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Traditional Land Use and Environmental Degradation in the Chittagong Hill Tracts of Bangladesh

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Abstract

Many of the tribal communities that live in the Chittagong Hill Tracts (CHT) practice shifting cultivation (jhum). However, traditional jhum cultivation has proved to be destructive and unsustainable as cropped land is no longer given enough time to recover its fertility between cropping cycles. Increasing pressure on the land to meet the needs of the growing populations has led to the shortening of fallow periods to only three to five years. The problem was exacerbated by the building of the Kaptai Dam that displaced 100,000 tribal valley cultivators and pushed them in to practising jhum cultivation on the forested slopes. Traditional jhum cultivation can no longer meet local people's subsistence requirements and the removal of large areas of forest has had an adverse effect on the environment causing much soil erosion. The system has caused enormous deforestation, soil degradation, fertility reduction, and siltation in lakes and waterways. This paper recommends that jhum cultivation be adapted to make it environmentally friendly. The Chittagong Hill Tracts have a wealth of natural resources. A detailed inventory needs carrying out of the area's resources to guide a coordinated programme involving the government, semi-government organisations, politicians, researchers, planners, NGOs and, most importantly, native hill dwellers in meeting their needs whilst conserving the area's natural resources.

Introduction

Bangladesh is a predominantly agricultural country. Most of the area is made up of alluvial floodplains and deltaic sediments. Only about 12% is hilly uplands. The hilly areas are mostly in the Chittagong division in the far southeast, and Sylhet division in the northeast. The alluvial floodplain soils of Bangladesh are highly fertile but vulnerable to flood, drought, river erosion and siltation. These lands are mostly level, subject to seasonal flooding in the rainy season, and suited for rice, jute and wheat production. There is little scope to expand cultivation in these areas as cropping intensities already exceed 200% coverage. The areas with the greatest potential to expand food production are the hilly areas of the country.

Due to its regular flooding, only a limited number of crops can be grown in the alluvial plain lands. The hills are mostly free from seasonal flooding and are suitable for growing a wide range of field crops, spices, horticultural crops, forest plantations, rubber, coffee, and tea. Land use in the hilly areas is different to the plain alluvial areas, although the valleys and level to nearly level piedmont areas are cultivated in a similar way. Most hilly areas are closely dissected and sharply ridged with steep slopes that have shallow to moderately deep soils. The hill soils of Bangladesh are slightly to very strongly acid, rich in iron, manganese and potassium, and deficient in nitrogen, phosphorus, boron and zinc.

The natural vegetation of these hills is dense jungle that provided a safe habitat for numerous species of flora and fauna. Nowadays, human intrusion in the shape of shifting cultivation (locally called *jhum*), the reckless felling of trees, and the cultivation of annual and perennial crops on steep and very steep slopes is causing severe soil erosion, runoff, and landslides. This is leading to the siltation of stream beds, low lying areas, natural drainage lines, and lakes. In the past jhum cultivators left land fallow for 15 to 20 years before returning. This helped to restore soil fertility and productivity. Presently, because of rapid deforestation and increased population pressure, the fallow period is down to only three to five years resulting in accelerated soil erosion, nutrient depletion, land degradation, and a severe threat to biodiversity (Borggaard et al. 2002). Moreover, the monocropping of tuber crops like aroid, turmeric, ginger, and potato on hill slopes with deep ploughing and no soil or water conservation measures has increased degradation.

Physiography and Land Use

Bangladesh's four main physiographic units are the alluvial plains covering 75% of the area, mangrove forest covering 5%, terraced cultivation covering 8% and the hills covering 12% (SRDI 1997).

