

A9

A PROPOSED STRATEGY FOR AGRICULTURAL DEVELOPMENT

Of the Chittagong Hill Tracts of Bangladesh

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Introduction

This chapter proposes an intervention in discussions on formulating an agricultural development strategy for the Chittagong Hill Tracts (CHT) in southeastern Bangladesh. It is therefore particular to a relatively small corner of South Asia, but the reasoning and lessons to be drawn from this microcosm may be universal in the wider context of the Asia-Pacific region and in formulating effective policies to ease the often painful transition from extensive to intensive agricultural practices across the region. We discuss the ways in which development could occur in the CHT's various agro-ecological zones, from valley villages to communities situated on the hills, both well-connected and remote. In addition to crops, the roles of farm forestry, livestock, fisheries and other related economic activities are discussed. We urge that commercialization should be introduced to the CHT with caution, by charting a gradual transition from extensive to intensive cultivation and relying on more than one commercial crop.

We also discuss environmental problems such as increasing moisture retention and reducing soil erosion, because we see inevitable changes ahead in land-use patterns. There is also a need to set aside critical natural capital from production or extraction.

Institutional changes loom large in the strategy of transformation from extensive to semi-intensive and intensive agriculture, including gender equality, the manner in which land is allocated and managed and the management of non-timber forest

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products (NTFPs). We also stress the need for agricultural research to study upland crops, and point out the neglect of such studies in the past.

Background

This study is based on work done by the authors for various development agencies, such as the Asian Development Bank (ADB), the International Fund for Agricultural Development (IFAD) and the United Nations Development Programme (UNDP), as well as on fieldwork conducted between 2009 and 2012. We have drawn on knowledge gained from earlier work when formulating an agricultural development strategy for the CHT. In addition, we draw on knowledge gained from research conducted in similar regions, such as northeast India and Xishuangbanna, in China's Yunnan province.

The nature of agriculture in the CHT

The Chittagong Hill Tracts, located in southeastern Bangladesh, form the country's only extensive hilly region (Figure A9-1). They cover about 13,184sq. km, of which 92% is highland, 2% medium highland, 1% medium lowland and 5% residential areas and bodies of water. The population of the CHT is about 1.35 million, of which about 51% are indigenous people who inhabit the often remote upland areas. The indigenous peoples of the CHT are the most disadvantaged ethnic groups in Bangladesh. The majority of them are Chakma (48%), Marma (28%) and Tripura (20%). Agriculture is the main source of livelihood and the incidence of poverty is very high. Non-farm income opportunities are very limited, and in some areas, non-existent.

The two main land forms in the CHT are the hills and the valleys. Hill villagers engage mainly in *jhum* cultivation,¹ otherwise known as shifting cultivation or swidden farming, with some fruit horticulture. Valley villagers engage in the plough cultivation of paddy rice, along with a fair amount of vegetable and fruit cultivation. Many valley farmers also cultivate timber or *jhums* on the hill slopes, but more often than not, they are moving away from *jhumming* to either horticulture or timber plantations. The valley dwellers are mainly from the Chakma, Marma, Tanchangya and Bengali groups, while the Tripura, Mro and Bawm are hill dwellers, along with smaller communities, such as the Khyang, Pankhua and Lushai.

Of the CHT's rural households, 66% depend mainly on agriculture for their livelihood. Among these, 33% are involved only in plough cultivation and 20% only in *jhum* cultivation, while the rest combine both plough and *jhum* cultivation (UNDP, 2009, p175).

Communications and security of tenure: Key pre-conditions for agricultural development

Rural poverty in CHT communities varies with ethnicity, location, remoteness and gender. The indigenous peoples are in general poorer than the Bengalis. According

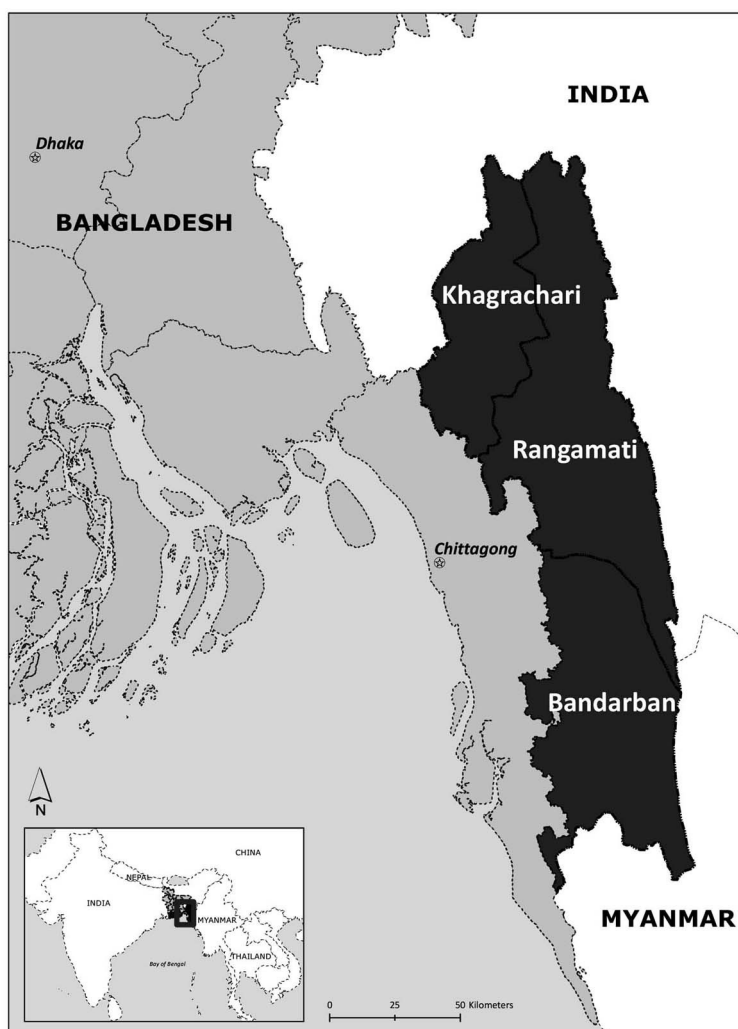


FIGURE A9-1: The Chittagong Hill Tracts of Bangladesh, showing the three districts discussed in this chapter.

to the UNDP, the average income for indigenous peoples in 2009 was about 62,000 taka (about US\$797) per year, while that for Bengalis in the CHT was 71,000 taka (\$912), and for rural households in Bangladesh as a whole, 84,000 taka (\$1079). Among indigenous peoples, the hill dwellers, who are mostly *jhum* cultivators, are poorer than the valley dwellers. Those who are further away from main roads, and therefore markets, are worse off than those who are closer. In addition, women, both indigenous and Bengali, are worse off than men in all communities. There is a substantial difference between women and men of all communities in terms of calorie consumption and decision-making power (UNDP, 2009).

Another factor to be taken into account is the difference in agricultural systems. As mentioned earlier, hill dwellers are mainly *jhum* cultivators, while valley dwellers rely mainly on plough agriculture. Remote hill communities who find it difficult to market their goods prefer to produce relatively non-perishable commodities, such as cotton, ginger and turmeric, in order to generate income. On the other hand, hill communities located on main roads prefer perishable products, such as fruit, for commercial production. Valley dwellers also cultivate perishable vegetables as commercial crops.

A discordant note in the development of commercial crops is the spread of tobacco cultivation, largely in the valleys. While providing substantial income, there is a substantial amount of environmental degradation involved in tobacco cultivation, as wood from forests is used in the drying and curing processes. However, there is a need to investigate whether the clearing of forests for use in tobacco processing might be checked by the promotion of village woodlots, where fast-growing firewood trees could be cultivated and sustainably harvested.

