Chapter Three

Summary of Working Sessions

The workshop consisted of four working sessions, each presided over by a chairperson. In each of the sessions three to four papers were presented, followed by clarification of queries and leading to an open discussion. The sessions were finally summed up by the chairperson. This section presents the synthesis of the papers presented according to the sequence of the working sessions.

Session 1

Hill Perspective: Sustainable Development Imperatives

Tej Partap

A clear understanding of hill phenomena is a crucial prerequisite for correcting the approach to hill problems and for the initiation of relevant development interventions to handle them. **The first step in this direction is to understand the development imperatives of hill characteristics.**

Rethinking development strategies for hilly areas, in general, and hill agriculture, in particular, could start with the development of an approach that would facilitate proper assessment of the constraints and potentials of hill areas, as well as the concept for and design of policy and programme options suitable to specific hill situations. This approach falls within the ambit of the 'Hill Perspective'.

One may define a 'Hill Perspective' as an explicit or implicit consideration of specific hilly conditions/ characteristics and their operational implications while designing and implementing development interventions for hilly areas.

The important conditions characterising hilly areas which, for operational purposes separate hill habitats from other areas, are called 'hill specificities'. The six important hill specificities considered here fall into two major groupings; one, a group better known for generating constraints to development and these are: Inaccessibility, Fragility, and Marginality; and the second group consists of specificities which, if harnessed properly, have the potential to provide comparative advantages for the development of hilly areas. These are: Diversity, Niche, and Adaptation Mechanisms or indigenous/traditional knowledge and practices of local hill societies in the context of resource use and management. Further, each of these hill specificities is three-dimensional in nature, viz., physical, biological, and socioeconomic, and the degree of existence of each dimension again varies between areas and regions and so would their implications for development imperatives.

To enhance the direct use value of these hill specificities in the search for sustainable development, one needs to spell out their operational implications in order to influence the decision-making processes affecting development programmes for the hills. The operational implications can be classified into the following two types:

- objective circumstances, which can be easily understood and incorporated into policy and programme designs, and
- dependant patterns of activities, including traditional practices and patterns of resource use as well as conventional development interventions.

Due considerations given to the complexity of varying degrees of the already-mentioned hill characteristics, their multiple dimensionality, and their interrelationships would give a contextual perspective to decisions and actions in hilly areas.

Sensitivity to a hill perspective would determine the relevance and effectiveness of any development activity in hilly areas.

The focus of development interventions should be on protection and enhancement of positive attributes and maximisation of their role in development interventions. The negative attributes should be treated in the opposite fashion. An understanding of these attributes can help greatly in determining development goals and priorities and in designing operational programmes.

Yet another important feature of **hill specificities** is that most of them are **interlinked in two ways**: (a) common causal factors and (b) shared consequences of disturbance to each other.

Even if the finer attributes and interrelationships of hill characteristics are ignored by development experts, they readily perceive the broad features of hill situations described as 'objective circumstances.' Accordingly, infrastructure, communications, and mobility are three interrelated basic facilities with which the pace of development is closely associated. But the conventional straight-forward approach to planning and creation of these facilities is hindered by the different physical, climatic, biological, and even socioeconomic (e.g., scattered settlement patterns) factors contributing to the 'inaccessibility' phenomenon.

Since most hill characteristics – acting as constraints or indicators of resource base potentials – are interlinked due to their broadly common causes and externalities when used, none of them can be treated appropriately in isolation. This forms a **compelling basis for an integrated approach** to development interventions.

Development goals and needs should be described and defined in broader terms with an explicit focus on issues such as equity, environmental stability, and, of course, economic betterment. In view of the intergenerational equity issues and inseparability of the long-term health of natural resources and their current use pattern, sustainability should be the explicit component of development objectives.

Development strategies for hill areas have to be **resource-centred**. The resource characteristics (fragility, heterogeneity, 'niche', etc) determine the choice and pattern of resource use, and this, in turn, should be directed not only to current productivity but to sustained use of the resource base.

To benefit from people's adaptation mechanisms and also to make development interventions relevant to the heterogeneous conditions of hill habitats, it is essential that "planning from below" becomes an integral part of the development approach in the hills.

Owing to the above-mentioned factors, such as (i) the 'objective circumstances' of hill habitats, (ii) inadequate understanding of them and their projection by development planners as merely 'constraints to development', (iii) the inadequacies of conventional cost-benefit norms to account for negative and positive externalities associated with development interventions, and (iv) the limited replicability of plains' development experiences in the hills, the conventional development models and approaches need significant changes to become relevant to hill areas. This becomes all the more clear if one compares the major features and orientations of the conventional development approaches with the hill perspective approach. Several examples can be mentioned about orientation and features of the conventional development approach vis-a-vis the approach based on the hill perspective.

The hill perspective framework discussed above is not a simple conceptual exercise. Its relevance and usefulness has already been proven in analysing a few success stories in the Hindu Kush-Himalayas where, knowingly or unknowingly, imperative features of hill specificities were incorporated into the design and conduct of the projects/programmes.

To make the hill perspective a widely usable decision-making tool, more application-oriented versions of this perspective will be useful. At present the Mountain Farming Systems' division of ICIMOD is engaged in this exercise.

Potentials for Producing Medicinal and Aromatic Plant Resources as High-value Cash Crops in the Chittagong Hill Tracts

Md. Waliuzzaman

Application of herbal medicines for the treatment of diseases dates back to more than 1000 B.C. In China, extracts of various medicinal plants have

been used for centuries for healing common diseases. Based on these experiences, gathered over the centuries, in using the medicinal properties of these plants, two indigenous medical systems have developed – the Unani and the Ayurvedic. The Unani system of traditional medicine was developed by Muslim practitioners and the Ayurvedic system was developed in India by the Hindus. Today, people in the rural areas of Bangladesh use herbal medicines prescribed by Unani and Ayurvedic practitioners for treatment of their day-to-day ailments.

Terraced land and the climatic conditions of the Chittagong Hill Tracts and Sylhet are congenial for the growth of such plants. A systematic programme to facilitate economic benefits from these hilly areas by producing medicinal and aromatic plants can generate local employment as well as cash for the tribal people living in these areas.

In the Chittagong Laboratory of Bangladesh Council of Scientific and Industrial Research (BCSIR), the species of medicinal plants planted were, namely, *Terminalia arjuna, T. bellirica. T. chebula. Phyllanthus emblica, Strychnos nuxvomica, Rauwolfia serpentina, R. Tertraphylla, R. vomitroria, Cassia fistula, Holarrhena antidysenterica, Catharanthus roseus*, etc. Nearly 100 species of medicinal plants were planted in the experimental plots of the laboratory.

In addition to medicinal plants, preliminary trials for the production of essential oil-bearing plants were undertaken in 1975. The selected variety of lemon grass was exhaustively cultivated in the Chittagong Laboratory campus in the late seventies. Several other species of essential oil-bearing plants were leased out and some firms are now producing them commercially. The BCSIR also set up two extraction plants near Rangamati town around the same time, but they have closed down because of lack of raw materials. These plants were established for the extraction of lemon grass oil based on the cultivation of lemon grass in the area. But, unfortunately, *jhum* cultivation of lemon grass could not be sustained for more than two seasons due to an interruption in the supply of lemon grass because of the so-called *Shantibahini* insurgency.

The Chittagong Hill Tracts' district covers about one-tenth of Bangladesh and is an important area for the cultivation of medicinal and aromatic plants. The Chittagong Hill Tracts' Development Board and the Department of Forests can provide necessary back-up services. The people of CHT should be able to earn additional cash and improve their living standards by growing medicinal and aromatic plants. With the availability of proper irrigation facilities, the Barind Tract area can also be profitably used for plantation of specific medicinal and aromatic plants.

But this availability alone is not sufficient for commercial exploitation. Production of such plants on private land has not yet started. Large-scale collection of plant resources from forests will be feasible once the pockets for their cultivation are properly identified. However, the collection process is a difficult one and the cost of their transportation to a manufacturing site must be taken into account. Currently, the plant resources used in Bangladesh for commercial production of herbal medicines are mostly imported from India and Pakistan.

Private flat lands are normally preferred for the cultivation of paddy, pulses, vegetables, and so on. Any deviation from the existing cropping pattern has to be acceptable to private land owners. In order to convince them to switch over from the existing crops to new ones, the proposal has to be financially attractive.

Unlike the complexity of marketing herbal medicines, aromatic plant products should appear more attractive to land owners because of the established market for the latter, namely, soap, cosmetics, pharmaceutical industries, and so on. It is worth mentioning that some essential oils, such as lemon grass oil and citronella oil, which are currently locally produced, are using BCSIR's processes. Cultivation of aromatic plants being easier and their growth being quicker than medicinal plants, the owners of private land are likely to be more interested in the plantation of aromatic plants. At present there are farms near Savar, Dhaka, on which limited production of lemon grass oil and citronella oil is taking place. Considering the annual demand for essential oils (100 T per annum) and their export potential, commercial plantation of aromatic plants has a bright future.

Institutions that can be involved in the production of medicinal and aromatic plants are public sector organisations like the Bangladesh Forestry and Industrial Development Corporation (BFIDC) and Bangladesh Centre of Scientific and Industrial

Research (BCSIR) as well as tribal people and private entrepreneurs. However, commercial cultivation by the private sector is likely to be more feasible since it will have more flexibility in production planning, financial planning, and pricing for marketing on the basis of market forces.

BFIDC is more knowledgeable about the Hill Tracts' forest resources and the people's way of life and, therefore, is expected to be a suitable institution for the exploitation of medicinal and aromatic plant resources. BFIDC can set up its own extraction plants. On the other hand, the Chittagong Hill Tracts' Development Board, with its knowledge and experience of the tribals' economic activities and the complexities of their lifestyle, should be in a position to facilitate plant cultivation by the tribal people. Alternatively, the products cultivated by tribal people can be purchased directly by BFIDC for extraction of crude medicines or essential oils.

