying when transplanted from a wet nursery to a dry field and vice versa?"

SOLUTION OFFERED BY THE LOCAL EXPERT

Follow these steps:

- When transplanting alder saplings, uproot carefully and soak the roots in sprinkling water for a month. The old leaves will fall and new leaves will begin to emerge. The new roots will turn reddish.
- Plant in the field by firmly pressing the soil around the stem with your thumb so that air cannot penetrate into the ground. The saplings will survive. The same effect can also be achieved by packing the uprooted saplings in a moist Hessian cloth."

CONTRIBUTIONS OF LOCAL EXPERTS

The local experts in NEPED have helped to revive interest in the indigenous knowledge of the Nagas which was on the verge of being forgotten. The immediate impact of this has been in the following areas.

- Attention has been refocused on the preservation, regeneration and multiplication of indigenous species of plants.
- The local experts, being leaders at the grassroots level, have helped in adopting a bottom-up approach in the communities.
- Village nurseries have started marketing local species of trees. Species that were earlier found only in certain areas are now being grown in other parts of the state as well (germplasm exchange and transfer).
- Knowledge of the medicinal value of plants has been revived.
- The local experts have been instrumental in improving relations between the NEPED staff and farmers.
- NEPED has received vital feedback on project activities.
- Motivation and training of farmers by local experts has helped NEPED's project activities.
- Local botanical knowledge has been better linked to the formal study of botany in Nagaland.

Prepared by:
Raj Verma

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

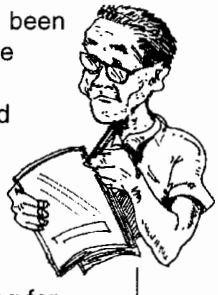
Improving the Effectiveness of PRA Methods

Participatory rural appraisal (PRA) belongs to a growing family of approaches and methods enabling local people to share, enhance and analyse their knowledge of life and conditions, making them plan and act accordingly.

- PRA depends on facilitators acting as conveyors and catalysts, but without dominating the process.
- PRA is a tool, and not an end in itself. It has often been misconstrued to be a substitute for the development process itself, which it is not. This misconception is fairly common among planners, especially those in the government.
- PRA methods are fast in assessing the situation, but do not offer quick solutions or short-cuts in reaching the objectives.
- PRA can never be given a specific time frame as it is difficult to anticipate the outcomes of a PRA exercise or to envisage where it will lead to or where it will end.
- PRA involves the people by taking their views into account and enabling them to participate in the development process.

NEPED's Use of PRA Methods

In NEPED, PRA has been extensively used. The methods have been mainly ad hoc, based on local situations, most of which were not so deliberate.



Example:
Research staff probing for details from an indigenous "medicine man", over a cup of tea, sitting in his kitchen in the evening after he has returned from the field, or a POU member joining the villagers in walking to their jhum fields, discussing various aspects of jhum, in an animated conversation.

Behaviour and attitudes

- Build good rapport with people.
- Approach the people without any preconceived notions.

Facilitation

- Enable people to investigate, plan and analyse.
- The more people participate, the greater the chances of success.

Flexibility and innovation

- Allow methods to "flow" and evolve continuously.
- Do not use fixed jargon and methods to cloud the "bigger picture".

Basic Principles of PRA

Sharing

- Sharing must be a two way process ranging from experiences to resources and data collection.
- The wider the base, the stronger the foundation.

Critical self-awareness

- Learn to understand your attitude and behaviour.
- Learn and accept your shortcomings to earn the people's respect.

Source: Robert Chambers

NEPED HAS USED PRA FOR:

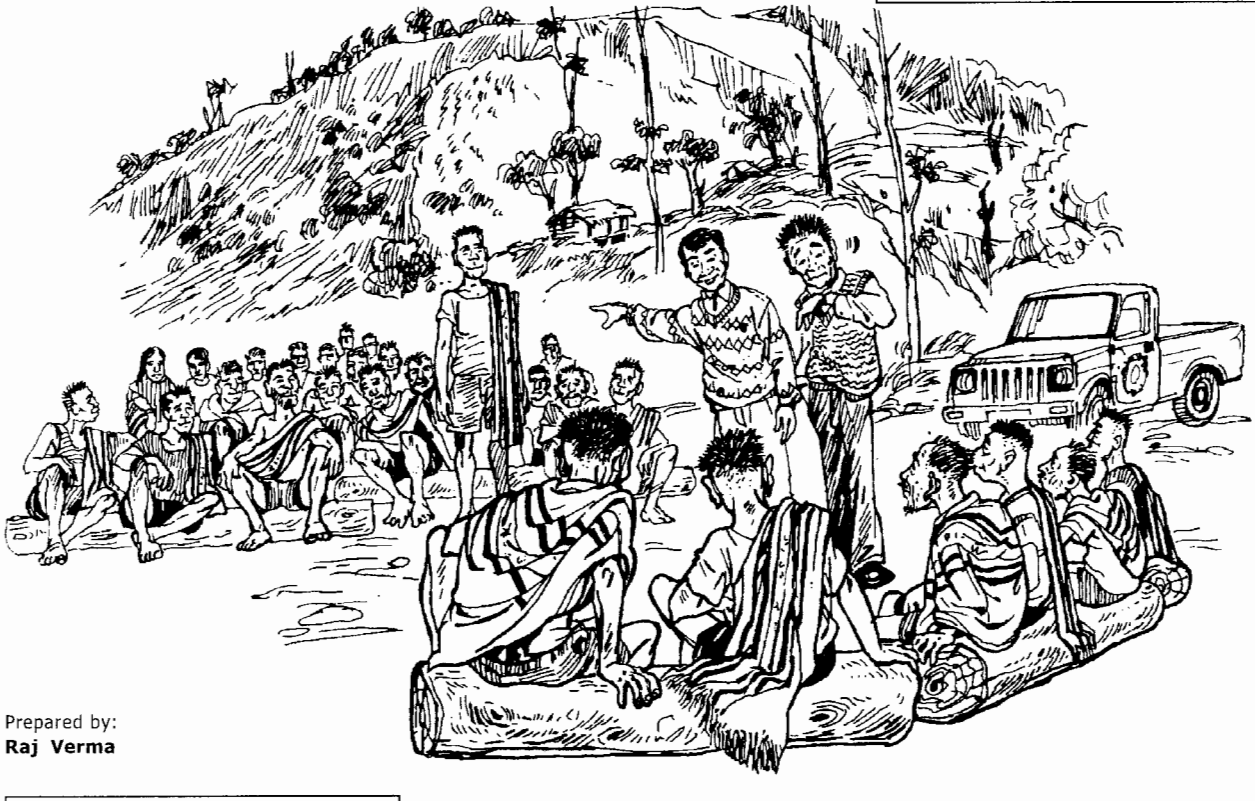
- **Empowering the poor and the weak.** The project has encouraged people to analyse conditions, building their confidence to state and assert their priorities for sustainable and effective participatory programmes.
- **The project process.** Identification, appraisal, planning, implementation, monitoring and evaluation of project processes.
- **Direct learning and updating.** Compiling and recording database on project activities, comparative studies, etc.
- **Training.** Dissemination and mass motivation programmes with various groups in the villages and towns.
- **Exploration.** The project consciously learned about the conditions that exist in a district or range, creating awareness about the project activities and subsequent benefits.
- **Research.** The project identified priorities and initiated participatory research, recording indigenous knowledge, the varieties of flora, crops, etc.
- **Policy review.** Policies are changed and adapted through timely, accurate and relevant insights.

LESSONS LEARNED

- Difficulty in identifying the target groups and enabling them to participate without too much interference from the village hierarchy.
- Rushing under time constraints to get results, often at the cost of limited participation by the villagers.
- Find the right questions to ask! It is often assumed that one knows what to ask, until the moment arrives.
- Avoid lecturing and imposing ideas. Listen, watch and learn.
- Rigid approach in project activities leads to limited participation.
- Full representation and participation of women is needed especially when implementing gender-based programmes.
- It is important to spend time in the field, preferably spending nights in the village.
- Be wary of consultants who claim but lack expertise, and do not understand the need for fundamental changes in their behaviour and attitudes.
- Attempts at a large-scale implementation of PRA in a blueprint mode by donors, without realising that PRA is already in use should be discouraged.

Remember

- **Do not lecture, dominate, interfere or interrupt.**
  This sounds easy. It is not. We tend to be habitual interrupters.
- **Ask open-ended questions**
  Not those that have simple "Yes/ No" answers.
- **Show interest and enthusiasm**
  Try to learn from the people.
- **Embrace error**
  "Okay, so that was a mistake we made. Now what can we learn from it?".
- **Do not carry out discussions for too long.**
  Stop before people get tired.
- **Use the six helpers –**
  Who, what, where, when, why and how?
- **Keep your schedule flexible**
  Sometimes, villagers need more time to refocus.

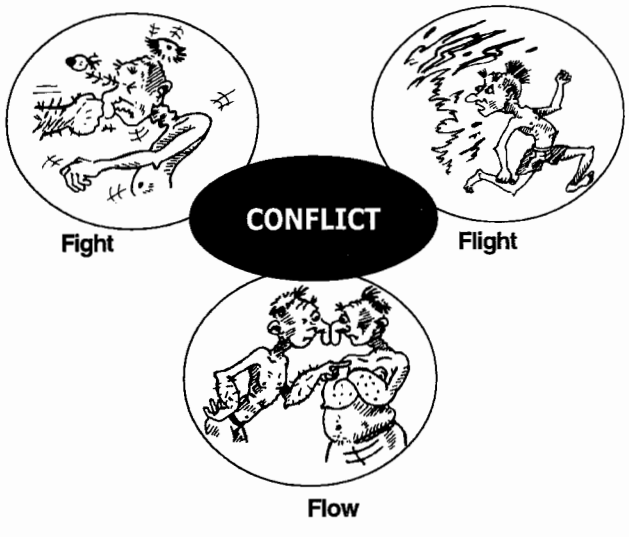


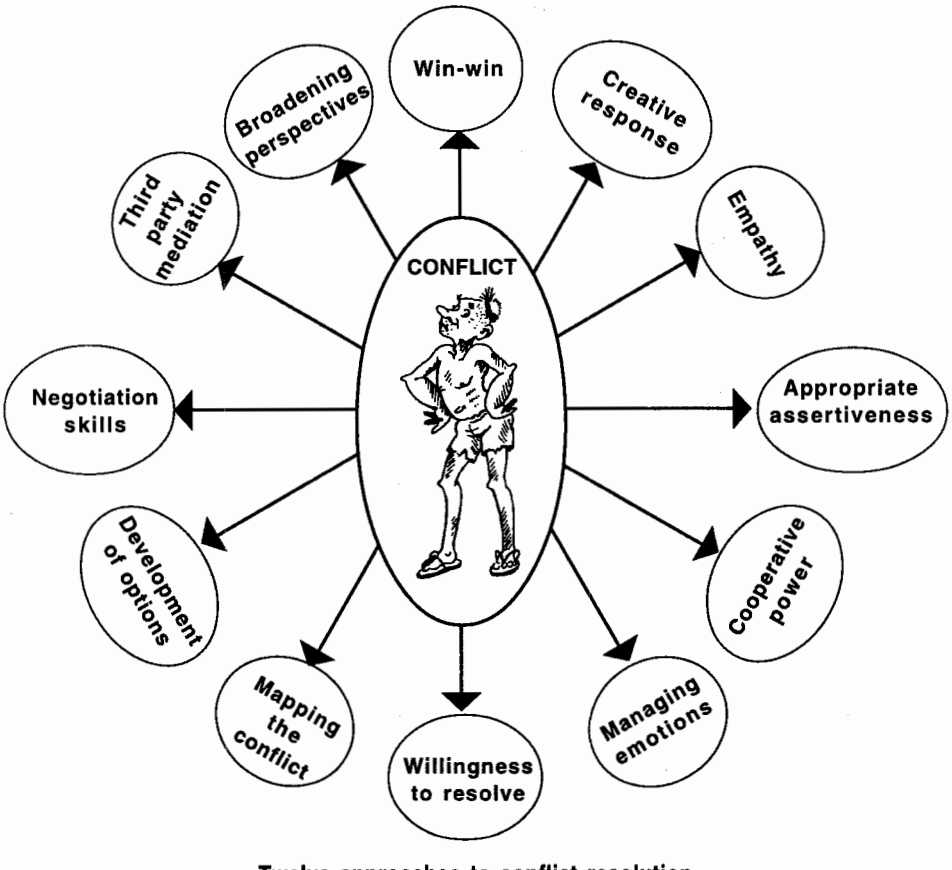
Prepared by:
Raj Verma

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Conflict Resolution Skills in Project Management

A commitment to conflict resolution creates a good working environment and improved human relationships. For project managers, especially in a multi-dimensional project area, skillful conflict handling is an important managerial tool. Conflicts can be of three types: fight, flight and flow. The third type, flow, requires conflict resolution skills and some approaches to conflict resolution are described.





