V. Ethnobotanical Enterprise

Rural Appraisal Technique for Hilly Areas of Bangladesh

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Introduction

D&D, RRA and PRA are the common rural appraisal tools used for the identification of problems associated with land use and designing solutions in quickest possible time, with least expenditure. These are much effective as grass-root level people are involved in a bottom up approach. The techniques are applicable to all land type including hilly areas of Bangladesh. The basic method employs the following:

1. Composition of a multidisciplinary team.
2. Collection of information regarding existing land use system from the field with active participation of rural people where development activities will be undertaken.
3. Collection of information from published and unpublished sources regarding the sites.
4. Identification of the problems in maximizing the production up to its potential.
5. Cross checking the available technologies to be applicable to site and designing measure for increasing production.
6. Cross checking with the farmers for their acceptability.
7. Identify researchable issues for which technologies are not available.

However, there are some differences in the three appraisal tools. In case of RRA, the multidisciplinary team visit to the field or site in question, observe land use problems and cross check the observation on the basis of structured and semi-structured questions, design different options for increasing production and cross-check the options with the farmers. If the farmers accept the technologies, those are accepted and in case of any difference in opinion, the options are revised and readjusted. If any problem remains unaddressed, it is taken as research issue and measures are being taken to resolve the problem in a long-term basis.

The D&D is similar to RRA but differs only in designing solution of land use problems only with the tree. Hence, most of the information gathering is focused to production and marketing of trees in all possible ways.

In case of PRA multidisciplinary team works as triggering factor to ensure peoples' participation of different cross sections for identification of problems without any structured or semi-structured questions. The basic method of the appraisal tools are as follows:

Step in D & D

These are five distinctive stages of D&D. These are:

1. Prediagnostic Stage.
2. Diagnostic stage.
3. Design and evaluation stage.
4. Planning stage.
5. Implementation stage.

The basic questions and key factors that need to be considered during D&D process are shown in Table 1.

Sub-systems of farm families

The needs and production function of farm-families can be categorized into the following sub-systems:

1. Cash
2. Food
3. Fuel wood
4. Shelter
5. Livestock
6. Others

During D&D process, the participants should try to identify the problems of each sub-system and prioritize them as all the problems cannot be met at the same time. The important queries about each sub-system could be:

Cash

Where he gets cash?

1. Selling his produce
2. Selling labour

What does he do with cash?

1. Use for the purchase of supplementary food during lean season purchase vegetables and protein.
2. Uses for purchasing clothes.
3. Uses for medicines.
4. Others.

A basic question to each sample farmer would be useful for designing agroforestry intervention is that:

What he would do, if the could get Tk. 10,000 as loan. The answer to this question will lead the questioner to know about the aptitude of the farmer and possible intervention of the problems.

Food

1. Does he produce enough food?
2. How long supports him?
3. When he purchases rice and other vegetables?
4. What are the different varieties of crops he grows?
4. What are the cropping patterns?
5. How much land he has as homestead and crop land?
6. What does he grow in his homestead?

Fuel wood

1. Does he use wood as fuel or burn cow-dung and agricultural residues? If yes, quantify them and find out the shortfall?
2. Does he purchase fuel wood from market?
3. What are the trees found in his homestead or crop field?
4. What are the produce he gets from trees?
5. Is he acquainted with fast growing trees?
6. Are the seedlings available?
7. Does he know about their management?
8. What are the sources of seeds of trees he has planted in his area?
9. Are there potentiality for growing fuel wood species?

Shelter

1. What is the house made of ?
2. When he has constructed it ?
3. Where he gets raw material or construction materials?
4. What about the sanitation problem and drinking water?
5. Others

Livestock

1. How many livestock he has ?
2. How many poultry birds he has ?
3. Why he rears them ?
4. What returns he gets from them ?
5. How he feeds them ?
6. Others.

Method of conducting field survey

Multidisciplinarity of the team : It may be mentioned here that the team should be multidisciplinary in nature so that bias can be avoided. There should be personnel from both biophysical discipline, economist and social scientists so that all aspect may be covered during identification of the problems and designing intervention.

Information approach : Before putting any question to the farmers, it is better to greet him/her and tell him/her the objectives of the team. During field survey, the questioner should be as informal as possible. Otherwise, the farmers might not respond freely and correctly. If known to the team, the question may be put to the farmers in local language which will make the farmer confident.

Art of putting question : It is most important part of the interview. While asking the question, the question should be open ended which means that the question should not limit response of the farmers to yes or no.

Visiting the homestead and crop field : In some cases, the farmers can not tell exactly the amount of land he possess in homestead and crop land. It is therefore, better to walk around his homestead and crop land to have an idea of his and holding.

Avoiding questions the answer of which are visible. It is better to avoid questions the answer of which are visible during the walk around the land he posses. For example, if the question is-what tree species do you grow in your homestead while standing on the homestead.

Avoid challenging the farmers : The farmers should be allowed to express his view and during his presentation, the team member should not interfere and should not challenge him for any of his statement.

Avoid having response from a particular person : During interview, most of the case, a number of people are gathered and among them, one or two persons will be observed who will try to answer all the question even if not put to him. It is better to avoid such respondent.

Division of labour within the team: All team member should not ask question at the same time. One person should be selected as questioner, one should work as rapporteur, other team member may s upplement questions if the team leader drop any questions.

One the basis of the above principles, the problems may be identified and prioritized. According to the principles of D&D, the solution should include tree as a component to alleviate problems. In designing the interventions, the potential role of trees should be kept in mind.