If such arrangements for the cultivation of aromatic and medicinal plants materialise, Bangladesh could save on foreign exchange and also provide indigenous medicines to the people.

The local production of medicinal and aromatic plants will help to provide cheap and safe herbal medicines in Bangladesh, and, consequently, aromatic and medicinal plant resources will be well harnessed. The country will become less import dependant and the rural poor will have easy access to locally-produced medicines.

For sustainability, in the context of the Chittagong Hill Tracts' people, there should be provision of (i) incentives for agricultural inputs at subsidised prices; (ii) a free supply of initial plant seedlings/ seeds/cuttings to be arranged by the local administration; (iii) proper care of the plantation at various stages of cultivation, harvesting, and transportation of the plants to the processing site for maximisation of extracts; (iv) the necessary technological support from BCSIR to the tribal people in all of these activities; and (v) transportation of the plants by the tribal people under a contractual arrangement with the help of the CHTDB.

For sustenance of the system, the cultivator will have to be paid in cash to avoid harassment over product prices. For plantation activities to continue, peaceful conditions will have to be restored to build up the confidence of the tribal people. The two BCSIR extraction plants, each having a processing capacity of 0.5 tonnes of lemon grass per day, are lying idle and need investment to bring them back into working condition.

Poverty and Access to Land: Perspective and Issues in the Chittagong Hill Tracts of Bangladesh

Salehuddin Ahmed
Shafiqur Rahman

On account of topographical and soil conditions, land suitable for intensive agricultural field cropping is extremely scarce in the CHT. The table below reveals that the land available for cultivation during 1975/76 to 1985/86 was around five per cent. From the table, it can also be seen that the land not used during 1975/76 and 1980/81 was used later, but the current fallow and cultivable wastelands are also increasing. Most of the land is used for a single crop, mainly paddy. Although forests are the natural vegetation of the CHT, unrestricted cutting and shifting cultivation have reduced the forest area from 91.09 per cent in 1975/76 to 82.3 per cent in 1985/86. The forest area, in actual terms, is far less than the area quoted here. Reports have shown that the percentage of forest area is not more than 25 per cent.

Land is the main factor for production. Many years ago shifting cultivation was the only agricultural practice. For economic reasons it is being replaced gradually by more settled farming by both tribals and settlers. The plough is becoming more prevalent and is used chiefly in wet rice cultivation on flatter lands to increase the productivity of the area. Settled rice farming and virtually all non-agricultural activities are predominantly carried out by migrants. They also cultivate the lands of some hilly people as share-croppers but, in certain cases the migrants also are owners of land.

The system of land tenureship in the CHT differs fundamentally from that in other parts of Bangladesh. Most of the land is owned by the government, and its allocation/disposal is controlled by the Deputy Commissioner. The Deputy Commissioner can allocate up to five acres of flat land suitable for plough cultivation to one individual or family and up to 10 acres of hill land (up to 100 acres in exceptional cases) for fruit or other tree cultivation.

Items	CHT			Bangladesh		
	1975/76	1980/81	1985/86	1975/76	1980/81	1985/86
Total area	32,59,520 (100.00)	32,59,520 (100.00)	32,71,000 (100.00)	3,52,80,640 (100.00)	3,53,08,640 (100.00)	3,57,85,000 (100.00)
Not available for cultivation	91,560 (2.8)	1,11,060 (3.4)	2,83,000 (0.9)	66,21,652 (18.8)	67,12,062 (19.0)	72,20,000 (22.2)
Forest	29,69,037 (91.09)	29,10,858 (89.3)	26,91,000 (82.3)	54,37,730 (15.4)	54,16,075 (15.3)	52,37,000 (14.6)
Cultivable waste	13,850 (0.4)	29,467 (0.9)	52,000 (1.6)	6,61,599 (1.9)	6,18,556 (1.8)	6,70,000 (1.9)
Current fallow	9,751 (0.3)	31,207 (5.4)	64,000 (2.0)	15,91,442 (4.5)	14,03,624 (4.0)	9,97,000 (2.8)
Net cropped area	1,75,322 (5.4)	1,76,928 (5.4)	1,91,000 (5.8)	2,09,68,187 (59.4)	2,11,57,483 (59.9)	2,16,61,000 (60.5)
- Single crop	86,266 (2.6)	1,21,924 (3.7)	1,51,000 (4.6)	1,22,50,399 (34.7)	1,14,56,215 (32.4)	1,15,16,000 (32.2)
- Double crop	81,991 (2.5)	48,462 (1.5)	34,000 (1.0)	72,69,168 (20.6)	80,40,214 (22.8)	84,92,000 (23.7)
- Triple crop	9,065 (0.3)	6,542 (0.2)	6,000 (0.2)	14,48,620 (4.1)	16,61,414 (4.7)	16,53,000 (4.6)

Source: Statistical Year Book 1990

In practice, most of the flat alluvial lands are held under a long-term lease, giving permanent and heritable rights, for which rent is paid. Land for shifting cultivation is not allocated to an individual but to the village, the headman being responsible for the distribution of the land among the villagers. The size of the plot depends on the family size. The average family size in the CHT was found to be 5.82 in 1991.

The Bangladesh Government decided in favour of raising commercial crops, such as rubber and pineapples, in the CHT and, in 1980, allotted more than 550 plots of 25 acres each for horticultural and other development activities by private entrepreneurs. Between 1980 and 1986, 64 plots in four *mouza** of Bandarban were allotted.

In general, the landholding patterns indicate that land ownership is very much skewed in the CHT; as in the whole of Bangladesh. According to the 1983/84 land statistics, only 8.5 per cent (those having 7.5 acres and more) households occupied 28 per cent of the land area, while in the whole of Bangladesh the figures were 4.9 per cent and 26 per cent respectively. In the CHT, small and medium farmers are in a better position than in Bangladesh as a whole. Small farmers (44%) holding land from 0.05 acres to 2.4 acres occupy 14 per cent of the land area in the CHT. Medium farmers (48%) with landholdings from 2.49 acres to 7.49 acres occupy 58 per cent of the land area.

It is estimated that about 15 per cent of the CHT tribal families are mainly shifting cultivators and have little or no farmland. The Asian Development Bank (ADB) survey in 1978 in three northern valleys showed that shifting cultivators fall among the poorest 25 per cent in Bangladesh with a per capita income below US $ 45.00.

The first rehabilitation scheme in the CHT commenced in 1957 in anticipation of the displacement of farmers due to the construction of the Karnafuli

* a *mouza* is an administrative/revenue unit recognised in the CHT, generally comprised of a group of villages of shifting cultivators

Reservoir (Kaptai Dam). Since then, four rehabilitation and resettlement schemes have been undertaken. About 23,500 families have so far benefitted from these schemes. The previous schemes were based on agriculture but, owing to a shortage of suitable agricultural lands, horticulture-based schemes were later introduced.

A Settlement Scheme of the Local Department of Forests for *Jhumia*, with a Focus on Proper Village Land Use, Planning, and Implementation

M.A. Sattar

The Chittagong Hill Tracts' district of Bangladesh is characterised by a primitive form of agriculture – shifting cultivation.

The problem associated with shifting cultivation, viz., the mode of living and a possible solution in light of the changing situation, can be better grasped provided the history of the evolution of the farming system, geology, soil, climate, people, customs and tradition, and other related issues associated with the system are taken into account.

The hills are composed of soft and poorly consolidated sandstones, mudstones, shales with conglomerates, limestones, and secondary rocks. Because of the unconsolidated nature of the materials, terracing is not feasible in most parts. A slight error in contour level and appropriate slope inward, without stabilising the edge by application of an appropriate technique, may result in collapse of terracing through erosion and landslides and even displacement of crops in heavy rain.

According to land capability assessment on the basis of predetermined criteria, the land forms of the Hill Tracts are divided into three broad categories - river terrace land, 'bumpy' land, and higher land.

Forestall International Ltd, in general, recommended tree plantation in a planned manner in order to arrest soil erosion on the higher land forms. Forestry was strongly recommended for the high rugged uplands.

It appears that the soil under shifting cultivation in Unclassified State Forests (USF) is mostly sandy loam and the sand under forests is clay loam. The moisture-holding capacity of forest soil is higher than that of the soil under shifting cultivation, and it is considered to be an important factor in supporting plant growth without irrigation.

Three types of forest vegetation are recognised:

- tropical wet evergreen forests,
- tropical semi-evergreen forests, and
- tropical moist deciduous forests.

Shifting cultivation, locally known as *jhum*, is a very old farming system. Shifting cultivators are called *jhumia* (a Burmese word) and the land where this form of agriculture is practised is known as *jhum*.

Prior to 1818 A.D., *jhum* cultivation was the only form of agriculture practised by the tribal people of the Chittagong Hill Tracts. Even then, it was extremely difficult to popularise plough cultivation owing to the resistance and unwillingness of the people to bring about any change in their traditional way of life. In light of the situation, the most strategic places in the Chittagong Hill Tracts, particularly the catchment areas, were declared reserve forests under colonial rule in 1880 and shifting cultivation in specified areas was prohibited. This resulted in the reduction of areas used for shifting cultivation. The rapid increase in population also exerted a profound influence on traditional farming and the fallow period decreased alarmingly beyond the critical limit of sustainability.

Currently four types of shifting cultivators can be recognised. They are:

- those practising shifting cultivation only - all hillmen residing on ridge tops and some residing along the banks of streams;
- those practising mainly shifting cultivation with one area for plough farming;
- those practising mainly plough farming with some shifting cultivation; and
- those depending upon plough farming only and shifting cultivation occasionally in order to preserve ancestral traditions.