Along with remoteness or nearness to markets, another factor affecting the development of horticulture and other tree crops is the absence of tenurial security. A large part of the land belonging to indigenous peoples is unregistered and liable to be lost to immigrants, particularly where road networks are developed. Insecurity of tenure reduces the incentive for medium- to long-term investments, such as in horticulture or timber. Instead, insecure tenure promotes short-term investment in seasonal crops, which neither provide the highest income for the households nor benefit the environment.

Consequently, a sustainable agricultural-development policy that seeks to change land-use systems, i.e. in favour of tree crops as opposed to seasonal and root crops, depends on two crucial factors. The first is the improvement of road communications, including not only the extension of main roads but also the linking of villages through access roads. Analyses by both the Asian Development Bank (ADB, 2010) and the Food and Agriculture Organization of the United Nations (FAO) (Bala et al., 2010) stressed the importance of road communications in promoting perishable fruit-tree crops. The second is tenurial security for indigenous farmers over the land they currently cultivate. These are essential pre-conditions for agricultural development in the CHT. The FAO identified another favourable factor: education (Bala et al., 2010). Households with higher levels of education are more likely to change their agricultural systems than are households with lower education. However, this chapter is confined to agricultural-development strategy and cannot explore the impact of education.

Food security and poverty reduction

There is obviously a close connection between poverty reduction and food security. Those who are not poor are in a position to secure the food they require, whether through self-production or purchase, although sufficient food may not guarantee

adequate nutrition. While the first condition for reasonable well-being remains secure access to adequate food, nutritional security is an additional requirement.

In 1975, the World Food Summit emphasized the need for supplies of adequate food, but 20 years later, the 1995 World Food Summit declared ‘... food security, at the individual, household, national, regional and global levels ... exists when all people, at all times, have *physical and economic access* to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.’ (FAO, 1996, p3, *emphasis added*). The declaration further recognized that ‘poverty eradication is essential to improve access to food.’

Food security is therefore a condition in which there is sufficient nutrition, and this is the result of a combination of household and individual access to food and the ability to absorb nutrients. In more detail, individual food security is the result of:

1. The availability of food at macro or national levels, in terms of quantity, whether produced domestically, imported, or released from government stocks. In Bangladesh, food availability is usually regarded as a measure of available food grains, which are the chief source of energy, particularly for the poor.
2. Access to food by households through their own production, market purchases or government entitlements and distribution among household members on the basis of various social norms, bargaining positions and gender relations.
3. Ingestion and absorption of food and the assimilation of nutrients, all of which may depend upon access to safe water, the absence of parasitic diseases and overall good health.

It is therefore necessary to distinguish between the different levels at which food security is to be discussed, i.e. national, household or individual. At a national and even regional level, food security tends to focus on the lack of perfectly competitive markets for food grains, the economic and political pressures that arise from inadequate supplies and the need to emphasize domestic production so as to avoid appearing over-dependent on external trade. At the household level, there is clearly no requirement to produce one’s own food. This is why the World Food Summit in 1995 linked household food security to poverty reduction rather than household production of food.

Consequently, the objective of an agricultural development policy for the CHT – as for any other similar sub-region – must be to increase farmers’ access to food, meaning that farmers’ incomes must increase and the incidence of poverty decrease. There is no need for individual households to produce their own food; rather, they must be able to produce an income that is adequate to secure the food they need. Remote communities and households may feel compelled to produce their own food, but less remote and well-connected communities and households should be under no such compulsion. This point was eloquently expressed by a group of Bawn farmers in Farrukhpara (community), close to Bandarban town. When asked why they grew only fruit but no rice, they replied, ‘Why should we produce rice? By

growing and selling fruit we can get more rice (and other commodities) than we can get by cultivating rice ourselves.’

The CHT is part of the Bangladesh economy and also part of the region calling itself the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation, or BIMSTEC. The western part of the CHT is generally well connected to adjacent districts of Bangladesh, while the eastern part faces external borders. Communications are not good in the east and there are many barriers to trade. Discussions with the Regional Council, Hill Development Councils and key informants all revealed that the well-connected western part of the CHT was better off than the poorly-connected eastern part.

The reason for this difference is that well-connected households can take advantage of the wider market with which they are connected. They can specialize in ventures where their productivity is higher than that in the surrounding plains, while buying those products in which their productivity is lower. In general, rice productivity in *jhums* will be lower than that in irrigated fields, while the productivity of several fruit crops will be relatively higher in the hills than on the plains. Therefore, an agricultural development and food security strategy must take into account the location of the CHT within Bangladesh and within BIMSTEC. Trade in BIMSTEC is still relatively restricted by a combination of factors, including poor communications, restrictive laws, demands for payment by officials and armed gangs of insurgents and ex-insurgents.

Placing the CHT within the context of the Bangladesh economy and BIMSTEC, we suggest that any strategy aimed at agricultural development and poverty reduction should pay attention to (1) the relative productivity of different crops in the CHT and surrounding regions and (2) the likely impacts of increasing production in the CHT on both regional prices for these products and the income benefits they provide.

Setting the context: Comparing productivity

According to the UN Development Programme, paddy productivity in ploughed and irrigated valley fields in the CHT is estimated to be 3.4 tons per hectare (UNDP, 2009, p83). This is higher than the national average of 2.7 tons per hectare. Paddy cultivation in the valleys of the CHT is therefore clearly competitive: rice from here can yield higher profits than paddy cultivated on the plains. The rice productivity of *jhums* is much lower, at just 1.5 tons per hectare.² It would have to be marketed at a price higher than that of rice from the plains, mainly as a niche product with a limited market based on its flavour.

Consequently, while *jhum* rice will continue to be cultivated for self-consumption and as a niche product, it is not likely to be the growth area of CHT agriculture. Furthermore, there is little scope for extending the limits of *jhum* cultivation. The population-land ratio is increasing and *jhum* farmers are being forced to shorten the fallow period, with a resulting fall in productivity. This shows that further extension of *jhumming* is not feasible as a development strategy.

There are also limits to the availability of land for ploughed paddies. The topography of the CHT means that land available for plough cultivation is limited to narrow valleys. However, investments in water-control structures can increase the area of irrigated land and promote double cropping, with rice followed by winter vegetable cultivation. Small reservoirs formed by water-control structures can also be used for aquaculture.

While increasing production in the valleys is an important part of a strategy for agricultural development in the CHT, this will not reach the hill farmers, who are the most food-insecure farmers in the region (Bala et al., 2010). For these farmers, the strategy must be based on developing higher-value production within existing *jhum* areas. In well-connected villages, fruit production is rising and can be further increased, but increasing the production of perishables will not work to improve incomes in remote villages. While it is expected that currently remote villages will become better connected over time, it is necessary for households in such villages to also have an agricultural development strategy, pending the improvement of road communication. For remote hill farmers, the promotion of non-perishable high-value crops is thus an important possibility.

CHT production in the national market

The CHT could, for instance, develop horticulture, where it would have an advantage over growers on the plains of Bangladesh – or at least a lesser disadvantage than that currently faced by *jhum* farmers. The question, though, is whether an increase in horticultural production in the CHT would have a strongly negative effect on product prices, such that higher production might lead to lower overall income. In order to evaluate this, we must look at the CHT's share of national production of the chief horticultural crops and condiments, such as ginger and turmeric.

The second Chittagong Hill Tracts Rural Development Project, funded at a cost of US\$50 million by the Asian Development Bank and the Government of Bangladesh, expects that its project activities between 2011 and 2018 – chiefly the construction of roads and promotion of commercial agriculture – will expand the area's production of fruit and commercial crops. Estimated increments in outputs are shown in Table A9-1.

For most products, the expected increase in the CHTs' production is less than 1% of national production. Only in the case of lychees and mangoes is the ADB project (the Second Chittagong Hill Tracts Rural Development Programme) expected to raise production by about 2% and 3.3% of national production, respectively. Therefore, we can conclude that the additional production of fruit and condiments in the CHT is unlikely to have a negative effect on the prices of these products. Even if the expected increase in CHT production was doubled, the additional output would not have a negative effect on prices.

