CHARM

CHARM Project Report 8

ASIA PRO ECO

EUROPEAID CO-OPERATION OFFICE

CHITTAGONG HILL TRACTS IMPROVED NATURAL RESOURCES MANAGEMENT

Bangladesh

PLANNING FOR IMPROVED NATURAL RESOURCES MANAGEMENT : PILOT STUDY IN BANDARBAN SADAR UPAZILA

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PLANNING FOR IMPROVED NATURAL RESOURCES MANAGEMENT: PILOT STUDY IN BANDARBAN SADAR UPAZILA

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List of Acronyms

AMSL	Above mean sea level
BCAS	Bangladesh Centre for Advanced Studies
BWDB	Bangladesh Water Development Board
CBO	Community Based Organization
CEGIS	Center for Environmental & Geographic Information Services
CHARM	Chittagong Hill Tracts Improved Natural Resources Management
CHT	Chittagong Hill Tracts
CHTDF	Chittagong Hill Tracts Development Facility
CHTDB	Chittagong Hill Tracts Development Board, Bangladesh
DAE	Department of Agricultural Extension
DEM	Digital Elevation Model
DoF	Department of Fisheries
EU	European Union
FAO	United Nations Food and Agriculture Organization
GIS	Geographic Information System
GoB	Government of Bangladesh
GRAUS	Gram Unnayan Sanghaton- NGO based in the Chittagong Hill Tracts
ISRIC	International Soil Reference and Information Centre, Wageningen, The Netherlands
MoL	Ministry of Land
NRM	Natural Resources Management
RS	Remote Sensing
SRTM	Shuttle Radar Topography Mission (NASA Satellite)
UNDP	United Nations Development Programme, Dhaka
SRDI	Soil Resources Development Institute
UNO	Upazila Nirbahi Officer (Administrative head of the Upazila)

Executive summary

An area of 9295 km-2 (78% of the total area) of the CHT is either degraded or sensitive to degradation upon disturbance and so requires some form of conservation, land rehabilitation or protection. For sustainable use, CHT lands require adaptive management with conservation strategies to ensure both productive and sustainable land management. The most vulnerable areas are best protected through nature conservation or rehabilitation.

In the framework of the Chittagong Hill Tracts Improved Natural Resources Management (CHARM) project a pilot study was done to test methodologies for improving natural resources management. The applied methodology for participatory natural resources management (NRM) planning involved various stakeholders, including government agencies and local people at the upazila, union, and grass-root levels. The process started at the grass-root level, and the results were taken up to the next levels (union and upazila level) through workshops.

Bandarban Sadar was selected as the study area. The customized NRM planning involved the following four stages: 1) situation analysis, 2) stakeholder consultations, 3) problem census and clustering, 4) participatory formulation of management options.

Policy formulation in natural resources management needs to be based on right information and judgment. The development of the CHT region requires a broader and regional perspective in weighing options and priorities in cross-sectoral planning. A methodology was applied that provides a basis for planning sustainable management strategies with regional and spatial stratification for ecosystem stability and land conditions. The derived map provides a tool to identify: 1) where soil and water conservation strategies are needed, and 2) which particular technology may be advised and be expected to succeed based on the prevailing conditions, such as present land cover, slope, soil properties, and administrative land class. The study showed that the dominant area in the CHT comprises lands vulnerable to degradation.

Cross-sectoral planning will be the responsibility of line agencies in the region. The critical assumption is that government funds, channeled through line agencies, are available in a timely fashion with overall coordination of MoCHTA, the Regional Council and HDC. In addition to government agencies and departments, non-government organizations can play a vital role in implementing NRM planning. The responsibilities of the relevant agencies for implementing and monitoring the plan as well as the implementation mechanisms are discussed in this report.

1.1 Background

The development of the Chittagong Hill Tracts (CHT) has lagged behind because of sustained conflict in the region. Institutions that support sustainable development are rudimentary. Proper planning and land management support are vital to the post-conflict sustainable development of the region. Soil erosion and forest degradation, resulting in declining crop production and loss of biodiversity, are common in the CHT with off-site effects on downstream and urban areas, such as flash floods, landslides, dam-siltation, and declining water quality.

A pilot for planning Natural Resources Management was prepared as part of the Chittagong Hill Tracts Improved Natural Resources Management (CHARM) project. CHARM is a collaborative project being implemented jointly by ISRIC World Soil Information of The Netherlands, Lleida University of Spain, and from Bangladesh, the Center for Environmental & Geographic Information Services (CEGIS) and the Bangladesh Centre for Advanced Studies (BCAS), with support from EU-Asia Pro Eco, Component A, Diagnostic Activities (DIA). CHARM aims at capacity building of national and local level institutes and improving the information basis for decision making. This pilot study tested a methodology for planning sustainable land management alternatives for improving environmental conditions and decreasing environmental hazards, thereby improving and securing livelihoods of people in the CHT.

The CHT is a resource rich zone with abundantly beautiful landscapes and hill forests along with a cultural diversity of 12 ethnic groups. In this hilly region, cultivable land is an important but scarce resource, inhibiting development. Natural Resource Management Planning is concerned with the planning and management of natural resources for the proper utilization of existing resources for present and future needs. A Natural Resource Management Plan includes resource maps, supporting and relevant documents and reports, and resource management options and strategies.

1.2 Objectives

The overall aim of the CHARM project is to establish sustainable natural resources management in the CHT. Improved resources management will halt or even reverse forest and soil degradation, enhance water quality, improve agricultural production, and protect biodiversity. This will provide a healthier living environment for the people of the CHT and provide opportunities for more economic returns on farming and forestry. Sustainable land use will decrease the risk of environmental hazards like flash-floods, landslides and dam-siltation and thus improve the water quality and quantity in the downstream as well as urban areas.

The specific objectives for preparation of a Natural Resource Management Plan are:

- Development and testing of a participatory methodology for improved natural resources management planning;
- Identification of sustainable management practices that maintain or enhance resource quality, maintain productive capacity and prevent degradation;
- Testing and applying the developed methodology in a selected pilot area;
- Developing capacity through providing access to information; and
- Assist in the development of integrated regional and local level planning.

1.3 Rationale of the selection of the pilot area

A multi criteria analysis including both quantitative and qualitative analysis was performed to select the pilot area. Various quantitative indicators, including socio-economic and environmental indicators were taken into consideration such as population density, rate of economic activities, accessibility, land fertility, and crop suitability as well as qualitative indicators such as accessibility, institutional setting.

1.3.1 Quantitative Analysis for Prioritizing Areas

All upazilas were ranked on the basis of a quantitative analysis of socio-economic and environmental indicators (see table 1.1). Each indicator was given a weightage value for importance in conducting the pilot study.

a. Socio - Economic Indicator (SI)

Per Capita Income (Tk): means the ratio of the total income and the total population. The upazila with low per capita income was given higher priority.

Literacy Rate: means the percentage of literate people within the population. Literacy rate indicates education level. High literacy rate was given high priority.

Population Density/Square km: Is the ratio of the total population and total area. The area having high population density or population pressure will likely have more diverse land use and cross-cutting issues in natural resources management and be more focused. Therefore it received a higher weightage.

Number of Ethnic Groups: indicates the ethnic diversity within the upazilas. The upazila with a low number of ethnic groups was given a low priority.

Economic Activity rate: is the ratio of the economically active population (excluding household activities) to the total population. Economically active populations comprise people (10 years and older) who are engaged or would be engaged in the production of economic goods and services.

Pahari population (%): is the ratio of the Pahari (tribal) population to the total population. Areas having more Pahari population was given more priority and therefore the upazila with more Pahari population was given a higher weightage.

b. Environmental Indicator (EI)

Non Agricultural Land (%):includes classes such as settlements and water bodies. The focus was on those areas, which had a low coverage of non-agricultural land.

Agricultural land (%): represents the amount of agricultural land within an upazila. Higher priority was given to the area with more agricultural land.

Fallow Land (%):areas that are presently fallow, excluding uncultivable land. Areas with more fallow land received more priority.

Land Degradation (%): the calculation is based on the area of land that is vulnerable to high to excessive degradation and landslide risk. Land with higher degradation rate was given higher weight.

Perennial Crop (%): the ratio of land with perennial crop production relative to the total agricultural land area (with land uses such as timber trees, bamboo, jackfruit, and mango). The area with less coverage of perennial crops was given priority.

Jhum and Annual Crops (%): areas where *jhum* and annual crops are harvested each year such as rice, spices, and bananas. Areas with more *jhum* and annual crop production received priority.

Forest area (%): areas covered by the boundary of forests within the upazila. Upazilas having less forest area received higher weight.