The major sloping upland areas of the country are the hills of greater Mymensingh, Sylhet, Chittagong district and the Chittagong Hill Tracts (CHT). These lie in the southeast and northeast of the country. They are part of the Hindu Kush-Himalayan region and are one of the youngest mountain chains of the mid-Pliocene to early Pleistocene ages. The geology is characterised by three main series of rock with the two older series (Surma and Tipam) exposed in the higher elevations of the anticlines, and the relatively younger Dupi Tila series eroded at higher elevations and now underlying the low hills of the synclines (Hassan 1999). Most of these hills are closely dissected and sharp edged with mainly steep slopes ranging up to an altitude of 1000m.

The Chittagong Hill Tracts cover about 76% of Bangladesh's hilly area. Officially 26% of this area is under reserved forest and the rest is under unclassed state forest. Large areas are fallow, made up of abandoned jhum fields that have been replaced by secondary undergrowth of shrubs, vines, sun grasses, thickets and weeds. The rest is covered by horticulture, forest plantations, bamboo, cane, rubber, and tea plantations.

Small dams in the hilly creeks and streams capture large amounts of rain and seepage water for domestic use. These reservoirs are used for raising fish, watering livestock, irrigation and as tourist attractions.

Valley lands are used for cultivating rice. Farmers use fertilisers and high yielding varieties. The fields are irrigated by building earthen dams across streams, canals, and rivers to divert water into the fields. Irrigation is also done by low-lift pumps, tube wells and other local equipment. So far, deep tube-wells have not worked well in this area possibly due to the embedded sandstones and shale beds at shallow depths and the absence of desirable water layers.

Agricultural Potential of CHT

Bangladesh's Soil Resource Development Institute (SRDI) has mapped the soils and land resources of the Chittagong Hill Tracts (SRDI 1986). Most agricultural development programmes in the tracts have been based on this work's recommendations. SRDI carried out

a soil survey of the CHT's 25 administrative areas (thana/upazila) from 1994 to 2002 to assess the existing natural resources. The results were published in Bengali (SRDI 1994-2002). The slope class data in Table 6.1 is based on these reports.

There is only limited land suitable for agriculture in the CHT as 79% of its area is steeply sloping with severe to very severe limitations on agriculture (Table 6.1). Many of these areas have shallow soils and suffer from soil erosion as a result of deforestation and jhum cultivation.

Table 6.1: **Distribution and extent of slope classes in Chittagong Hill Tracts**

Slope class	Slope %	Area (ha)	% Covered	Crop suitability	Crop limitations
Nearly level	< 5	83,104	6.2	Very good	Minor limitations
Gently sloping	5-15	26,518	2.0	Good	Few limitations
Moderately sloping	15-30	102,136	7.7	Fair	Moderate limitations
Steep	30-50	297,536	22.4	Less suitable	Severe limitations
Very steep	50-70	399,482	30.0	Restricted for agricultural use but good for watershed protection purposes	Very severe limitations
Excessively steep	> 70	349,786	26.3	Unsuitable for agriculture – only useful for watershed protection purposes	Very severe limitations
Settlements & water	30-70	71,939	5.4	Mostly urban areas, cluster villages, Kaptai lake, and rivers	
Total		**1,330,501**	**100**		

Source: SRDI 1994-2002

Land Rights

Reserved forests cover 3,483 km^2 (26%) of the Chittagong Hill Tracts. The rest is unclassed state forest areas used mostly for jhum cultivation. The problem of land rights is acute in this region. The CHT regulations have regulated land rights in this area since 1900. The objectives of the regulations were to "protect the rights and interests of tribal people, their customs and practices, their local and racial peculiarities and prejudices and thus preserve their cultural identities" (Shelley 1992). The CHT was divided into three taxation circles, each headed by tribal chiefs (raja). The regulation's rules were amended a numbers of times to 1935. These led to the repeal of the permit system and the declaration of CHT as a 'backward tract', thus enabling the then ruling power – the Governor General of India – to govern CHT as an excluded area. The restriction on the entry of non-tribals was lifted in 1964, causing much dissatisfaction among tribal people (Mohabbat 2002).