Steps in RRA and PRA

The basic steps in RRA and PRA are more or less similar. The two methods differ in exploration method for appraisal of rural situation. The following are the steps of RRA and PRA:

Site selection : Sites for PRA analysis are picked either through requests from the community or upon the recommendation of an extension officer. Locations tend to be places where there have been prolonged ecological difficulties or downturns in productivity.

Preliminary visits : A PRA team generally consists of 4 to 6 specialists from the field of water, soil, forestry, livestock, community development, and other skills related to natural resources management. The team meets with village leaders before starting a PRA to clarify what PRA will do as well as what it will not do.

Data collection : The team collect data on the existing resources, potentials and organizations involved in the locality for the rural development directly or indirectly.

Spatial data : A village SKETCH MAP is compiled in cooperation with village leaders to identify physical and economic details and to locate the community's infrastructure.

The team prepares a village *TRANSECT*, in cooperation with residents, to identify types of land use, problems, and opportunities to solve problems. The transact also helps the team to determine whether there are sub-zones within the community that require special consideration.

FARM SKETCHES are organized for a representative sample of households in the community. Six to eight farms are identified, with attention to include examples of the variety of ecological, income, land use, and ethnic variation present in the community. Team members prepare sketches by walking around the farm with household heads.

Time-related data: The PRA Team meets with residents to discuss what they consider to be the most important events in the community's past and prepare a TIME LINE. Data are gathered in group meetings which include community residents from different backgrounds and perspectives, including young and old and men and women. Problems and opportunities are discussed.

TREND LINES are developed, based on village perspectives, of a thirty or forty year pattern of changes in resource issues such as rainfall, crop production, soil loss, deforestation, health, population, and other topics of concern to the community. The PRA Team organizes groups of residents and leaders for this exercise.

The PRA team organizes a *SEASONAL CALENDAR*, using group meetings similar to those for the time line and trend analyses. Data on topics such as land use, hunger, disease, food surplus, and cash availability are organized and entered into a time scale of 12 to 18 months. The seasonal calendar also helps to record village views of problems and opportunities.

Social data: Individual FARM INTERVIEWS are carried out at those households where sketches are compiled. Details of the sample will vary, depending on the goals of the exercise but normally will be the same as the farm sketches in Section 3.1.

The PRA Team also gathers data about VILLAGE INSTITUTIONS. Groups of residents are asked to rank community institutions in order of importance and to construct diagrams that indicate the relationships between and among village units. This is also called Venn Diagram.

Technical data : In addition to the time, spatial, and social data, the PRA Team assemble information of ECONOMIC AND TECHNICAL FEASIBILITY, i.e. water or soils, needed to help villagers rank project activity.

Data synthesis and analysis : The PRA Team, sometimes with one or two village leaders, organizes the collected data and compiles a list of problems and opportunities for possible action. Problems can be organized by sectors or simply set out as a long list of topics. Opportunities are also discussed and assessed and presented in a full listing.

Ranking problems : Villagers comes together to rank the listed problems. In some cases, the PRA Team members lead the discussion. There have also been instances in which a village leader has served as Chair.

The outcome is a set of problems that villages groups agree are ranked from most to least severe.

Ranking opportunities : Villages groups then rank opportunities that address the highest priority problems.

Different strategies are possible to achieve consensus about the most feasible opportunities. Criteria for ranking include stability, equity, productivity, sustainability, and feasibility.

Implementation : Once the PRA is completed, it is necessary to implement the suggestions. The best results in follow-up have been achieved when a village leader has taken the lead. For organizing the people, extension agencies could be effective.

Table 1. The basic logic of agroforestry diagnosis and design (D&D).

Basic question	Key factors consider
PREDIAGNOSTIC STAGE	
WHICH LAND USE SYSTEM ?	Distinctive combinations of resources, technology and land user objectives
DIAGNOSTC STAGE	
HOW WELL DOES THIS SYSTEM WORKS ?	Problems in meeting objectives, causal factors, constraints and intervention point
DESIGN AND EVALUATION STAGE	
HOW TO IMPORVE THE SYSTEM ?	Specifications for problem-solving or performance enhancing interventions.
PLANNING STAGE	
WHAT TO DO TO THE DEVELOPMENT AND DISSEMINATE THE IMPROVED TECHNOLOGY	R & D needs and extendion needs
IMPLEMENTATION STAGE	
HOW TO ADJUST THE PLAN OF ACTION OF NEW INFORMATION	Feedback from research and extension trials, independent farmers innovation etc.

Role of Ethnobotany in Sustainable Development of Hill Farming System

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Introduction

There is now growing recognition for the relevance of ethnobotanical knowledge and its potential role in the design of sustainable development and alternative economic options. Ethnobotanical knowledge refers to practical knowledge related to uses of biological resources within indigenous cultural groups based on their intimate experience accumulated over many generations. The term "indigenous" or 'local knowledge' is used to refer to that knowledge which is generated and transmitted by communities, over time, in an effort to cope with their own agroecological and socioeconomic environments. The knowledge is generated and transferred through a systematic process of observing local conditions, experimenting with solutions, and readapting previously identified solutions to modified environment, socioeconomic and technological situations (Fernandez 1994). Now it is also recognized that indigenous knowledge can cut research and development cost significantly (Posey 1996).

Ethnobotany is an interdisciplinary science for documentation of indigenous knowledge and interactions between people and plants. Classical ethnobotany simply makes list of plants by local names, scientific names and their uses. However, the applied ethnobotany emphasises many other aspects (Martin 1995).

The salient aspects focus on:

- Systematic inventory of biodiversity;
- Document indigenous knowledge related to biological resources;
- Assess the dynamic aspects on sustainable use of plant resources, particularly in the face of market economy;
- Transfer and replicate the indigenous practices and knowledge concerned into the places /situations/ systems, where conditions are similar for community conservation and development;
- Integration for alternative economic options.