In appendix A an overview is given of the indicator cluster rating for the socio-economic and environmental indicators. All upazilas with a cumulative weight of higher then 90 was considered potentially suitable as pilot area. The upazilas with a priority ranking of 1 to 7 (1 = high, 7 = low) based on the quantitative analysis of the socio-economic and environmental indicators are listed in Table 1.1.

Table 1.1: Ranking of Upazilas of the Chittagong Hill Tracts Region

District	Upazilla	Ranking based on SI & EI
Khagrachhari	Panchhari	1
	Khagrachhari Sadar	2
Bandarban	Bandarban Sadar	3
Rangamati	Kaptai	4
Khagrachhari	Dighinala	5
Rangamati	Rajasthali	5
	Rangamati Sadar	6
Bandarban	Rowangchhari	6
Khagrachhari	Manikchhari	7

1.3.2 Qualitative Analysis for Prioritizing Areas

Qualitative indicators such as 'accessibility' and 'institutional setting' were used for the selection of pilot area. These indicators were given a weight for prioritization. Accessibility factors such as communication facilities, access to unions, and travel time and 'institutional setting' were assessed through factors such as communication, level of cooperation between different government institutions, and presence of NGOs, and development organizations. A weightage value of 1 to 3 was given implying 1= Good, 2= Moderate, 3= Poor (Table 1.2).

Table 1.2: Qualitative indicator ranking of Upazilas of the Chittagong Hill Tracts Region

District	Upazilla	Accessibility (weight)	Institutional setting (weight)	Total (weight)	Priority Ranking
Khagrachhari	Panchhari				
	Khagrachhari	3	3	6	5
	Sada	1	2	3	2
Bandarban	Bandarban Sadar	1	1	2	1
Rangamati	Kaptai	2	3	5	4
Khagrachhari	Dighinala	2	2	4	3
Rangamati	Rajasthali	3	3	6	5
	Rangamati				
	Sadar	2	1	3	2
Bandarban	Rowangchhari	3	2	5	4
Khagrachhari	Manikchhari	3	3	6	5

Other issues such as the political condition was taken into account during the selection of the suitable pilot area. The area was selected on the basis of whether it had natural resources management projects that provided a research infrastructure and whether the area was mutually acceptable to all i.e., the local communities, institutions, development organizations, Hill District Councils, and Regional Council.

1.3.3 Findings

The combined priority ranking from the qualitative and quantitative analysis were used to select a suitable area for the pilot study. The three most suitable upazilas selected were:

- Bandarban Sadar
- Khagrachhari Sadar
- Rangamati Sadar

One upazila was selected for the pilot study out of these three. Bandarban Sadar was selected for the pilot study amongst others because of its high ethnic diversity, high economic acitivity rate, high percentage of agricultural land, and high proportion of jhum cultivation.

1.4 Assumptions and risks

Assumptions :

- The activities would be implemented within the shortest possible time.
- Major natural resources management issues discussed in the planning workshops would be representative of the study area.
- Major land use types would be broadly identified.

Risks and limitations :

- A detailed land use survey was not conducted due to time constraints.
- Difficulties were faced in accessing all the hamlets.

2.1 Basis of the plan

Participatory resource mapping was done as a first step in Natural Resource Management (NRM) planning was as a way to involve stakeholders from all levels in identification of the major issues for management of natural resources in the CHT area. The participatory planning approach was followed to develop a plan with active involvement of community level stakeholders including concerned male-female of different occupation and social hierarchy. In this process participants identified the problems and issues and causes, and possible solutions for improvement of natural resources management. The planning process was carried out at the following three levels:

1. Grass root
2. Union
3. Upazila

The development of a resource management plan was done bottom-up, taking the results from one level into discussion to a level of higher aggregation; the results from the grass root level workshops were compiled and presented at the union level workshop. Consequently the results of the union level workshops was summarized and presented in the Upazila level workshop.

2.2 Form and content

2.2.1 Form

The NRM plan contains a set of activities, proposed for specific area and issues. Action may involve new management options, improvement of existing options or a combination of these activities. Defined priority actions may be undertaken by both public and private agencies. Plans will secure coordination between the activities of the local authority, other public agencies, and NGO's. The form adopted for this plan will vary according to its purpose.

2.2.2 Content

A natural resources management plan contains

- Resource information/maps and other diagrams
- Methodology documentation and justification
- Proposed management options
- The methodology documentation and justification includes A customized methodology description with recommendation for improved natural resources management
- The present conditions, problems and prospects of the area
- Summary findings from grass root, union and upazila level workshops
- The strategic basis of the prioritization of problems and issues
- Implementation mechanism
- Coordination and monitoring mechanisms

2.3 Approach to preparation of the NRMP

2.3.1 Preparation of NRMP

The participatory Natural Resources Management Planning required involvement of a range of stakeholders in the process, including representatives of government agencies at upazila level and local peoples, representatives of non-government development agencies at union level and also grassroots level participants.

The customized NRM plan developed, involved the following seven stages:

- Situation analysis
- Formation of Stakeholder forum
- Problem census
- Cluster problems
- Planning Workshop
- Formulation of management option
- Implementation of management plan

The last activity is a part of the implementation phase of the plan. Relevant institutions for the implementation of the NRM plan are discussed in Chapter 3. The responsibilities of the relevant agencies for implementation and monitoring of the plan, and the implementation mechanisms are discussed in Chapter 5.

2.3.2 Situation analysis

A situation analysis has been carried out to gather an idea on the current situation of the pilot area. It involved collection of local knowledge on organizations and institutions and compilation of primary and secondary information on union and upazila. In addition a reconnaissance survey assisted in analyzing the base line situation of the upazilas of the respective union.

2.3.3 Formation of Stakeholder Forum

Grass root level

The main stakeholders are defined as primary users of natural resources at the family unit level. Primary stakeholder groups in the study area were selected to participate in the study during the reconnaissance visits, the familiarization processes & situation analysis stage. The primary stakeholders' groups were identified as the representatives of the occupational groups i.e. farmers, forest products (mainly fuel wood) & other vegetation collectors, day laborers, women and natural resource related traders.

Union level :

At the union level, stakeholders included the Chairman, Headman, Karbari, Union Parishad Member, School Teachers, NGOs, and other groups and individuals.

Upazilla level:

The secondary stakeholders at upazilla level were defined as the individual, groups or institutions who though not the direct resource users but play an active role in the management and control of resources viz. who area placed at the upper hierarchies (management and control level). Potential secondary stakeholders included, UNO, all other upazila level government officials, UP Chairmen, NGO representatives, Journalists (upazila level), local professionals, and other concerned bodies and individuals.

2.3.4 Problem census

Stakeholder consultations were held in each union as part of NRM planning process. Each of the unions were divided into clusters based on discussions with local people, different government departments, UP chairmen, Karbari, Headman, NGOs considering the geophysical setting, resources, land use patterns, and dependency and main occupation of the people. One workshop was organized in each union where people are more dependent on natural resources. Problem census was carried out at the grass root level for preparation of the plan..

2.3.5 Cluster problems and activities

Results of the grass roots level workshops and from discussions with Karbari and headman were clustered.

2.3.6 Planning Workshop

Selection of participations

Union level workshop: A half day workshop was organized in each Union and a total of 5 workshops were organized in the pilot area. In this workshop, secondary stakeholders along with the representatives of primary stakeholders attended and took active part in the workshop process. Participants in each union level workshop were the UP Chair, Karbari, Headman, NGO representative, representative of civil society, representatives from grassroots' level and school teachers. The persons were identified in discussion with the UNO, and other key persons.

Upazila level workshop: Upazila level participants was selected in discussion with the administrative head of the Upazila (UNO), other government agencies and upazila level stakeholders. In addition grass root level Upazilla level representatives, and representatives of civil society were invited and participated in the workshop.

Union level: Participants at the union level prepared a preliminary plan based on the clusters and findings of problems and issues, prioritization, and solutions.

Upazila level: At the upazila level, the accumulated union level findings were presented. The workshop participants proposed management options both the local and national priorities according to the different clusters..

Review of group findings

Each group in the workshop presented their cluster-wise plans. The participants rigorously examined each activity and provided valuable comments and suggestions. After a thorough review and incorporation of suggestions and comments from the participants the activities were finalized in the plenary session.

Prioritization of clusters

The participants were invited to vote for prioritization of the clusters considering the local situation and importance of activities. The priorities were fixed on the basis of the voting results and then presented to all participants. The priority list of problem clusters obtained from the grass root, union and upazila level workshops is given in Annex B.

2.3.7 Formulation of management plan

All the union and upazila level data and information were analyzed following the workshops. The planners evaluated the options for development with consideration of the input from local stakeholders.