The building of the Kaptai Hydroelectric Dam in the middle of the hill tracts in the 1960s accelerated the destruction of the area's forests. It displaced 100,000 tribal people by submerging much of the best agricultural lands. These people were forced to take up shifting cultivation. The 1973-1996 armed conflict displaced thousands more. The peace treaty signed in December 1997 between the government and the tribal insurgents ended the conflict. A regional council was formed and a land commission set up in June 1999 to solve the land problems of displaced people.

Land ownership in most of the CHT is not clearly defined as a cadastral survey has only been carried out in the valley areas. The sloping upland areas have not been demarcated. The district administration and tribal chiefs are both involved in administering these lands. This dual responsibility has resulted in conflicts between land users and landowners. The farmers do not own the land and so attach little importance to conserving its future productivity. In each jhum season they exploit the soil to its maximum. These farmers do this in the knowledge that they may never use the plot again. This outlook is destroying the long-time sustainability of the hill soils. The nomadic *jhumias* have traditionally not practised settled agriculture and have given no attention to restoring the lost fertility and productivity of fallowed lands, mainly due to their lack of land rights (Borggaard et al. 2002). The possession of land rights is almost a pre-condition for practising sustainable production as it creates social, political and economic awareness among farmers. The CHT needs a cadastral survey to work out permanent ownership status for land users or to implement some sort of long-term lease system.

Shifting Cultivation

Shifting cultivation is the traditional cultivation practice of tribal communities in Bangladesh's hilly regions. This mixed cropping system is practiced in CHT and in the hills of the greater Chittagong district. In this rainfed upland cultivation system, an area is entirely cleared of its vegetation by cutting and then burning the cut material in the dry season. Seeds are sown or broadcast after the first April showers. The usual practice is for seeds of hill paddy, maize, millet, vegetables, chilly, melon, pumpkin, hill cotton, spices, and other species to be mixed and sown into small holes (Figure 6.1).

Figure 6.1: **Traditional jhum field on a steep slope in CHT**

As the rains set in the seeds and weeds germinate after which weeding is carried out (Borggaard et al. 2002). The crops are harvested as they ripen from July through to December. Afterwards, the jhum cultivator moves onto another site. Up to about 50 years ago the jhum cropping cycle was 15-20 years, which left enough time for soils to restore their fertility. But, increased population pressure and the scarcity of suitable land has led to the period between cropping dropping to 3-5 years. During the peak jhum season of May to July, the hilly areas receive heavy high intensity rainfall. The cleared jhum plots are very susceptible to soil erosion during this time (Gafur et al. 2002).

After cropping, abandoned jhum fields are left fallow. The jhum cultivators do nothing to restore the fertility of these areas as they have no title to these areas. The abandoned fields produce weeds, sun grass, shrubs and trees which have little economic value. After the 3-5 year fallow period these areas are again cleared and the cycle is repeated. The areas may be cleared within different boundaries and by different farmers.

The resultant washing away of the fertile topsoil of many hill slopes has turned vast areas of CHT into barren, nutrient deficient, unproductive lands. A study found that 41 tonnes/ha^2 of soil was lost through the jhum cultivation of a moderately steep to steeply sloping jhum field in one season (Gafur, et al. 2002). This suggests that the long term effect of jhum cultivation is more damaging than previously presumed. Commenting on jhum cultivation practised in the adjoining area of Mizoram, Northeast India, Lienzela (1997) called for the banning of shifting cultivation "to save Mizoram and her environment". The situation in CHT is even more urgent due to the three times greater population pressure and the much shorter fallow periods. Even though only about 2.5% of the CHT's hilly areas are currently used for shifting cultivation each year, almost the whole mountainous area except for the Kaptai Lake and reserved forest areas have been jhum cultivated in the recent past (Borggaard et al. 2002).