Twelve approaches to conflict resolution

PROCEDURE

Each of the 12 approaches for conflict resolution covers a vast area of study.

It is important to understand what exactly the problem is. Confront it in your mind, and then address the following questions, depending on which approach best suits the problem or is most likely to resolve the conflict.

A set of questions is given below against each approach. These can be utilised by managers to resolve conflicts that they may face within a project.

REMEMBER!

Conflict resolution does not provide solutions to the problem in itself, but creates the basis towards reaching a solution that is friendly, acceptable and sustainable.

CONFLICT RESOLUTION APPROACHES

WIN-WIN

(I want to win, I want you to win too.)

- What is my real need here?
- What is theirs?
- Do I want it to work for both of us?

CREATIVE RESPONSE

(We can get something good out of this.)

- What opportunities can this situation bring?
- How can I capitalize on it?

EMPATHY

(I think I can understand why they feel strongly about this.)

- What is it like to be in their shoes?
- What are they trying to say?
- Have I really heard them?
- Do they know I am listening?

APPROPRIATE ASSERTIVENESS

(Be soft on the people, hard on the problem.)

- What do I want to change?
- How will I tell them this without blaming or attacking?
- Is this a statement about how I feel, rather than what is right or wrong?

Cooperative power

(It is our problem, not theirs or mine.)

- Am I using power inappropriately?
- Are they?
- Instead of opposing each other, can we cooperate?

Managing emotions

(Maybe I am taking this as a personal attack.)

- What am I feeling?
- Am I blaming them for my feelings?
- Will telling them how I feel help the situation?
- What do I want to change?
- Have I removed the desire to punish from my response?
- What can I do to handle my feelings? (Write it down, talk to a friend, or punch a mattress.)

Willingness to resolve

(Maybe I just do not like the person.)

- Do I really want to resolve the conflict?
- Is resentment caused by something in my past that still hurts?
- Is resentment caused by something I dislike in them, because I will not accept it in myself?

Mapping the conflict

(Maybe my approach is wrong.)

- Define briefly the issue, the problem area, or conflict in neutral terms that is agreeable to all and that does not invite a "yes" or "no" answer; e.g., address the problem as "planting" and not as "should I supervise the planting?"
- Prepare a map (chart) about this defined problem.
- Be prepared to change the statement of the issue, as your understanding of it evolves through discussion.
- Also, draw other maps of related issues that may arise.

The Conflict Map

Issue: Define the issue
Who: Name each important person or group involved.
Needs: Identify the needs of each individual or group.
Concerns: List down the concerns or fears of each individual or group.

DESIGNING OPTIONS

(Well, I may not get all I want, but neither will they.)

- What are the possibilities? What seems impossible might yield good ideas.
- What options give both of us more of what we want? Be creative, mix and match.

NEGOTIATION SKILLS

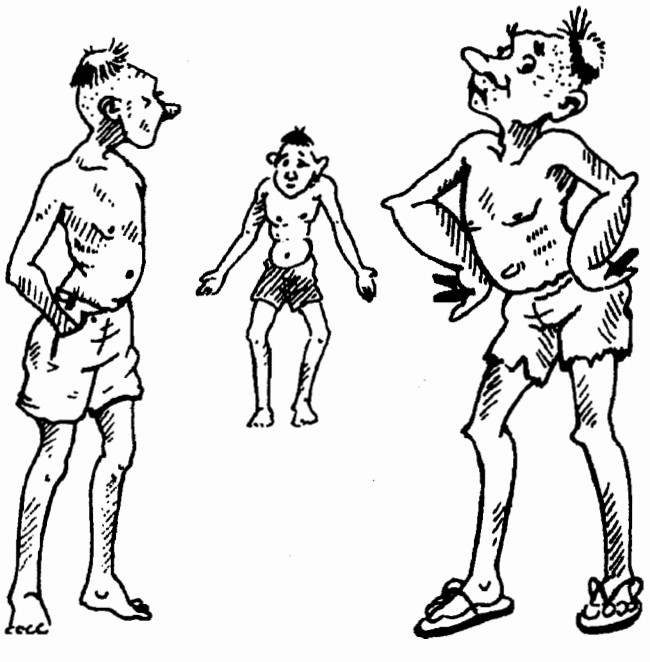
(OK! So I concede points, but I reach the goal.)

- What do I wish to achieve? (Be really clear about the general outcome, though you may change your route.)
- How can we make this a fair deal, with both people winning?
- What can they give me?
- What can I give them?
- Am I ignoring objections? Can I include them?
- What points would I want covered in an agreement?
- Is there something that could be included to help them save face?
- Is saving face important to me? Do I particularly need anything?

MEDIATION

(Maybe we need someone else to help us.)

- Can we resolve this ourselves or do we need help from an unbiased third person?
- Who could take on this role for us?
- Is mediation the most appropriate role for me? If so:
  - How would I set up and explain my role to both parties?
  - Can I create the right environment for people to open up, understand each other and develop their own solutions?
  - What might help?



BROADENING PERSPECTIVES

(It is not my view that counts, but ours.)

- Am I seeing the whole picture and not just my own point of view?
- What are the effects of this beyond the immediate issue on other people or groups.
- Where might this lead in the future?

REMEMBER!

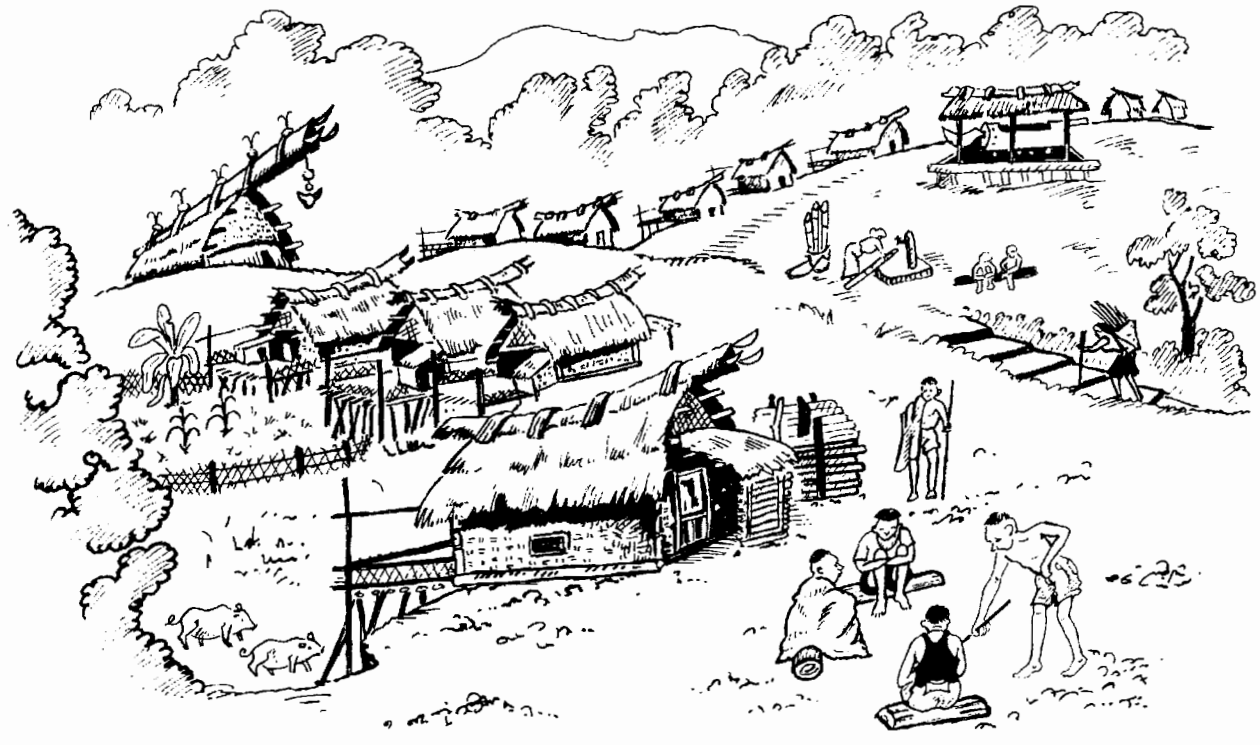
Winners do not **do different things**, they **do things differently**.

– Shiv Khera

Prepared by:
Raj Verma

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Guidelines for Culture-sensitive Project Implementation



- The project area should be within a specific cultural and ecosystem zone so that there is uniformity in implementation. Hence, there would be standard solutions to a similar set of issues. But remember that needs and solutions are often different.

- Study, analyze and learn the cultural background, local systems and customs, biodiversity and past experiences of the project area. The project should conform to the social fabric of the culture zone.

- Appreciate and acknowledge the fact that farmers have an innate and inherent instinct for survival. Hence, they have an intimate relationship with their environment. This is their major strength.

- The project must be unique to win the farmers' attention. Project activities should be diverse, promoting financial or social incentives and must fit into the farmers' daily routine.

- Identify the traditional or community-based institutions that can be the agents of change. Every social structure has its own set of institutions that have cultural and social acceptance. These should be utilised to implement the project objectives, whenever possible.

- To implement the project, carefully screen and select individuals by involving the local communities to ensure that role models are created.

- From the inception of the project, involve the community, as much as possible, in all activities and decisions. The community must feel that they "own" the project.

- Sustain the interest of the farmers by introducing or pointing out innovations over the project period. Keep reminding them that this is due to their good work. Remember, they have a short attention span when disinterested!

- Have a flexible plan of action, and the ability to make changes at the local level by involving the community directly.

- Build upon the strengths of the farmer. Integrate traditional knowledge with components of proven technologies for improvement at farm level.

Prepared by:
Raj Verma

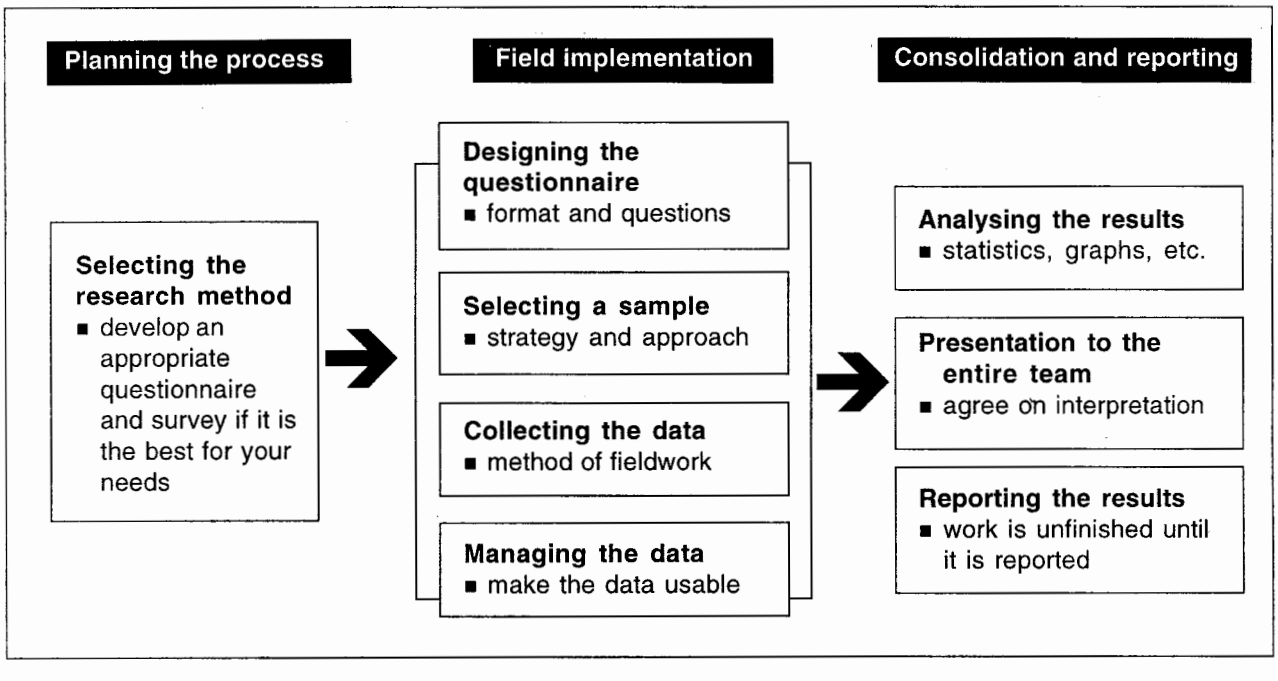
Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Conducting Surveys

Collection of information on project impact is often very difficult. This is especially the case in Nagaland where difficult terrain and a limited communications network affect the number of site visits that can be made and the time spent at each site. In some cases, a sample of project sites can be selected and formal questionnaires can be used to collect information.