The pilot study team first identified general categories of improvements (strategies) and then identified individual options within those categories. The categories reflect different interventions for improvement.

2.4 Methodology/Approach

After comprehensive discussions with the main agencies and relevant project partners Bandarban Sadar was selected as the pilot area. The details on the activities conducted under the pilot study are given below:

a. Data collection and survey

b. Union level workshops

c. Upazila level workshops

d. Preparation of draft land use plan of the pilot study area

Data collection and survey

Data collection and survey work was carried out simultaneously with union level workshops in September 2006. This activity included the collection of data from primary and secondary sources:

1. Preparation of base maps using data from secondary sources (Mouza database, IRS image, LandSat image, SOB Topo map 1:50,000, LGED base map). The base map includes the following data and information:

- Administrative boundary
- Settlement
- River
- Water bodies
- Roads
- Growth centres (collected from LGED)

[See Map -01: Annex C]

2. Clustering of upazilas into several units was done considering the present use of natural resources and union (lowest administrative unit) boundaries using secondary information and including remote sensing, and GIS analysis. Each unit will be termed as cluster. A total of 5-6 hamlets from each mouza were selected out of 10-12 hamlets for conducting the reconnaissance survey and social survey in all the unions on the basis of the following factors:

- Accessibility
- Availability of educational institutes
- Experienced and knowledgeable Karbari

[See Picture -01: Annex C]

3. Identification of sample sites within each cluster with proper representation of all types of natural resources in the area.

4. Conduct reconnaissance survey (using GPS) and social survey in all the unions for identification of the extent of the following class

i. Agricultural land: The agricultural area involves the following categories
   - Plough land: Lands used for intensive irrigation-oriented agriculture are generally known as "plough lands".
   - Jhum land: The lands where "Jhum"-Shifting cultivation or slash-and-burn method of farming in hilly regions is carried out.

[See Picture -02: Annex C]

ii. Plantations: plantation areas such as rubber plantations

iii. Settlement

iv. Infrastructure: Growth centres (hat/bazaar), schools, religious centers, health centres/clinics etc.

v. Water bodies

vi. Others: Para centres

5. Prepare the updated major natural resources information and maps: The natural resources information for each union will be prepared taking into consideration all the data collected from survey.

Conduct union level workshops

A total of 5 workshops were held in all unions of Bandarban Sadar within 14th September of 2006. After data collection and inventory, workshops were held at the union level. The workshops included the following activities:

1. Presentation of the union level information and maps;
2. Analysis of the present land use patterns and forecast of the land use changes based on population growth, characteristics of change of land use pattern;
3. Identification of potential and alternative land use classes, and;
4. Preparation of the updated natural resources maps and information of the union.

[See Picture -03 & 04: Annex C]

Conduct upazila level workshop

The upazila level workshop was held with participation of the relevant stakeholders. The activities during the workshop are as follows:

1. Presentation of the upazila land use map;
2. Analysis of the present land use practices and forecast the future land use patterns based on growth characteristics of population and physical conditions;
3. Identification of potential and alternative land use classes, and;
4. Preparation of the final natural resources maps and information of the upazila level, compiling all the union level data and maps.

[See Picture -05: Annex C]

Preparation of draft plan

The draft natural resources management plan was prepared following the upazila level workshop. The draft plan included all the union and upazila level data, information, maps and reports. It contained a synthesis of all information including future projections about possible land use changes, agricultural practices, identified opportunities, and constraints.

[See Map -02: Annex C]

3.1 Demographic and socio-economic condition

3.1.1 Demography

The population of the country is evenly distributed throughout the 64 districts except for the three Hill Tracts districts. The CHT is sparsely populated in contrast to the rest of the country due to the heterogeneous topographic characteristics and differences in history, economic background, social organization, religious customs, birth and death rates, cultivation, food habits, and other social customs. The population growth rate of the CHT is 3.23, which is much higher than the country's rate of 1.54. In-migration from the plains is the main source of the high population growth. The proportional distributions of populations by district are: Bandarban 22.40%, Khagrachhari 38.50% and Rangamati 39.11% (Source: LGED 2001).

The population density of Bandarban district is 83 per square kilometer whereas 152 per square kilometer in Bandarban sadar; which is almost double.

3.1.2 Density

The population density per square kilometre in the Hill Tracts region is very low compared to the rest of the country. Out of the 64 districts in Bangladesh, Bandarban ranks 60th in terms of highest population density (Population Census, 2001, BBS). Following table shows the historical, present and projected population density in the region. The population density of Bandarban Sadar is 152 in 2006, will be 166 and 185 in 2010 and 2015 respectively according to the data from Population Census, 2001, BBS.

Table 3.1: Population distribution in Bandarban Sadar

Year	Population					
	Male	Female	Urban	Rural	Total	GR
1981	15852	12968	10092	18728	28820	1.78
1991	27873	21838	26121	23590	49711	5.60
2001	37200	28820	39230	26790	66020	2.87
2006	42986	33056	46977	29083	76060	2.87
2007	44053	33848	48434	29486	77920	2.45
2008	45121	34641	49891	29889	79780	2.39
2009	46188	35433	51348	30292	81640	2.33
2010	47256	36226	52805	30695	83500	2.28
2011	48323	37019	54262	31098	85360	2.23
2012	49390	37811	55719	31501	87220	2.18
2013	50458	38604	57176	31904	89080	2.13
2014	51525	39396	58633	32307	90940	2.09
2015	52593	40189	60090	32710	92800	2.05

Source: Charm Project, 2006

3.1.3 Sex ratio

The distribution of sexes over a population group is the resultant of culture, fertility, mortality and migration of people to an area. The sex ratio (i.e., number of males per 100 females) of the CHT is 118 (2001) and 130 in Bandarban Sadar, which are much higher than that of the country as a whole (106) in the same year.This high ratio for the region may be attributed by the high sex ratio (135) of Bangalis who are living there, meaning that in particular, Bangali men have migrated to the area. (BRAC). In the CHT the sex ratio, in the 1991 census, was 119 where the whole country's was 106. While the sex ratio increased from 1991 to 2001, it is currently decreasing.

The sex ratio in the CHT indicates that there were more males compared to females for all the ethnic groups. Marmas had the highest sex ratio (109.4), while Mro had the lowest (101.4). The sex ratio for working age groups, i.e., 15-64, was 120.9 for Bangalis, 113.8 for Chakmas, 111.2 for Marmas, 108.4 for Mros, and 112.2 for Tripuras.

3.1.4 Household

Households are divided into three categories namely, dwelling, institutional and others. The total number of households in Bandarban is about 0.06 million. On average, Bangalis had 5.3, Chakmas had 5.5, Marmas had 5.1, Mros had 5.8 and Tripuras had 5.2 members per household. Although the size of the households in most cases included 4-6 members for all ethnic groups, larger families were not uncommon among Chakmas, and were particularly evident among Mros. In the case of Chakmas, 31% of the households had 6-7 members and 21.8% of Mro households had eight or more members in their families (BBS 2003). Under the CHARM project, BCAS has done a household survey which also corroborates the above data.

3.2 Socio-Economic Activity

Health

General malnutrition and poor sanitation are identified as the main problems in the health sector. Access to safe drinking water is a key problem for communities in the CHT and is a serious problem in Bandarban, where only 15% of the households have access to tube-well water. The steep topography and the hard bedrock underlying much of the region make the installation of tube-wells difficult. As a result, wells are not drilled deep enough and dry up quickly. Very few tube-wells are therefore seen in Bandarban Sadar. People mostly drink *jhiri* [rivulets from the hills] water. Compulsory use of mosquito nets and introduction of health education have been suggested for the local people. A Malaria Research Centre at Bandarban has been long overdue. Furthermore, access to basic health care for the population is a pressing issue, especially in the remote areas. It was found that diarrhoea was more prevalent among Bengalis compared to other ethnic groups, and it was the lowest among Mros and Tripuras. Malaria and Vitamin A deficiency cause acute health problems in Bandarban Sadar and people suffer from different types of life threatening malarial and blindness diseases.

Education

The major obstacles for development in the CHT and for sustainable development in general, are the interrelated issues of poverty and low rates of education. In Bangladesh, individuals seven years and older who can read and write and perform simple mathematical calculations independently are considered to be literate. In 2001, the literacy rate in Bandarban was 42.17% whereas the national literacy rate was 45.3%. The average teacher to school ratio in Bandarban is 3.05 whereas for the country it is 3.61 at the primary level. On the other hand, the same ratio at secondary level is 12.47 in Bandarban and 11.65 for the country as a whole (BBS, 2003, National Population Census 2001, Bangladesh Department of Primary Education, BANBEIS).