A sample survey of four villages in the Chittagong Hill Tracts was undertaken by the University of Dhaka during 1962/63 and 1968/69. It was found that out of 112 families, 81 (72%) were solely dependent on shifting cultivation and 17 practised plough cultivation.

All lands of the Chittagong Hill Tracts belong to the government, apart from a few areas at the bottom of

valleys where settlement has taken place in the recent past. Land revenue administration in the CHT is also different from the rest of the country and is still regulated according to the provision made in the Chittagong Hill Tracts' Manual-1910. Currently, shifting cultivation is permitted only on Unclassified State Forests outside Government Reserve Forests. According to the provision, shifting cultivators are allowed to cultivate land on payment of *jhum* tax at fixed rates embodied in the manual, irrespective of area by person. In general, according to tribal conventions, a widow would pay half the *jhum* tax. The whole of the Chittagong Hill Tracts is divided into three circles (*Chakma, Bohmong,* and *Mog*). Each circle is headed by a hereditary tribal chief and is divided into a number of *mouza** headed by a headman. *Jhum* tax is divided amongst the headman, the tribal chief, the Deputy Commissioner, and the representative of the government. A proportion of the tax which is to be deposited is also mentioned in the manual.

The shifting cultivators enjoy the perpetual rights of cultivating the land that they first clear for cropping. There is no limit to the area one can clear but, in general, swidden size varies from two acres to four acres depending on local conditions. Some cultivators may leave the community temporarily but still retain the right of cultivation after return.

Abandoned swidden land can be cultivated by another person with the oral permission of the person who previously cultivated it. In case of the death of a cultivator, the rights of cultivation go to all the sons of the deceased who live in the ancestral home.

Shifting cultivation was practically a system of food production before the intervention of technological innovations and when the population pressure was extremely low.

The *taungya**plantation system originated in Burma and was transferred to Bangladesh in 1872 as a first step towards sedentary cultivation under the "world-food" programme.

The Sitapahar plantation along the Karnaphuli River in Kaptai was established in 1872 and continued in subsequent years on the same lines as in Burma.

A *jhum* control division was established as per Government Notification No XIV-107/61/31 on the 11th of January, 1962, with the following objectives.

- To grow fruit orchards in accessible and suitable areas
- To undertake cultivation on suitable terraces, followed by permanent settlement
- To grow permanent tree cover on the sides and slopes to conserve water for the healthy growth of orchards and other vegetable products on the lower slopes
- To encourage the plantation of species to be used as industrial raw materials; e.g., the match industry, plywood, and kapok (cotton)
- To manage the area on a commercial basis, as long as it is not contrary to the above objectives.

Afforestation of Unclassified State Forests (USF) and the Rehabilitation of *Jhumia* from 1980/81 to 1984/85 (1st phase).

This scheme envisaged afforestation of 50,000 acres and the rehabilitation of 15,000 *jhumia* families to increase the productivity of USF, thereby enhancing the economic condition of the local people.

Integrated Afforestation and *Jhumia* Rehabilitation on Unclassified State Forests in the Chittagong Hill Tracts

This scheme envisaged afforestation of 53,000 acres of USF and the rehabilitation of 3,400 *jhumia* families to increase the productivity of USF, thereby enhancing the economic condition of the local, landless *jhumia* people. The scheme commenced in 1984/85 and ended in 1988/89.

Conclusions

It is well known that the success of social forestry/ agroforestry/community development or any development activity depends largely on the conscious support and active participation of the community in which the project is based.

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* *taungya* - a type of traditional agroforestry system in which food crops are intercropped with properly spaced forest trees.

The residents in a community (homogeneous in all respects) will not support or participate in projects that do not address local problems and interests. It is the satisfactory redressal of such problems and needs which motivates the local people to participate in a given project.

Therefore, in the implementation of community development projects, the role of project administrators or managers is of crucial importance in motivating the local population to participate in carrying out projects directed towards local development. Ideally, the involvement of the local people in carrying out the projects should start at the very inception and continue until the end of the project.

More importantly, however, local people must also have a share in the benefits that accrue from the project.

Recommendation

A high-powered coordination committee headed by the highest authority in the nation, with experts for proper planning and implementation, may be considered. Programmes in such sensitive areas should be people-oriented and should be speedily executed to resolve the multidimensional problems of the existing situation in the CHT.

Session 2

Hill Area Development Approach: an Overview

Dr. Mohammad Haroonur Rashid

The hill areas of Bangladesh, with a total area of 13,181sq.km., are better known as the Chittagong Hill Tracts. The topography of the area is mountainous with rolling to undulating 'bumpy' and hilly surfaces. The hills run from the south in a north-westerly direction and range from 305 to 610 metres above sea level in the north to from 460 to 884 metres in the south.

The total annual rainfall in the hill tracts varies generally between 2,159mm and 3,000mm, rising sometimes to 3,800mm. The maximum and minimum temperatures vary between 20°C - 35°C. The maximum temperature is reached between March and April and the minimum between December and January.

The total land mass of the hill tracts can be broadly divided into two categories, i.e., reserved forests and Unclassified State Forests (USF). Of the total area of 1.32 million hectares, about 0.36 million hectares, or 27 per cent, are reserved forests under the control of the Department of Forests. The remaining 0.96 million hectares of Unclassified State Forests are mostly barren scrub or grasslands. Only about three to four per cent of hill tracts' land is under paddy cultivation, mostly in the northern valleys.

According to the 1991 population census, the accumulated population of the three hill districts in 1991 was 974,775, about 0.9 per cent of the national total of 111,455,185 persons. The annual growth rate of the hill population was 2.63 per cent during the census period (1981-1991), compared to the national annual growth rate of 2.17 per cent during the same period. The Hill Tracts' population is ethnically and culturally distinct from the rest of the country and is composed of some 12 to 13 tribes.

The main economic activity in the hilly tracts is agriculture. About 62.24 per cent of the household income is derived from agriculture or agriculture-related activities, compared to the national estimate of 58.16 per cent. Agriculture in the CHT contributes about 2.86 per cent to the country's GDP.

The Chittagong Hill Tracts are divided into three administrative districts, 26 *thanas**, and 110 Unions. A new administrative set up was introduced under the Local Government Council Act, 1989, for the benefit and welfare of the tribal populations of the three hill districts.

An important physical feature of the Chittagong Hill Tracts is the Kaptai multipurpose dam. The construction of the dam submerged about 765sq.km. of land, including a large proportion of the best valley bottom lands, and displaced an estimated 20 per cent of the total population. To

* a *thana* is an administrative unit.

reduce pressure on *jhum* cultivation and to resettle displaced families, a number of settlement schemes was implemented.

The development strategies pursued in the hill tracts up to the late seventies were *ad hoc* in nature and were short-term in their focus. Due to the problem of inaccessibility, food security was the cardinal focus of the strategy. Although foodgrain production increased during the initial years, it more or less stagnated afterwards despite an increased flow of high-yielding variety (HYV) inputs, technologies, and so on. However, the introduction of horticulture, as a deliberate policy, to exploit the unique conditions of the area led to a significant increase in horticultural production.

Due to various government development interventions the incomes of certain groups of people are expected to increase significantly. This may, however, give rise to a new type of conflict. As long as certain groups and areas remain outside the domain of public support programmes, the pressure on natural resources will continue. This is evident from the continuous process of shifting cultivation in the USF, as well as the encroachment of reserved forest areas for *jhum* farming, shrinking the forest cover further.

Agriculture in the Chittagong Hill Tracts: Findings of a Field Survey in the Year 1992

Md. Abul Quasem

The Chittagong Hill Tracts are situated in the southeastern corner of the country. The region is comprised of three districts, namely, (i) Rangamati, (ii) Khagrachari, and (iii) Bandarban and covers about 10 per cent of the country's land area. The population numbers one million.

The region in general is a mass of hills, ravines, and cliffs originally covered with dense bamboo trees and creeper jungles.

Topographically almost all the land in the district is high, i.e., flood-free. There are just over a 100sq.km. of medium land where crops can be cultivated but that, again, is dependant on the degree of land slopes. This pattern of topographic distribution is completely different from the Bangladesh average where only one-third of the land is high land.

The climate in the Chittagong Hill Tracts is very similar to the rest of Bangladesh and it receives monsoon rainfall during July/August and dry weather in December/February. The average precipitation appears to be marginally higher in the region than elsewhere, amounting to 2,700mm.

The soils in the region are broadly brown hill soils, which are acidic in nature and, according to texture, are sandy-loam to clay-loam.

The land capability in the region, taking into account the land slope, terrain characteristics, water retention capacity, and the fertility of soils can be grouped into five types, of which only two are suitable for paddy cultivation. These account for six per cent of the total land and cover up to 20 per cent slope areas. The soils need regular application of organic and inorganic fertilisers to maintain productivity and some soil conservation practices are necessary to reduce rapid deterioration in soil quality.

The tracts are very rich in forests and occupy 45 per cent of the country's reserve forests. The cultivable land however accounts for less than one per cent of that in the whole country.

Only six per cent of the total area of the hill tracts provides potentially good land and there are serious limitations on the choice of crops. Whatever little is grown is limited to the valley bottoms and their productivity is low.

A field survey was undertaken in all three districts of the region (Rangamati, Khagrachari, and Bandarban) in 1992.

The primary purpose of the survey was to measure the regional differences in land use, productivity of crops, and economic conditions, keeping in mind the ethnic communities and the regions of the hill tracts.