The NEPED project conducted a survey in order to assess several specific project impacts. Although NEPED has almost 1800 project sites, it was possible to get good results from a small randomly selected sample.

The Survey Process



DECIDING ON THE RESEARCH METHOD

Researchers have different options for collecting information in the field such as:

- focus group interviews;
- field observation;
- log book records that farmers can fill up;
- participatory rural appraisal (PRA); and
- formal questionnaires.

Carefully select the method that best suits your needs keeping in mind:

- how the information will be used;
- the budget resources available;
- your analytical resources; and
- that subjective data are also important.

DESIGNING A QUESTIONNAIRE

1. Carefully plan your data needs including quantitative and/or qualitative information.
2. Make a draft of sections of your questionnaire, along with sample questions.
3. Meet with your team and discuss the entire questionnaire, item by item.
   - The first section should include background information like the name of the person being interviewed, the interviewer, location, age, education, date, etc.
   - The following sections should then cover the main information needs.
4. Revise and put it in the format that will be used in the field. Then check it thoroughly.
5. Pre-test the questionnaire on people like the ones you will include in the survey, and revise the questionnaire accordingly.

Hints for Designing Questionnaires

DO

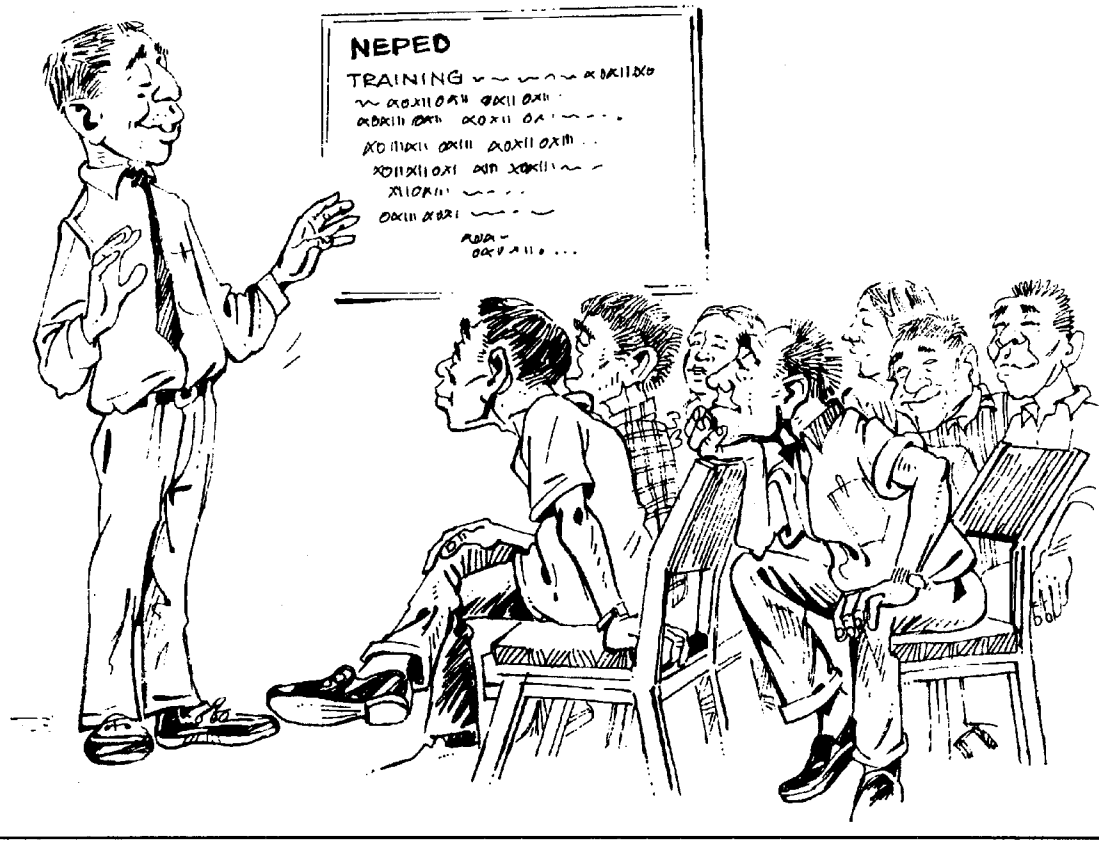
- Check the sections and questions to make sure you are getting the information you need.
- Use only necessary questions because time is valuable (both yours and the respondent's).
- Use clear easy-to-understand language.
- Choose a format that can be easily filled up in the field.
- If local dialects will be used in the field, use words or questions that are easy to translate.
- Pre-test the questionnaires.

DON'T

- Use leading questions.
- Ask questions requiring more than one answer.
- Start the questionnaire with controversial or difficult questions, save them for last.
- Forget to include a space to record non-responses on the questionnaire.

Development of the NEPED Questionnaires

Questionnaires were developed by the project team and pre-tested under actual field conditions. Field officers were trained in questionnaire methods and translations were agreed upon prior to leaving for the field. Pre-testing revealed problems in the questionnaire design, which were corrected. English was the main language but translation was made in the field. In most cases, questions and answers were done in Nagamese.



Selecting A Sample

1. The sample must be accurate, but also possible to collect in the field.
2. There are two types of errors that normally affect your results: measurement error and sampling error.
3. There is a trade-off between the two types of errors; when one goes up, the other goes down.
4. Random sampling strategies are best suited to most survey needs, helping avoid bias and allowing smaller samples.
5. Simple selection rules, like selecting names from a hat, often work well.
6. Sampling procedures can be very complex, so it is best to consult an experienced statistician.

Errors Affecting Survey Results

Sampling error - In a random sample, several non-typical cases affect the results

Measurement error - When questioned, some exaggerate because they want to please the interviewer

Statistical sampling is a complex subject and many factors need to be taken into account. Whenever possible, consult an expert in surveys and statistics.

Hints for Sampling

DO

- Target the right people in the sample.
- Let the sample show the diversity in the study population.
- Make sure the sample is large enough to be valid.

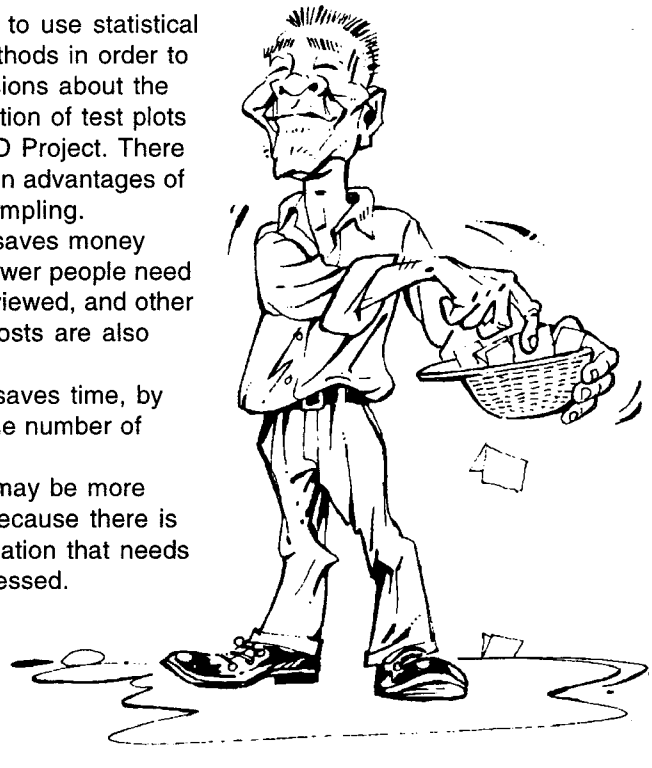
DON'T

- Select the sample to fit your biases.
- Believe that big samples are always best.

NEPED Use of a Statistical Sample

It is possible to use statistical sampling methods in order to draw conclusions about the entire population of test plots in the NEPED Project. There are three main advantages of statistical sampling.

- A sample saves money because fewer people need to be interviewed, and other research costs are also reduced.
- A sample saves time, by reducing the number of interviews.
- A sample may be more accurate because there is less information that needs to be processed.



COLLECTING THE DATA

1. Interviewers should be fully trained to administer the survey.
2. Check materials that will be needed.
3. Give sufficient notice to the villagers (interviewees).
4. Schedule for officers' visit.
5. Pre-fill background information.
6. Keep interviews to the people being interviewed.
7. Ensure that individual answers will remain confidential.
8. Ask every question in the same way and at same order.
9. Always thank the people being interviewed for their time and honesty.

Hints for Interviews

DO

- Be completely familiar with the questionnaire.
- Practice administering the questionnaire.
- Be sure about how words are translated into the local dialects.
- Use a pencil, not a pen, and correct errors immediately.
- Fill up all sections and never leave any blank responses.
- Make a note on the margin of any special interpretations that might be needed.

DON'T

- Schedule the interviews during inconvenient times.
- Rush through the survey.
- Skip over questions.
- Lead the person being interviewed with changes in tone or expression.
- Delay in submitting completed questionnaires for data entry.

NEPED Data Collection

In the NEPED survey, interviews in each selected village were conducted during a two-week period. Thorough training about how to administer the questionnaires helped ensure that all were properly completed in the field.

MANAGING THE DATA

1. A data base format should be first determined and set up using a good computer program (Quattropro, Excel, Lotus, etc.).
2. Decide on a consistent coding system for qualitative data. For example, if there are three possible answers (yes, no, don't know) they could be coded as 1, 2, 3 respectively.
3. Decide on a code for non-response (you will get some). Many researchers choose a number that will not otherwise be in the results like 99.
4. Fill up the complete data base using a few (2 or 3) completed surveys and then check that it is correct and meets all your data analysis needs.
5. Headings and questionnaire numbers should be clearly labeled, including units (if appropriate).
6. Maximise use of the computer to make calculations, not by hand.
7. Once convinced that the data base format is correct, enter all data.
8. Entry errors are inevitable, so the entire data set will need to be checked. Tests of reasonableness (such as means, ranges, charts) often help identify errors.

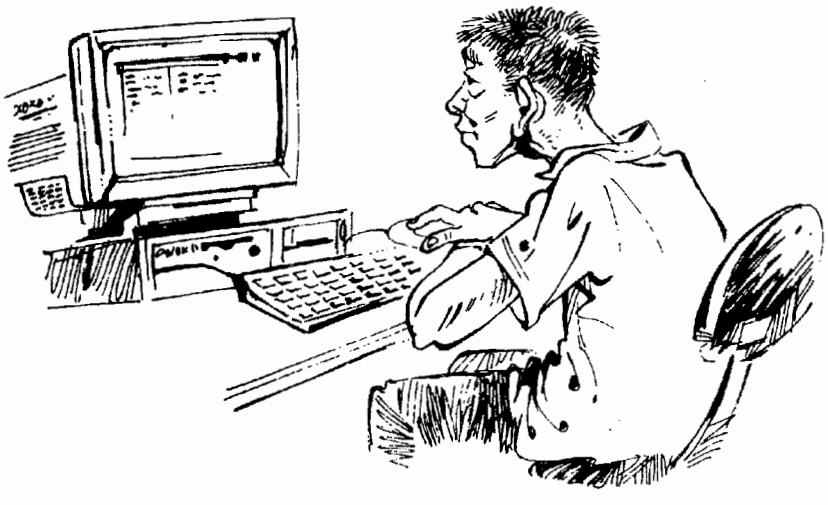
Hints for Managing Data

DO

- Check and re-check your data
- Use "tests of reasonableness"
- Organize the questionnaires so you can easily check for entry errors.

DON'T

- Start the analysis until you are certain the data entries are correct.
- Ignore numbers in the data that seem too large or too small. Check them out.