TABLE A9-1: Crop production increments through CHT Rural Development Project.

<i>Crop</i>	<i>National production (tons)</i>	<i>Estimated incremental output in CHT (tons)</i>	<i>Increment as percentage of national production</i>
Brinjal (<i>Solanum melongena</i> L.)	334,300	960	0.28
Mangoes (<i>Mangifera indica</i>)	639,800	12,840	2.0
Lychees (<i>Litchi chinensis</i> Sonn.)	40,000	1350	3.37
Banana (<i>Musa</i> spp.)	909,000	300	0.03
Papaya (<i>Carica papaya</i> L.)	105,000	513	0.48
Jackfruit (<i>Artocarpus heterophyllus</i> Lam.)	719,900	237	0.03
Turmeric (<i>Curcuma longa</i> Linn.)	98,500	178	0.18
Ginger (<i>Zingiber officinale</i> Rosc.)	57,000	237	0.42

Source: ADB (2011).

The CHT in BIMSTEC

Besides the domestic market, the CHT region is also connected to the wider regional markets of northeast India and Myanmar as part of BIMSTEC. Trade with these regions is now largely informal, but is likely to grow and become more formal. Higher rates of growth in northeast India mean that there is an expanding market for livestock in particular. As transport and related communications improve, the CHT will be able to grasp growing opportunities to market its products.

What is important is that the agricultural development strategy for the CHT should not be limited by its domestic market. Rather, the



Solanum melongena L. [Solanaceae]

Production of brinjal, eggplant or aubergine is expected to be significantly boosted by rural development projects in the CHT.

wider Bangladesh domestic market and growing cross-border trade should both be taken into account.

Perceptions of change and potential

In order to develop an agricultural development strategy, the opinions of farmers in the CHT must be taken into consideration. During preparations for the ADB project, a study was carried out in 60 villages in various locations (valley, hill and fringe areas of Kaptai Lake) and covering all major ethnic communities. The study documented villagers' perceptions of the structural changes that had taken place in their agricultural systems in the preceding decade and sought their perceptions of the kinds of agricultural changes they thought had the potential to be beneficial in the future. The main responses are shown in Tables A9-2, A9-3 and A9-4.

The major negative change in livelihoods in the valleys was the decline in importance of *jhumming*, which went from being important in 42.1% of valley villages 10 years earlier to being important in just 10.5% of valley villages at the time of the study (Table A9-2). Ploughed rice, turmeric, fruit, fishery pursuits and timber all increased in importance, but the biggest change was in the importance of wage labour – it was ranked as important by just 21.1% of villages 10 years earlier, but was regarded as important by 63.2% at the time of the study, an increase of 42.1 percentage points. This could be evidence of a rapid increase in landlessness, but it definitely shows that with the increasing importance of ploughed rice and vegetables, there was a concomitant increase in wage employment.

TABLE A9-2: Changes in the importance of agricultural systems and crops in CHT valleys over the previous 10 years (Percentage of farmers involved, based on responses from 60 villages).

<i>System/crop</i>	<i>Valley 10 years ago</i>	<i>Valley now</i>	<i>Percentage points difference</i>
<i>Jhum</i>	42.1	10.5	-31.6
Ploughed rice	57.9	78.9	21.0
Vegetables	42.1	42.1	0.0
Chorakochu (Taro) (<i>Colocasia esculenta</i> L.)	10.5	15.8	5.3
Ginger	42.1	52.6	10.5
Turmeric	42.1	57.9	15.8
Fruits	21.1	42.1	20.0
Livestock	52.6	47.4	-5.2
Fishery	10.5	31.6	21.1
Timber	21.1	42.1	21.0
Tobacco	5.3	15.8	10.5
Wage labour	21.1	63.2	42.1
Other, incl. Coriander (<i>Coriandrum sativum</i> Linn.)		5.3	5.3

Source: ADB (2010).

TABLE A9-3: Changes in the importance of agricultural systems and crops in CHT hills over the previous 10 years (Percentage of farmers involved, based on responses from 30 hill villages).

<i>System/crop</i>	<i>Hill 10 years ago</i>	<i>Hill now</i>	<i>Percentage points difference</i>
<i>Jhum</i>	75	13.9	- 61.1
Ploughed rice	44.4	27.8	- 16.6
Vegetables	36.1	25.0	- 11.1
Chorakochu (Taro) (<i>Colocasia esculenta</i> L.)	11.1	13.9	2.8
Ginger	41.7	22.2	- 19.5
Turmeric	44.4	66.7	22.1
Fruits	13.9	41.7	27.8
Livestock	33.3	27.8	- 5.5
Fishery	2.78	8.33	5.55
Timber	22.2	44.4	22.2
Tobacco	2.78	8.33	5.55
Wage labour	19.4	41.7	22.4
Other, incl. Coriander (<i>Coriandrum sativum</i> Linn.)	-	-	-

Source: ADB (2010).

TABLE A9-4: Scope for agricultural development according to location.

<i>Livelihoods</i>	<i>Lake shore fringe</i>		<i>Hill</i>		<i>Valley</i>	
	<i>No. of villages</i>	<i>%</i>	<i>No. of villages</i>	<i>%</i>	<i>No. of villages</i>	<i>%</i>
New <i>jhum</i> fields	0	0.0	5	13.9	2	10.5
Fruit orchards	5	100	19	52.8	7	36.8
Plough cultivation	0	0.0	12	33.3	12	63.2
Vegetables	1	20.0	1	2.8	7	36.8
Ginger	0	0.0	12	33.3	7	36.8
Turmeric	3	60.0	24	66.7	9	47.4
Timber	1	20.0	20	55.6	8	42.1
Nursery/herbal medicinal plant	0	0.0	0	0.0	1	5.3
Tobacco	0	0.0	2	5.6	2	10.5
Livestock	3	60.0	18	50.0	10	52.6
Fish	2	40.0	3	8.3	4	21.1
Business/trade	0	0.0	3	8.3	3	15.8
Weaving	0	0.0	1	2.8	1	5.3
Other (specify) e.g. wage employment outside	0	0.0	0	0.0	0	0.0

Source: ADB (2010).

In the hills, what came as a surprise was the sharp fall in the number of villages that ranked *jhumming* as very important – from 75% 10 years ago to just 13.9% at the time of the study (Table A9-3). There was also a decline in the percentage of villages that ranked ginger as very important. On the other hand, fruit, timber, turmeric and wage labour all gained importance. Landlessness was on the rise in the hills, as well as in the valleys.

These trends were confirmed by the staff of line departments, *karbaris* and headmen from the hill districts in responses to questionnaire surveys conducted during workshops in October 2011 and March 2012.³ *Jhumming* is on the decline, with both fruit-tree plantations and timber taking its place. Ginger and turmeric continue to increase

in importance and tobacco cultivation is important in the low hills of Khagrachari. However, a new trend has sprung up – the cultivation of chillies, both in areas under tobacco cultivation and in distant locations. Chillies, like ginger and turmeric, are a non-perishable crop when dried. Additionally, chillies are of low weight and volume for price. That makes them particularly suited to off-road locations where the need to carry goods to market sets a strict limit on the weight of produce that can be sold.

The agricultural systems and crops that can be developed obviously depend on the agro-geographic location. Farming in the hills is different from farming in both the valleys and at the lake shore. Table A9-4 shows how respondents to the ADB study of 60 CHT villages regarded the potential of various agricultural alternatives.

The livelihoods that villagers on the lake shore fringe thought they could develop included fruit orchards, growing turmeric, raising livestock or fish, and growing vegetables or timber, in that order. Farmers in these villages cultivate *jhum*s on hill slopes, but *jhumming* was not something they were keen to develop. They cultivate substantial areas of paddy, but the extent depends entirely on the management of Kaptai Reservoir. If the water is retained at a low level there is more land available for paddy cultivation, but if the water level is high, then less land is available. Therefore, even though paddy cultivation yields a high net income, the farmers were unable to treat it as a livelihood they could develop as the availability of land is beyond their control.