The average family size is 6.1, which is very close to the national average of 5.8, but in Bandarban district it is much lower (4.9 members). This may be because of the higher child mortality rates there. The proportion of females is much lower than that of males in the area.

Land owned by a household in the tribal communities includes three types of land: (i) individually-owned, (ii) government-owned with

possession rights enjoyed by individuals, usually known as *khas* land, and (iii) *jhum* land which is government-owned but may be used by a household or a community without them claiming possession rights. In the study areas, *khas* land, inclusive of *jhum* land, accounts for 14 per cent of the total land area, the highest being among *Murang*, who do not own any land in the literal sense. The average size of land holdings is 6.1 acres which is about three times the national average. Land cultivated by the communities accounts for about half (47%) of the total land owned, which includes pure paddy land as well as land used for fruit and spice cultivation. Of this land, paddy accounts for 36 per cent and homesteads 2.2 per cent, the absolute size being 0.14 of an acre per household.

The functionally landless (up to 0.5 of an acre) households comprise 15 per cent of the community, which is quite low compared to the Bangladesh average of about 40 per cent. The large land owners (7.5 acres and above) account for a greater percentage (27%) than the national average.

The principal land use is for forests (43%), followed by rice cultivation (36%). Rice has a greater share of land (above 40%) than forests in one community only (the *Marma* in Bandarban and Khagrachari). Fruit gardens are found to be more important in the *Murang* communities in Bandarban and the *Chakma* in Rangamati, the area average being 15 per cent in the study areas, which is much higher than elsewhere in the country. Tenant cultivators in the whole community account for 21 per cent and half of them are owner-cum-tenants. They cover 13 per cent of the rice land.

Only half of the households own cattle and the number owned by a household on an average is 1.5, but this increases to four when only cattle-owning households are considered. There are less goat/sheep owning households.

In selected areas of the hill tracts, rice is the only crop and other crops, such as sugarcane, jute, wheat, potatoes, mustard, and pulses, are grown to some extent. Pulses and oil seeds are cultivated by *jhum* methods. *Jhum* cultivation includes four major crop combinations. They are (i) *aus* paddy and bananas; (ii) bananas and papayas; (iii) peas, cucumbers (*marfa*), and vegetables; and (iv) sesame, cotton, and millet. *Aus* paddy, cultivated through *jhum*, has a coverage of more than one-third of the total *aus* area in the region.

The levels of adoption of modern rice, inclusive of *pajam* (a rice variety), are higher in the region than in the country as a whole. The average coverage was 66 per cent of the total rice area compared to the national figures of 45 per cent in 1991.

Among the six community areas, the *Murang* community practices *jhum* cultivation exclusively, and this includes three combinations, mainly, (i) *aus* paddy with bananas; (ii) bananas with papaya; and (iii) peas and cucumber. In the two *Marma* communities both double and triple cropping are practised. Again, in terms of crop acreage, both double and triple cropping are found to be more prevalent in Khagrachari. The *Marma* community of Bandarban also widely practise triple cropping. The main patterns on double-cropped land are (i) *aus* (HYV) + T. *aman* (HYV), (ii) *aus** (local) + *aman* (HYV), and (iii) *aus* (HYV) + *omn* (local). The triple cropping in Bandarban includes, surprisingly, all three modern paddies, e.g., *aus* (HYV) + *aman* (HYV) + *boro* (HYV). The next most important pattern is *aus* (HYV) + *aman* (local) + *borao* (local).

To conclude, the cropping patterns are predominantly rice based and modern paddies have been widely adopted for both double and triple cropping.

The average per acre yields of modern rice (around 30 maunds of paddy) are almost the same level in all tribal communities.

Fertilisers are not applied to local varieties of rice except by the *Tripura* community in Rangamati. Fertiliser use is almost limited to modern *aman* and *boro* paddies of which 70 per cent of *aman* (HYV) and 40 per cent of *boro* (HYV) acreages are subject to fertiliser applications. In the case of *aus* (HYV), only 17 per cent of the area receives fertiliser and this is concentrated in the *Tripura* community of Khagrachari.

The intensity of fertiliser use in the region is estimated to be less than five kg per acre of rice acreage and, in terms of households, this amounts

* *aus, aman, omn, boro, and borao* refer to rice varieties (both local and introduced).

to 15kg a year, which is very much lower than the national average.

The major adult occupational groupings here are (i) farming, (ii) *jhum* cultivation, (iii) wage labour, (iv) trading, and (v) services. In the case of minors there are two more: students and those of school- going age who do not go to school.

Among adult males the primary occupation in the region is farming (38%), followed by *jhum* cultivation (21%) and wage labour (14%). Agriculture (proper) employs the highest proportion of males in Khagrachari and is prevalent among the *Chakma* community in Rangamati. Quite a high proportion of women (two-thirds) are reportedly housewives, as elsewhere in the country. The direct employment of women in agriculture, inclusive of *jhum*, is found to be only 19 per cent and three per cent participate as wage labourers. Women's employment in agriculture is highest among the *Marma* community of Khagrachari.

The prevailing wage rate for a male worker in the region is Tk 48 for eight hours a day. The lowest rate exists among the *Tripura* society of Khagrachari. Women wage earners receive Tk 32, which is 25 per cent lower than the male rate.

The income reported here refers to the net income amount to paid-out costs. Rough estimates of the average household income are Tk 41,641 or Tk 6,904 per capita, indicating that income in the hill tracts is not lower than the country's average rural income.

Among selected communities, there are wide variations and the lowest income is earned by the *Murang* community, and this is just half of the tribal average. According to per capita income, the *Marma* community in Bandarban appears to be the most well-off, followed by the same community in Khagrachari. These income figures suggest that the *Marma* community in the hill tracts are economically better off than other communities. The most deprived families, on the contrary, are the *jhumia* whose average household income is Tk 24,188.0, and, in terms of per capita income, they earn just 70 per cent of the average tribal income.

Among the different sources of income, the primary source is found to be agriculture, as in the plains of Bangladesh. Agriculture accounts for two-thirds of the total income, which is a little higher than the 1990 rural income estimated for Bangladesh as a whole. Non-crop agriculture in the hill tracts has a substantially higher share in income (30.3%) and forests alone contribute about 13 per cent.

Agriculture in the hill tracts is poorly developed because of unfavourable topography and soil characteristics. The poor crop yields appear to be mainly due to lack of proper soil management practices and inappropriate levels of fertiliser use. Levels of adoption of modern rice varieties are, however, higher than the national average. The declining trend in crop yield seems to be caused by soil erosion and monocropping of rice. Agricultural extension services in the area should be intensified and particular attention given to soil and input use.

Farm producers in general complained of very low prices of vegetables, fruits (bananas, papayas, pineapples), and spices (ginger and turmeric). The low prices can be attributed to general social tension in the area and the frequent disturbances that occur in the markets.

Irrigation is rarely practised on tribal farms and households do not take adequate interest in the procurement of irrigation equipment as they are not fully aware of the benefits.

Fertiliser prices are 25 per cent higher. They are also not available in the local markets other than on market days.

There are also reports of crop damage by wild boars and occasionally by wild elephants in the Khagrachari communities. Rats also cause extensive damage to *jhum* crops.

Institutional financial support to tribal farm households is almost absent. The present study shows that only one-sixth of the households received bank credit and that too was limited to two communities. This credit reached them two to three months late. Nobody in Bandarban has received institutional credit.

Development of agriculture in the hill tracts is seriously constrained by poor agricultural marketing facilities and the consequently low prices of their outputs, especially fruits, vegetables, and spices. Social tension also interrupts farming practices, resulting in lower per acre crop yields.

Long-term investment in agriculture (e.g., installation of irrigation equipment, procurement of power tillers, and soil improvement) is being discouraged by the low profitability of crops.

Development programmes for infrastructure building and institutional establishment appear to be the key inputs needed for agricultural development in the hill tracts.

Environmental Aspects of Development Projects in the Chittagong Hill Tracts, Bangladesh

Mahfuzul Haque

Environmental awareness is a comparatively new phenomenon in Bangladesh. Through the Water Pollution Control Act of 1977 and the Environment Pollution Control Ordinance of 1977, practically little was accomplished in terms of overall environmental management. This was mainly because of the various limitations of the concerned government agencies, lack of political will, and the absence of appropriate measures to implement them.

During the late fifties, when the Kaptai Hydro Electric Project in the CHT was commissioned, Environmental Impact Assessment (EIA) was not carried out. Environmental issues were not taken into consideration, and there was a number of negative effects from the project. An area of 250square miles was submerged, displacing around 100,000 local people, mostly *Chakma*. A similar example of ill-conceived development intervention is shrimp cultivation in Chakaria Sundarban and other coastal districts of Bangladesh, for which no EIA was carried out. The conventional method of shrimp cultivation causes deforestation, engulfs agricultural land, and contributes to increasing salinity, thereby damaging future agricultural production and the future of fishing as a whole. Another example, from the sixties, which brought about unmitigated environmental disaster affecting half a million people in southern Bangladesh, is Beel Dakatia, the country's second largest waterbody, 24km long and 16km wide, in the Khulna and Jessore districts. It remained totally bogged in brackish water as a consequence of the ill-planned coastal embankment projects of the Water Development Board.

Regarding the ongoing Flood Action Plan (FAP), it is alleged that the probable adverse impact of the FAP projects on the Jamuna Char areas will cause the displacement of around 7.5 million people. FAP has concentrated more on structural interventions, such as construction of embankments, dykes, and plodders, which will have a negative impact on the fragile wetland ecosystem of Bangladesh.

The highlands of Bangladesh, commonly known as the Chittagong Hill Tracts (CHT), are home for a number of tribes. These tribes which are ethnically different from the people of the plains.