Back in 1965 the Canadian Forestal Survey Group (SRDI 1986) raised the alarm about rapidly decreasing fertility and yield decreases in jhum plots caused by the reduction in the fallow periods. They also reported increased landslides, soil erosion, nutrient depletion and the irreversible degradation of land, soil and environment. Since then these problems have increased as the population density has increased from 29 km^2 in 1961 (BBS 1993) to 96 km^2 in 2000 (Gain 2000). Jhum cultivation is practised mainly by the area's 13 tribes.

Population increases, mainly from in-migration from the plain areas, is causing new problems. These settlers are introducing plain land cultivation techniques on the hill slopes. They practise deep ploughing (spading), and grow tuber crops like potato, aroids, ginger, and turmeric along the slopes rather than along the contours (Figure 6.2) a pattern of cropping that is very susceptible to soil erosion.

With an estimated output of only US$362 against an input of US$380 ha/yr jhum cultivation in CHT is not cost-effective (Gafur et al. 2002a). At present production levels the system cannot even feed a family of four. It is very labour demanding with 88% of total 'expenditure' going on labour.

Most jhum cultivators do not have regular unemployment. When not working on their jhum plots they often sit in their *tang ghars* (temporary huts in the jhum field) making household items from forest products. Elderly family members make baskets, mats, furniture and ornamental goods out of bamboo, cane, cotton and other materials. There is a good demand for these handicrafts and they provide a crucial extra source of income for jhumia families.

Figure 6.2: **Tuber crops like Arum are grown across slope contours**

The jhum system results in severe losses of soil and essential plant nutrients by erosion each year. Assuming 2.5% of the CHT's land is under jhum each year, it has been estimated that nearly one million tonnes of soil, containing several tonnes of nutrients, is lost from the jhum cultivated areas of CHT each year. Compensating for this loss of nitrogen, calcium, potassium, phosphorous, sulphur, boron and zinc would involve applying about 14,000 tonnes of commercial fertilisers per year. The cost of applying this, as of March 2001, was about US$1.8 million per year (Gafur et al. 2002a).

Plantations

Rubber

Over the last two decades rubber (*Hevea brasiliensis*) has emerged as an important economic activity in the CHT. Many countries have used rubber cultivation to replace shifting cultivation. Rubber plantations give better economic returns, a more equitable distribution of income, and better forest cover to reduce soil erosion (Jayasena and Wickramanayake 1996). The Bangladesh Forest Industries Development Corporation (BFIDC) suggests that rubber cultivation is economically sound giving an internal rate of return of 15%. The 1965 Canadian forest survey (SRDI 1986) estimated that about 0.24 million hectares of the CHT's medium sloping unproductive uplands were suitable for rubber, coffee and other agroforestry crops. Many other hilly areas of the country are also suitable, but only about 25,000 ha of land, amounting to 10% of the area of suitable land, is being used for growing rubber. However, the viability of rubber plantations is being threatened in recent years as synthetic rubber is becoming popular.

This problem needs addressing by government and private initiatives to encourage cultivators to move away from monocultures of rubber to mixed plantations of rubber with timber, fruit orchards, and other crops. Another suggestion is to ban the import of synthetic rubber to stabilise the price of locally produced rubber. In addition, on-farm research on rubber should

be initiated to identify higher yielding varieties and clones that are more appropriate for the Bangladeshi environment.

Tea

Tea (*Camellia sinensis*) is one of Bangladesh's main exports. Tea plantations cover more than 2% of the country's area and account for 2.8% of world tea production. Since 1950 the number of tea gardens in Bangladesh has increased from 103 to 160 in 2000. There is a growing demand for tea within Bangladesh such that it has been estimated that in 10-15 years domestic production will match domestic demand. The average productivity of Bangladesh's tea gardens is only 1,176 kg ha^2, compared to average figures for India of 1,800 kg, and for Kenya of 2500 kg ha^2. In about 12,000 ha of old tea gardens the productivity is only 460 kg ha^2. The average land use is only 44% of the granted area and the remaining 56% of government allocated land has not been brought into tea production.