Most of the ethnobotanical works are towards ethnopharmacology and medicinal plants. Application of ethnobotanical knowledge towards biodiversity management, community development and conservation is gaining momentum, (Martin 1995, Born *et al.* 1996a, 1996b). Knowledge of ethnobotany can also be integrated towards the development of sustainable agroforestry systems (Martin 1995, Alam 1996, Alam 1997) and upland farming system.

Attributes of upland farming system

There is no consistency in the definition of what really constitutes an upland. In general slope and altitude separate uplands from other land areas. Compared to the two dimensional spatiality of the plains, upland habitats are characterized by three dimensional spatiality. The third dimension in upland specificities includes inaccessibility, fragility, marginality, diversity, niche and human adaptation (Khisa 1995, Pratap 1995).

Bangladesh consists of about 12 per cent uplands out of its total land area; and 75.6 per cent of greater Chittagong Hill Tracts are uplands.

Farming is an activity carried out by households on holdings that represent managerial units organized for the economic production of crops and livestock. A farming system is a unique and reasonably stable arrangement of farming enterprises that the household manages according to well defined practices in response to the physical, biological, and socioeconomic environments and in accordance with the households' goals, preferences, and resources (Shaner *et al* 1982)

Socio-economic aspects

Shifting cultivation is the most prevalent form of landuse in the uplands, which causes denudation of vegetation and loss of top soil. The strategy of agricultural development in the uplands necessarily requires that it should be adaptive, flexible and sustainable. Sustainability should be ecologically sound, economically viable and socially acceptable. Now 'SALT' is gaining momentum for upland land husbandry.

The sustainable management of natural resources in upland development can be achieved through :

* the integration of indigenous knowledge in development processes;
* the enhancement of local capacities for upland resources management;
* the restoration of ecologically degraded lands; and
* the conservation, and sustainable use and management of biodiversity.

Upland people take a lot of food plants from wild states other than major food crops cultivated in farming systems.

Usually they gather them from wild states. Most of them are non-timber food crops. Thus there exists a lot of ethnobotanical knowledge about food plants among hill people. These food plants can easily be integrated in hill farming systems. Thus the knowledge of ethnobotany can be utilized in shifting cultivation and different SALT systems for the sustainable development of farming systems towards food security.

Many non-timber forest plants like bamboos, rattans, broom grass, medicinal and aromatic plants, sun grass, are also associated to the lives of uplanders. Hill people use many plants like these for making houses, household implements and other domestic purposes. They also sell the gathered surplus in the market, that brings money. Thus many plants are related with socioeconomic activities and income generation of hill people. Most of the non-timber economic resources are harvested from wild state. Indiscriminate harvest and exploitation cause depletion of natural resources in the tropics (Peters 1994). Forest people spend a substantial amount of their time for gathering the non-timber produces from wild states, far away from their homes. Uncertain amount of harvest also does not ensure stable marketing. Only cultivation and integration of a commodity in a farming system can ensure its steady production, sustainable management and market potential.

Ethnobotany and hill farming system

Ethnobotany is a knowledge system either as documented or undocumented folk-lores. It preserves information on utilization of individual plant, propagation and management techniques, and processing of many plant products. Most of the available documented information of ethnobotany are on ethnopharmacology and individual plants. Knowledge about individual plant has many production aspects. A knowledge system is a treasure, but it can not work itself. It is being utilized.

Farming system is a production system. It utilizes knowledge and information from different knowledge systems. Major

components and individuals of components in upland farming systems are plants. With increasing demographic pressure, more and more natural plant resources need to be integrated into sustainable cultivation systems. So information of ethnobotany can be retrieved and utilized in selecting production income oriented food and other plants for upland farming systems. It can also focus on indigenous system of soil classification, recognition of plants, local methods of plant production, propagation, management, pest control, general recognition of the value of polyculture, etc.

Ethnobotany can play a catalytic role in developing alternative options of production systems like agroforestry. It focuses the following major links with agroforestry (Alam 1997) and thus to upland farming system:

Crop diversification: It ensures more productive components which are key factors for sustainability of a land based production system. Ethnobotanical knowledge about local wild and semi-cultivated plants is a guide in selecting new crops in a farming system.

Domestication of new crops: Many fruit, f odder, fibre, medicinal and other non-timber economic plants are utilized and harvested by local people. With indiscriminate harvesting these resources are depleted. Also the genetic bases are eroding. Their domestication and cultivation can ensure sustained production of the commodities, and conservation of genetic resources. Ethnobotanical data base can be utilized in this regard.

Market orientation: Direct observations and recording, local market survey, etc., are part of ethnobotanical data gathering methods. Through these methods we can get an idea about marketable commodities from different habitats. This knowledge of ethnobotany can help in selecting market orientated products and plants for integration in a farming system.

Indigenous technologies: Local communities have their indigenous technologies of food production, processing, management, etc. There are also technologies related to other off-farm production oriented activities. Innovation of indigenous knowledge systems must be encouraged, so that individuals can find new opportunities to mitigate the unfavourable changes. Adoption and appropriate adjustments of indigenous technologies can help in keeping system socioeconomically sustainable. Upland farming system can thus be benefited from ethnobotany.

Replication of prototype: The combination of annual food crops and perennial tree crops have been tested by indigenous people in different micro- environments for many generations, which can easily be replicated in similar habitats and communities for development.

Sustainable development: The recognition and reinforcement of indigenous knowledge systems can form the basis for an alternative development model. The capacity of these systems to integrate multiple disciplines are beginning to demonstrate higher levels of efficiency, effectiveness,adaptability and sustainability of many of the conventional technology systems (Mathius-Mundy 1993). Integration of ethnobotanical knowledge can enhance the sustainable development of upland farming systems.