Economic activity

People who are engaged or desire to be engaged in the production of economic goods and services are considered economically active people. The economic activities of the CHT people differ greatly from those of the rest of Bangladesh, often involving dangerous work in the natural environment (hunting, honey collection, slash and burn cultivation). While there is some variety in the economic activities of both the Parhari and Bangali people, the economy of the CHT in the rural sector is predominantly agriculture-based, with some commercial enterprises based on agricultural activities. Parahari agriculture is characterized by the traditional shifting or swidden cultivation (*jhum*). Common *jhum* crops grown on the same plot include paddy, cotton, watermelon, lady's finger, bottle gourd, sesame, and a variety of indigenous seeds.

Both the Pahari and the Bengali practice plain land agriculture in the first phase of economic activities, involving land cultivation and fishing from rivers, lakes, small streams (khals) and other water bodies. In this phase, people also depend on honey collection and hunting for

income and food. Agricultural cultivation and dependence on natural resources continue when people turn to the second phase of economic activities. Many people supplement farm income with the production of handicrafts in small cottage industries, making furniture, baskets, and metalwork. Some of these goods, especially furniture, are exported outside the CHT. The tourist demand for handicrafts has created incentives for people to become involved in production. NGOs are promoting these cottage industries as successful business models.

The CHT is in transition between the second and third phases, and employment is increasing in (eco)-tourism. Dominated by Bengalis, tourism has potential for growth through proper promotion and assuming that political stability continues.

Table 3.2: Percentage Distribution of Household Members by Age and Gender for Bandarban district

Age group (Year)	Male	Female	Both
0-4	10.4	9.8	10.1
5-9	10.8	14.2	12.5
10-14	13.0	12.9	13.0
15-25	24.1	24.0	24.0
26-49	27.5	28.0	27.8
50-59	7.6	6.6	7.1
60-69	4.2	3.2	3.7
70+	2.4	1.3	1.8
Total	100.0	100.0	100.0

Source: (Alam et al. 2007)

Under the CHARM project, the Bangladesh Center for Advanced Studies has conducted a survey of 463 households in the three districts of the CHT. The employment distribution of the members of these households is revealed from this survey. This survey also showed that a significant portion of the population is dependent on one or another form of agriculture; the survey also indicates just how varied the income-generating activities of the people are.

3.3 Physical Setting

Landforms and geology

The hilly landscape of the CHT is the result of geological uplifting, faulting, tilting, folding and dissection of sedimentary rocks dating from the Tertiary Period (about 65 thousand to 2 million years ago) associated with the uplift of the Himalaya mountains and subsequently the formation of Assam and Burma Hills including those in the eastern part of Bangladesh. The geological formations comprise folded and compressed consolidated sedimentary rocks in various degrees of consolidation, i.e. fine-grained shales, siltstone and sandstone of Pliocene and Miocene age (van Engelen et al. 2007). Dissected plains over sandstone are the dominant landform in Bandarban Sadar, lcoated North and North-East of Bandarban town and South-South-West. Bandarban town and a relatively small surrounding area comprise overlying siltstone. To the East and South-East of Bandarban city are medium gradient hills dominantly over sandstone. The landforms in Bandarban Sadar are: steep hills (22-170 m), medium gradient hills (23-149 m), dissected plain (5-222 m; extreme values, but most are below 100 m), and valley bottoms (7-111 m); altitude ranges are derived from the SRTM Digital Elevation Model.

Valleys occurring among the high hills are very narrow with sharp gradients, and as a result have little or no accumulation of sediments. Valleys elsewhere are wider and composed of deep alluvial deposits. Low hills are formed mainly over unconsolidated Dupi Tila and Dihing sandstones and shales of the late Tertiary age. Their summits are generally less then 60m, but occasionally up to about 150m above MSL.Dominant landforms are rolling to steep low hills, with rounded tops and strongly dissected edges of higher anticlines, and very steep slopes.

Soils

The dominant soils in the Bandarban Sadar area are deep, well drained, yellowish brown sandy loam to loamy sand. They occur in the dissected plains in the western part of the CHT. They are developed on unconsolidated sandstones. Minor valleys occupy a small part of this unit. There are three soil types in the dissected plains and one in the flat valley bottoms: Hazaribak (55%), Teiabil (25%) and Kaptai deep soils (20%), and Karnaphuli (5%) respectively.

Soils of the dissected plain in Bandarban Sadar

Hazaribak consists of deep, well-drained, yellowish brown sandy loam to loamy sand over

unconsolidated sandstone. Teiabil soils are well-drained, deep, strong brown to yellowish red, sandy clay loam with many red mottles and iron concretions in the subsoil. Hazaribak soils consist of deep, well-drained, yellowish brown sandy loam to loamy sand over unconsolidated sandstone. Kaptai soils are well-drained, deep, yellowish-brown to strong brown, silty clay loams.

Rock fragments occur in the lower part of the soils. Karnaphuli soils are very deep, variable mottled, indicating a moderately good drainage condition and have a dominant texture of sandy loam with layers of silt loam, loamy sand or sand as a result of sedimentation in an alluvial environment.

[See Picture -06: Annex C]

Agricultural considerations

Teiabil soils are relatively poor agricultural soils despite their depth and moderately fine texture. Their fertility and moisture-holding capacity are low, and their occurrence on the summits makes them easily susceptible to erosion. Extreme aridity during the dry season severely limits the agricultural potential of the Hazaribak soils. Low fertility and their occurrence in areas of steep slopes results in further moderate to severe limitations. Fertility and the moisture-holding capacity of the Kaptai soils are relatively good. Their topography is less favourable for agricultural use. Karnaphuli soils have a fairly good moisture-holding capacity and are moderately fertile. These soils occur in a flat topographic position.

[See Picture -07: Annex C]

Soils on the steep high-gradient hills in the South-East of Bandarban are overlying consolidated sedimentary rocks, mainly fine, sandstones interbedded with siltstones. Three soil components can be distinguished within this unit: The larger part of the unit is occupied by two soil types: the Kaptai series that occur in a shallow variant - less than 60 cm deep (60%) and a deeper one (25%). The remaining 15% of the unit is characterized by the Belaichari series.

Kaptai soils are well-drained, yellowish-brown to strong brown, silty clay loams ranging in depth between less than 60 and more than 150 cm. Rock fragments occur in the lower part of the soils. Belaichari soils are excessively well-drained, shallow, yellowish-brown sandy loams, with pieces of rock over hard sandstone.

Fertility and the moisture-holding capacity of the deep Kaptai soils are relatively good, but the prevalent steep slopes mean severe limitations for agricultural use. The low moisture-holding capacity of the shallow Kaptai soils makes them prone to droughtiness. Belaichari soils are very poor for agriculture. Severe limitations include shallowness and consequent droughtiness, very steep slopes and low fertility.

Soil erosion risk

Soil erosion means the loss of soil on a surface. In Bandarban geological erosion takes place, which is the process by the hills, mountains and valleys that make up the earth's surface have been weathered and shaped by wind, rain, snow, and floods in a process that has taken millions of years. Slope cultivation and high intensity rainfalls cause accelerated soil erosion in steep hilly areas. This type of erosion causes soil degradation in the upper and lower catchment areas. Soil erosion is especially high in the first year of *jhum* fallow and under mono-culture timber plantations such as Teak.

Drainage

Hill slope soils in Bandarban Sadar are well to excessively well-drained. Some of the valley bottom soils are moderately well to poorly-drained.

Climate

Bandarban has the highest rainfall among the three CHT districts, with the other two districts having almost similar annual rainfall distribution. Bandarban district expereinces 3121 mm mean annual rainfall of which 18% occurs in the dry period and the remaining 82% occurs in the wet season. The mean annual temperature is approximately 26^{o}C and the mean minimum and maximum temperature varies from 22-30^{o}C. High temperatures are observed between March and October, while the month of January has the lowest temperatures. The maximum highest temperature was recorded at 40.5^{o}C during May 1995; the lowest recorded temperature was 5.5^{o}C in February 1961. Over the past decades, the yearly maximum temperature has been increasing

whereas the minimum temperature has remained stable. Mean humidity is approximately 78% in Bandarban. Maximum humidity occurs during July and August and minimum humidity occurs in January and February.

Daily total sunshine hours range from four to eight hours in the CHT area. In the monsoon season the mean sunshine hours are around four to five hours; and during the dry season, it varies from seven to eight hours. Mean wind speed is approximately 170 knots per day (KPD) in Bandarban. High wind speed is generally observed in the months of June, July and August and low wind speed is observed in the months of November and December. Highest evaoptranspiration is generally observed in the Bandarban area. The evapo-transpiration in Bandarban is 560 mm and 796 mm in the wet and dry periods respectively.