Prepared by:
Merle D. Faminow

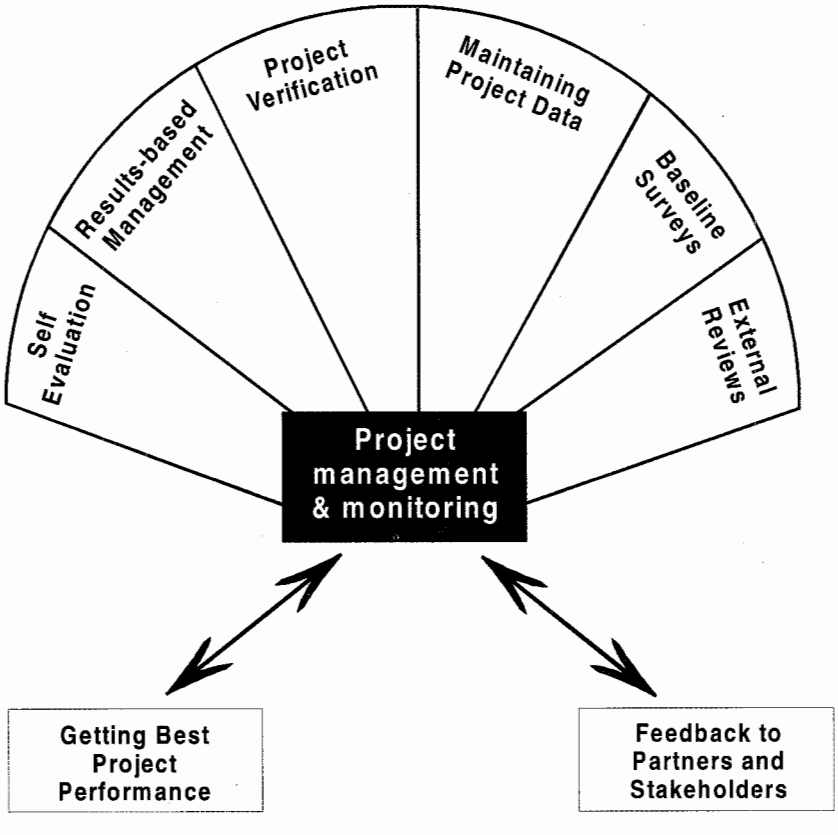
Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Managing and Monitoring Project Information

Implementing projects is complex, especially when operating in far-flung communities. All the partners in the project have responsibilities to ensure that planned results are achieved. Managing a project and monitoring information are key components of all projects, because progress must be reported to stakeholders. More importantly, doing this well will increase project effectiveness in the field.

Benefits from Good Project Management

- Better relevance to the conditions and needs of the target group
- More effective use of project resources and team capacities
- Cost-effectiveness
- Streamlined project reporting, freeing up resources for more fieldwork



EFFECTIVE PROJECT MANAGEMENT PRACTICES

SELF-EVALUATION

Self-evaluations help organisations better understand their own performance and address their strategic issues. They contribute to a better understanding of the project objectives and experiences in meeting those objectives. As a result, project members can see their role in the overall project more clearly leading to better team work and project success.

A self-evaluation can be conducted to review one or more specific areas of the project (perhaps to consider a particular problem that has arisen) or for a complete overview of operations. The organisation/project team itself has a measure of control over the objectives, methods and interpretation of self-evaluation.

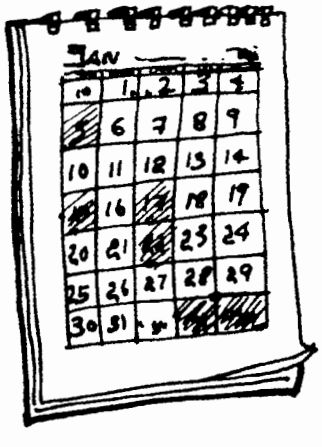
Self-evaluation involves a commitment of time and energy and it also provides knowledge to improve the operation of a project. Proven experience with self-assessment shows its value. Projects should utilise this management tool as a regular component of project operation. Toolboxes and other forms of assistance for conducting a self-evaluation are available (e.g., the IDRC approach: *Enhancing Organizational Performance*).

Typical Reasons for Conducting a Self-evaluation

- To make strategic decisions such as whether the project should grow, shrink or change its objectives.
- To make program decisions such as whether new activities should be started or different activities should be merged.
- To make financial decisions such as seeking new funding or determining ways to stretch an existing budget.
- To make staffing decisions such as adding or eliminating project officers.

How long will a self-evaluation take?

- A self-evaluation takes time and energy.
- The process depends on many things, including the issues studied, depth of analysis, type of information needed and so on.
- Report preparation is often the most time consuming part and might not be necessary.
- It can take from a few weeks to a year to complete, depending upon the complexity.
- However, information gained from a self-evaluation may save time and money in the future as well as enhancing the chances that the project will meet its objectives.



RESULTS-BASED MANAGEMENT

Results-Based Management (RBM) is an ongoing tool designed to help project staff "plan for results." RBM requires project planning, implementing, monitoring and reporting on results in an integrated fashion. It emphasizes the use of quantitative measurement of project impacts in an effort to make projects more results-oriented.

A key building block to RBM is the Logical Framework Analysis, which shows all key components of a project in a 16-cell table. It provides a framework for the project.

The Logical Framework Analysis (LFA) for Project Planning and Monitoring

Narrative Summary	Expected Results	Performance Measurement	Assumptions/ Risk Factors
Project Goal	Impact	Performance Indicators	Assumptions Risk Indicators
Project Objectives	Outcomes	Performance Indicators	Assumptions Risk Indicators
Inputs/ Resources	Outputs	Performance Indicators	Assumptions Risk Indicators

What does the LFA tell us?

- The first column describes how resources link to the project goal and objectives.
- The second column shows the "project results chain" – impact, outcomes and outputs.
- The third column shows the indicators that will be used in monitoring the results.
- The last column gives the key assumptions and risks that must be monitored.

KEY ELEMENTS OF RESULTS-BASED MANAGEMENT

ACTIVITIES are specific processes using project resources and personnel that must be done to implement the project.

For example, in the NEPED project, the main activities are establishing test plots and local-based nurseries and providing training to farmers, etc.

OUTPUTS are short-term developmental results that are the consequence of completed project activities. Outputs contribute to planned outcomes.

For example, in NEPED, some of the outputs are the number of test plots where agroforestry is implemented, the number of nurseries actually established, the number of farmers trained, etc.

OUTCOMES are medium-term developmental results that are the consequence of completing a combination of outputs, but within the duration of the project.

For example, one outcome of the NEPED project is the successful implementation of agroforestry in Nagaland, which is the result of outputs such as test plots, nurseries and trainings.

Ultimately, these outcomes should cause beneficial **IMPACTS**, which are broad and long-term effects. They are the logical consequence of the outputs and outcomes of the project.

For example, the main impacts from the successful establishment of agroforestry of the NEPED project will be the increased income of farmers from the improved land-base management, once they begin to harvest trees.

PROJECT VERIFICATION

Procedures to verify that work is conducted properly are extremely important. Of most interest, activities should be implemented on time in a cost-effective fashion and have achieved planned results.

- Resources that would allow multiple visits to field sites must be available.
- Project officers should work directly with the people targeted by the project and not just visit the District Headquarters.
- Payments should be made in stages, which ensures not only operating capital to do the work but also links payments to results.
- Performance monitoring leads to the project being taken seriously.
- Two-way communication between project recipients and project officers is extremely important.
- Utilising local-based field staff helps ensure fuller cooperation and impact in the field.

Reporting

Good project reporting is essential, because:

- It helps project personnel keep focused on results.
- Donors keep up with project status.
- Other development partners learn about the achievements.
- Changes in the project quickly become known.

MAINTAINING PROJECT DATA

An important tool in managing and monitoring all project information is the computer. A complete and accurate database for project activities is essential. The purposes of a database are:

- To provide an updated record of project activities and expenditures.
- To facilitate project progress reporting.
- To facilitate project management.
  An appropriate Management Information System (MIS) is necessary for financial management and control. Technical progress must be checked against project expenditures to ensure that sufficient funds are allocated to complete activities and work plans.
- Progress must be checked against budgeted funds and the budget reallocated, as necessary, as the project progresses.
- All donor organisations have their own requirements and will offer assistance if requested.

The NEPED Experience

In NEPED, the use of the Management Information System (MIS) helped measure progress against expenditures and identified savings from one set of activities that could be applied to new ones. As a result, funds were freed up for activities such as the expanded women's tree nursery program, farmer exposure trips and contributions to local-based NGO activities. Without a good MIS, these savings would not have been identified until it was too late to act.

BASELINE SURVEYS

A baseline survey is a key component of any project. It provides a means of measuring the project performance in achieving the objectives.

- The baseline survey establishes conditions at the beginning of the project.
- It should be designed to allow tracking of project activities in producing outcomes and impacts.
- Measurements should be made of specific factors that the project will be trying to change.
- It allows to clearly document the changes made as a result of the project.
- It shows the way by which the project benefits people.

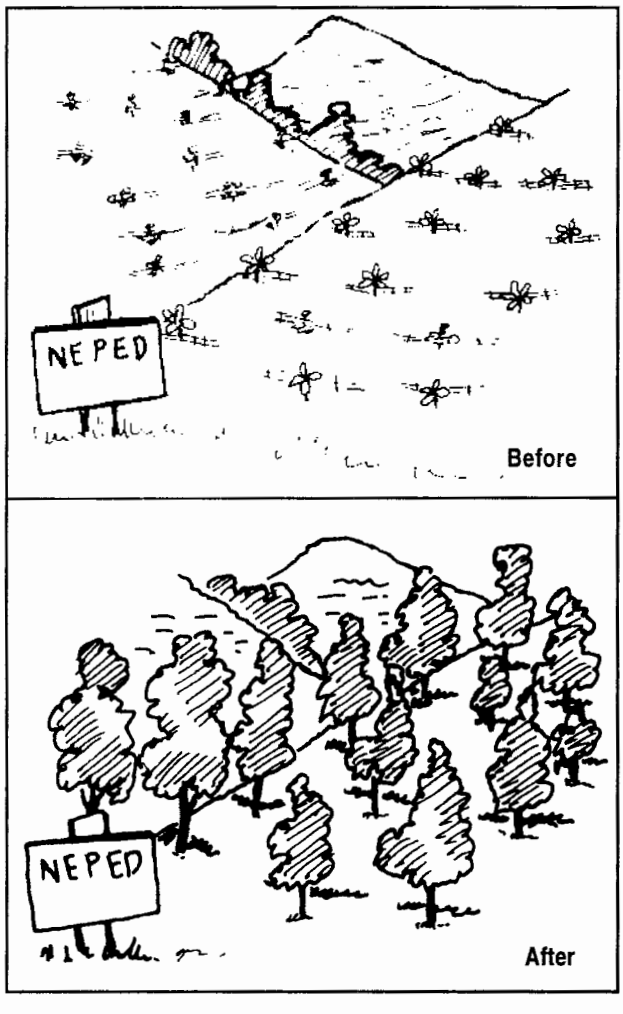
Hints for Baseline Surveys

Do

- Treat the baseline survey as a key component of your project.
- Start the baseline survey work as soon as feasible and avoid procrastinating.
- Ensure that the data needs, collection methods and method of analysis are appropriate before you start. If in doubt, seek assistance.
- Use the information being collected as a guide to strategic decisions made along the way.

Don't

- Treat the baseline survey as an unnecessary distraction from fieldwork.
- Think that other evaluation methods replace a baseline survey.



EXTERNAL REVIEWS

External reviews are a key component of all international projects and many local projects as well. Donor organizations are responsible for the best use of their funds and all have established specific procedures to ensure that projects meet their guidelines. Two specific forms of external reviews are usually used.

- Financial audits are used to ensure that funds are used appropriately and efficiently. External auditors are appointed to regularly visit the project site and assess financial records.
- Technical reviews are conducted by a team of experts contracted to visit the project area.
  - Mid-term reviews are usually conducted.
  - End-of-project reviews are always conducted.

It is important for project participants to cooperate fully with evaluation teams. Do not try to hide weaknesses but use the process as an opportunity to ensure that the project is reviewed fairly.

Hints on External Reviews

Do

- Make sure that all project documents and reports are made available to the evaluators.
- Organise all information and data that might be required during the field visit.
- Present this information to evaluators in a clear and concise manner.
- Carefully select the itinerary of the field visit to provide the best information to the team.

Don't

- Try to cover up problems. The evaluators will find out in the end.
- Forget to tell evaluators about all your accomplishments, including the unplanned ones.
- Treat the evaluation as a routine exercise.
- Show only convenient project sites. Also show remote areas.

Presented by:
Merle D. Faminow and Kurt K. Klein

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

Key Elements For Health and Nutrition

Health is Wealth! Health is the very foundation of human welfare and is the basic necessity for a happy life. But it is impossible to keep good health without proper nutrition. By nutrition, we refer to the science of nourishing our body.

Most Nagas depend on forests for their food. In one village alone, it was found that about 44 wild vegetables were routinely consumed. Health of the forest ecosystem will be reflected in the health of the people.