State of ethnobotanical knowledge

Indigenous knowledge about plants and the processes for their utilization are the main focuses of ethnobotany. They are existing as practices, taboos, ritual beliefs, folklores, and are being transmitted from generation to generation. These treasures have been little inventioried and documented. Most of the papers published so far are mere lists of plants with their uses. In documenting the uses major

emphasis has been given on medicinal uses and ethnopharmacology. A good number of papers on ethnobotany are found in journals like, *Economic Botany, Ethnobiology, Ethnobotany, Advances in Ethnobiology, Journal of Economic and Taxonomic Botany,* and many botanical journals.

Present ethnobotanical recording process is such that it only communicates about a plant but does not work for information retrieval. It also provides information on parts used for different purposes. For retrieval and utilization this information is to be codified and incorporated in d-base. Future information gathering also should be designed in a systematic way. If we are truly interested in recording information in a retrievable form, then we need a system in which the points of reference are stable and the observations are recorded in a standard format.

A sample list of potential plants for hill farming systems is given in Table 1. The list is based on some ethnobotanical papers published in Economic Botany, Journal of Economic and Taxonomic Botany, Indian Journal of Forestry and Indian Forester. The table is organized into production and service functions, and socio-economic orientation of the species. The production functions have been organized scanning the published reports, but service functions and socio-economic attributes have been incorporated by the author.

Gender role

Indigenous knowledge systems are also gender oriented. Women have much knowledge about food plants, aromatic plants, and plant products for hair wash and skin care. They are also conversant with their harvesting, processing, cultivation, management, etc. Women's relation with perception of environment tends to be comprehensive and multidimensional (Fernandez 1994; Misra 1994, Quiroz 1994). So in recording ethnobotanical data women's knowledge should be respected. They should also be brought in decision making in designing and planning.

PRA as a tool

Participatory Rural Apprisal (PRA) is now used as a cost effective tool in designing and developing many community development programmes. It yields valuable information on indigenous knowledge because they involve farmers as actors rather than respondents. PRA has been suggested as one of the important ways of ethnobotanical studies (Martin 1995, Gurung 1994). It can be used as a tool in retrieving ethnobotanical data from the communities and linking them in designing development programmes.

Conclusion

Local knowledge system is concrete and relies strongly on local institutions, practical experiences and directly perceivable evidences. Studies of these knowledge may provide important insights into appropriate technology for sustainable development and resource management. Ethnobotanical studies could be focused on inventories of plant use patterns in relation with production systems, ecosystems, conservation of resources, income generation and market orientation.

Codification of existing information, and development of systematic and standard methodologies for future data collection are desired. Also indigenous knowledge system needs to be protected. The knowledge and information collected must be organized and evaluated in ways that enable and encourage the innovation processes of both local communities and researchers. Finally we should not forget that ethnobotany is the interaction between people and plant. So, to integrate the knowledge of ethnobotany in a production system, building rapport with the people is a must.

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Table-1: A sample list of some potential plants for hill farming systems- based on some published ethnobotanical literatures. (Production functions have been taken from published reports; service functions and socioeconomic attributes have been incorporated by the author).

Species	Production functions										Service functions			Socioeconomic attributes	
	Timber	Food	Fodder	Medicine	Oil	Fish Poison	Tannin	That ching	Fibre	Detergent	Hedge	Nitr. Fix.	Soil conser	Market oroemt	Cottage indus. raw mat
Acacia coccina		+					+			+				+	
Adhatoda vasica				+							+			+	
Aphanamixis polystachya	+			+	+	+								+	+
Artocarpus lacucha	+	+	+	+										+	
Aurando donax			+					+			+		+		
Baccaurea ramiflora	+	+		+										+	
Cassia alata				+							+	+	+	+	
Carissa carandas		+		+							+			+	
Cinnamomum cecidodaphne	+			+	+									+	
Derris elliptica				+		+						+	+	+	+
Dioscorea spp.		+		+										+	
Emblica officinalis	+	+	+	+										+	
Ficus auriculata	+	+	+	+									+	+	
F. glomerata	+	+	+	+									+	+	
F. semicordata	+	+	+	+									+	+	
Flacourtia jangomas	+	+		+										+	
Garcinia cowa	+	+		+										+	
G. xanthochymus	+	+		+										+	
Grewia asiatica		+	+	+					+					+	
Imperata cylindrica			+	+				+			+		+	+	
Litsea cubeba	+			+	+									+	
L. kingii	+		+	+										+	
Madhuca latifolia	+	+		+	+									+	
Mallotus philippensis	+		+	+	+									+	
Mangifera sylvatica	+	+		+										+	
Phoenix sylvestris	+	+		+				+	+					+	+

Table-1 (Contd.)

Species	Production functions										Service functions			Socioeconomic attributes	
	Timber	Food	Fodder	Medi-cine	Oil	Fish Poison	Tannin	That-ching	Fibre	Detergent	Hedge	Nitr. Fix.	Soil conser	Market oroemt	Cottage indus. raw mat
Protium serratum	+	+	+	+											
Pterygota alata	+	+			+									+	
Ricinus communis			+	+	+						+			+	+
Sapindus mukrosi	+									+				+	
Schleichera oleosa	+	+	+	+	+			+			+		+	+	
Sterculia foetida	+	+		+					+					+	
Stixis suaveolens	+	+												+	
Tephrosia candida				+		+					+	+	+		
Terminalia arjuna	+	+		+			+							+	
T. bellirica	+	+	+	+			+							+	
T. catappa	+	+		+											
T. chebula	+	+		+			+							+	
Tinospora cordifolia				+										+	
Thysanolaena maxima			+	+				+			+		+	+	
Veteveria zazanoides			+	+	+						+		+	+	
Xanthoxylum spp	+	+		+	+									+	+

Indigenous Technology for Processing of Forest Produces

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Introduction

Ethnobotany is an interdisciplinary science of indigenous knowledge about plants and their interaction with the people. It relates to plants, their utilisation, management and socio-economic aspects. Traditionally, ethnobotany is concerned with the documentation of knowledge and cataloguing medicinal and other economic plants. Modern perception of ethnobotany includes also the exploring different dimensions of utilisation. It is an indigenous system which strongly relies on local institutions, practical experience and directly perceivable evidences. Studies on these aspects may provide important resource management and conservation.