It is interesting to note that even in the hills, farmers saw little scope for the development or extension of *jhum* cultivation. Instead, they favoured the cultivation



Curcuma longa L.
[Zingiberaceae]

In most parts of the CHT, farmers favour turmeric as a crop worthy of development.

of turmeric, timber or fruit-trees and the raising of livestock. Tree farming for timber could certainly be adopted in the hills, provided it was not done in monocultures. The returns could be quite high, given the price of teak. However, a very restrictive system of harvesting and marketing timber leads to high transaction costs (viz. payments to various officials and traders) and limits returns to farmers.

In the valleys, major importance was given to the development of ploughed agriculture: almost two-thirds of valley villages, as opposed to one-third of hill villages and no fringe villages, considered ploughed cropping important for developing livelihoods. This was followed by raising livestock and growing timber, turmeric, fruit and vegetables.

Turmeric is grown as an annual crop and can be cultivated even in fields over which farmers do not have secure tenure. On the other hand, timber and fruit cultivation are multi-year investments and can be undertaken only where farmers have security of tenure over their land. This underlines the importance of tenurial security if farmers are to benefit from improved communications. Without improved communications, they will not be able to market increased commercial production. Similarly, ploughed cultivation requires security of tenure because both land improvement and irrigation infrastructure are involved.

The UNDP programme, Chittagong Hill Tracts Development Facility, has been providing grants to so-called Para Development Committees (PDCs) for various production or social interventions at village level. These committees are elected by communities and consist of one-third women, one-third vulnerable households (as defined by the community), and one-third from the remainder of the people. The committees mobilize villagers for planning and implementation of various projects and are directly responsible for the management of their community bank accounts and the proper utilization of grants and community funds. In the next section we examine the manner in which the UNDP grants have been used, in order to gauge farmers' understanding of the potential of different production interventions.

Investment in rearing livestock was the most preferred option in all districts, almost twice as popular as agricultural cropping. An average of 8% of the PDC projects involved investment in agricultural machinery. In Khagrachari district, with its

TABLE A9-5: Kind of projects initiated by Para Development Committees from grants, up to December 2011.

<i>District</i>	<i>Total no. of projects</i>	<i>Livestock (%)</i>	<i>Agriculture (%)</i>	<i>Rice bank (%)</i>	<i>Agricultural machinery (%)</i>	<i>Aquaculture (%)</i>
Rangamati	3823	35	24	17	8	5
Khagrachari	2682	41	12	14	12	4
Bandarban	2846	40	22	21	6	4
Total	9351	38	20	18	8	4

Note: Not all project data was entered into this table.

Source: Community Empowerment Cluster, Chittagong Hill Tracts Development Facility.

broader valleys and low hills, agricultural machinery was clearly more important than in the other districts. Again, with generally better communication in Khagrachari district, it was no surprise that it ranked lowest in the proportion of projects establishing rice banks, from which the poor can borrow in times of scarcity. Aquaculture was quite low, at less than 5%. The main point to be drawn from Table A9-5 is that investment in livestock is clearly the most preferred investment option in all three districts.

Agricultural development strategy for the CHT

Criteria for assessing a strategy

An agricultural development strategy aims to achieve certain goals; in this case, increased well-being and improved food security for both women and men. As pointed out earlier, both of these goals require a higher per capita income for households, where income includes both cash income from sales of commodities produced and the imputed value of self-consumed produce.

Does a household's per capita income translate into a similar per capita consumption, and thus similar food security, for all members of the household? Data for the CHT (e.g. UNDP, 2009) show that the food available in a household is not always distributed equally. In particular, women and girls get less food than men and boys. The data also show that women spend more hours at work per day than men. Additionally, the 'heavy' work formerly performed by men, such as clearing primary forest for swidden agriculture, is now much less because the vegetation to be cleared nowadays amounts to nothing more formidable than secondary forest. Consequently, it can be safely assumed that women, working longer hours than men and bearing the additional burden of child rearing, require more energy and nutrition – but they get less than men. This unequal gender distribution is not the same in all communities; it is most unequal among the Bengalis and least among the upland cultivators, such as the Mro, with indigenous lowland cultivators, such as the Chakma and Marma, somewhere in between.

Consequently, the intra-household distribution of consumption must be considered in assessing the ability of an increase in per capita income to generate well-being. The greater the intra-household inequality in consumption of food and essentials, such as healthcare, the smaller will be the impact of an increase in household income on the household's overall well-being. This also means that an agricultural development strategy that reduces gender inequality will have a greater impact on overall well-being than a strategy that increases it.

The question, then, is whether a reduction of intra-household gender inequality should be included as part of an agricultural development strategy, or whether this should be an add-on to be tackled by a separate gender policy. This is the conventional way of tackling gender inequality in agricultural development. However, an agricultural development strategy should not only include what is to be done, but also how it is to be done, or how the strategy is implemented. Women are not only

farmers in most CHT communities, but they also perform most of the labour (other than clearing the land) in, for example, *jhum* cultivation. Thus, the roles of women, and the gender issues that determine these roles, must become part of the agricultural development strategy.

An agricultural development strategy that includes the manner of its implementation would not directly include the way in which consumption is to be distributed within households. Nonetheless, it could include factors that are known to affect this distribution of consumption, such as women's participation in marketing and cash handling, women's ownership and management of land and access to new technology. By including the manner in which women will take part in the interventions that form a part of the agricultural development strategy, there could be an impact on the distribution of consumption within the household.

An agricultural development strategy usually extends over a specific period, say five or 10 years, but households and communities continue beyond that time, as do agricultural and other production systems. How, then, can a need for sustainability be incorporated in an agricultural development strategy? The simplest condition is that the productive capacity of the CHT at the end of the period should not be less than it was at the beginning. Alternatively, at least the rate of deterioration should have been reduced. Deterioration can be measured by two indicators: soil erosion and biodiversity.

Summing up the above, it can be posited that an agricultural development strategy should be judged on the basis of the following outputs:

1. An increase in household income per capita;
2. A reduction in intra-household gender inequality, in terms of access to and control over land, technology and markets;
3. A reduction in soil erosion; and
4. Preservation of biodiversity.

Agro-ecological zones in the CHT

The CHT region as a whole forms an agro-ecological zone, but there are also two main sub-zones – the valleys and the hills – with different farming systems. In the valleys, there is or can be irrigated cultivation, but on the hills, it is of the rain-fed variety. Of course, there can be water retention systems to increase the moisture content of soil on hill slopes, but cultivation there will remain basically rain-fed. The soil on the hill slopes is shallow, while that in the valleys, where soil from the slopes collects as a result of erosion, is deeper. Shallow soils in rain-fed conditions and deep soils with irrigation thus define the two sub-zones within the CHT.

Different conditions in the hills must also be taken into account. Two of these are the mild slopes in Khagrachari district, with hills that are not very high, and the steeper slopes with greater height in Bandarban district. Finally, there is another sub-zone beside the Kaptai reservoir or lake. This is made up of 'fringe' lands on

the shores of the lake that appear in winter, when the lake waters recede. With fresh deposits of silt and high moisture, these lands are very fertile, but are available for only one agricultural season, as the lake creeps back over the land with the onset of monsoon rains. When flooded, the land could be used for fish culture in cages or pens.

Strategy for the valleys

Valleys form only 5% of the land area of the CHT, but they are important to the region's economy because valley households have a higher per capita income than households limited to hill-slope cultivation. The valley economy is a combination of wet or irrigated rice, some vegetable cultivation and *jhum*, timber or fruit plantations on the hill slopes. The yield of irrigated rice in the CHT valleys is higher than that on the Bangladesh plains. Those households that have wet-rice plots often move away from *jhumming* and switch to plantation cultivation of timber or fruit trees on the hill slopes. Ploughing using draught animals has also been substantially replaced by mechanization. Pumps are also used to lift water from the valleys into surrounding terraces.