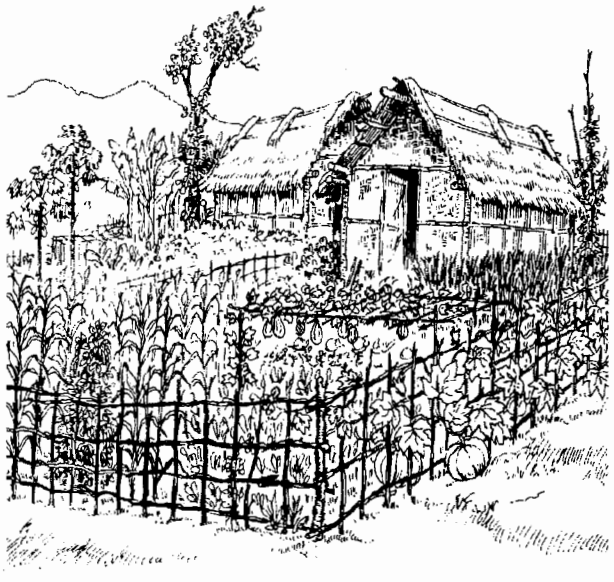
Options for a Healthy Diet

- Eat fresh raw vegetables.
- Store fresh vegetables in a cool place to avoid nutrient loss.
- Wash before peeling or chopping.
- Avoid washing chopped vegetables to conserve the soluble vitamins and minerals.
- Peel vegetables as thinly as possible. Thick peeling results in the wastage of vitamins and minerals.
- Cook food with the lid on or in pressure cookers.
- Avoid over cooking and reheating the vegetables.

NUTRIENTS

Proteins, carbohydrates, vitamins, minerals and fats are the five nutrients that we derive from the food we eat. Nutrients have different specific functions:

- Minerals and vitamins protect the body against diseases.
- Fats and carbohydrates give heat and energy.
- Proteins build and repair body tissues.

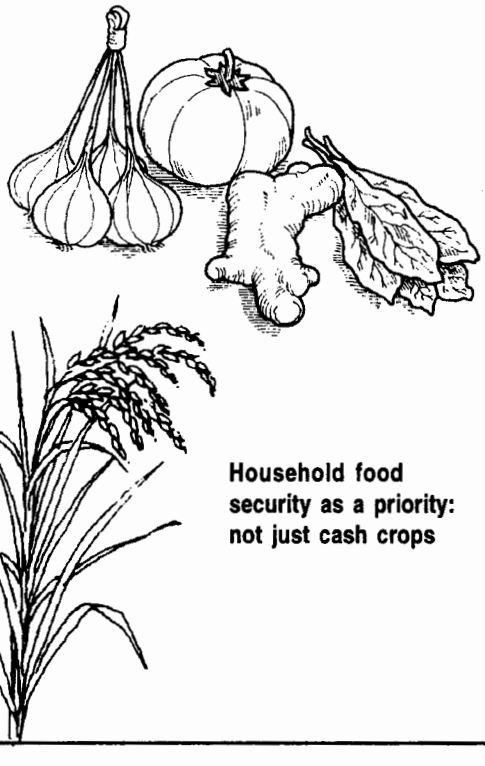


Well-maintained home gardens will help families remain healthy.

Include food producing plants in tree plantations.

Options for a Healthy Diet

- Maintain home gardens with a diverse range of vegetables.
- While planting trees, look for opportunities to plant vines, fruits and vegetables, which are essential for nutritional requirements.
- Keep domestic nutritional needs as a priority – do not just plant cash crops.
- Traditional Naga food preparation ensures a healthy and balanced diet with lots of green leafy vegetables.
- Conserve forests that provide traditional food items.

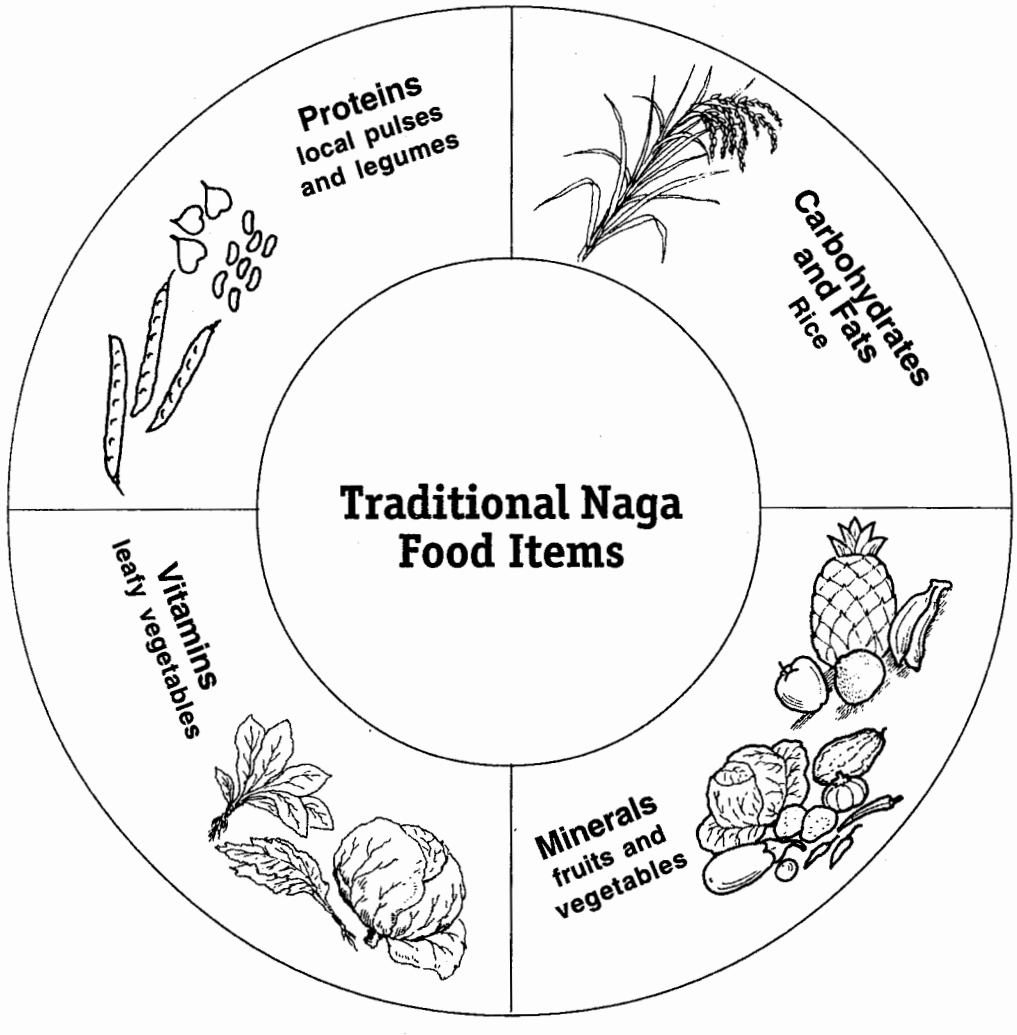


Household food security as a priority: not just cash crops

Discussing management options of forests to ensure food security goals are also met.

TRADITIONAL NAGA FOOD ITEMS

- Boiled leafy vegetables
- Homemade seasonings like fermented soybeans, bamboo shoots, herbs, etc.
- Native legumes and pulses
- Local pounded rice
- Lot of dried or smoked meat
- Local fruit species



Prepared by:
Chozhüle Kikhi

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

About NEPED

The Impact of NEPED on Tree Plantation and Soil Conservation Practices

The NEPED project has produced major changes in agroforestry practices in Nagaland and many look to be long lasting. In contrast to many schemes designed to introduce high technology into a region, the NEPED concept used participatory strategies that conformed to the existing ecosystem by modifying, but not changing fundamentally, existing farming systems. The strategy for improvement involved farmer-based testing and selection of alternatives. Farmers themselves also led the technology transfer process through interactions with other farmers, village councils and government workers.

Recently, villagers have become much more conscious of the need to save and renew forests, conserve soils and wildlife, and conserve biodiversity. Individual and group decisions have been taken that may, in time, reverse many of the destructive practices associated with jhumming, cutting of primary forests and hunting of wildlife.

Integration of agroforestry practices into traditional jhum fields provides an ecologically sensitive solution to continuing population pressures on existing farmland in Nagaland. There has been an enormous change in Naga agroforestry practices in a very short period of time. These will have long term impacts not only for the villagers who were fortunate enough to participate in the NEPED project but also for those who observed, understood and applied the technology.

NEPED activities also have led to a greater awareness of the importance of women in village life and, increasingly, women are assuming larger roles in decision making. In some notable instances, women have been undertaking their own productive activities for financial gain and are increasingly optimistic about the future.

TREE PLANTATION

NEPED officers promoted the use of a range of local species of trees to improve biodiversity in jhum lands. Local experts in various regions of Nagaland were engaged to assist in the identification of indigenous species with desirable characteristics, such as fast growing, usefulness for firewood, etc. Farmers who took part in the NEPED project were trained in techniques to use locally available planting materials wherever possible. Other villagers were encouraged to adopt these techniques through various means, including village level meetings.

Survey Results

- Before NEPED, only about 55% of the villages even thought about planting trees.
- The average village in Nagaland has over 200 households and nearly 40% have planted trees since the NEPED project began. About 150,000 trees per village have already been planted.
- About 43% of the villages have now passed resolutions to plant trees.
- About 1/3 of Naga villages have used Village Development Board (VDB) funds for planting trees.
- However, about 10% of villages have jhummed primary forests since NEPED began.

What are VDB funds and how can they be accessed?

For the past 20 years, all villages in Nagaland have been eligible annually to obtain Village Development Board (VDB) funds from the central government. These funds go directly to Village Councils through the Nagaland government.

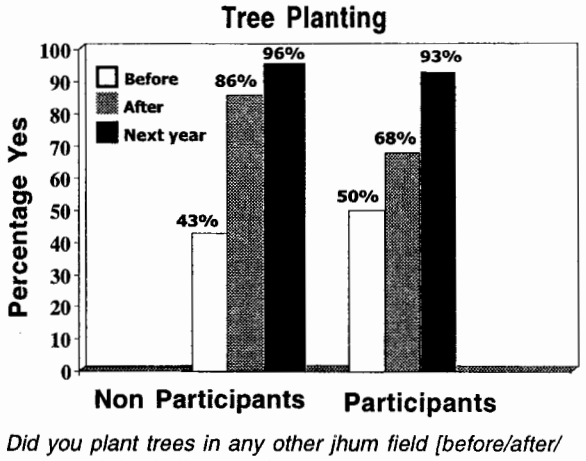
Village Councils decide on the distribution and use of the VDB funds. Since the structure of these governing bodies varies by district and tribe, decision making processes also are not uniform across Nagaland. In general, villagers with good ideas can come forward and make a case for using the funds for specific purposes. While the VDB funds have been used for all kinds of enterprises, the Village Councils increasingly have been using these scarce funds for the planting of trees.

For more information on VDB please refer to the overview on page 2.

The evidence is strong that villagers have been planting many more trees since the NEPED project began. Even among villagers who participated in the project, two-thirds claim to have planted trees in some other jhum field after joining the project and most plan to plant more trees in the future. This is a major increase over the 50% who planted trees before the NEPED project came to their villages.

ADAPTATION

Practices introduced in the NEPED project plots have spread quickly to other farmers across Nagaland, a clear indication that the technology and information has spread. In a random sample of villagers who did not participate in the project, significantly more villagers (twice as many) planted trees in a jhum field after the project came to their village than those who planted trees before. This is also true across all districts of Nagaland. Furthermore, virtually all of these villagers indicated that they were likely to plant trees in the future.



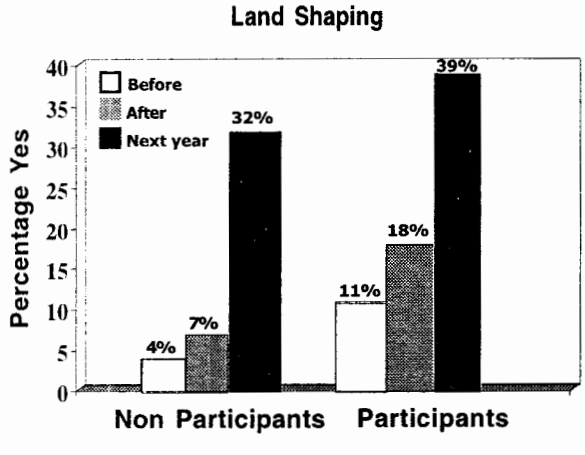
Did you plant trees in any other jhum field [before/after/ next year] the NEPED project came to your village?

NEPED STYLE LAND SHAPING

NEPED encouraged villagers who participated in the project to undertake a special type of land shaping that used trenches to stabilize the steep terrain. Deep trenches were dug horizontal to the terrain. These would fill gradually with top soil from above creating very productive areas for plant growth. The soil also would be prevented from washing down the steep hills.

The NEPED style of trench land shaping is very labour-intensive and many villagers do not adopt it for that reason. Many saw weaknesses in the approach: in certain cases, if the trenches were not dug exactly perpendicular to the slope, deep trenches could increase, not decrease, soil erosion.