Bangladesh supports a rich flora. About 5000 plant species are estimated to occur in Bangladesh. Main floral diversity is found in the hilly forests of eastern part of the country. The area is covered with evergreen or semi-evergreen forests. Different stories of the forests are occupied by various types of plants. The hill forests are not only rich with floral or faunal diversity, but also with ethnic diversity. There are about 13 tribes in this area. Of these, the *Chakma*, *Marma* and *Tipara* form the majority. The living and livelihood of the hilly people are linked up with the plant communities from the pre-historic time. With the development of rural infrastructure, changes in biological and cultural diversity are taking place.

Ethnobotany is obviously a broad field. There is world-wide resurgence of interest in the study of this field. In Bangladesh, however very limited information is available on all aspects including the distribution and utilisation of medicinal plants. Its many other aspects are also neglected. There is no report on the methods of harvest and processing of plants and their products used by the tribal people. This study attempts to describe indigenous knowledge of ethnic people about harvesting and processing of timber, bamboo, rattan and sun-grass. These plant resources are integral part of their life. The information is based on the limited observation and interview with the ethnic community particularly with *Chakma*, *Marma* and *Tipara* communities.

Plant Resources

Timber :There are about 400 tree species in the Chittagong Hill Tracts. Most of the timbers are used as construction and fuel wood. However, there are some species which are preferred by the tribal people. *Gutgutia* (*Protium Serratum*), *gamar* (*Gmelina arborea*),*udal* (*Sterculia spp*), etc. are among these timbers. It is interesting to note that these species are more or less durable and are resistant to biodeterioration. *Gamar* is dimentionally stable, does not show any degradation during long time use. They may not be aware of the scientific reason, but know it through the traditional use.There are some species like garjan (*Dipterocarpus* spp.), *nageshwar* (*Mesua ferrea*), *toon* (*Toona ciliata*), *telsur* (*Hopea odorata*) etc., for which they have prejudice to use. They believe that the use of nageshwar (*Mesua ferrea*) timber, may invite snakes in the house and *garjan* attracts thunder storm and lightening.

Harvesting of trees is made during the dry season between November and January. Trees with round and straight bole are preferred. From the experience, the tribal people can identify the matured trees. Usually the maturity of the trees is checked by striking the stem with the back of a sharp iron tool, called "dao". Creation of metallic sound indicates that the trees are matured enough for harvest. This practice helps them to eliminate the juvenile wood and thus enables to get better quality wood with less defect. They avoid cutting the deciduous trees at the time of leaf flushing. The trees are cut about 1 m above the ground. This allows the sprouting of coppices to grow undisturbed from the browsing by the animals. It helps contribute to natural regeneration of the forest.

Moisture content in the stem is higher during the rainy season. Besides, this is the growing season of the trees. Trees are not felled during the wet season. It has the scientific basis of harvesting. During the winter it has lesser chance of attack by fungus and insects due to low temperature and humidity. Saw is not used for harvesting. Locally made sharp tool is normally used for cutting and very frequently axe is used for converting the timbers into planks. The planks are partially sun-dried before the use.

Bamboo : Chittagong Hill Tracts is rich with bamboo resource in respect of species diversity and abundance. There are about seven naturally occurring species of bamboo. Most important species are *muli* (*Melocanna baccifera*), *mitinga* (*Bambusa tulda*), *ora* (*Dendrocalamus longispathus*) and *dolu* (*Neohouzeaua dullooa*). Cultivated *baijja* (*Bambusa vulgaris*) is used as house post. *Muli* is used for the construction of floor, wall and roof of house and for various household implements.

Like trees, bamboos are also harvested during the dry season. Maturity of bamboo is tested by striking it with the back of a *dao*. A metallic sound is the indication of maturity. Besides, change in colour from green to yellowish is taken into consideration. Bamboo made houses are replaced after 4- 5 years.

Rattan : Chittagong Hill Tracts support a good number of rattan species as well. The important rattan species are *kerak bet*(*Calamus viminalis*), *budum bet* (*Calamus latifolius*), *chikan bet* (*Calamus guruba* and *golak bet* (*Daemonorops jenkinsianus*). Rattans are used for binding material, furniture, basket, etc. Harvesting is made during the dry season. The ethnic community allows the plants to take the advantage of the monsoon for maximum growth. The maturity of the rattan stems is judged by the disappearance of leaf sheath near the base of the culm. After harvest, rattan stems are split and sun-dried prior to use.

Sungrass : The sun-grass (*Imperata cylindrica*) is a very important resource for the tribal community. It is used for that ching purpose. Usually, the roof of all the huts is made of sun-grasses. It is harvested in November and December. Generally, the women collect the grasses from the forests. After collection, the sun-grasses are thoroughly sun dried for 2-3 weeks and then used. Normally the grasses need replacement after 2-3 years.