The development strategy for the valleys needs to involve only relatively small modifications. The first is that monoculture plantations of timber or fruit trees should be discouraged on the hills. Instead, farmers should be encouraged to adopt mixed plantations, whether for fruit or timber. The other is that small reservoirs should be built to increase the area under irrigation. Plots of land thus fed with water could support a second winter crop, either vegetables or wheat. In addition, the reservoirs could be used for seasonal aquaculture during the monsoon rains.

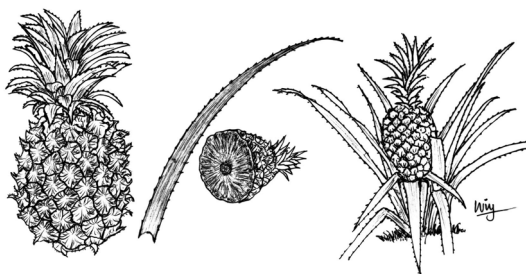
Well-connected hill villages

Hill villages can be differentiated on the basis of how well served they are by roads, and consequently their access to markets. In villages located on metalled roads, motor transport can be used to take goods to markets, but farmers in remote villages are limited by the amount of produce they can carry. Consequently, the availability and cost of motor transport are factors limiting the participation of hill farmers in wider markets.

Farmers in remote villages are forced to produce more of what they require for their own consumption than villages with easy access. Thus, they are unable to benefit from schemes promoting specialized or larger-scale production. In addition, there are likely to be fewer traders in any single commodity in remote village markets than those in larger towns. With a greater degree of monopoly, the prices that sellers receive are likely to be lower in distant village markets.

In better-connected villages, the agricultural development strategy could promote multi-strata fruit production. The Bangladesh Agricultural Research Institute's Hill Agriculture Station in Khagrachari district reports that pineapple-based multi-strata fruit cultivation could suit the upland terrain, and the net returns could be as high

as 148,809 taka (\$1912) per hectare. Furthermore, pineapples could perform a dual function of not only providing income, but also reducing soil erosion.



Ananas comosus (L.) Merr.
[Bromeliaceae]

Pineapples could form the basis of multi-strata fruit production and, at the same time, combat soil erosion in better-connected villages.

Poorly-connected or remote hill villages

A strategy for remote villages must take distance and location into account. Fruit is highly perishable and only limited quantities can be carried to market. Therefore, cash crops in these villages should include not just the traditional ginger and turmeric, but also the less demanding chilli and even hybrid maize. Hybrid maize has a yield that is more than 50% higher than that of conventional maize, but it is used mainly for processing into animal feed. Therefore, marketing channels would need to be established. Initially, the maize might have to be taken to the nearest market, for instance, to Chittagong. But growing volumes would eventually lead traders to production areas.

Farm forestry

Many farmers grow timber trees on the hill slopes, mainly teak and *gamari* (*Gmelina arborea*). Since timber trees take at least 12 to 15 years to mature, the cultivation of timber is undertaken only by those farmers who have a surplus and can afford to set aside land for many years. Often, farmers who engage in wet-rice cultivation in the valleys are those who undertake timber plantation.

Tropical hardwood timber, such as teak, is an obvious product in which the CHT has a comparative advantage over the plains. With growing incomes in South Asia, there is likely to be an increase in demand for timber. However, before farmers in the region can benefit from this growing demand, there are some issues that need to be tackled.

There is a tendency for farmers to plant only one tree species – that which they find most profitable. This might extend to one more species, such as *gamari*. Not much grows under these timber trees and there is a loss of biodiversity through monoculture. If whole villages and whole areas were covered by timber trees, this could become a serious problem.

Is it possible to combine farm forestry of timber trees with the preservation of biodiversity? Biodiversity is a public good whose benefits extend beyond the individual farmer to the area, the region, and even the country and the world. It would be unlikely that individual farmers could be persuaded to give up some income



Zingiber officinale Roscoe
[Zingiberaceae]

A crop that is relatively non-perishable, ginger is favoured for development in remote hill villages.

in favour of biodiversity, since they tend to plant whatever they perceive as advantageous and would not set aside their own land for biodiversity. Given these circumstances, an effective way of maintaining biodiversity would be to ensure that each village designates a portion of land as common property on which cultivation of any kind, or even farm forestry, is prohibited. This would deal with the problem of maintaining biodiversity while taking the onus away from individual farmers.

Another issue with regard to farm forestry is that of

restrictions on trading in timber. Unlike other agricultural commodities, the timber trade is highly controlled. The ostensible purpose is the prevention of timber theft from state forests, but what it does is reduce returns from farm forestry and thus restrict its growth. Growers of timber in the CHT have to sell their produce to local timber traders for about one-third of its wholesale price in Dhaka. The large difference is due to the payments that have to be made to officials all along the line. This clearly reduces the returns from farming timber. A reform of the so-called transit rules would reduce the amounts to be paid to various officials and increase the potential returns to farmers.

Agroforestry

Agroforestry is a combination of trees and cultivation. Not all types of cultivation can be carried out in this manner – or, at least, not without a substantial fall in productivity. However, there are some crops that can be cultivated in combination with trees, and turmeric and ginger are among them. Coffee can also be cultivated in the shade, although experiments by the World Agroforestry Centre have found that the yield of shade-grown coffee is about 30% less than that grown in full sunlight. Like some organic foods, shade-grown coffee commands premium prices, which could compensate for the lower yield. However, such premium coffee requires special marketing arrangements, and at present Bangladesh has no market, even for regular coffee beans. Therefore, in order to adopt coffee growing on a substantial scale, CHT farmers would have to establish links with roasters.

Raising livestock

The rearing of livestock has received repeated consideration as an important option for investment in the CHT. The local market, as well as that on the Bangladesh plains, is very large. Additionally, there is the prospect of exports to both India and Myanmar. As well as being a source of income, livestock can also function as a safety-reserve asset for farmers. Finally, it is possible to take livestock to the market even from remote areas.

Livestock farming in the CHT differs from that on the plains in terms of the number of species reared. On the plains, there are religious objections to pig farming, but this is a highly profitable pursuit in the CHT that boasts the highest growth rate of all livestock farming in the region. CHT pig farmers supply both the domestic and international markets. The CHT is also home to a type of bison, the mithun, which is still in the process of domestication. Earlier, mithun were reared by Mro farmers in forest enclosures, but other communities have now entered the field. However, large numbers of mithun died in 2011 of foot-and-mouth disease.

With the exception of chickens, other livestock, including cattle, pigs and goats, are all expensive and investing in them requires a large amount of capital. There is also an element of risk, as the capital is lost if animals die. Expanding the rearing of livestock in the CHT requires two kinds of change. The first is a change in the provision of services. There are virtually no veterinary services in the CHT, other than in district or *upazila* (subdistrict) headquarters, and high rates of animal mortality reduce potential income from investment in livestock. The fact that many small farmers still invest in livestock despite poor, or even non-existent, veterinary services demonstrates the importance they place in this activity. In order to increase livestock holdings, veterinary services need to be improved, so as to reduce animal mortality. This is a vital part of the agricultural development strategy for the CHT.

Second, returns from livestock can be increased by improving animal feed. Most animals in the CHT are grazed, usually watched over by children. Stall feeding would improve the medical condition of animals and reduce the incidence of parasites, both in animals and humans, and would have the added advantage of keeping children in school. However, the shift from grazing to stall feeding would be feasible only with assured higher returns, which are in turn dependent on improved veterinary services.