The entire area receives heavy monsoon rains and is a mass of subtropical jungles and small hills with a network of rivulets and streams. The hills range in height from a few hundred to 4,000 feet. Fed by torrential rains and washed by recurring floods, the entire area is a thick green mass, consisting of a variety of plants, creepers, and trees.

Various projects have been implemented in the hills without properly evaluating the environmental aspects of the people therein.

For centuries, *jhum* cultivation worked effectively. There was no serious deterioration of the soil and the plots lay fallow for at least seven years. Fallow periods are essential for *jhum*. If either the population increases or the land available for cultivation decreases, shifting cultivation is no longer viable.

Plough cultivation is labour and capital intensive as it is dependent on chemicals, fertilisers, and insecticides.

Ploughing itself causes greater disturbances to the soil than hoeing, resulting in a more rapid decline in the physical condition of the topsoil. Shifting cultivation did not require elaborate marketing because it was practised at subsistence level; borrowing and bartering were supportive pillars of the *jhum* economy. So far, no efforts have been made to improve upon shifting cultivation.

The economic differences among the shifting cultivators were less marked. Their egalitarian societies with intact ties of tribal solidarity have better prospects for the future. The misery, malnourishment, and starvation existing in the plains did not exist in the hills until the early sixties.

So far, many agro-based projects have been taken into the hills. Special attention should be given to

the socioeconomic and emotional outlooks of the people before approval of these projects and before totally discarding the swidden method of cultivation.

It is a common belief that the hills are empty and thinly populated. In fact, the statement is not true. The hills, especially those of the CHT, are overcrowded as less land is available for agriculture. A survey showed that only two per cent of the land is suitable for rice cultivation and another 21 per cent for horticulture, leaving 77 per cent for forests.

Another survey showed that only five per cent of the land is rated to be suitable for intensive agriculture.

A project on the river Karnaphuli near Kaptai was commissioned in 1963. The reservoir created by the hydroelectric project submerged 250square miles of prime agricultural land accounting for 40 per cent of the total cultivable land in the tracts. Some 100,000 tribes, mostly *Chakma* sedentary rice farmers, were displaced by the project. They were promised both financial compensation and land. The compensation package did not work well. Many left for India as refugees.

The effects of the dam were negative: (a) it displaced people; (b) it shortened the *jhum* cycle to less than from five to seven years; (c) it resulted in declining soil fertility and low yields; and (d) owing to inundation, pressure on meagre land resources increased. A socioeconomic study conducted by a group of academics revealed the fact that 69 per cent of the *Chakma* (interviewed) felt that they were well off before the commissioning of the project.

Kaptai's five units produce 242 megawatts; only 11 per cent of the total production. Therefore the question arises - was it worth undertaking this project to generate such a small quantity of electricity at an enormous environmental and social cost?

The Upland Settlement Project was undertaken by the government in 1979. The main components of the project are: (a) Human Settlement; (b) Horticulture; (c) Rubber Plantation; (d) Community Facilities; (e) Construction; (f) Advisory Services; and (g) External Training.

During a tour of the project area, it was seen that the upland settlement and afforestation programmes have made significant progress. It is too early to assess the rubber plantation project, as the gardens are young; they will mature within four to five years.

In order to generate employment among the tribals, a number of factories have been established. These include paper mills, a plywood factory, and match factories in Chanraghona, Rangamati, and Kaptai. The workers employed in these factories are mainly from the plains and these establishments have failed to ensure the resettlement of the displaced *Chakma* people.

Forestry programmes adversely affected the hill people. The Swedish International Development Agency (SIDA) has funded a project to plant trees and provide technical training to the tribal people in forest industries and in road development. This massive commercial forestry programme could deprive the *jhumia* of more than half of their traditional land.

It would be advisable to examine the development projects in the Chittagong hills keeping in mind the socioeconomic, environmental, and emotional needs of the people of the locality. Some recommendations are summed up below.

- All development projects in the CHT should be examined from an environmental perspective before being approved.
- Before approval of a project, the sociological/ anthropological aspects, which may be termed "Ethnic Impacts Assessment" should be taken into consideration.
- As the tribal people are a small minority consisting of less than one per cent of the population of the country, they need to be assured that their rights as minorities will be safeguarded in all development projects in the CHT.

Session 3

Upland Settlement Component with Rubber as a Prospective Perennial Cash Crop in the CHT

S.K. Khisa
A.T.M. Emdad Hossain

In this document the authors have suggested that rubber could be a potential perennial cash crop for

the CHT from the biophysical and socioeconomic perspectives. Experiences of the Chittagong Hill Tracts' Development Board in rubber plantation on a small scale were deemed to be beneficial.

Sustainability and Potentials of the Low-cost Water Harvesting System in the Chittagong Hill Tracts

Quamrul Islam Siddique

Harvesting of water resources in the Hill Tracts, apart from the hydroelectricity generated by the plant in Kaptai, has remained at a very low level. Therefore, cost-effective water harvesting techniques are essential for the Hill Tracts' region.

Irrigation is practised nearly everywhere on paddy lands during the dry season. The farmers erect earthen cross-dams on the beds of perennial *chara** to impound water for irrigation by gravity flow or by using Low Lift Pumps (LLP). The earthen dams, having heights of up to five metres are usually reinforced with wooden and bamboo posts and are temporary. They are washed away, sometimes even two or three times during every irrigation season, thus creating problems. This type of low-cost water harvesting technology and excavating and re-excavating of distribution canals are generally undertaken by local farmers on their own initiative. Pumps with capacities of up to one or two cusecs are fielded on the banks of the rivers and *chara* where sufficient water is available at the time of *boro* and *aus* cultivation. The fields are irrigated by gravity flow from such pumps, each one covering between four to 16 hectares.

Open type, permanent water-conservation structures, with wooden stop-logs or steel gates constructed crosswise between piers in beds of narrow and shallow *chara,* have been built recently to provide longer life to the system. In some places, dams have been constructed with better engineering designs to create relatively larger reservoirs which may be beneficial for purposes other than irrigation.

A sizeable number of water harvesting schemes has been constructed in the Hill Tracts by the Bangladesh Water Development Board (BWDB); the following are worth mentioning:

- the Mondakini Irrigation Scheme, and
- the Water Control Structure over Sonaichari Khal.

Mondakani is a small irrigation project located at Santirhat in the Fatikchari *thana* of the Chittagong District. It is a good example of a sustainable water conservation structure using hill *chara*. The project can irrigate an area of about 360 ha. The main component of the scheme - the water retention structure - failed twice after its construction and was reconstructed.

Another example of inadequate sizing of a hydraulic structure was the construction of the Water Control Structure over Sonaichari Khal at Ramgar *thana* in Khagrachari District.

The BWDB constructed a two-vent water control structure over the stream in 1980/81 for irrigation purposes. It was then found that the capacity of the structure was also adequate to take care of flood discharge. During the monsoon of 1982, the water control structure sustained serious damage and became virtually ineffective for the intended purpose.

The main causes of failure of the two above-mentioned water retention structures were:

- operation difficulties, the stop-logs were not removed from the structure during flash floods;
- incorrect estimation of design flood flow, Manning's equation;
- non-compliance to operational guidelines; and
- blockage of waterway through the structure by floating logs and debris.

The following schemes under the Canal Digging Programme (CDP) and the Special Affairs' Division (SAD) will be implemented by the Local Government Engineering Department (LGED) in the CHT:

- the Kuradiachara Water Conservation Scheme, and
- the Bamerchara Irrigation Scheme.

The first scheme is to be implemented by the LGED under the Canal Digging Programme. The main component of the project is a water conservation

* *chara* - a small stream.

structure over the Kuradiachara in Garjantilla village under the Bhaibonchara Union of Khagrachari Sadar *thana*. Re-excavation of a canal for irrigation of croplands by gravity will also be undertaken under this project.

Construction of lock on the Kuradiachara near the earthen crossdam has been planned. The structure will also provide a facility for releasing water downstream. A water users' group, consisting of farmers, is to be formed to ensure effective management of the system. Implementation of the project is expected to boost agricultural production and enhance employment opportunities in the area through increased agricultural activities.

The Bamerchara Irrigation Scheme in Banshkhali *thana* of Chittagong District is to be implemented by the Local Government Engineering Department with assistance from the International Fund for Agricultural Development (IFAD). The main components of the scheme are construction of a spillway, water retention structure, guide embankment, field channels, and so on.

Before building a sustainable water control structure, it is important to summarise the causes of failure which can be attributed to:

- inadequate mapping and data collection,
- inadequate planning and design,
- construction deficiency, and
- inadequate operation and maintenance practices.

Mapping is being carried out by using GIS (Geographic Information Systems).

Proposals/recommendations for better implementation of water resource schemes are given below.

- The gates of water retention structures in flash streams of the hill districts should be open-top types and should have dimensions that allow at least 50 per cent of the peak flow to pass over the gates if these are closed. If dams are to be built to create mini-reservoirs, spillway sections with capacities to pass full flash floods from catchment areas should be provided. Such spillways should not have gates.
- It is not advisable to construct stop-log operated structures in flashy streams. Instead, manually-operated mechanical, vertical lift gates should be used to ease the operation.
- Special care should be taken during hydrological analysis to provide appropriate structure sizes.
- Adequate supervision should be carried out by qualified field staff during construction of the structure. Design standards and specifications should be strictly followed.
- Based on field requirements, annual and periodic maintenance plans should be developed and followed up.
- In order to make the water harvesting system sustainable, due attention should be given to strengthening and developing institutional and management capacities through the Water Users' Association (WUA), as well as to the participation of farmers in irrigation management.
- The Local Union (*Parishads*), people's representatives, and farmers should be involved in every stage of the process, from needs' assessment to design, construction, and organisation and management of the irrigation system. The farmers need to develop a sense of ownership of the irrigation system through intensive motivational activities.
- To promote the participation of farmers, legal status should be given to the water users' associations.