Conclusion

It is evident that the ethnic community does have the access to the modern scientific processing and harvesting facilities. But what they are adopting bear more or less some scientific basis. They have learnt these through long experience and traditional uses. However, there is an ample scope for improving these techniques. A substantial amount of timber can be saved if it is converted even by a hand axe. Biodeterioration can also be minimised by air drying the plant resources properly to an appropriate moisture content level. Full protection from insect and borer attack can be achieved by adopting simple treatment process developed by the Bangladesh Forest Research Institute.

Intellectual, Biological and Cultural Property Rights

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The Context : Changing concept of property

The global trend of progress demands that countries be a part of the world market economy and thus each country is subject to various international agreements that are expected to ensure a steady development in this direction. The eight countries of the Hindu Kush-Himalayan region fall in the lowest rung of economic development with five countries falling in the least developed country category (Afghanistan, Nepal, Bhutan, Bangladesh and Myanmar) and the other three in the low income developing country category (Pakistan, China and India). If the scale of economic activities in the mountainous region alone of the latter three countries is considered, the Gross National Product (GNP) of these regions in each country is comparable with the other LDC neighbors. The reasons for such a sorry state of affairs are far too many and diverse including the continuing process of the flow of resources from the mountain regions to outside without involving much value addition locally.

For most part of the human history, security and the path to power have been vested in land: land to graze animals, gather food and medicine, collect fuel wood and build shelters. While this is true for settled communities, nomadic ways of life entrusted more authority on community decisions. However, in all these variations from individual to community control, the access to and the use of common land was governed by rules often linked to seasonal, biological and cultural factors. This scenario rapidly changed with the onset of industrial revolution and increasing commercial value of the common resource. In the context of HKH countries, much of the community land was brought under government control to meet the raw material requirement; initially by the colonial rulers and replaced later by the bureaucracy. While there has been some success in the recent past to revert the control over common property to communities, a new form of invasion has set in.

This time it is the unearned use of indigenous knowledge, cultural traditions and biological diversity that is considered as the 'raw material' for future industrial needs, particularly in the biotechnology industry. In the same spirit notion of property is being extended to these resources. Mountain communities have evolved a tremendous range of practices to suit their diverse ecological and socio-economic environment and are so positioned with strength. However, their interests are not adequately addressed in many of the recent trade agreements; though, they find a place in some of the non- binding principles such as Agenda 21. The issue of intellectual property rights (IPRs) over bio-cultural resources is a matter of great concern in this regard. This paper attempts to introduce issues and developments in the arena of IPRs and implications thereof upon the local mountain communities in the HKH region.

Emergence of IPRs as a means of economic dominion

The world's present intellectual property system has its roots in 19th century

European efforts to promote interests of private industry in scientific and industrial growth. There are five major forms of intellectual property rights: patents, plant breeders rights, copyright, trademarks, and trade secrets as explained briefly in Box 1. These laws give inventors monopolies and discourage competitors. Legally, in order to get a patent in most countries, three basic criteria need to be met, namely, a product or process must be:

* new (or can claim 'absolute world novelty')
* non-obvious (that is, includes a real inventive step)
* useful (has commercial application).

In return for depositing a sample of the patented product or process and describing it so that others skilled in the art can replicate it, inventors get the right to:

* exclusive monopoly over the invention for 17 - 25 years
* royalties (a surcharge above the normal sale price) on the use of their invention
* control access and set the conditions for the sale of invention, meaning the right to deny or vary costs depending on the customer and market conditions.

It was late not so long ago when plants and life forms could be patented and one of the first international agreements, the Union for the Protection of New Varieties of Plants (UPOV) was signed in 1961 to protect the plant breeders rights (PBR). This was the time when public and private seed corporations were beginning to expand business across the globe as part of the Green Revolution technological package. There are two operative UPOV conventions dated 1978 and 1991. The 1978 convention allows farmers to save and replant PBR-protected seed from their harvest while the 1991 version restricts the rights of farmers to save seed and make PBRs more like patents, extending the scope of the monopoly granted to the certificate holder. The first patent on genetically engineered microorganism was granted in the United States in 1980. In 1987, US Patent and Trade Mark office ruled that animals are patentable too.

Current patent regimes allow for exclusive monopolies, meaning that patent-holders may arbitrarily set the conditions for access to their inventions. Many patent-holders resort to manipulative practices by setting different prices and conditions for marketing their products through other companies, thereby excluding some buyers completely. Small and upcoming companies are faced with restrictive trade practices as they do not have the market or product range of the bigger firms. Patents, therefore, are scale-biased in favour of transnational corporations.

The late 20th century has seen the further development of patent systems developments around the patenting of life forms that are products of biotechnology and industrial manipulation of genetic materials. It is based on the idea that genes are inventions and products because the process of isolation, extraction and ex-vivo replication of biological material requires techniques which human beings alone are capable of putting into practice and which Nature is incapable of accomplishing itself.

The newly established World Trade Organisation has a mandate to implement the General Agreement on Tariffs and Trade (GATT) which has a specific covenant on the Trade Related Intellectual Property Rights (TRIPS). The TRIPS section of GATT may be the most ambitious multilateral agreement ever made in the area of intellectual property. Divided into seven parts and 73 Articles,

it covers issues of copyright and related rights, trademarks, geographic indications, industrial designs, patents, lay out designs of integrated circuits, trade secrets, control of anticompetitive practices in contractual licenses, as well as provisions on enforcement, acquisition, maintenance of IPR, and related dispute-settlement mechanisms. In other words, it stipulates that all signatories must conform to industrial country standards of intellectual property law. The TRIPS agreement includes a provision (Article 27, 3b) that excludes from patentability, 'plants and animals other than microorganisms, and essentially biological processes for the production of plants or animals other than nonbiological and microbiological processes'. The same provision also guarantees 'the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof'.