A move away from grazing to stall feeding would also require a collective decision made at village level and enforcement of the decision. The successful enforcement of collective decisions about stall feeding has been observed across the border, in the Indian states of Mizoram and Nagaland.

Aquaculture

The CHT has numerous small waterways, although most are seasonal. It should be possible to construct small dams in the valleys, to provide irrigation water. The resulting reservoirs could then be used for aquaculture, perhaps involving fast-growing species such as *pangus* (*Pangasianodon hypophthalmus*) or tilapia. The economy of such fish

farming is well established on the plains of Bangladesh. However, to promote it in the CHT would require backward-linked investments in rearing fry and fingerlings. Such investments could initially come from a private-public partnership.

In terms of its potential for developing aquaculture, the CHT has the advantage of the Kaptai reservoir, which has a maximum surface area of almost 70,000ha. Fisheries production from the reservoir has increased over time and was recently 8,000 tonnes per year, but its potential is more than double that. To raise this production capacity, floating aquaculture technologies may be used, such as cages and pens.

There is a risk that increasing aquaculture will compete with indigenous species for space and resources. In order to preserve biodiversity, development of aquaculture would need to be combined with the establishment of sanctuaries.

Shortening value chains and agro-processing

Commercial products from the CHT reach wholesale markets in Chittagong through a chain of intermediaries. Village-level traders buy from small producers; then there are traders at district headquarters and other towns who operate in aggregating markets, and major aggregators take over at the exits of the CHT, such as the city of Rangamati. The chain of agents ends with wholesalers in Chittagong, who often finance the smaller agents along the line. There is a fair amount of competition at each stage, except in remote, hard-to-reach locations, where competition is non-existent. As a result of the competition, financial returns are not excessively high at any stage.

One problem with such lengthy supply chains is that the longer the chain, the higher the spoilage of fresh produce, such as fruit and vegetables, resulting in reduced income for both farmers and traders. There are two ways in which the supply chain could be shortened. First, trucks could be engaged to deliver the produce directly to wholesale markets in Chittagong or Dhaka. However, reports suggest that indigenous entrepreneurs from the CHT have tried this before, and have failed, indicating that market operators have 'locked them out' on ethnic grounds.

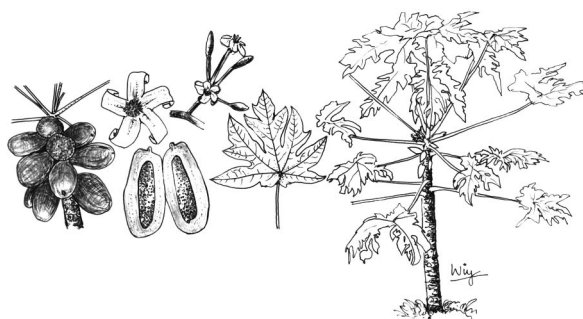
Another way is to sell directly to major buyers, such as food processors and retail chains. These buyers may be interested in shortening the marketing chain so as to improve quality. Along with improved quality and lower prices, this could still give farmers a better deal than selling in local markets.

Retail chains could also be approached to market organic produce. However, supplies of organic produce may not be readily available in the CHT, where the use of fertilizers to support yields is widespread, even in *jhum* fields. To be certified organic, the land used to produce crops must remain free of inorganic inputs, such as fertilizers and pesticides, including weedicides or herbicides, for at least three years.

Fresh produce from the CHT is almost entirely sold as unprocessed raw material. Processing takes place in major urban centres, such as Khagrachari, Rangamati, Banderban and Chittagong. The drying and powdering of ginger and turmeric can substantially increase incomes if carried out at household or community level,

through solar drying, for example. However, crushing and powdering facilities require electricity and need a larger scale of production to be profitable. These would need to be located in district or subdistrict towns. Independent marketing of such products would be difficult because of competition from established chains, so a more feasible approach would be to seek contractual arrangements with established agro-products processors and marketers.

An analysis is needed of the different activities that take place within the value chains that produce and market fruit and spices (such as ginger and turmeric) in the CHT. This would develop an understanding of where and how value is added at each stage of these production and marketing systems, as well as identifying leverage points at which profits can be maximized.



Carica papaya L. [Caricaceae]

Current rural development is expected to boost the annual papaya harvest in the CHT by 513 tons.

Peri-urban development

The three district towns of Rangamati, Bandarban and Khagrachari are important local markets for many agricultural commodities. Administrative and educational facilities are developing in these centres and tourism is growing in the hill districts, so the demand for agricultural commodities is certain to rise.

Taking advantage of the growth of these urban markets, a special peri-urban development project could be launched with a focus on developing vegetable and fish production for the towns. Milk processing facilities with chilling plants could also be set up to serve these growing centres.

Commercialization and caution

The agricultural development strategy proposed here relies largely on an increase in commercial production of agricultural products such as fruit, timber, and so on, which are best suited to the agro-ecological conditions of the CHT. However, wide price fluctuations are characteristic of marketed primary products and it is necessary to cover the risks inherent in ramping up commercial production. In the absence of a national system of social protection for farmers, ways of dealing with volatile price conditions must be developed by the farmers themselves. An important way to do this is to develop more than one commercial crop, so that falling prices for one crop can be made up by increasing prices for the other. For example, a combination of

different fruits, or growing coffee with pepper, could be developed in order to guard against big losses of income that could result from relying on just one commercial crop.

A gradual transformation from extensive to semi-intensive and intensive farming has been proposed for the CHT. Such intensifying systems could include more than one commercial crop.

Environmental issues

Deterioration of landscapes in the CHT can be measured in a basic manner by observing the severity of soil erosion. Given the region's hilly topography, some amount of soil erosion is inevitable, but the rate of erosion accelerates with human activity. The extent and rate of soil erosion depends on the area of land under cultivation, the farming systems involved, including forest management methods, and water management. The latter is related to cultivation systems, but goes beyond cultivation.

The absorption by plants of soil nutrients is usually taken into account as a factor of soil degradation. However, this is a measure of the efficiency of plants, since the higher the level of soil-nutrient absorption, the higher the resulting value of the plant product. This measure does not cover soil-nutrient replenishment, which has to be taken into account in any measure of environmental sustainability. The problem of soil degradation is not one of nutrient absorption, but likely depletion of soil nutrients through non-replenishment. Nutrient replenishment can take place in a number of ways: through fallowing, as in swidden cultivation, or through the application of inorganic and/or organic fertilizers.

Moreover, replenishment cannot be confined to the major nutrients, such as nitrogen and phosphorus. Other minerals must also be present in minute quantities. These trace minerals are often a key part of the nutrient complex of soils, and they are not mimicked by inorganic chemicals. Consequently, it is essential that sufficient organic manure be applied to fields. This can be mulch, ash or animal manure, and it must be applied along with inorganic fertilizers.

Watershed management

There are a number of reasons for the environmental degradation that has occurred in the CHT. These include improper road alignments and construction; the intensive harvesting of timber, including clear felling; very short *jhum* fallow periods (rotations have fallen from 15 or 20 years to as short as two or three years); and a combination of *jhum* and root-crop cultivation on steep slopes. In addition, there is leaching of vital soil nutrients such as nitrogen and potassium. Degradation can be seen in the loss of topsoil, formation of gullies and frequent landslides. The result is tumbling productivity and severe water shortages. Degradation of the hill slopes also leads to accelerated sedimentation of Kaptai lake.

Environmental degradation and falling productivity has led to more land being brought under cultivation, including highly unsuitable land on steep slopes. However, the land frontier cannot be extended endlessly. There is clearly a need to mitigate the impacts of environmental degradation in the CHT.

This can be accomplished through watershed management. A watershed is a hydrologic unit of a discrete drainage area; an area of land where all of the water that is under it or drains off of it goes to the same place. A micro-watershed is a smaller hydrologic unit, sometimes comprising one village and draining into a single valley. A micro-watershed is often the unit within which watershed conservation is planned and implemented.