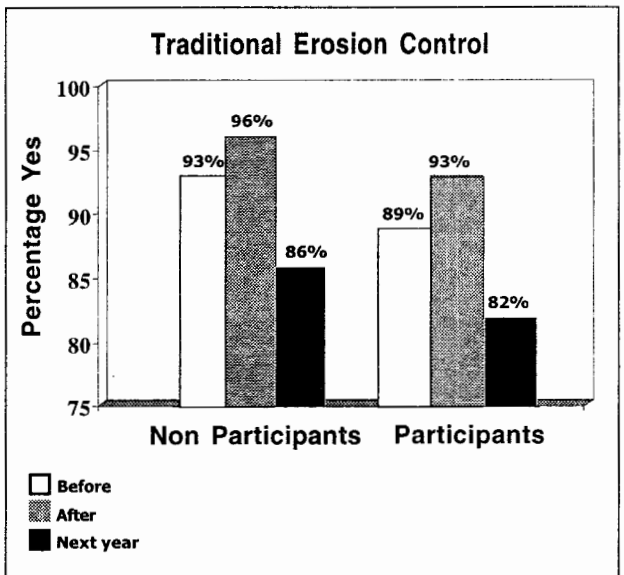
The project significantly increased the NEPED style of trench land shaping in jhum fields, although the level remained low. About 18% of participants and 7% of other villagers adopted the practice. Many more indicated an intention to use this kind of trench land shaping in the future (although it is likely that not all who indicated an intention to do so will get it done because of resource constraints).



Did you use any NEPED style of trench land shaping [before/after/next year] the NEPED project came to your village?

TRADITIONAL EROSION CONTROL

Most farmers have used other traditional erosion control methods of placing poles, trash and other materials across the slopes. Fewer villagers indicated an intention to use traditional erosion control methods in the future; this could indicate that they intend to switch over to NEPED style of trench land shaping (as indicated in the previous chart).



Did you use any traditional form of erosion control [before/after/next year] the NEPED project came to your village?

It is fair to say that NEPED has had a major impact on the Naga society through the changes in tree plantation and soil conservation practices undertaken since the project began. Virtually every village in Nagaland has been affected. Although it will take several years before the newly planted trees can be harvested, the results of the survey indicate that the NEPED methods have spread rapidly throughout the villages without the guidance and assistance of specialized staff and without any financial assistance other than that available through normal sources. This indicates that the changes in agroforestry practices likely will be long lasting and sustainable.

Erosion Control: NEPED Style vs. Traditional Style

	Pros	Cons
NEPED Style	■ More effective ■ Lasts longer	■ Three times as labour intensive to construct ■ Must be done at times when labour is needed for other tasks ■ Costs more ■ May increase erosion in some areas
Traditional	■ Inexpensive ■ Uses available materials ■ Few or no cash costs	■ Not as effective for erosion control ■ Needs fixing periodically

Prepared by:
Kurt Klein

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

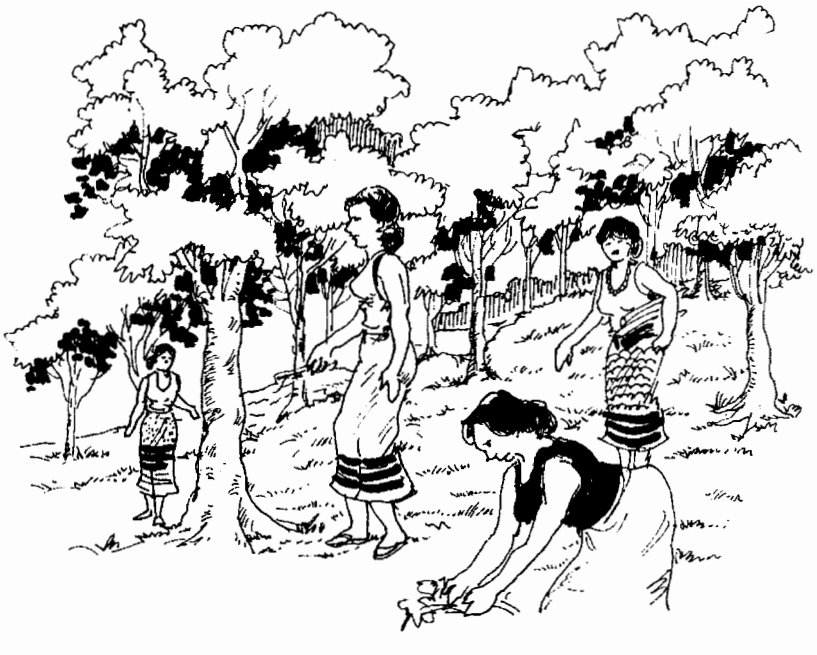
Women's Participation in NEPED

One of the main objectives of the NEPED project is the development of villages in Nagaland through tree plantation and agricultural farming. The interest of the villagers, including women, has already been aroused and large areas of tree plantation have already been established. The most critical component for success is the availability of adequate, good quality planting stock. Therefore, the proper management of tree planting and nursery activities plays a dominant role.

The NEPED project has four main components for women.

1. Women's Test Plots

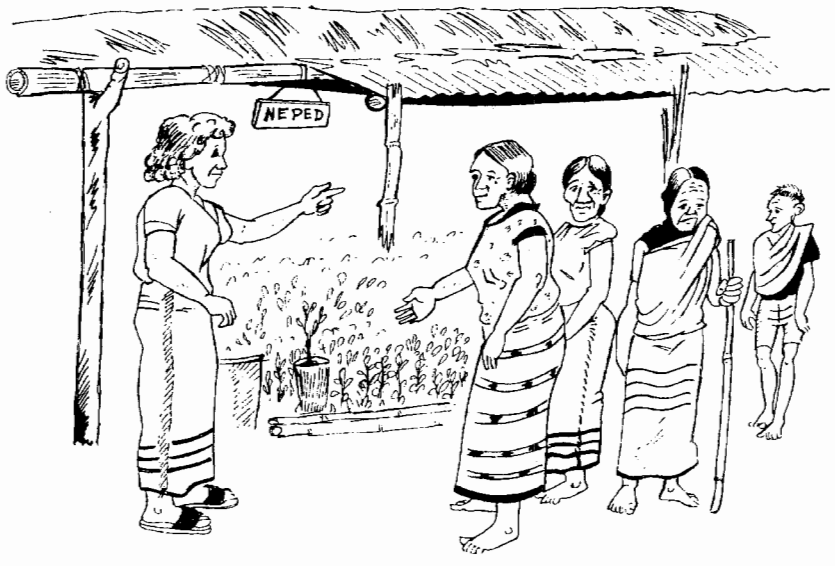
These are test plots where women groups tested the NEPED agroforestry technologies.



- Following the successful establishment of a women's test plot in one village in Kohima district in 1995, the Village Councils were advised to allot test plots to women's groups if specific requests were made. Additional test plots were allotted if the number of women interested was high. A total of 94 test plots have been established by the women groups in Nagaland.
- When women's test plots were established, the women had full authority in the management of the plot and in decision-making although the land still belonged to the community.
- Women worked with dedication, sincerity and team spirit not only to get material support from the project but also to benefit when the trees mature. They often remarked that they should have planted trees earlier.
- Technical and material support were provided by the project which further encouraged women's participation.

2. Women's Nursery

Women's groups who were willing and capable were assisted to establish tree nurseries. Limited cash assistance was provided for each nursery. Out of the 80 nurseries supported, some continued and earned good profit. Technical guidance was provided through training and supervision. At times, tree nurseries formed the "hub" around which various awareness training programmes for women were conducted.



3. Women's Empowerment Training

Two programmes were conducted:

1. Basic Women Empowerment Training; and
2. Advanced Women Empowerment Training.

A total of 213 women from 123 villages participated in the Basic Training in 1996-1999. In 1996, 30 candidates from 21 villages were selected from the Basic Training to participate in the Advanced Training.

4. Exchange Trips

Exchange visits outside the state were organised for women in order to provide opportunities to learn about how women elsewhere have involved themselves in agroforestry. Some participants took the initiative to act as trainers in their respective villages to create awareness about the environment and related problems as well as on women issues.

Women Empowerment

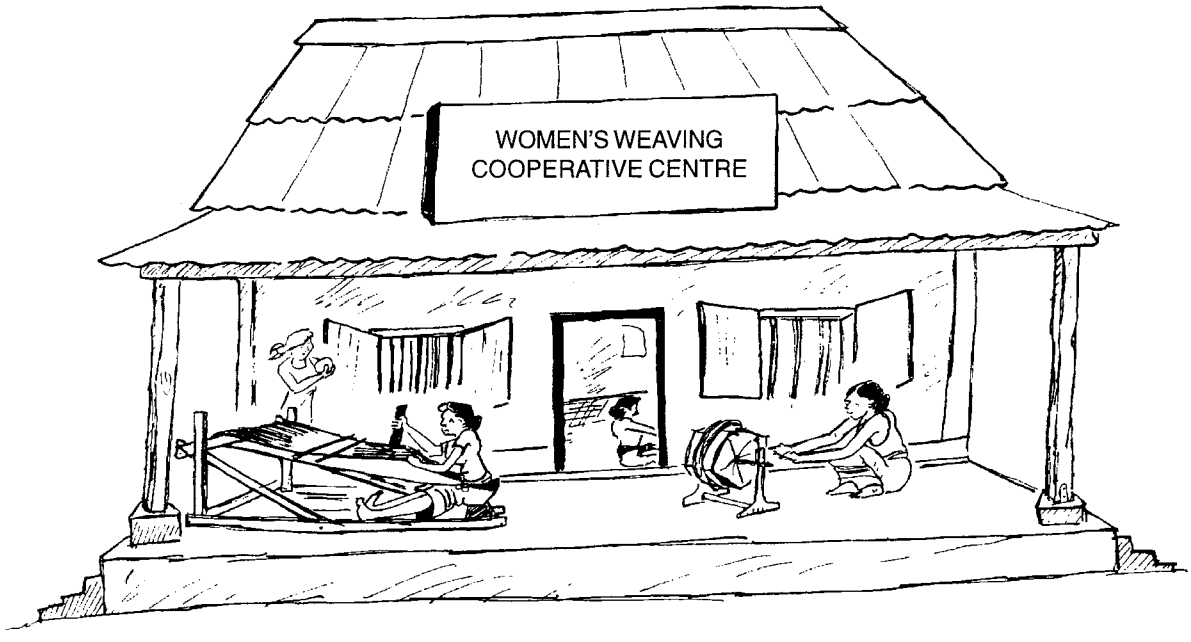
Empowerment is a process by which awareness is created among rural women, to equip them with technical knowledge for socio-economic development, to have access and control over productive resources which will lead to confidence, self-reliance and participation in decision-making.

OBSERVATIONS

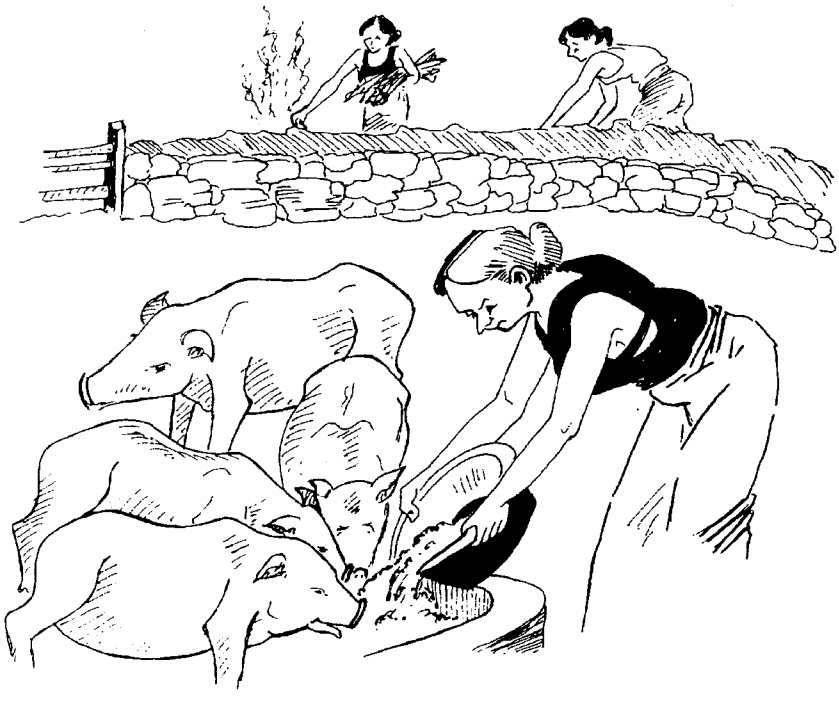
- There is a growing enthusiasm for participation; in NEPED, women came forward and participated actively.
- Women have started buying land for tree plantation.
- Participation of women in farm decisions has increased.
- Women received support from the 25% women's share of the Village Development Board (VDB) fund for various activities; e.g., horticulture and handicrafts.