Land use

The pressure on the land of the CHT will continue to increase. In order to predict future changes it is necessary to understand present land use and land utilization patterns. The land use of the whole CHT has been broadly categorized into four classes including: Non-agricultural, Agricultural, Forest and Fallow land to determine the present land use pattern of the three districts including all the thanas. In Bandarban Sadar there is 1,344 ha non-agricultural land, 23479 ha of agricultural land, 24088 ha of forest and 40021 ha of fallow land (SRDI, 1996-2002). Thirty eight per cent of the CHT region is forest area, 36% fallow land, 20% agricultural land and 6% non-agricultural land. Forty one per cent of Bandarban is fallow land, 37% forestland and about 20% of agricultural land.

Forests

The forest lands in the reserved forests have potential for sustainable cultivation, but are still being rapidly degraded due to monoculure plantation, illegal logging, shifting cultivation, and poor management. If the present trend continues, these reserved forests will be devastated and converted into unproductive forest land. The policy of the Forest Department had been to convert the natural forests into [L1] more commercially productive plantations through a system of artificial regeneration. This has had a serious impact on the natural environment, and has resulted in increased soil erosion and silting in rivers and reservoirs. There is an urgent need to bring these areas under sustainable forest management and planning. Unfortunately, this will not be possible until the present problems related to the forests are settled. The forestry sector therefore needs to be addressed on a priority basis through proper natural resources planning and management before it is too late. There is a total of 1111943.88 hectare of reserve forest area in the CHT of which 29.09% is in Bandarban District. It is estimated that less than half of this area actually has tree cover (GoB 1993). The table below shows the classification of the forest area in Bandarban District.

Table 3.3: Classification of forest area (ha), 2002-03

Sl.	District / Classification	Bandarban (Area in ha)
1	Reserved & Protected Forest (RF & PF)	107,739
2	Acquired Forest	0
3	Un-classed Forest	15,639
4	Total Forest Area (under control of FD)	123,378
5	Unclassified State Forest (USF)	200,066
6	Khas F. Area	0
7	Planted Forests (Private)	26,184
8	Total Forest area under MoL (row 5)	200,066
9	Total Forest area under FD & MoL (row 4,8)	323,444

*Source: BBS, 2005, *ADB, 2001*

Natural Forests

The CHT is situated in a humid tropical forest zone. The natural forests of the CHT are mainly characterised as mixed evergreen and deciduous forests. The forest trees can be ecologically classified into the following types, which intermingle with each other (Ishaq 1971).

3.4 Existing Land use practices

Household characteristics

Households surveyed in the Pilot Area to analyse present land use systems, as a mean, own 801 decimals and use 1036 decimals, values that are significantly higher than in other areas of the CHT and higher than those found for the district of Bandarban in the wider survey undertaken by the University of Lleida for the CHARM Project (Olarieta et al. 2007).

The households were divided into two groups:

- those that obtain as much or more income from outside the farm than they obtain from the farm, hereafter called part-time farms, and

- those that obtain more income from the farm than from outside it, hereafter called full-time farms.

As a mean, full-time farmers own (430 decimals) and use less land (833 decimals) than part-time farmers (1089 decimals and 1194 decimals respectively), and the proportion of land the former own in relation to the land they use (51%) is smaller in comparison to the latter (91%).

Furthermore, full-time farmers use larger amounts of land for ploughland, *jhum* and horticulture, while part-time farmers devote most of their land (over 80%) to rubber and wood plantations (see Table 3.4).

Over 70% of households have some domestic animals, mostly birds (hens and ducks) and/or pigs, while cattle are only present in 30% of households (up to 7 cows). Over 80% also collect wild products, mostly fuelwood (amounts vary from 600 kg/year to 2000 kg/year), bamboo, and bamboo shoots.

Table 3.4.- Land ownership and use according to the main source of income of the surveyed farms

Mean area (decimals)	Full-time farms	Part-time farms
land owned	430	1089
land used	833	1194
fruit garden	117	34
Jhum	120	57
Plough land	149	30
rubber garden	0	300
wood plantation	298	590

Ploughland

Production system

Ploughland basically occupies valley bottoms, river banks and lower slopes in the CHT, and only a small proportion produces 2-3 crops per year. The main crops are rice, vegetables, sugarcane, and potatoes. Tobacco is very frequent on the sandy river terraces in the area around Ruma. Rice production varies mostly between 15-30 maunds/acre/crop.

This is the land use system that concentrates the biggest amount of inputs. In most cases, both synthetic fertilizers and pesticides are used, while on the other hand in very few cases manure is applied.

Urea is the most frequently applied fertilizer, usually accompanied by triple superphosphate (TSP) and muriate of potash (MP). Rates of manure application are less than 1 t/acre/year.

Jhum

Production system

Jhum is practised on slopes up to 45° and often steeper, although slopes beyond 45° are generally not considered suitable. The most frequent cycle involves 4-5 years fallow, while the longest fallow recorded is 7 years.

For the cropping year, a continuous plot is slashed and burned, more or less regardless of the variability in the conditions within the plot. Therefore, if some gullies or small areas with slopes steeper than 45° are within the *jhum* plot, they will also be slashed and burned.

The main species used in *jhum* are rice, turmeric, marfa, chilli, and ginger, although many others are less frequently intercropped. Banana and other species may be planted and collected even after the cropping year, during the first fallow years. Stems of banana plants may be kept from fire and piled so as to produce mushrooms during the cropping year. Rice production is mostly in the range 10-30 maunds/acre.

Use of external inputs is less frequent than in ploughland. Pesticides and synthetic fertilizers are still applied in most cases. Urea is used frequently, while TSP and MP are not often applied and use of manure is a rarity.

Fruit gardens

Production system

Fruit plantations mostly occupy slopes up to 35°, and in the case of pineapple even up to 40°. In every case recorded, fruit gardens bear a mixture of various species (mostly pineapple, mango, jackfruit, litchu, and jolpai), sometimes including even a few species for wood production (teak, gamari).

Pesticides are frequently used and to a lesser extent synthetic fertilizers too. In many cases fertilizer management is inbalanced as farmers tend to use urea without TSP or MP. Manure is rarely used and only for some specific species, like orange and mango.

Plots visited during the surveyed had good ground cover, with little apparent soil erosion. All plots with pineapple plantations that were visited during the survey had the rows along the contour, but soil erosion features were more obvious, particularly during the first year of the plantation and if the distance between rows is 1 m or more. With closer spacings and older plantations the eroded soil seems accumulate in the next row of pineapples.

Wood plantations

Production system

Plantations recorded are mostly a mixture of teak and gamari, and occupy slopes up to 45°. Adoption of these plantations is quite widespread, and most of them have over 100 decimals. When not mixed with fruit trees, the density of trees in wood plantations is very high, from 1000 to 4500 trees/acre.

Farmers often plant teak and gamari in *jhum* plots instead of leaving them under fallow. Farmers stated that in this way their tenure on the plot is asserted, whereas if it was left fallow many of them argue that the Forestry Department may take it away from them. Frequently farmers believe that this land use is also a form of soil conservation.

After planting, wood planation plots are usually weeded by hand during the first 3 years and afterwards by setting fire to the undergrowth. Fertilizers or pesticides are not usually applied.

Rubber plantations

The number of households with rubber gardens that were interviewed was relatively very small, but they were clearly distributed into two categories: either settlers from government programmes or large households with other sources of income from outside.

These plantations are weeded usually twice a year for the first years. Fertilizers (urea, TSP, and MP) are applied at a rate of 40-80 kg/acre/year.

3.5 NRM Institutional capacity

About 7 institutes were identified which are directly involved in natural resources management in Bandarban. It was concluded that most agencies lacked sufficient skilled professionals for adequately addressing natural resources management issues, indicating a need for professional development through training. The agencies have access to computers, but these are not used in support of decision-making or advice in natural resources management. The survey provided information on the present status of available data in different government agencies and their information needs. The specific information needed by the agencies include information on administrative boundaries, transportation network, land management unit boundaries, soil productivity, soil erosion, geology, vegetation, hydrology, and soils.

List of NRM agencies:

a) Bangladesh Agriculture Development Corporation (BADC)

b) Department of Agriculture Extension (DAE)

c) Department of Fisheries (DoF)

d) Department of Forest (DoFo)

e) Department of Public Health and Engineering (DPHE)

f) Hill Cotton Research Centre (HCRC)

g) Soil Resource Development Institute (SRDI)

3.6 Major NRM issues, problems and recommendations

Soil erosion in wood plantations

Teak and gamari plantations show very obvious features of intense soil water erosion, with estimated rates of 60-270 t/ha/yr that are consistent with those found in the literatures. Such rates of erosion will lead to the complete degradation of the soil in the short-term (less than a century).