Together with the above two, another provision of TRIPS which makes it mandatory for all members to *'establish a system for the grant of exclusive marketing rights'* has been viewed as a threat to the interest of local communities in the third world countries. Developing countries have until the year 2000 to implement the intellectual property provisions and the least developed countries have until 2004; with possible extensions in both the cases.

Implications of IPR mechanisms for mountain communities

The above mentioned concepts of intellectual property differ radically from most rural and indigenous systems of knowledge and innovation prevalent in the mountain communities. Here, society perceives knowledge and innovation as a collective creation and not as commodities. This community creation of knowledge is held in trust for future generations and it is unheard of farming communities to grant unlimited rights to land and resources, or to permit ownership of the process of life. Concepts like stewardship or custodianship come much closer to rural realities than those such as exclusive monopoly or intellectual property. For example it is widely recognised that traditional farming practices have immensely contributed to the promotion and management of agricultural biodiversity and in the development of modern varieties. However, genetic material from a landrace, patented by a breeder gives him all claims to the material, whereas the farmer from whose farm the material was taken has no right on it. The logic is that even when a landrace is used in a commercial plant variety, breeders almost always extract and adapt a gene or gene complex to make one of several hundred components in a new plant variety. Considering the alternative option for a farmer trying to obtain PBR, to be eligible for protection, he/she would have to prove that the variety is:

* Distinct: distinguishable by one or more characteristics from any other variety whose existence is a matter of common knowledge;
* Stable: remain true to its description after repeated production or propagation;
* Uniform: homogenous with regard to the particular feature of its sexual reproduction or propagation;
* Novel: not have been offered for sale or marketed in the source country, or for longer than four years in any other country.

The farmer or his community would have to prove that they were the only ones to use the landrace or breed the cultivar in addition to all the above legal requirements. More so, some of the prerequisites are actually in conflict with the farmers breeding priorities as they would prefer varieties that posses variability and

adaptability and thus try to create cultivars with intravariety genetic diversity. This is just one example of how the different forms of patents are biased towards the industrial society. A balanced picture of the advantages and disadvantages of the various forms of IPRs for local communities is presented in Box 2.

Four member countries of the HKH region have already accepted the membership of the World Trade Organisation (WTO) and are thus required to reform their patent laws in accordance to the provisions of GATT and TRIPS. These countries are Pakistan, India, Bangladesh and Myanmar; while China has the status of an observer and Nepal is also trying to gain the membership. Further discussion on likely implications of these agreements on the existing patent laws of most of the countries can be well illustrated taking the example of India. Some of he significant provisions are that while current Indian laws provide a patent protection in the food and drugs sector only for seven years, the new provision would need 20 years protection. At the same time new provisions prohibit a ceiling on the amount of royalty that can be charged on a patent. This would clearly imply longer monopoly periods and at substantially higher prices. Two more provisions that go together are one abolition of the system of awarding 'process' patents in chemicals and pharmaceuticals to 'products' patents only; and second importation being considered to be working a patent would have tremendous impact on the domestic manufacturing industry. These changes are likely to affect everyone in the society, particularly in access to two basic necessities of food and medicine, as the influence of new provisions would stretch right from farmers, scientists and breeders, consumers, and state-financed research institutions to the overall state of markets and technology.

To begin with, farmers would have to pay expensive patenting fees to be able to buy genetically engineered seeds, which would not only be more expensive than the conventionally bred seeds but also cannot be saved for the next crop as the patented variety belongs to the patent holder. A higher price for practically all other inputs particularly agrochemicals, would be baneful to small farmers. Only a small section of farmers with a relatively large land holding will enjoy the economies of scale and would be able to sustain themselves. Mountain farmers are particularly disadvantaged on account of being small and working with low capital and high risk. Vagaries of the weather conditions predominant in mountain areas would put undue stress and risk on farmers. Lifting of the existing regime of subsidies being advocated under the GATT provisions would further deprive the farmers. At the same time, the strength of national and state agricultural research agencies to provide new varieties would diminish as scientists and breeders would be denied access to patented varieties for further breeding. Progress and innovations in breeding will depend on the affordability of patent fees. Live resources such as genes and living cells as well as characteristics like 'high protein' and 'dwarfness' would become the private property of biotechnology companies. Research and extension will further suffer because of restrictions on the free exchange of information, and increased privatisation of research would lead to further internalisation (secrecy) of research results. As a consequence, the current problem of global food supply would be further aggravated and would influence those communities most who are not self-sufficient in food production such as the population of the HKH region.

Significant steps to safeguard future interests of mountain communities

In the context of above discussion and emerging issues, considerable thinking

and advocacy campaigns to safeguard the interest of the local communities are underway throughout the world. To begin any sound argument, a more systematic analysis of the contribution that local knowledge and resources have made and continue to make is to be understood in economic terms. Box 3 provides a brief overview of the role of community knowledge in global. Though, the IPR regime being promoted currently is trying to overcome the losses to the industrial north, it fails to provide mechanisms to financially safeguard the contribution of the local communities of the south.

In the wake of these sharp realities and rising awareness on these issues many alternative views are being promoted. One significant development on these lines is the concept of Farmer's Rights. As introduced in the FAO's international undertaking on Plant Genetic Resources, farmers rights mean rights arising from the past, present and future contributions of farmers in conserving, improving, and making available plant genetic resources. These rights aim to:

* assist farmers and farming communities, in all regions of the world, specially in areas of origin/diversity of plant genetic resources (useful for HKH farmers) in the protection and conservation of plant genetic resources, and of the natural biosphere;
* allow farmers, their communities, and countries in all regions to participate fully in the benefits derived, at present and in future, from the improved use of plant genetic resources, through plant breeding and other scientific methods.