Women's Use of Funds

In Nagaland, by law, 25% of all funds allocated are required to be spent on women. In a survey of Nagaland in 1999, 96% of Village Councils reported that women were allocated their 25% share from the VDB fund. Of these, 11% reported that women used the fund for tree plantations.



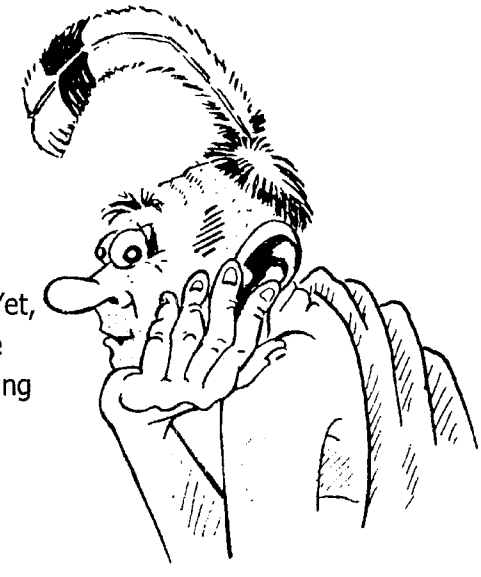
- Some women have been involved in infrastructural projects such as building construction, rice mills and orchards.
- Some women have also been involved in livestock, apiculture and other farming systems.
- To ensure success, the developmental project for women should be need-based.
- Strong training programmes help ensure that nurseries and tree plantations are successful.
- A network of women's leaders for women and for the community should be encouraged.
- A plant identification programme for women should be developed.



Prepared by:
Vizonyu Liezie

Resource book produced by the NEPED Project (Government of Nagaland, International Development Research Centre and India-Canada Environment Facility) and the International Institute of Rural Reconstruction.

After NEPED: Strategies for Action

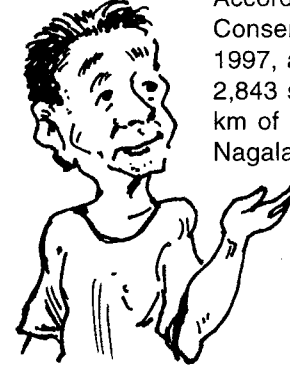


Villagers in Nagaland are now convinced that planting trees will generate income. They have enthusiastically responded to NEPED and the Government of Nagaland programmes with tree plantation on a massive scale. Yet, consultations throughout the state with Village Councils, Village Development Boards and farmers themselves reveal a strong feeling that additional measures to broaden the agroforestry base in Nagaland are needed.

The strategies for action most needed require the development of appropriate technologies for value addition industry at the local level, fair access to markets and a broadening of the agroforestry systems being adopted. Importantly, environmental conservation is now widely acknowledged as a critical component of all development strategies.

These strategic needs are linked in the flow chart presented in the next page.

Do you know that . . .



According to the Nagaland Chief Conservator of Forest, in 1996-1997, a cumulative total of 33% or 2,843 sq km of the total 8,629 sq km of classified forests in Nagaland had been degraded.

THE FUTURE

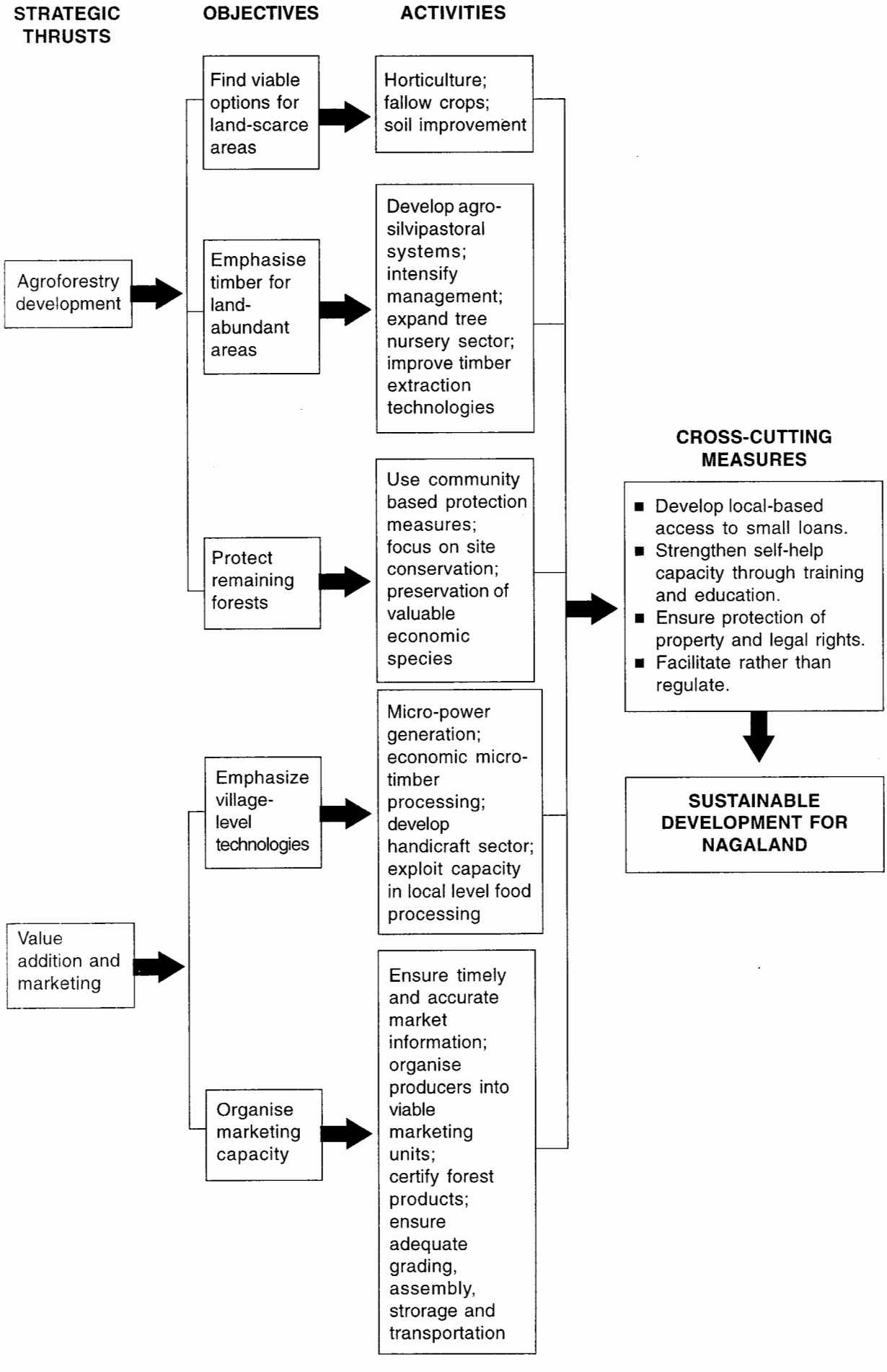
Progress has been made in the first step of a community-based approach to preserving Nagaland's forests. Tree plantation has been activated in jhum fields and many farmers now believe agroforestry will provide income to support their families.

Benefits from Planting Trees

In a survey conducted in 1999, villagers were asked what benefits they expected as a result of planting trees. Their responses:

- More than 90% expect to use the money from sales of firewood and timber to support their children's education.
- About 85% view planting of trees as security for old age.
- Most villagers emphasise the benefits from cash sales over home consumption as their reason for planting trees.

STRATEGIC THRUSTS FOR SUSTAINABLE DEVELOPMENT IN NAGALAND



The following additional steps should be taken to further improve land management and ensure that Nagaland's land resources continue to be productive:

- There is a need to identify and adopt the best tree management practices, as well as make harvesting and marketing plans that give the best returns.
- Remaining forested areas, especially on mountain tops, need to be protected.
- Better market access and opportunities for sale of timber and non-timber forest products should be provided.
- Locally-based opportunities for value-adding and processing should be provided to generate employment and income options for the Nagas.

Sustainable development of the natural resource base in Nagaland will depend on a balanced approach that includes biodiversity conservation, sustainable management of existing forests, economic development and recognition of cultural traditions.

SPECIFIC NEEDS

Effective approaches for preservation of accessible primary forest, while establishing integrated community-based plans for best management and harvesting practices for timber and non-timber products from agroforestry, are needed:

- Potential fallow management crops, targeted at specific agroclimatic zones must be evaluated and recommendations drawn up.
- The best silviculture and agro-silvipastoral management systems for use in agroforestry must be evaluated and implemented.
- Community-based management plans for agroforestry must be identified, developed and disseminated.
- In land-scarce areas, an emphasis on fast-maturing agroforestry crops well suited to the agroclimatic conditions are needed.
- Community-based solutions for protection and sustainable use of accessible primary forest land need to be adopted on a wide scale.
- Effective and equitable local-based marketing options for agroforestry products must be developed.
- It will be necessary to identify and encourage appropriate technologies for local processing capacity for selected agroforestry products.
- Some alternative livelihoods related to agroforestry are needed.

IMMEDIATE STRATEGIES NECESSARY

Most small farmers do not yet have specific management/marketing plans and have not incorporated non-timber forest products into their agroforestry systems.

Between the years 2000 and 2005, farmers with tree plantations established in the past five years will be required to:

- Discover the best strategy to harvest products during the thinning stage.
- Decide on how to optimise returns from the trees as they mature to timber-market size.
- Choose among the alternatives to select new fallow management crops for the thinned plantations.
- Get access to cash markets for many types of products (poles, timber and fallow management crops) in the hope of getting a fair return.
- Ensure the food security and other basic needs of their families.

ACTION PLAN

- A multi-faceted approach is required to strengthen agroforestry and to protect the remaining primary forest.
- Development activities must provide benefits to residents of rural villages where development needs are greatest. Villagers/farmers are also the ones who have the most to gain or lose from land use management.
- Rural villagers/farmers can best take advantage of opportunities that:
  - are linked to their main agricultural activities;
  - are feasible when established on a small scale;
  - can provide income and employment options for both men and women;
  - have marketing and processing requirements within reach of villagers; and
  - consider their existing workload and resources.

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Annexes

Glossary of Terms

A

Abiotic factors The non-living components of the environment that directly affect plant and animal life, such as water, carbon dioxide and light

Acidic soil Has a pH less than 7 on the 0-14 scale which is used to define acidity and alkalinity

Aeration Process of ventilating soil or crops to attain a uniform temperature that is near the ambient air temperature and encourage the development of soil microorganisms

Agroforestry A land-use that involves deliberate retention, introduction or mixture of trees or other woody perennials in crop/animal production systems to benefit from the resultant ecological and economic interactions

Agronomy The study of soil and the improvement of crop production

Alder *Alnus nepalensis*, a tree species endemic to the sub-Himalayan region and well sought for its nitrogen-fixing capabilities, timber quality and ability to coppice

Alder-based system The system of cultivating crops with alder trees

Alkaline soil Has a pH of more than 7 on the 0-14 scale which is used to define acidity and alkalinity

Ameliorate To make better, especially more tolerant

Annual A plant completing its life cycle in one season or one year

Apex Top or highest point

Appendage An additional part of a structure or organ

Asl Above Sea Level

Astringent Substance that binds or draws together soft tissues

Axil, Axillary The angle between the leaf and stem; hence axillary flower or bud

B

Bark The skin or cover of the stem

Base The bottom or lowest part

Biodiversity The variety of living things expressed in genetic, species and ecosystem dimensions. There may be more specific terms generated, e.g., agro-biodiversity for the biodiversity of agriculture; cultural diversity for the biodiversity of human culture

Biological control Pest control strategy that employs methods such as conservation, introduction, augmentation, and mass release of parasites, predators and disease organisms

Biomass The total biological mass usually expressed in weight per unit area

Biotic factors The living components of the environment that by their activities affect the life of an organism

Bi-sexual Having both male and female reproductive organs, especially in plants

Brine solution Salt water or solution

Broadcasting The process or method of sowing by scattering seed

Budding A form of sexual reproduction in which a new individual develops as an outgrowth of a mature organism

Buttress root A plant-like outgrowth at a tree's base, providing extra support to the tree

C

Capsule A dry fruit formed out of two or more fused carpels which split open when ripe

Carrying capacity The largest number of a population of a species that the environment can support

Catkin A crowded spike of tiny flowers, hanging down from the twigs of the plants, which bears unisexual flowers only

Colic Severe pain in stomach and bowels without diarrhoea

Collar The part of a plant where the root meets the stem.