The reasons for this are related to:

- the almost complete absence of ground vegetation, which in turn may be related to the high density of trees in these plantations, the dense shade of the trees and the use of fire for weeding. This would also help maintain low levels of organic matter in the soil.
- rain drops falling from teak and gamari leaves are much greater than those falling from other species with smaller leaves, therefore contributing to smaller rainfall interception (Calder, 2001).

Furthermore, these issues would also lead to high surface runoff in these plantations, which results in increased peak-flow and decreased base-flow in the catchment. The high density of trees may also lead to increased consumption of water.

Planting of teak and gamari during the fallow period of *jhum* plots does not replace the role of fallow in terms of soil conservation and improvement.

Suggestions for improvement of these plantations may include:

- realizing that trees are no guarantee of soil conservation,
- mixing small-leave species and species producing high amounts of litter such as bamboo and fruit trees.
- decreasing the density of trees in order to allow the development of undergrowth that will help control soil water erosion.

Decline of productivity in *jhum* land

Most farmers acknowledge a 50% decline in productivity of jhum land during the past 10-12 years. Soil water erosion (which results in a decrease in soil water holding capacity and organic matter and nutrient content) is, most probably, the mainprocess involved in the decline of productivity in *jhum* land. With the present cycle of 1 year cropping plus 4-5 years of fallow, a mean annual rate of erosion is in the order of 20-30 t/ha/yr. This implies that a soil 30 cm deep would erode in 100-200 years of a continuous 5-year jhum-cycle, while a soil 60 cm deep would take 200-400 years to erode.

Suggestions for improvement of the *jhum* system may include:

- improved fallows with species that both increase the rate of return of organic matter to the soil and have some commercial interest for the farmer: commercial bamboos and various leguminous shrubs (Pueraria phaseoloides, Cajanus cajan),
- use of weeds obtained in the cropping year for mulching or composting,
- avoid slashing and/or burning areas around gullies and steeper slopes within the *jhum* plot.

Management of fire in *jhum*

The spread of *jhum* fires to neighbouring plots is quite frequent. In order to decrease this risk, improvements may include:

- improved supervision by farmers during the fire,
- removing slash from the edges of the *jhum* plot leaving a slash-free strip as wide as possible to the neighbouring plots.

Use of dangerous chemicals

Some very dangerous pesticides are used in ploughland, jhum, and fruit gardens. Pesticides such as Parathion (already forbidden in many countries), Dieldrin, and Dichlorvos (Nogos) are highly toxic and dangerous for the environment, while Diazinon (Basudin), Furadan, Mancozeb, and Malathion are toxic for fish and wildlife species. Malathion is under increasing suspicion for its toxicity for humans.

Marketing and accessibility

Some of the main problems reported by the farmers in relation to their activities are those related to produce marketing. These issues require:

- development of producer cooperatives and associations, which could build on existing community links,
- improved road network,
- simplified and cheaper selling permits and taxes in the case of wood plantations.

4.1 Participatory natural resources mapping

A Thana map was prepared from secondary data sources (Mouza database, IRS image, LandSat image, SOB Topo map 1:50,000, LGED base map). With the help of local communities and Thana map 5/6 hamlets were selected for every Mauza for survey. Survey team visited all those hamlets and identified the Jhum land, plough land, natural resources, water resources, planted forest and settlement of those Mouzas. Then they prepared union level draft land use map using GIS techniques according to their survey findings. This union level draft maps were presented at union level workshop for their comments and then those comments were incorporated on the map. Thus five union level Landuse maps were prepared for preparing a Participatory land use map of the Bandarban Sadar area.

[See Map -03: Annex C]

4.2 Alternative Land use practices

A field inventory and a literature review were made of the current land management practices (Olarieta et al. 2007). Options for improving current practices and alternatives land use systems are discussed in the next paragraphs.

System of rice intensification

The System of Rice Intensification (SRI) is an alternative management system of paddy rice that involves earlier transplanting of single seedlings, wider spacing between them, and control of irrigation water. It has provided good results in various countries and was tried in Bangladesh with mixed success. During our survey farmers were asked about it, but none of them were using this system, and most of them argued it would require a higher amount of labour and more careful management of seedlings and weeds.

Is spatial agro-forestry an alternative to *jhum* in the CHT?

Spatial agroforestry systems, such as SALT and CHIAT, have been suggested and tried in the CHT as alternatives to jhum. Adoption of these systems has been rather low and apparently the main reason is the difficulty in managing the system. Further reasons may be the unclear performance and long-term sustainability of these systems.

In other countries in Southeast Asia it has also been found that farmers seldom adopt these technologies unless under the cover of some project (Do Dinh Sam, 1994; Morrison and Dubois, 1998).

Is horticulture an alternative to *jhum?*

Horticulture does not seem to be a viable alternative for a majority of farmers in the CHT. Households with sizeable fruit gardens are mostly those with relatively big land sizes and/or have other important sources of income from outside the household.

The survey by Rasul et al. (2004) similarly showed that only 8% of the surveyed households in the Bandarban and Alikadam districts had significant amounts of land devoted to horticulture, and that the adoption of this land use system was related, among other factors, to the presence of a government settlement programme and to availability of off-farm income and other productive resources.

4.3 Management options and recommendations

This paragraph will discuss some aspects that have not been dealt with in previous sections, while a general view of all suggestions for improvement for the various land use systems is shown in Table 4.1.

Soil organic matter

The topsoil organic matter content in ploughlands in Bangladesh has decreased by 20-46% in the past 20 years, leading to low productivity in this land use system (Zahid Hossain, 2001). While no actual data seems to be available specifically for the CHT, the reasons for this processes may be partly related to the small use of manures or compost. Application of nitrogen alone, without phosphorus and potassium, also decreases soil organic matter content.

The use of green manure crops, and incorporation of crop residue, increases soil organic matter while maintaining high grain

yields. This green manure may be provided by transition crops, like some leguminous shrubs such as Cajanus cajan, between the dry and wet seasons, which can also help save large amounts of nitrogen.

Soil acidification

Soil acidification is undermining the soil resources of Bangladesh in general and those of the CHT in particular. While acidification is partially a natural process, management practices may intensify it. Synthetic fertilizers such as muriate of potash and particularly the high doses of urea used in some cases add to the acid load on the soil. While an alternative to urea may be difficult to find, use of liming materials may prove very valuable.

The effects of soil acidification on plant production are intensified by low levels of soil organic matter, and therefore improvement on the latter issue would have a double positive effect.

Weed management

Weeds obtained in plougland and jhum are just disposed off in most cases. Biomass of weeds may be around 1-2 ton/ha/year, and this amount provides a good source of compost or mulch.

Table 4.1: Suggestions for improvement for the main land use systems in the Pilot Area.

	General management systems	Management details
General suggestions for all systems	Increase organic matter applications Use weeds for mulch or compost Use lime in very acid soils Research on environmental and commercial use of indigo (Indigofera tinctoria) Planting trees does not guarantee soil conservation Avoid use of dangerous chemicals: Parathion, Dieldrin, Dichlorvos Research on Integrated Pest Management	
Plough land	Research on Rice Intensification System Incorporate relay crops in dry season for green manure and saving N (cowpea, indigo)	Use organic fertilizers: plant residues, compost, manure Do not use urea alone, but in combination with TSP and MP
Jhum	Improve fallows with species producing litter, fixing nitrogen and saving nutrients: bamboo, cowpea indigo Do not burn gullies nor steeper slopes within jhum plots	Use weeds for mulch or compost Do not use urea alone, but in combination with TSP and MP. and lime if possible Keep slash-free wide margins with neighhouring plots for burning
Ginger, turmeric	Use weeds for mulch or compost Improve fallows with species producing litter, fixing nitrogen and saving nutrients: bamobb, cowpea, indigo Do not burn gullies nor sleeper slopes within jhum plots Dig trenches across the slope to divert runoff	Do not use urea alone, but in combination with TSP and MP. and lime if possible Keep slash-free wide margins with neighbouring plots for burning Intercrop with chilli, maize, mandarin
Gruit garden	Oranges and pineapple are better planted on south-facing slopes Avoid altitude over 300 m for pineapple Ensure irrigation for drought sensible species: litchi, mango, orange, jolpai	Keep good grass cover in the plot Use mulch with weeds around trees
Wood plantations	Mix species, using bamboo, small leave trees, cowpea to ensure good ground cover Decrease total density of trees Do not burn undergrowth	
Forest regeneration	If natural regeneration is not good, use plantations with many different species to improve it	Research on introduction of *Amomum villosum* in forests

4.4 Regional planning and conservation needs and strategies

4.4.1 Spatial planning and policy and the impact on people and their environment

Innovative farmers respond to opportunities for improvement of land management and production. However, their efforts are often constrained by poor institutional support, including lack of land title, weak extension services, inadequate credit and marketing facilities, and poor transport and communications (Rasul et al., 2004). Institutions involved in the development of policy plans and regulatory frameworks for land use have a significant influence in the lives of the rural poor: farmers and the environment will benefit from increasing the capacity of local institutions to service the rural people and develop policies that support more sustainable and productive land use. The Kaptai dam and people downstream will benefit from better-managed land, with less erosion and forest logging, through reduction of river siltation and flooding hazard and improved river water quality.