  The benefit from a water control structure is usually measured in terms of increased agricultural production resulting from reduction in flood threat, increased availability of irrigation water, improved/controlled drainage, and so on. The scheme should contribute towards changing cropping patterns and increasing cropping intensity.
- The whole region would benefit immensely if appropriate structures were to be installed at suitable locations to store water for irrigation.

Experiences of the Betagi-Pomora Project and the Prospect for the Chittagong Hill Tracts

Abul Hasnat Golam Quddus

Having realised the consequences of deforestation, the government and a number of non-government agencies have undertaken several participatory forestry projects to come up with a solution to this national problem. The primary goals of these projects are to protect the existing forests, expand the forest area through the use of *khas* and different types of forest lands, and regenerate the denuded hills; one of these projects is the Betagi-Pomora community forestry project.

The project area is located at a distance of 24km from Chittagong city. Betagi is on the southern side and Pomora on the northern side of the Chittagong Kaptai road.

This area belongs to the agroecological zone of the 'Northern and Eastern Hills' of Bangladesh. In general, 20 per cent of the hillocks consist of very steep slopes - 50 per cent are steep slopes and 30 per cent gentle slopes.

Out of the total land (4,587 acres) under the Pomora project *mouza*, 58.3 per cent is agricultural land. In Betagi, agricultural land occupies only 36.2 per cent of the total land of the project *mouza* (975 acres).

Broadly, the Betagi-Pomora project is aimed at achieving three goals: (i) to regenerate denuded hills, (ii) to protect the forest from illegal felling with the help of the settlers, and (iii) to rehabilitate landless peasants.

The project began functioning in Betagi with 72 landless families in 1979; later, in 1980, another 96 families were settled in Pomora. The number of families, however, increased later to 82 and 144 in Betagi and Pomora, respectively. A four-acre plot was allotted to all selected villagers on a temporary lease basis under the following conditions:

- the settlers would carry out the suggestions of the Department of Forests;
- the settlers would live permanently on the plot; and
- the settlers would not work outside for additional income.

In 1987, the temporary lease status of the Betagi settlers had changed to that of a semi-permanent ownership deed (for 25 years) with restriction on selling the plot. The tenurial arrangements of Pomora, however, are still on the original temporary lease basis.

One of the most important objectives of this project was to cover denuded hills by planting trees. This objective has been achieved to a great extent. Agroforestry, which was almost unknown a few years ago, has emerged as an important source of household income, particularly for the previous landless project households.

Various types of agroforestry land-use practices, with a wide mix of species, have evolved in the project areas. Long-rotation forest species are generally mixed with short-rotation horticultural species. The lemon has become an important species in the agroforestry land-use practices of the project areas; it is a good source of income for agroforestry farmers. The plantation of long-rotation forest and horticultural saplings has been carried out on hill tops and on the slopes of hills. Paddy cultivation is concentrated on flat and valley lands. Significant portions of the terraces in the settlements are used for vegetable cultivation.

The tenurial insecurity and the original status of land are perhaps the main reasons for devoting more land to short rotation crops in Pomora, because long-rotation forest species and multipurpose species require a longer time to generate income. This insecurity of tenure has perhaps been a disincentive to the plantation of long-rotation trees and has encouraged allottees to resort to short-rotation crops to obtain immediate returns from their investments.

When flat or agricultural land is not available, settlers raised short-rotation, shade-tolerant agroforestry crops such as turmeric, ginger, varieties of *arum**, and other root crops for quick household income.

On the higher slopes and hill tops, where agriculture and tree planting are difficult, settlers prefer to keep the land vacant for natural regeneration of forest trees and grass.

Sungrass and fuel from naturally-grown forests add considerable income to a household.

The economic condition of the settlers has improved significantly over the years. The change is more conspicuous in Betagi than in Pomora. The post-settlement, mean monthly family income of Betagi settlers has increased about four times from their pre-settlement income, while in Pomora it has only doubled.

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* *arum* is *Colocasia sp.*

The post-settlement assets increased in value by about 335 per cent over the pre-settlement assets. The settlers in Betagi have experienced an economic improvement of 531 per cent and those of Pomora about 232 per cent, although the pre-settlement assets of both villages were close at the inception of the project.

Multiple regression analysis indicates that credit taken by the settlers and the number of years the settlers lived on the plot positively contribute to income from agroforestry. These two variables together cause about a 20 per cent variance in the income from agroforestry.

Betagi and Pomora differ widely in terms of agroforestry income with almost the same amount of investment in it. The former has almost double the income of the latter. The temporary nature of the lease agreement of Pomora settlers has probably discouraged them from employing the necessary family labour in agroforestry gardens such as those of the Betagi settlers. They suspect that the gardens will no longer be theirs after they are developed.

Another indicator of the well-being of settlers is their employment status. Previously, the vast majority of the present settlers used to remain unemployed for more than half of the year, whereas almost all adult male members of the family now enjoy self-employment year round. This has not only improved their economic standing, but also the self-esteem of the members because they are free from the tension of perennial unemployment. In addition to the adult male members of the family, women and all children above 10 years of age are involved in agroforestry activities in both settlements. In fact, participation of daughters in agroforestry is proportionately much higher than that of sons; and this is true in almost all respects, apart from buying and selling of products in the market and working outside the family as wage labourers.

Credit facilities were introduced based on the *Grameen* Bank model, at the very inception of the programme. When a group member was given a loan, the group as a whole was made responsible for its repayment. The repayment rates in both settlements are reported to be around 80 per cent.

One of the most important sources of income for the settlers of Betagi and of Pomora is agroforestry products, and these include lemon, guava, fuelwood, and different seasonal fruits.

The most important change in the lives of the settlers is their occupation. Agroforestry, which is now the major occupation of nine out of 10 settlers, was not the occupation of even three per cent before the settlement period.

Although none of the women work outside the home for financial gain, almost all of them are engaged in agroforestry activities in addition to their domestic chores.

One conspicuous feature of the *bhumiheen* (landless) settlements at Betagi and Pomora has been the conflict between the settlers and the local elites. When these *khas* and protected forests were distributed among the landless, the local elites sharply reacted and tried to prevent the landless allottees from taking possession of the land. A total of 51 lawsuits was launched by the previous illegal occupants of the forest land against the allottees and the concerned government and local officials, resulting in the postponement of the project.

By now, almost all of these litigations have been settled in favour of the government and the allottees, because the elites have no legal basis to establish rights over the land. Moreover, by now, the settlers have developed group solidarity vis-a-vis their relationships with outsiders.

Solidarity among the settlers was much stronger in Betagi than in Pomora. In Betagi almost all settlers were landless, daily wage earners who accepted agroforestry as their major occupation. This homogeneous background probably provided the basis of solidarity among the Betagi settlers because they could socialise with each other without inhibition.

In contrast, group solidarity among the Pomora settlers was poor. They came from different occupations and far off places; many of them were not landless and one-third of the plot owners did not live on the plots.

Betagi and Pomora also differ in the quality of their cooperative societies. The Betagi *Bhumiheen Sameeti* is well organised with virtually no irregularities regarding holding of annual elections, financial management, and discharging respective responsibilities, although there is a certain amount of factional politics. In contrast, Pomora *Bhumiheen Sameeti* is poorly organised. Elections have not been held for a long time, and there are complaints regarding the distribution and reallocation of plots.

There is no doubt that the hillocks are greener now than they were in the pre-project period. Not only new plantations, but also regenerated natural species have contributed to this. Agroforestry, which was almost unknown to the present settlers, has become their major source of livelihood, but not without paying a price. The allottees, wherever possible, expand their agricultural land by cutting gentle slopes out of the hills.

The initiators of the project strongly advocated training on agroforestry for the settlers. In the early states of the project, some training programmes were conducted for the settlers of both villages by the Forest Department at Kaptai. Only about one-third of the settlers received training on spacing of plants, selecting species, tending gardens, and using fertilisers. The training does not seem to have had any impact on the adoption of agroforestry. Case study records show that both men and women depend more on traditional production practices than on innovations presented at the training programmes.

- The Betagi-Pomora project has demonstrated that one of the important preconditions required for successful implementation of a similar project depends greatly upon tenurial security.
- Replication of the project will largely depend upon allotees' adoption of agroforestry as their major occupation. Hence, selection of the right kind of settlers is vital for the successful implementation of such a programme.
- The Betagi-Pomora project was first introduced by a village social worker. This social worker brought high government officials from the Dhaka Secretariat to Rangunia for discussions but failed to achieve anything concrete. When the same matter was taken up by Professor Alim, Professor Yunus, and Mr. Mabubul Alam Chasi, the project bore fruit. It was made possible because these personalities had the capacity to use the national power structure for the purpose. Therefore, to replicate this project in other parts of the country, strong patronage from political and professional leaders and community organisations should be ensured, otherwise, despite pronounced policies, implementation of the programme may be stalled.
- In addition to the various factors that contributed to the success of the project, the *Bhumiheen Sameeti*(s) played a very crucial role in organising the landless and resisting the opposition of local elites. Had there been no participation of landless poor through these *sameeti*(s) gaining possession of the plots against the organised opposition of the local elites would have been difficult. Development of such a strong local-level organisation is a precondition for the successful replication of similar projects.
- The vast majority of prospective settlers are likely to be landless and poor. Dr. Yunus, using his *Grameen* Bank model, provided credit to the settlers of Betagi and Pomora, and this greatly facilitated agroforestry production. Therefore, for replication of the model, appropriate credit organisation is a prerequisite.
- In the initial stage, technical training, extension activities, establishment of a nursery for seedlings, and availability of other inputs are important for the replication of the model.
- The expansion of project areas in the greater hill tracts means production of more perishable commodities without proper marketing facilities. Therefore, in order to avoid any catastrophes in the future, development of marketing and transport facilities is vitally important for replication of the agroforestry regimes, because perishable agroforestry products should find their way to the market as quickly as possible.
- It is observed that women with ownership rights enjoy greater equality with men in decision-making than women without such rights (Pomora). Therefore, in the interest of protecting the rights of and ensuring social justice for women, they should be made co-owners in any lease agreement.
- In future, the agroforestry package should include an aggressive population control programme to avoid the subdivision of plots into tiny portions
- The Betagi-Pomora project should be watched carefully to see how the growing numbers of family members are affecting the use of the hills.