A major intervention is needed to encourage smallholder tea production in suitable parts of the country, not only to meet increasing demand, but also to provide employment opportunities to CHT people. A feasibility study carried out by the Bangladesh Tea Board (BTB 2000) suggested that an additional area of 46,856 ha of land in three CHT districts could be converted into small holding tea plantations. This would create jobs for about 100,000 families, reduce soil erosion, and improve the local environment. Smallholder tea plantations are beginning to be established in many parts of CHT.

Small Watersheds — a Hidden Treasure

CHT's small watersheds offer great potential for introducing sustainable development measures to protect these environments and improve local livelihoods.

In small watersheds integrated, participatory, and sustainable development programmes can be implemented for community empowerment to meet livelihood and food security needs. For a long time the CHT's watersheds have experienced excessive erosion, organic matter depletion, nutrient removal by runoff and burning, deep ploughing on steep slopes, indiscriminate logging, and destruction of flora and fauna. This has led to many watersheds becoming barren and unproductive.

The average annual rainfall in CHT is 2682 mm. There are distinct wet and dry seasons with the rainy season running from May to October. There is a sharp increase in rainfall from May to June with July rainfall accounting for 24% of annual rainfall. The annual reference evapotranspiration is about 1350 mm leaving a potential rainfall excess of 1350 mm/yr (Gafur et al. 2002). This huge amount of excess rainfall drains out of the hills along with eroded soil material through the CHT's numerous watercourses. The heavy rainy season downpours are followed by serious dry season water scarcity. The surplus rainwater could be preserved by building more small dams to satisfy year-round water needs for irrigation, fisheries and other uses.

The CHT have small, medium, and large watersheds. These can serve as water reservoirs by building small earthen dams to store water. The Bangladesh Agriculture Development Corporation, local government councils, the Chittagong Hill Tract Development Board, the fisheries department, NGOs and private entrepreneurs have built such dams. These initiatives should be extended across all Bangladesh's hilly areas. In some areas micro-hydro systems are

being installed to produce electricity. In plains areas huge earthworks are needed to make a pond. This is not the case in the sloping uplands as building a dam or embankment on the side of a watercourse preserves a large amount of water. This can have a large positive impact on local people's socioeconomic conditions and on the local environment. In 1961 the building of a dam across the Karnaphuli River created the 596 km^2 Kaptai reservoir. Building dams across the rivers Sangu and Matamuhari would also create large reservoirs. However, this displaces many families, which could reignite insurgency activities.

The government is working to bring small watersheds under diversified production systems using the integrated efforts of all stakeholders for the efficient economic use and sustainable development of these areas.

Conclusion and Recommendations

Introducing sustainable production systems in CHT is a difficult job. The urgent implementation of the following recommendations would help ensure the sustainable productivity and the biodiversity of the Chittagong Hill Tracts and the socioeconomic well-being of the area's people. The author looks forward to seeing the prudent management of the CHT's natural resources to support future generations.

- Promote the gradual abandonment of jhum cultivation and the rehabilitation of affected jhum cultivators.
- Leave reserve forests intact and carry out a massive afforestation and social forestry programme on unclassed state forest lands to promote the production of tea, rubber, fruit, spices and other forest species.
- Stop the cultivation of steep hill slopes for growing annual and seasonal crops. These areas should only be used with caution for long-term plantations with contouring, strip cropping, and sloping agricultural land technologies (SALT).
- Introduce secure land rights or land titles and measures to rehabilitate displaced people and migrants.
- Develop sustainable and environmentally friendly cultivation techniques as substitutes for jhum cultivation including promoting tea growing and rubber plantations mixed with timber, fruit trees, spices, and other crops.
- Undertake programmes in the CHT's small watersheds to promote the building of small earthen dams to preserve water. Multipurpose use of this water, including small hydro schemes, will improve the socioeconomic conditions of hill dwellers. This approach should be spread to all sloping upland areas in Bangladesh and should involve the carrying out of associated research.

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