Compost Rotted plant material, made from garden rubbish and kitchen vegetable waste and used as an organic fertilizer

Composting The process of treating waste organic matters to encourage its decomposition to nutrients suitable for plant uptake and growth

Contour A line joining points of equal height or altitude. Used in mapping topography

Coppice A form of woodland management in which trees are cut back regularly to encourage growth of numerous adventitious shoots from the base and the resulting thicket is turned a coppice or copse

Cordon Three or more stems

Cover crop Vegetative cover or permanent sod sown, or allowed to develop as a managed means of controlling soil condition

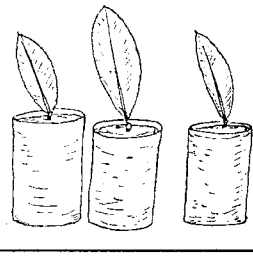
Crop residue Portion of plant left in the field after harvest such as stems, leaves or possibly pods or cobs

Crop rotation A system of growing a succession of crops in one field

Cropping system The physical and temporal arrangement of crop species usually described within a given area

Culm The jointed stem of grass or bamboo which is usually hollow

Cuttings Various plant vegetative materials used in propagation



D

Dao A local utility implement or tool used by the Nagas for cutting and chopping

Decoction A preparation made by boiling a substance in water or other liquid

Dermatitis Inflammation of the skin

Desuckering The act or process of removing suckers

Dibbling The process of using a pointed tool for making holes in the ground for seeds, bulbs, or young plants

Diuretic Which causes an increase in the flow of urine

Dormancy An inactive period often exhibited by seeds and buds during which growth is stopped

Drupe A fruit whose seed is contained in a hard pit or stone covered by soft, pulpy flesh with a thin outer covering

E

Ecosystem A unit comprising a community of living organisms and their environment where there is a continuous flow of energy and matter through the system

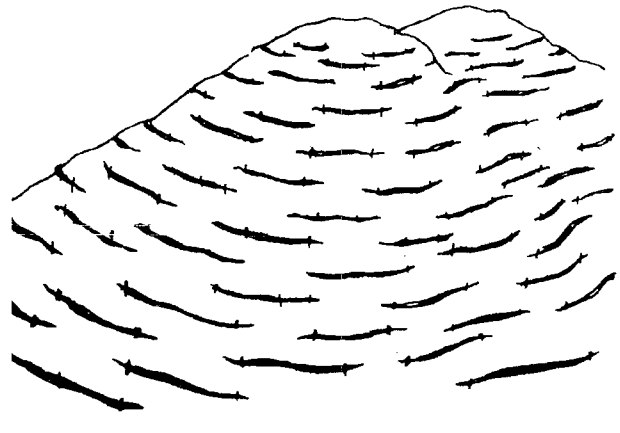
Empowerment The act or process of giving power; or state of being empowered

Equitable system A fair, just and impartial system

Ex-situ Outside the natural habitat

F

Fallow Farm land that has been left without crops being planted



G

GENDER The socially-constructed roles and responsibilities assigned to women and men in a given culture or location and the societal structure that supports them

GENDER ANALYSIS A close examination of a problem or situation to identify gender issues

GERMINATION A process of growing, developing or sprouting

GRAFTING The process of putting a shoot or bud from one tree or plant into a slit in another tree or plant, so that it will grow as a part of the host

H

HERBACEOUS Like a herb; having stems that are usually soft and not woody

HOME GARDEN An intensive system of cultivation near the home which incorporates crops for food, medicine and other regular or high value consumption

HUMUS Organic matter remaining in soil after the major portion of added residues (roots, tops, manure) have decomposed

I

INDEHISCENT Describing a fruit or fruiting body that does not open to disperse its contents

INDIGENOUS Describing an organism that is native to an area, i.e., that has not been introduced from another area

INFLORESCENSE The arrangement of flowers on the stem or axis and in relation to each other

INSECTICIDE Any chemical used to control or kill insects

IN-SITU In the natural habitat

INTEGRATED PEST MANAGEMENT (IPM) Economic, ecological environmental and social strategy that focuses on long-term prevention or suppression of pest problems through a combination of techniques such as encouraging biological control, use of resistant varieties or adaption of alternative cultivation practices or modification of habitat to make it incompatible with pest development

INTER-CROPPING Planting of two or more crops together in various configurations of time and space

J

JHUM A complex and comprehensive social system of agriculture used in Nagaland, India; local name for 'slash and burn' or 'swidden'

JHUM CYCLE Span of time that is taken to complete the rotation period of the jhumland of a village; time taken from one slash to another

K

KHEL A Nagamese term used to describe a sector or area of a locality or village

L

LAYERING A method of propagation by which a shoot is induced to root while still attached to the mother plant

LEACHING Process of movement of water soluble chemicals out of the soil root zone with the water that drains out of the soil

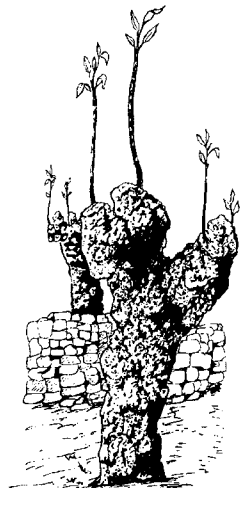
LEGUME A dry dehiscent fruit containing one or more seeds; e.g., beans and peas

LEGUMINOUS Belonging to the same group of plants as beans and peas

LENTICEL A usually lens-shaped body of cells formed in the corky layer of bark, which serves as a pore for the exchange of gases between plant and the atmosphere

LOCAL EXPERTS A group of knowledgeable and respected men, drawn from the various Naga tribes, who assist in the planning, implementation and monitoring of NEPED activities

LOPPING Removal of unwanted branches or twig



M

MANURE Solid or liquid animal waste often mixed with organic waste and applied to soil

MARCOTTING The practice of binding moist moss onto branches to promote new roots which may be severed from the mother plant and planted elsewhere

MICRO CLIMATE Climate of a small area such as surrounding an individual plant

MIXED CROPPING Multiple species planted in a variety of spatial and temporal arrangements

MONOCULTURE Growing of a single species of plant in a given unit area

MULCH Organic material, such as peat, leaf mould, or shredded bark, that is spread on the ground to suppress annual weeds; also applied around the base of tree and shrubs to help absorb and retain water and add nutrients

N

NAGAMESE A local dialect based on Assamese, Bengali and Hindi commonly used in Nagaland

NEPED Nagaland Environmental Protection and Economic Development (NEPED) project through people's action; project supported by the Government of Nagaland, the India-Canada Environment Facility (ICEF) and the International Development Research Centre (IDRC)

NGO Non-governmental organisation

NUTRIENT Substance which is used by an organism for production of energy, maintenance and production of body and regulation of life-sustaining processes

NUTRIENT CYCLE Path of a nutrient through the ecosystem, including its assimilation by organisms and its regeneration in a usable inorganic form

O

OFFSET A short shoot that arises from an axillary bud near the base of the stem and gives rise to a daughter plant at its apex

P

PANICLE Inflorescence with a branched main axis whose branches bear loose

PERENNIAL A plant that grows year after year, which does not necessarily die after flowering

PESTICIDE Any one of various substances used to kill harmful insects (insecticide), fungi (fungicide), vermin, or other living organisms that destroy or inhibit plant growth, carry disease, or are otherwise harmful

POLLARDING Tree whose stem has been cut off in order to obtain a flush of shoots, usually above the height to which the browsing animals can reach

POLYCULTURE Growing of several species of plants in a given unit area

PROPAGATION The act or process of breeding plants or animals

PRUNING Partial or complete removal of vegetative or fruiting wood from a plant to control its size, remove broken or damaged tissue, alter plant shape, remove unnecessary growth or balance growth

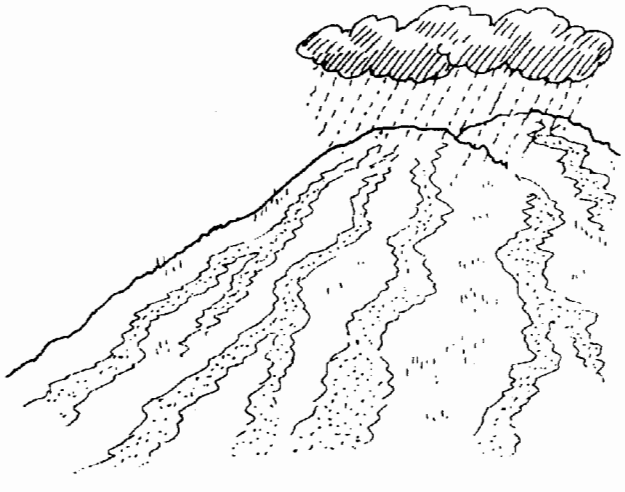
R

RADICAL A young root

REPLICATION PLOT Areas of jhum field in which communities themselves have adapted or adopted the NEPED test plot agroforestry technologies

RENIFORM Kidney-shaped

RUN-OFF WATER Water, such as rain, that flows off the land in streams



S

SAPLING A young tree, especially a young forest tree, with a trunk from one to four inches in diameter; the term is used for young trees that are taken to fields for planting

SCION A bud or branch cut for grafting or planting

SEEDBED Soil prepared by natural or artificial means to promote the placement and germination of seed and growth of seedlings

SEEDLING A young tree generally less than 1 inch in diameter; young trees that are still in the nurseries before planting

SHOOT A branch, stem or twig

SOIL CONSERVATION Protecting soil against agents of erosion

SOIL pH Soil acidity or alkalinity

SPACING Distance between points or objects

SPAWN The production of eggs by fish, frogs, shellfish and other animals growing or living in water

STEM The main axis of a plant, usually above ground and supporting leaves, flowers and fruits

STOLON Common in grasses, this slender branch or shoot is capable of forming both buds and roots and is, thus, used in plant propagation

STONE FRUITS Fruits, also known as "drupes" with one or more seeds

STOOLING The act of cutting off a stump or root of a plant to allow young shoots to grow

SUCKERS A shoot growing from an underground stem or root

T

TENDRIL A slender, simple or branched organ arising from leaf or stem or part of them which can twine round a support

TEST PLOT A NEPED project initiative; areas (usually about 3 ha) of jhum field where farmers agree to test the NEPED agroforestry technologies

TILLER Grass stump arising from a lateral bud at the base of the plant is the process of tiller formation

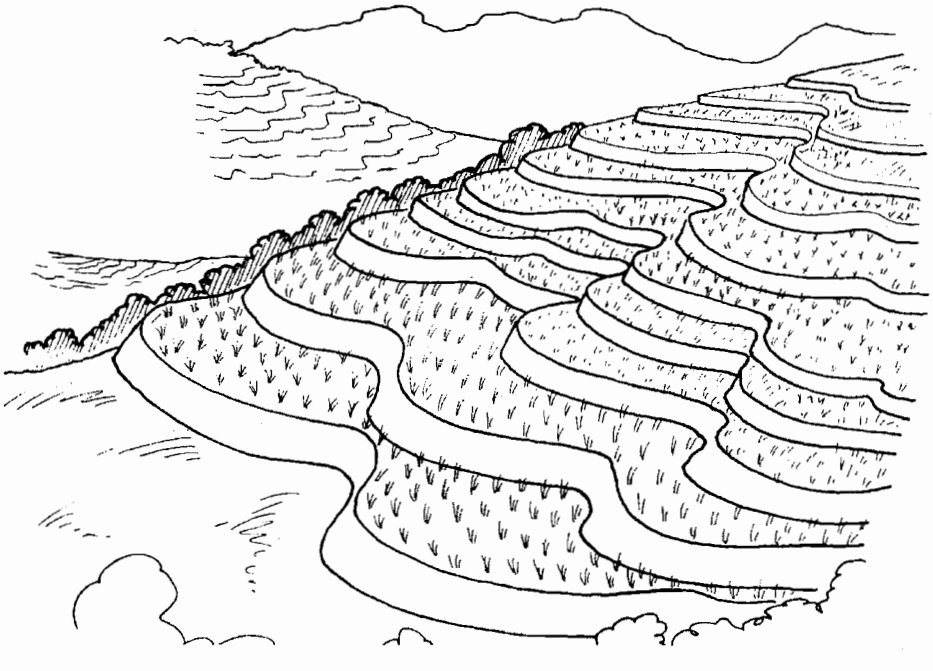
TRELLIS A frame of light strips of wood crossing one another with open spaces in between, especially one supporting growing vines

TROPHIC LEVEL Position in the food chain including the first level which are decomposers (bacteria, fungi); second level which are producers (plants); third level which are primary consumers (fish, insects); and fourth level which are secondary consumers (carnivores, birds)

W

WET RICE CULTIVATION (WRC) Rainfed lowlands rice cultivation where bunds separate the fields with rice often submerged for part of the crop cycle

WET TERRACE RICE CULTIVATION (WTRC) As in WRC but found on steep slopes which have been contoured to create terraces; typically much less water is available for cultivation



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