Land Management for Sustainable Productivity in the Chittagong Hill Tracts Based on Geophysical Characteristics

Dr. M.M. Hassan
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The Chittagong Hill Tracts include three administrative districts, namely, Khagrachari, Rangamati, and Bandarban. The hills are of two types. The high hills (> 100m in elevation) have mostly shallow soils developed over semi-consolidated tertiary rocks. These hills are closely dissected and have steep to

very steep slopes. The low hills are developed over unconsolidated sediments. The soils are usually deep. Land-use systems in the hill areas include shifting cultivation, the *taungya* system, plantation forestry, and industrial plantation. Land degradation, e.g., through soil erosion, loss of nutrients, and organic matter depletion, has resulted from intense logging or felling of forest trees. As a result, soil erosion, landslides, mass movement, siltation, flash floods, and so on, are regular phenomena in the hill areas during the rainy season. Watershed areas have been destroyed and all these factors are responsible for environmental and socioeconomic imbalance in the hill areas.

This paper also deals with management aspects such as flood control, resettlement, improved cropping patterns following different slopes, and afforestation. Several recommendations concerning soil conservation strategies and an institutional framework and policies that might help to achieve sustainability of land productivity in the CHT are given.

Session 4

Sloping Agricultural Land Technology (SALT): Prospects for Replacing Swidden Agriculture

S.K. Khisa

Soil erosion is a widespread and serious problem in the region because of pressure on unsuitable steep to very steep lands. *Jhum* cultivation is the most prevalent form of land use. The Kaptai dam submerged some of the best A and B class agricultural lands, and the population displaced increased pressure on the remaining flat valley bottom lands as well as on the hilly lands, thereby reducing the *jhum* cycle to as short a period as three to five years. Such a short period is inadequate for natural growth of vegetation to restore soil fertility. As a result, the soil fertility in the region is gradually declining, crop yields are becoming low, and to sustain a *jhumia* family with a single plot of *jhum* is becoming increasingly difficult.

Recently, the cultivation of *mukhi kachu* (*Colecasia esculenta*) and ginger (*Zingiber officinalis*) through intensive soil work denuded many hills in the Matiranga, Cuimara, and Manikchari areas, resulting in the devastating loss of topsoil. Planting of *kakrol* (*Momoridica dioca*) at Betbunia is one example of such a case. However, it is not the fault of the farmers alone, rather it is the inability of extension services to motivate farmers to adopt soil conservation practices.

The Kaptai reservoir in this region is gradually silting up, reducing the generation of hydroelectricity. The river systems are sedimented, irrigation canals clogged, and watersheds polluted with surface run-off, carrying away eroded particles with nutrients.

Studies conducted at the soil conservation station in Ramgarh (established in 1964) showed that the runoff from land deprived of its vegetation cover, on a 50 degree slope, was 345.8 tonnes per hectare per year and on a 20° slope, 98.8 T/ha/year. A forestall survey, calculated from an estimated area of 1,21,457ha, estimated the annual soil loss to be about 4.2 million tonnes, assuming 40 per cent of this land was on a 50 degree slope and that half of this was exposed annually and half of the wash-off was retained on the ground.

A four-member mission of the International Centre for Integrated Mountain Development (ICIMOD), headed by the Director General of the Centre, visited the CHT region in March 1992 and agreed to help identify appropriate technological options for controlling the soil erosion problem in the CHT. As a follow up to this agreement, a Sloping Agricultural Land Technology (SALT) demonstration project is being financed by ICIMOD and implemented by the CHTDB at Lama and Khagrachari in the Bandarban and Khagrachari hill districts.

SALT was developed as an appropriate farming system for the uplands in the Philippines in the mid-1970s at the Mindanao Baptist Rural Life Centre (MBLC) in response to the needs of the local farmers to have a sustainable system of upland farming.

SALT is a simple, applicable, low-cost, and timely method of farming hilly lands. It is a technology developed for farmers with few tools, little capital, and little training in agriculture.

Basically, SALT is a method of growing field and permanent crops in four-to six-metre wide bands between contoured rows of nitrogen-fixing tree

species (NFTS). The NFTS are thickly planted in double rows to form hedgerows. When a hedge is 1.5 to 2.0 metres tall, it is cut back to a height of 40cm and the cuttings are placed in strips between the hedgerows, also called alleys, to serve as organic fertiliser. Rows of permanent crops in every third strip are dispersed throughout the plots. The strips not occupied by permanent crops are planted with cereals or other crops and legumes.

SALT testing and demonstration in the three hill districts of CHT will facilitate widespread introduction of this technology in CHT. At the farmers' level, there is a need to promote it through contacts with farmers at union and *thana* levels. The contact farmers can be motivated, trained, and equipped with the technology and also supplied with necessary inputs, such as seeds of nitrogen-fixing tree species (NFTS), for hedgerows. This approach may ensure both improved conservation and food production. When the project period is over, this approach should be included in the core programme of the CHTDB under the supervision and guidance of qualified staff of the Hill Farming Natural Resource Management Division; which needs to be created and fitted into the organogram of the Board.

To raise agricultural productivity, a multi-dimensional approach should be taken covering production technology and management for field and horticultural crops, soil conservation, water harvesting, animal raising, and farm planning.

Supplementary initiatives to generate employment opportunities and additional income sources need to be identified, e.g., poultry keeping, beekeeping, mushroom cultivation, and cottage industries.

A suitable and economic water-harvesting system should be developed and adapted for this hilly region so that the available natural springs and rainwater can be used effectively for crop production.

Implementation of the social forestry programme on degraded *khas* lands will provide vegetation cover to protect these lands and cater for fuelwood and fodder needs.

Marketing and processing support systems are required in the region, particularly for fruits and vegetables.

Development of Non-farm Activities in the Chittagong Hill Tracts

Z. Bakht

The farm sector in CHT can hardly provide a solution to growing unemployment, poverty, and overall development of the CHT. The land can no longer support the excess labour and, in the absence of substantial migration outside, both short- and long-term policy objectives should be geared to the creation and development of non-farm activities in the region. Traditionally, tribal people have been exposed to a subsistence economy where, apart from farming, people engage themselves in various types of activities, mostly on a non-commercial basis. These activities include, *inter alia*, weaving cloth for the family, building houses using family labour, and even manufacturing tools and equipment to carry out such activities. As these are not exchanged in the market, official statistics often fail to record them as non-farm activities, even though they save a lot of expenditure.

Data pertaining to non-farm activities (NFA) are very rare in Bangladesh and, for the CHT, the problem is more than acute. The main source appears to be the Betagi *Bhumiheen Sameti* (BBS) that undertook a census of Non-farm Economic Activities in 1986.

The census reveals that NFAs account for about one-fourth of the employment in all sectors. It showed that, of the total number of persons engaged in these activities, 88 per cent are male and 12 per cent female. Persons engaged on permanent, temporary, and household premises account for 74, 1, and 24 per cent respectively. Manufacturing accounted for about 43 per cent of the total employment and for about one-fourth of the total establishments. This is followed by wholesale and retail trade/restaurants and hotels that accounted for about one-third of the total employment and 48 per cent of the establishments.

A diseggregation of the type of NFA in permanent establishments points out that trade, restaurants, and hotels account for about 59 per cent of permanent establishments and about 74 per cent of the total employment in those establishments and thus turned out to be the dominant NFA sub-sector.

In terms of permanent location of NFA in the CHT, about 60 per cent of the establishments are reported

to be in urban areas while 40 per cent are in rural areas. The comparative figures for Bangladesh are 46 and 54 per cent respectively. It could possibly be due to the fact that one important determinant of NFA establishments is better infrastructural facilities, which only urban areas have in the CHT.

The most impressive growth rate has been in the case of non-agricultural activities such as forestry, livestock, and fisheries. Starting from a low base of 1.2 thousand in 1961, these activities employed about 12 thousand in 1981 and then 26 thousand in 1991 - implying a growth rate of about 12 per cent per annum between 1981-91. The growth rate in the service sector has been about 16 per cent, while that of the trade sector has been as high as 22 per cent. Employment in manufacturing grew at 5.2 per cent per annum during the same time period.

The rapid growth of NFA in the CHT thus absorbed the entire additional labour force, relieving agriculture of its burden. The agricultural labour force declined in absolute terms in the CHT, as elsewhere in Bangladesh. The share fell from 88 per cent in 1961, to 62 per cent in 1981, and 60 per cent in 1991.

The findings tend to indicate that, in response to intense population pressure on limited land, people have tended to move from farm to non-farm activities in large numbers.

It appears that, apart from retail trade and business services with a substantial edge in terms of productivity, the productivity syndrome in the CHT compares unfavourably with that of Bangladesh as a whole. Further, in many of the activities, the productivity is lower than the prevailing agricultural wage rate.

In 1990, there were 47,901 handloom units and 59,279 looms operating in the CHT. These accounted for 22 per cent of the total units and about 12 per cent of the looms in Bangladesh. It is reported that handloom weaving has traditionally been geared to the needs of the family and, of late, a very negligible surplus is available for the market.