Managing run-off, whether of soil or water, is not simply a matter of interventions by individuals on their own farms. It also involves actions, including land-use planning, on whole hillsides, i.e. in a micro-watershed. While farmers and households decide what they do on their own fields, these decisions can be influenced by projects and other forms of public action. There are also external issues that accompany different kinds of interventions at individual-farm level. The benefits of controlling an erosion gully might be quite limited, if a farmer's own land is not much affected. However, controlling gully-based erosion can provide benefits to the rest of the village by reducing soil erosion. In such situations, public funds should be provided to finance the work and farmers who lose some land should be compensated.

Increasing moisture retention and checking soil erosion

Planting hedgerows and constructing structures of stone or mud are both measures that seem to increase moisture retention and check soil erosion. Contour bunding with stones or mud or planting vegetative hedgerows can help to collect soil, rather than let it be washed away. Small ponds can be built at the top of hills to collect rainwater and release it over time. Small ponds excavated at the top of land plots have also been used to provide water when rainfall is delayed and to increase moisture content as the retained water percolates down the plot.

In South Asia, both government and non-governmental organizations have considerable experience of such watershed management measures. A combination of these measures has been shown to increase soil moisture content and reduce soil erosion over time. However, two important issues need to be dealt with. First, planning and implementing measures on a whole hillside or a micro-watershed scale requires collective action by households in at least one village. Second, it is important that incentives be provided to ensure that land owners undertake the necessary measures.

In order for collective action to be sustained, it must involve the participation of all or at least a large majority of members of a village community. In the CHT, Para Development Committees are appropriate organizations for collective action, but the mere existence of such a committee does not necessarily mean it is functioning well. It is particularly important to ensure that women have an adequate voice and role in a community committee's decision-making and functioning. In indigenous CHT

communities, women perform most of the labour in *jhum* fields, so they must be a part of decision-making and implementation of watershed management schemes. In essence, all stakeholders should take part in decision-making.

Incentives to carry out watershed management measures are required at two levels. The first is payment for days worked on the schemes. The other involves the use of part of a farmer's cultivable land for watershed management measures. Payment of wages for days worked on such projects could come from government employment schemes or from watershed management programmes, with equal wages for women and men. The second incentive is needed to convince farmers to set aside part of their cultivable land for a water management scheme, and this is a little more complicated. Vegetative hedgerows or stone structures take up cultivable land, and in an immediate sense, they reduce the area available for cropping. However, over time, they will increase productivity and this will compensate farmers for taking part of their cultivable land out of production. But to be induced to take the initial step, farmers might require immediate compensation.

Field experience has found that where hedgerows themselves produce outputs that are of value, farmers more readily accept their usefulness (Khan et al., 2002). For instance, where hedgerows are of pulses, such as *arhar* (pigeon pea), not only does the hedgerow itself provide a valuable crop, but the plants also fix nitrogen in the soil. In fruit plantations, it has been observed that farmers sometimes plant hedgerows of pineapples to derive similar dual benefits. Therefore, it is necessary to identify hedgerow plants that produce a valuable output while having a synergy with the existing cultivation system, to make them more acceptable to farmers.

These synergistic plants will need to be tried and tested in the conditions in which they will be planted and maintained as hedgerows. Such testing is usually carried out in field stations far from the area in which they are to be used. In order to convince farmers of the potential benefits of the systems being tested, it would be useful, even essential, that trials be conducted 'on farm', with farm owners covered against any risk to their incomes.

Setting aside critical natural capital

The CHT region is an important reserve of biodiversity in flora and fauna. The transformation of primary forest into secondary forest and then into scrub reduces biodiversity, as does the planting of monocultures of timber trees. Even the transformation of secondary forest into fruit-tree plantations, including multiple varieties of fruit, reduces biodiversity. *Jhum* cultivation, on the other hand, does not seem to reduce the existing biodiversity in secondary forests, although the types of plants may change. However, the overall per capita income provided by *jhumming* is low. How, then, can a higher per capita income be achieved hand-in-hand with improved biodiversity?

Overall, the outlined agricultural management strategy is one of moving from extensive to semi-intensive and intensive production. Such moves would provide a

higher income from a smaller area of land, and thus enable larger areas to be taken out of cultivation. This would increase the CHT's contribution to absorption of carbon dioxide and other greenhouse gases, which could also generate additional income for the communities concerned.

If all of the land in a village was privately occupied, there is a very high likelihood that it would all be cultivated, within the limits set by the availability of labour and capital. Further, if the kind of cultivation was a monoculture of, say, rubber, timber or fruit trees, there would be a loss of valuable biodiversity. This would place all of the land-uses in the theoretical village in dismissal of the knowledge that uncultivated areas, secondary forests and primary forests, in ascending order, are more biologically diverse. Taking land out of cultivation would, under these circumstances, become a priority. Additionally, if local environmental concerns extended to protecting local water sources, cultivation would need to be prohibited close to stream banks or water sources, which are a critical part of natural capital.

If land at the head of a stream or along its banks is already privately owned, what can be done to take it out of almost certain cultivation? This was the case in some villages in northeast India, and the problem was solved by the village buying the land back from the private owners.

Every village should have an area of critical natural capital that remains out of cultivation. This area may be used for some extraction of non-timber forest products, such as firewood. However, this extraction should be controlled through community formulated and implemented rules, in a managed common property system. State ownership of such land would not work, as has been observed in many countries where state-owned forests have become ungoverned open-access forests in a situation of local poverty. They are soon degraded and cease to provide the environmental services of natural capital. Consequently, it is necessary to maintain these areas as part of each village's common property. It would then be possible to take account of the use values provided by these forests, including, for instance, the protection of water sources, which may not have a monetary value, but are important to the village. Village-owned forests can also be important repositories of biodiversity, with *in situ* preservation of plant varieties that are not being cultivated. Over time, village-owned forest land could be connected through protected corridors to become reserves for larger mammals.



Artocarpus heterophyllus Lam. [Moraceae]

As well as providing fruit, Jackfruit trees could also provide environmental benefits in the CHT.

Village management of areas that are used for neither cultivation nor the extraction of various timber and non-timber materials could, as village common forests, become a source of income for villages through the Reducing Emissions from Deforestation and Forest Degradation (REDD) mechanism. This income could reinforce the asset value of forests.

Requirements of watershed management

Watershed management is a complex exercise, involving individuals, communities and villages. Different ethnic communities need to agree on actions to be taken through a participatory process. The boundaries of villages and of their village common forests need to be clear. Further, since some of the activities involve interventions on private land, households must have secure tenure over these lands.

A participatory process of watershed planning needs to be combined with technical knowledge. Local knowledge is an important part of overall technical knowledge, but on its own, it would not be sufficient. Outside agencies, whether line departments or non-governmental organizations, need to plan the interventions with local organizations, secure their acceptance by the communities involved and facilitate the process of implementation.

Combining watershed management with adaptation to climate change

Climate change is likely to affect the CHT through a combination of reduced and erratic rainfall. Many traditional crop varieties are well-suited to survive water stress. However, resistance to stress is often realized at the cost of a lower yield. Such stress-resistant varieties need to be preserved, even while attempts are being made to develop higher-yielding varieties from them. Substantial research is needed to identify and develop stress-resistant varieties of rice and other key crops. Farmers and women in particular have a big role to play in this effort.

Moving towards gender equality

Any type of inequality diminishes the poverty-reducing effect of a given rate of growth. Conversely, a reduction in the extent of inequality increases the poverty-reducing impact of any rate of growth. Gender inequality, in particular, stands out for its contribution to poverty because it is likely to involve more than inequality in consumption. It diminishes the voice of women in both household and community affairs, and that has an additional impact on the consumption and well-being of children, particularly girl children.