Making sound policies and decisions on sustainable land management requires adequate information on natural resources. Through the process of land use planning, areas may be identified according to their potential and constraints for various uses and management types. Management alternatives may be indicated for current practices where appropriate.

4.4.2 Regional zonation for support of planning Natural Resources Management in the CHT

Land use planning involves assessing options for land use and management given the local opportunities and social, environmental and economic constraints. For specific environments, land use management types may be considered that are sustainable, socially acceptable and economically viable. Knowledge of the natural resources is required for sound planning and informed negotiations.

In a participatory process, where people make an effort to agree on the use of common resources, discussions must be supported by reliable, spatial data on the land. Mapping and documentation of the natural resources and their management is a way to illustrate the biophysical resources. Decision on policy priorities may be supported by environmental information such as on land cover change, erosion risks under current land cover, priority areas for forest and biodiversity conservation, and areas with potential for production forest, agriculture, tree crops, etc. Such information values the land in economic and environmental sense, giving options for land management and showing potential impacts of intervention.

The mapping and documentation of the natural resources of Chittagong Hill Tracts is a way to show what the physical area is composed of and to assess the status of the natural resources base. The environmental database was linked to models for analysis and decision support. The set of models -part of the environmental framework (Tyrie & Gunawan 1999; Mantel et al. 2002) may supply information on land cover change (impacts), erosion risks under current land cover, defines priority areas for forest and biodiversity conservation, and may define areas with potential for production forest, agriculture, tree crops, etc. Such information values the land in economic and environmental sense, giving options for land management and showing potential human intervention impacts.

The planning tools may support decisions in: 1) forest management; regeneration of forest land protects the genetic resources and diversity of forest flora and fauna, which in turn is beneficial for village communities, 2) agricultural management to increase productivity and decrease degradation, 3) identification of conservation areas and areas that have a potential for production.

Methodology for assessment of regional conservation priorities

A methodology was developed to indicate potential environmental hazards of land management and to assess priorities for production and conservation. The result of the analysis is a map indicating the vulnerability of areas under current land cover and based on an analysis of ecosystem stability and the resilience to impacts of human intervention. Based on this analysis a map can be created that indicates broad management classes with indication of priority for conservation (highly vulnerable to

degradation) or production (low vulnerability to degradation).

The zonation for assessment of priorities for conservation and recommendation for sustainable watershed management is the result of a multi-layered analysis of environmental constraints on watershed management (Tyrie et al., 1999). It encompasses relevant environmental constraints concerning soil erosion and land degradation, actual land cover, and social constraints through land use and tenure issues, and forest land status (RF, USF, PF). Each of the mapped classes represents a unique combination of these basic factors, which provide a basis for a sustainable management strategy.

The land classification method is based on the following features:

Land Status

Forest Reserve Land, inside or outside of Forest Reserve Land. The term Reserve Forest refers to 'state-claimed forest land' and is a tenurial designation referring to land the national government claims for the state forest and for which the Ministry of Forestry has the authority to manage.

Erosion Risk

As designated by the Erosion Risk Assessment module (Soter Water Erosion Assessment Program - SWEAP). Greater than 180 tons/ha/yr is considered an excessively high potential erosion risk (note: this is not an assessment of actual erosion risk, vegetative cover is not included in the calculation and indicates the potential impact of vegetation removal).

Critical and Fragile Land

As defined by environmental type, but based on propensity to degrade, e.g. Mountain forest land.

Ruggedness

Areas classified as having a low erosion risk, but with steep slopes are separated out at the land system level based on 3 classes of dominant slopes (<15%, 15%-30%, >30%; based on (NMFP, 1994)).

Land cover

Protection Factor (C-factor) is the degree of protection from soil erosion provided by present land cover. Areas with a low land cover considered more fragile or more erodible in combination with sloping terrain.

Presence of downstream infrastructures

The sedimentation of the Kaptai lake is an economic and environmental hazard. All watersheds draining into Kaptai lake were identified. Whether an area is part of a watershed that drains into Kaptai Lake is used as a criterion as it is an indicator for downstream impact of potential degradation and soil erosion. Land areas that drain into Kaptai Lake are given higher priorities for conservation, rehabilitation and reforestation.

Slope

Very steep slopes (>45%) are indicative of sensitivity of areas for degradation upon disturbance. In the analysis this is taken into account, and Private Forest land and Un-classed State Forest land with extreme slopes, under low vegetation cover, and draining into Kaptai Lake, are classified with priorities for reforestation and conservation of watersheds and critical ecosystems.

Results

Each land facet within the CHT regional database was evaluated using the criteria and rules described above. Areas requiring conservation and protection were identified first. The remaining areas are allocated to the appropriate land management class (i.e. production or rehabilitation).

Map 4.2 shows the results of the assessment of regional conservation priorities. North and North-East of Bandarban and South-South-West is dissected plain land over sandstone. Bandarban town and a relatively small surrounding area is overlying siltstone. The plain area N and NW and S-SW of Bandarban is classified as stable land that may receive priorities for production for planning. The medium gradient hills East and South-East of Bandarban city are classified lands with high erosion risk area which are unlikely to recover to their former quality after disturbance, such as

logging or burning, and should receive priority for conservation and rehabilitation in planning and land management support.

From a biophysical point of view an area of 9295 km-2 (78% of the total area) of the CHT has limitations for use and requires some form of conservation, land rehabilitation or protection. For sustainable use, CHT lands require adaptive management with conservation strategies to ensure both productive and sustainable land management. Some vulnerable areas might better be left for nature conservation or rehabilitation.

Policy formulation in natural resources management needs to be based on proper information and judgment. It should take a broader and regional perspective in weighing options and priorities in cross-sectoral planning for development of the CHT region. The methodology applied provides a basis for planning sustainable management strategies with regional and spatial stratification for ecosystem stability and land conditions. The derived map provides a tool to identify: 1) where soil and water conservation strategies are needed, and 2) which particular technology may advised and may be expected to be successful based on the prevailing conditions, such as present land cover, slope, soil properties, and administrative land class.

[See Map - 04: Annex C]

5.1 Implementation Mechanism

The natural resources management agencies or departments as per their mandated functions could implement the improved natural resources management plan periodically with the annual budget allocated from the central government of Bangladesh. In the CHT area the Regional council (RC), CHT Development Board (CHTDB), Hill District Council (HDC) can pursue the different NRM agencies and departments to implement the NRM plan through different development, maintenance projects and programs with assistance from NGOs, CBO and other institutes. Each agency has its own mandate, which is often focused towards a particular sector (for example soil resource development, forest etc.) without giving proper attention to the effect of such development activities on other sectors. Such mono-sectoral development activities are not fully effective and do not reflect the cross-sectoral issues and its consequences to the affected people as those activities are planned and imposed from the central government. There is a need for cross-sectoral planning as was identified by stakeholders in the national workshop on improving natural resources management in the Chittagong Hill Tracts in Rangamati (Mantel & Khan 2006).

With the involvement of multiple agencies and their multiple activities, the objectives of the plan should be practically achievable, depending on successful implementation through timely initiation of activities by the respective agencies or departments in the CHT area. The implementation will be the responsibility of the line agencies concerned. The critical assumption is that availability of government funds, channeled through line agencies in a timely fashion with overall coordination of MoCHTA, Regional Council and HDC.

Few political leaders who head the CHT institutions may have a direct role to play in implementation of this plan as functional chiefs of these institutions. The traditional leadership of CHT (e.g. Circle Chiefs, Headmen and Karbaris) also participates in various developmental forums (governmental coordination committees and panels etc.) and contributes to the articulation of local demands and opinions.

The civil society and media/press have a limited role in implementing the plan in the forms of creating public awareness for selected NRM issues and concerns and articulating local/community demands, such as deforestation and decay of the natural resource base, lack of physical and financial infrastructure, urgency of maintaining inter-community peace and confidence. As implementers of different projects and plans, both in partnership with government agencies and donors, NGOs working in CHT play a significant role. In case of foreign funded projects, NGOs need to government's formal clearance in taking up and implementing development projects.