The position of the Hill Tracts with regard to value-added from livestock and fisheries, compared to Bangladesh as a whole, indicates that the region earns, on a per capita basis, about four times higher an income from livestock compared to the country as a whole, but the level of income from fisheries is almost the same.

It appears that there is a great potential for the development of NFA in the Hill Tracts. Fourty-four per cent of the labour force is engaged in these activities and nearly half the income originates from them. It further appears that some of the activities not only have higher labour productivity than farm activities but productivity is also high compared to similar activities undertaken elsewhere in Bangladesh.

An important determinant of the expansion of NFA is the availability of required skills in the locality. Absence of adequate infrastructural facilities is also a potential source of employment in the sense that the vast pool of labour can be employed in the region to construct these facilities.

Quite obviously, the development of NFA is constrained by the existing political turmoil. One of the foremost challenges for the development of the Hill Tracts is, therefore, a political solution to these problems.

The interior, even the clustered villages, lack power connections and improved roads, without which commercial activities cannot develop. Many of the NFA require power connections for production and better roads for marketing and extension activities. Development of these appears to be the immediate task ahead.

A major constraint to the expansion of NFA is the limited demand for products. It is being argued that these products are consumed more by the people from lower income groups. With a rise in income level, however, more goods with relatively higher income elasticity are likely to be in demand.

For the development of small and cottage industries in the CHT, BSCIC has been implementing a project called "Development of Rural and Cottage Industries in the Hill Tracts" since 1974. The project provides training and supplies raw materials. The Hill Tracts' Development Board, established in 1976, implemented different projects worth Tk 3,303 *lakh** up to 1990. In 1992, BSCIC started

* a *lakh* = 100,000

another project at a cost of Tk 1,577 *lakh* for the development of clustered villages in Khagrachari and Rangamati to provide employment, help in the marketing of small and cottage products from clustered villages, and training to those involved in the activities.

The main areas of intervention lie in the development of handlooms, beehives, and sewing and some cane, bamboo, and wood products. Some problems have been identified and they are given below.

- First, the government's bar on new appointments tends to have an effect on the availability of trainers, whereas, at the same time, BSCIC does not have the required manpower. It may, therefore, be necessary to introduce a relaxation clause in relation to appointments.
- Second, the clustered villages turn out to be the targets of attack by the *Shantibahini,* resulting in dislocation in NFA activities in clustered villages. This makes it difficult to bring the people into the fold of the government credit programme, because when attacks take place the people living in the area tend to flock to nearby army camps. The recent efforts by the government to came up with a political solution appear to be timely and, once successful, the BSCIC credit programmes should materialise.
- Third, there are reports of conflict over financial and administrative powers.
- Fourth, in the CHT, local government councils have been vested with the activities of seven ministries since 1992, and the activities of BSCIC have also been placed under the control of local government councils. It is not clear, however, whether BSCIC local units take suggestions from the head office or the Special Affairs' Division. A lot of time is spent in correspondence between these authorities due to undefined sources of authority.
- Fifth, the development of CHT as a tourist resort seems to have the highest potential in terms of NFA employment generation. Therefore, preparation of a Master Plan to turn it into a tourist resort should be considered. This would have further linkages to the development of transport and communications, thereby generating more employment.

Some Innovative Traditional Farming-related Technologies, Systems, and Practices of the Hill People and Their Sustainability Implications

M.S. Uddin

In *jhum* farming, above ground vegetation is cleared and burned. Small holes are made with *dao** and seeds are sown in them. Clearing and burning opens the soil to heavy rain and causes soil erosion. On steeper soils, this problem is more severe. Recently, the hills have been spaded intensively from top to bottom for *mukhi kachu* cultivation, which further aggravates the erosion problem. *Kakrol* cultivation in the Betbunia area is another example. Apart from this, some innovative farmers clear their land by slashing and make scattered pits in which to plant tubers/rhizomes from which they get good yields for several years.

Most farmers do not use any fertiliser or manure on their crop fields. Some progressive farmers use only manure, while others use both manure and chemical fertilisers for higher crop yields.

The yield is generally low because of inadequate knowledge about appropriate sowing times under the rainfed cropping system. Sowing time plays an important role in the yield abilities of crops through proper use of residual soil moisture. Experiences have revealed that April-May and September-October planting is best for *kharif* and *rabi* crops respectively.

Zero tillage is one of the most important factors for higher crop production in rainfed agriculture, especially in the hilly region. As most of the hilly lands are slopy, conventional tillage operations are detrimental because of soil erosion. Zero tillage provides better yields of different crops on hill slopes.

Mulching is of immense importance in rainfed farming. Mulch is reported to conserve soil moisture, protect soil from erosion, reduce soil

* *dao* = a rod-like instrument with an iron-tip used for digging small holes for sowing seeds, commonly used by slash and burn cultivators.

temperature, minimise evaporation loss, and enhance root growth. Mulch materials are available in this region, but only a few innovative farmers are using mulch cover for their crops.

Traditionally, hill farmers have paid very little attention to crop pests. They place branches on their crop fields to attract birds that feed on insects. Some of the farmers have sprayed insecticides using hand-made bamboo sprayers. This situation is changing gradually and, at present, progressive farmers are using knapsack sprayers to spray insecticides. Post-harvest technologies -The tribals harvest *jhum* rice, make small bundles, and then thresh it with their feet or by beating it with wooden paddles. The rice is then carried to the house, sun-dried, and then preserved in bamboo containers locally known as *dool*. *Aman* and *boro* rice are harvested and carried to the farmhouse, then threshed by bovines. The threshed rice is cleaned using bamboo sieves. The grains are then dried in the sun and stored as described above.

Maize is harvested in two different ways - viz., (i) premature cob harvest and (ii) mature cob harvest. Premature cobs are either boiled or roasted and consumed by the family members or sold in the local market. Mature cobs are mainly used as seeds. Cob tips are bound together and hung on a bamboo in the kitchen.

Turmeric and ginger are harvested by spading. Suitable rhizomes are selected and sold in the local market. For seed purposes, the rhizomes are kept in the field and harvested before the next planting. Most of the ginger and turmeric is sold fresh in the local market. A negligible portion of turmeric is processed through boiling and subsequent drying. The dried turmeric is usually stored in gunny bags.

Pumpkins are generally harvested when they ripen and stored for further use.

Potatoes, aroids, and cassava are harvested when properly mature and are stored in bamboo *macha** in the coolest part of the house. Other vegetables and fruits are generally sold fresh. Milk is usually sold in the local market or nearby households. Some farmers process it into homemade curd. Curd is prepared on bamboo holes and sold in the market. Eggs are mainly used for hatching purposes and small amounts are sold fresh.

Technological advancement in hill agriculture has been slow.Traditionally, the hill people (tribes) are well acquainted with *jhum* farming. They use the valley floor for rice cultivation.

But, through experience and related knowledge, they have changed the crop combinations. At present, a number of different crop combinations is observed under *jhum* cultivation.

Mixed cropping is the next development in hill agriculture. It is technologically more advanced than the *jhum* form. It is practised by both tribal people and immigrant settlers. Mixed cropping is mainly restricted to flat or mild to moderately steep soils, and spading is carried out in most cases. As a result, higher crop yields are noticed. Technological advancement has mainly taken place through on-the-job learning. But, in recent years, a number of research and development agencies have been working for the agricultural development of the hilly region.

Rooting systems, water requirements, absorption capacity, and growth habits as well as canopy structures differ from crop to crop.

Excess moisture during the maturing stage damages the rhizome of turmeric which could be the reason for lower yields in the foothills. Simple conservation measures, such as mulching, can reduce topsoil removal. Crops such as maize, sesame, turmeric, and ginger have given good yields of 3.5-.4.0, 1.1-1.5, 45-55, and 15-20 T/ha respectively when cultivated with mulching.

The time of sowing plays an important role in the yields of crops through proper use of residual soil moisture. An experiment on the Khagrachari hill slopes obtained 70 per cent higher yields for cabbages by planting them in early October instead of in late September or early November. There was a significant yield reduction in maize when sowing was carried out after the first week of October.

Research work carried out on different crops on hill slopes (10 to 20°) by the Hill Agricultural Research Station, Khagrachari, revealed that zero tillage gave

* *macha* - a type of basket made of bamboo.

significantly higher yields for maize, but cabbages and tomatoes performed better with pit methods of planting on hill slopes.

Among the various factors affecting successful cultivation of crops, judicious application of fertiliser is an important one.

The population of the Hill Tracts is increasing rapidly, but the amount of arable land is decreasing day by day. The only option left is 'sustainable agriculture,' which means the management, conservation, and use of all natural resources through the orientation of technological and institutional changes in a manner that ensures the attainment and continual satisfaction of human needs for present and future generations. Crop selection according to slope degree, soil and moisture conservation, minimum tillage, mulching, proper fertilisers, and weeding can bring about a breakthrough in hill agriculture.

On the other hand, jungle clearing, burning, top to bottom spading, and so on bring environmental imbalance which is responsible for the prevailing extreme climatic changes all over the country. Therefore, creating awareness among hill cultivators, political leaders, and development planners regarding appropriate management practices for sustainable hill farming is of immense importance and is the only way to sustainable development of agriculture in the CHT.

The Chittagong Hill Tracts: a Socioeconomic Profile

Dr. M.R. Khan

The paper compiles existing biophysical, socioeconomic, agricultural, and economic statistics of the CHT. It compares these statistics to the national statistics.

To sum up, the paper states that 61 per cent of the people earn their living through agriculture. The value-added on agriculture is five per cent more than for other districts of Bangladesh.