The shift from *jhumming* to cultivation of commercial crops has often been seen to coincide with deterioration in the position of women and an increase in gender inequality. Does this mean, therefore, that in order to support a reduction in gender inequality, we should call for a return to *jhumming*? No. Swidden cultivation has been shown to afford households a low per capita income, and this is what needs to

change. A number of projects among indigenous peoples in Asia have shown that certain measures can promote gender equality even while the transition to intensive or semi-intensive agriculture takes place (Nathan et al., 2012). These measures, at the household level, include providing ownership of land to women, giving them training in new technologies, providing them with access to credit and, most crucially, giving them a substantial role in the marketing of commercial produce.

Changes in gender roles are also needed at community level. In particular, women's participation in community-level management organisations is vital.

In the CHT, neither indigenous cultures nor the Bengali culture favour women's participation in community councils. However, cultures are not static; while women take part in Para Development Committees, they also have positions reserved for them on *Union Parishads*, the councils that constitute the smallest rural administrative and local government units in Bangladesh. What is usually needed, however, is to make women's participation in community councils more effective.

Women play a traditional role as the custodians of technology and even, in some senses, of biodiversity. They undertake the planting of multi-species, multi-level *jhum* crops, carefully matching different species with micro-environments. They also manage the home gardens on whose diversity agroforestry is modelled. It is often seen, though, that projects and extension agencies have a general male bias and ignore women as farmers, instead directing their training to men, even when they don't do much of the farming. This makes the extension work less effective, as it depends on men learning the lessons and then passing them on to their wives, when neither of these things may occur. Rather, women should be trained directly in new technologies. This would not only make them more effective managers of their household farms, but could also spur their creativity in using their new and traditional knowledge in innovative ways.

The above points on reducing gender inequality deal not with the 'what' but with the 'how' of an agricultural development strategy. As already mentioned, it is not correct to think that only *jhum* systems can offer a measure of equality for women and that commercial farming systems must necessarily entail masculine domination. The technology and farming systems required for this change (the 'what' of agricultural development) need no redesign, but the methods of their implementation (the 'how' of agricultural development) should be designed to be gender-sensitive and reduce gender inequality.

The institutional changes required

Changes in methods of production, adoption of new crops and so on will require a variety of institutional changes. These have been discussed at various points in this chapter, but are brought together here. The word 'institutions' should be understood to mean the rules of access to resources. The institutional changes required include:

- Measures to improve security of tenure over farm land;
- Review and amendment of timber transit rules;

- Measures to increase women's roles in planning and decision-making at both household and community levels;
- Establishment of common-property management systems in village common forests; and
- Combination of private management of extractive plots (e.g. for NTFPs) with community management of village common forests.

Additionally, in order to invest in improved farming systems, households in the CHT will need some level of capital or savings. Most do not have this, so they will need access to credit to make these investments.

Transformation of extensive farming into semi-intensive and intensive farming

A change in cropping patterns away from annual field crops to perennial trees is a decision that rests with individual households. For these to be socially desirable decisions, two factors are essential: one, that the income from perennials promises to be higher than that from annual crops; and two, that households are economically able to make such a change. Even if perennials are understood to provide a higher income than annual crops, poor households often do not have the initial capital to make such a change. They may also be unable to wait for the few years it takes for perennials to mature and provide an income. Therefore, public support is required for poor households to make the change from field to tree crops. They need capital support for the initial investment and income support while they wait for the investment to mature.

As well as such support, it would be useful to manage a gradual transformation, rather than attempt a quick, once-and-for-all transition. One-fifth, for instance, of a farmer's land could be planted with trees while the remaining four-fifths continues to be planted with the usual crops. Even on this one-fifth plot, field crops could continue to grow until the maturing trees shaded them out. The tree plantation could then be extended when the first plot started to bear fruit.

This gradual transition mimics the *taungya* method, which originated in Burma. Growing trees were combined with field crops for a few seasons, until the trees formed a shading canopy. This is also the way in which *jhum* farmers in northeast India brought about a gradual transformation of their production system from field to tree crops (Leduc and Choudhury, 2012). The difference between this and the *taungya* system is that in this case the farmer owns both the trees and the field crops, while in *taungya* the state owned the trees and the farmer the field crops. This led to a conflict of interest, with farmers preventing the trees from maturing so they could extend the period of field cropping. Such a conflict would not arise when the farmer owned both the crops and trees, and there would be no threat to the maturing trees.

A gradual transformation of farming plots, rather than a quick, once-and-for-all transition, has been observed in a number of places in the CHT (see Khan et al., 2002) and in northeast India (Leduc and Choudhury, 2012). If the necessary technical and

financial support is provided and a participatory approach is adopted that involves all stakeholders, farmers are likely to undertake the same gradual paths of transformation from extensive to semi-intensive and intensive farming.

Management of non-timber forest products

There is not much extraction of NTFPs in the CHT other than firewood and bamboo, including bamboo shoots. Much of the recent increase in the extraction of firewood is for curing tobacco. Along with extraction of firewood for domestic cooking, tobacco curing is held responsible for a lot of deforestation. This need not be so, if certain institutional reforms are undertaken.

When forest products are extracted from, say, state forests, there tends to be over-extraction because these are in effect 'open access' resources. There is competitive over-harvesting resulting from a 'first come, first extract' system – what one person does not harvest will not be preserved; it will simply be taken by someone else. In managed common forests, where rules have been agreed upon collectively and are enforced, over-extraction can be controlled. But an additional element is required for the sustainable harvesting of a forest product.

Almost any system of resource extraction '...produces an impact on the structure and functions of tropical plant populations. If nothing is done to mitigate these impacts, continued harvesting will deplete the resource' (Peters, 1994, p40). Mitigating these impacts requires investment of labour and other resources, and such investment may not be forthcoming from individuals who do not also benefit from it. Therefore, in the interests of sustainable management, it would be beneficial to allow forest patches to be allotted to individual households, to manage and harvest. As has been done in some Amazon forests, or in Nepal, such individual patches could coexist with community forest areas. Community-adopted rules against cultivation of annual crops in these individually-managed patches would need to be enforced. However, where investment is needed, it would be useful to combine individual with community management. In this manner, there could be sustainable extraction of NTFPs.

Conclusions

In this chapter, we have argued that agriculture in the CHT needs to be placed within the context of the national and regional economies of which it is a part. The specific advantages of hill cultivation in producing fruit and spices need to be taken into account when formulating an agricultural development strategy. Overall there should be a transformation from extensive to semi-intensive and intensive agriculture. This, however, will require tenurial security for indigenous communities and improved communication networks, i.e. roads. Internally, movements towards gender equality at both household and community levels may not only promote agricultural transformations, but also intensify their impact in reducing poverty.

As a rule, intensive agriculture is carried out in individualized plots, where there is an unshakeable connection between investment of capital and effort and securing

the gains from such investment. It should be noted, though, that there are successful examples of collectively-owned villages, even within a market system (see Nathan and Kelkar, 1997). In any case, the sustainable use of lands and forests requires the enforcement of community-formulated rules concerning the extraction of resources. Any move towards agricultural intensification will both make possible and require the setting aside of critical natural capital within landscapes, such as biodiversity reserves and protected lands alongside streams.

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Notes

1. The term *jhum* is widely used in the eastern Himalayas. In the Chittagong Hill Tracts of Bangladesh the practice of shifting cultivation is called *jhuming* or *jhumming*, the farmer who practises shifting cultivation is called a *jhumia* and the plot of land where crops are grown is called a *jhum* (Rasul, 2005).
2. Rice is not the only crop grown in *jhums*, so the rice yield should not be taken as an indicator of overall income from *jhumming*. But when it comes to market for sale, then the yield of *jhum* rice becomes a factor in determining its profitability.
3. *Karbaris* are heads of indigenous villages or neighbourhoods, appointed by the chief or king of that community, for resolution of local disputes. Traditionally, a *karbari* is appointed for a single village or neighbourhood and a headman for several villages, for better governance of the area.