While the directives and principles mentioned above are soft laws there are more legally binding treaties such as the Convention on Biological Diversity (CBD).

All the eight HKH countries have either signed and/or ratified the CBD and its Article 8(j) states that Parties are obliged to :

* ensure that a fair share of the benefits go to indigenous and local communities when others use their knowledge or the resources that they have conserved;
* ensure that people of indigenous and local communities receive recognition and acknowledgement for their contributions to universal knowledge and welfare;
* help indigenous and local communities develop their own economic uses of their traditional knowledge and associated biological resources, which are consistent with traditions of sustainable use;
* ensure protection of the rights of indigenous and local communities over their knowledge, innovations and practices as a part of the broader goal of achieving protection of their cultural heritage.

Advocates of these clauses are arguing (Downes 1997) that the term 'equitable sharing of benefits' should be defined by reference to the costs incurred by indigenous and local communities in conserving their knowledge and associated biodiversity, rather than by reference to the value patents or an 'effective sui generis system' or both.

Heritage rights such as provided by the World Heritage Convention to which all the HKH countries except Bhutan have signed, provide another important instrument in favour of indigenous and local communities. In a special report of the UN Economic and Social Council (ECOSOC) on the cultural and intellectual property rights, heritage is defined as *"everything that belongs to the distinct identity of a people and which is theirs to share, if they wish, with other*

people. It includes all things which international law regards as the creative production of human thought and craftsmanship, such as songs, stories, scientific knowledge and artworks. It also includes inheritances from the past and from nature, such as human remains, and naturally occurring species of plants and animals with which a people has long been connected." **This concept of heritage is applicable to both the CBD and the FAO international undertaking on Plant Genetic Resources.**

This brings us to one of the greatest drawbacks of the currently promoted property rights system which assumes that property rights are individually or privately held. It is easy to challenge this under the ECOSOC provisions that *'the protection of cultural and intellectual property is connected fundamentally with the realisation of the territorial rights'* and tenurial rights are recognised by the 1989 ILO Convention 169: *'the right of ownership, collective or individual, of the members of the population concerned over the lands which these people traditionally occupy shall be recognised.'* Both heritage and territoriality are inalienable. They are elements of communal rights which have been recognised for indigenous communities by international law. HKH region has a large diversity and spread of indigenous communities and respective national governments should translate the provisions of these directives and principles into policy and action while negotiating other international agreements. These elements of communal rights must also be extended to other local farming communities in HKH. The experience generated in the region clearly demonstrates that increased community control over resources is critical to the improvement and widening of the development options. The fight for greater intellectual, biological and cultural property rights is central to the wider struggle for people's rights to gain control over their livelihoods which is basic to the sustainable development paradigm.

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Box 1 : Five major forms of intellectual property rights

1. Patent : A legal monopoly that covers a wide a range of products and processes, including life forms. To be patentable, inventions must meet three basic criteria. They must be novel, useful and non-obvious.
2. Plant Breeders' Rights : A law that grants a plant breeders certificate to those who breed new plant varieties. PBR is governed by two international agreements under Union for the Protection of New Varieties of Plants (UPOV).
3. Copyright : Legal framework intended to protect artistic and cultural works such as books, illustration, photographs and television programmes, from being duplicated and/or transmitted without the authors permission.
4. Trademarks : A legal monopoly over a name or a linguistic or visual symbol.
5. Trade Secret : An intellectual property right used when inventories do not wish to patent in order to protect themselves from competitors. Unlike patents, trade secret do not require inventories to publish and have no time limit.

Box 2: Advantages and disadvantages of various IPR mechanisms for local communities

Mechanism	Advantages	Disadvantages
Patents	Can safeguard knowledge legally Available in most countries	Limited term of protection Applications expensive and require legal advice Protect knowledge of individual inventors, not collective knowledge of communities Difficult and expensive to defend
Petty patents	Can safeguard knowledge legally More traditional knowledge may be protected than under patent Compared with patents, less expensive application procedure and shorter and less stringent examination	Available only in a few countries No international agreements to facilitate application in different countries Shorter period of protection than patents
Copyright	Easy to obtain Long period of protection	Protects expression of ideas but not knowledge itself Protection period not indefinite Subject matter must be in a physical form
Trademarks	Inexpensive Indefinite protection period, although may have to be renewed periodically May attract more customers to products of indigenous traders and trading organizations	Does not protect knowledge per se
Trade secrets	Can protect traditional knowledge with commercial application Can protect more knowledge than the other IPR types Can be traded for economic benefits by contract Inexpensive to protect	Available in fewer countries than patent and copyrights

Sourse : Possey and Dutfield. 1996

Box 3 : The role of community knowledge in global development

Health and Medicine	Food and Agriculture	Environment and diversity
Local : 80 per cent of the South's medical needs are met by community healers using local medicine systems.	Almost 90 per cent of the South's food requirements are met through local production. Two-thirds are based on community farming systems.	Almost 100 per cent of the biodiversity "hot spots" are in areas nurtured by indigenous communities and/or bordering the South's farming communities.
Global : 25 per cent (and growing) of western patented medicines are derived from medicinal plants and indigenous preparations.	90 per cent of the world's food crops are derived from the South's farming communities and continue to depend on farmers' varieties in breeding programmes.	The wild relatives of almost every cultivated crop are found in biologically-diverse regions of the South and are nurtured by indigenous communities.
Market : The current value of the South's medicinal plants to the North is estimated conservatively at US$ 32 billion annually.	The direct commercial value derived from farmer's seeds and livestock breeds is considerably more than US$ 5 billion a year.	90 per cent of the world's most biologically-diverse land and waters have no government protection and are nurtured exclusively by rural communities.