The Hill District Council may take a lead in implementing the plan, coordinating all activities of different line agencies under the HDC in a particular district headed by the Chairman. The HDC will thus be the key instrumental platform that will guide and monitor the implementation and further update of this management plan in future.

5.2 Institutional Setting

In CHT the institutional structure are rather different from other parts of the country. It has both formal and informal institutes, which are usually involved in planning, development and management activities in the area with its own mandates in their jurisdiction area under the umbrella of Ministry of CHT Affairs. A clear understanding of functions and responsibilities of different institutes and agencies working in the CHT is required to establish institutional linkage to accelerate the implementation process of the plan. Following are major functions and responsibilities including NRM issues of Ministry and different institutes and agencies in the CHT.

Ministry of Chittagong Hill Tracts Affairs

The MoCHTA has carried out the administrative and development functions of CHT area including the preparation and processing of development plans, management and coordination of subsequent implementation of development programs. It also provides for general guidance and coordination of all development programs undertaken by the Regional Council (RC), Hill District Councils (HDCs), CHT Development Board (CHTDB)

and other local bodies. Other development tasks under responsibility of the Ministry include: 1) the establishment of budgetary allocations to the RC, HDCs and CHTDB, 2) the examination of applications and proposals for foreign-funded NGO projects, and 3) planning and administering the 'bloc' grants.

Regional Council

The Regional Council (RC) is headed by a tribal chairperson, includes elected representatives from all ethnic communities of the region including women and/or other disadvantaged groups, chairpersons of HDCs. The RC is mandated for supervision and regional coordination of development activities of the CHT.

Chittagong Hill Tracts Development Board

The CHTDB was established based on the concept of the regional planning. One of the main functions of the Board is to prepare projects and schemes for the development of the CHT region. The Board generally implements project/program covering a wide variety of sectors such as physical infrastructure development, agro-forestry, education, communication, water supply and sanitation, irrigation, rubber cultivation, homestead gardening, fish-culture and Jhummia (shifting cultivators) rehabilitation. CHTDB has long experience and tradition of project implementation in the region. It follows specific 'guidelines' to collect proposals from the grass root/community level for selection of development projects and schemes. The process of upward transmission of the project proposals involves and engages different stakeholders such as the karbari, headman and Union Parishad chairman and members, and other local elites and institutions.

Hill District Council

The HDC is a representative body headed by a chairperson. HDC plays a very important role in the development and management of natural resources of the respective (hill) district. The HDC can initiate and implement development projects from their own and from government funds and also implements development projects and programs through the Transferred Departments. In the case of large projects or programs, the HDCs usually submit the proposals to the MoCHTA first for approval and funding. The HDCs generally prepare their plans on the basis of the local demands and needs. Local people's participation occurs when project proposal(s) are sent or formal requests are lodged for a particular development scheme to the HDCs through community level leaders such as Headman, Karbari. After receiving such proposal/request, the HDC examines and scrutinizes the proposal for recommendation and subsequent referral to the MoCHTA for approval.

In 1990 under the Chittagong Hill Tracts Regulations, the region was divided into Revenue Circles and Mouzas (a number of village/community). The Bomang, the Chakma and Mong circle chiefs were charged with the administration of the three Circles. The Chiefs appoint headmen for collection of revenue and other dues and are responsible for maintenance of the peace at the village level. The traditional leadership are acknowledged and respected by local people, and are therefore important in the planning process through articulating local demand, motivating people to participate in development activities, and liaising with the mainstream government agencies, such as the Deputy Commissioner's office, and the MoCHTA.

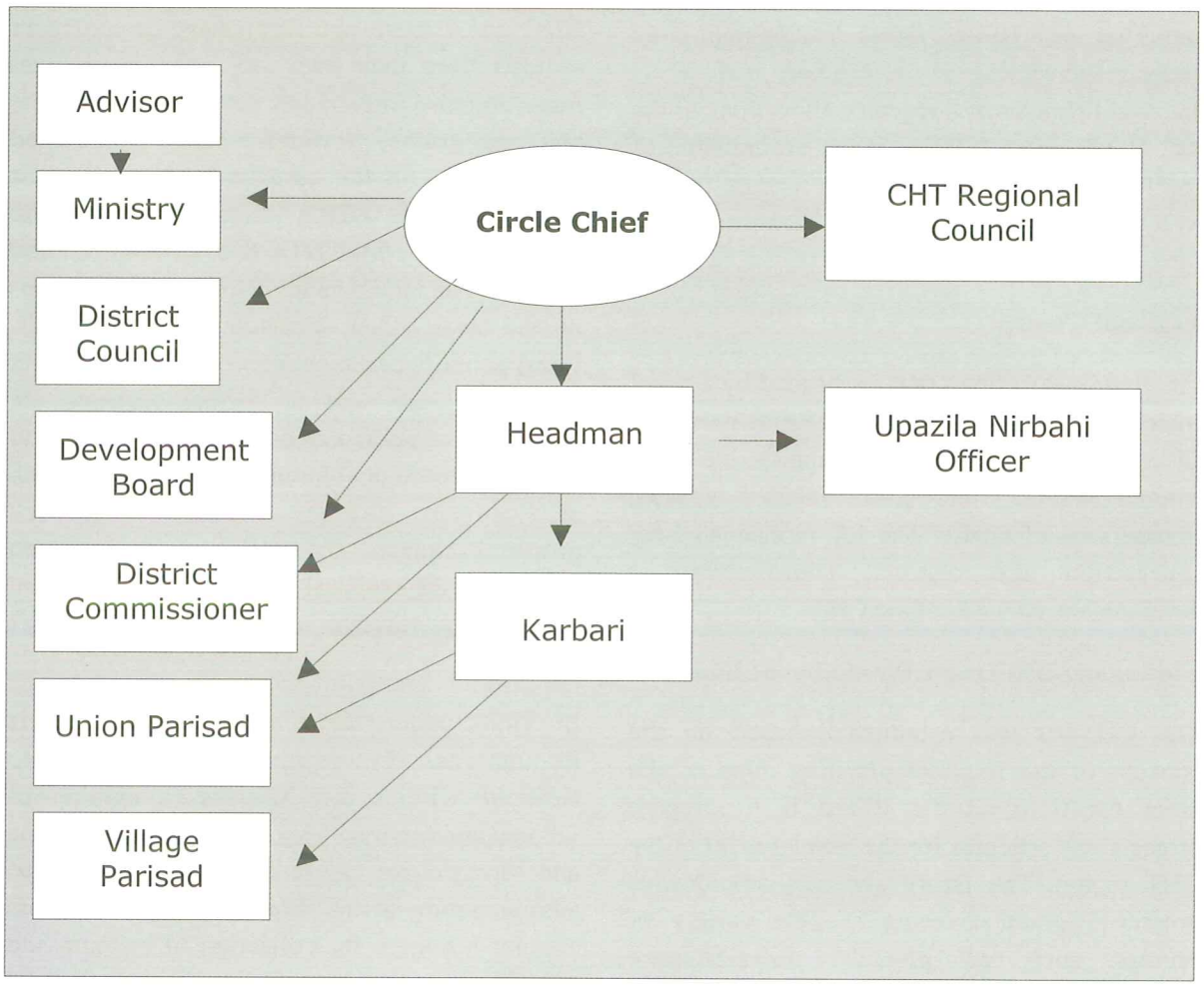


Figure 5.1: CHT administration (Islam & Alam 2006)

Government agencies and departments are directly or indirectly involved in NRM planning in the CHT area. The Hill District Council coordinates most of these agencies and departments. Government agencies and departments operating in the CHT region, and involved in project formulation and implementation are: Local Government Engineering Department (LGED), Roads and Highways Department (RHD), Forest Department (FD), Department of Agriculture Extension (DAE), Bangladesh Rural Development Board (BRDB), Bangladesh Water Development Board (BWDB), Department of Fisheries (DoF), Soil Resources Development Institute (SRDI), Bangladesh Sericulture Board (Sericulture is rearing of silkworms), Bangladesh Small and Cottage Industries Corporation (BSCIC), cooperative organizations, and District and Upazila Administration.

In addition of government agencies and departments, non-government organizations can play a vital role in implementation of NRM plan apart from their other responsibilities in the field of socio-economic development, and also implementation of development projects. NGOs in the CHT also carry out activities on diversified development issues, such as programs on agriculture, horticulture, nursery development, homestead gardening, social forestry, agro-forestry, fishery, poultry farming, live-stock farming, and protection of bio-diversity and environment.

With respect to improvement of the natural resources management the Hill District Council of each district could be the focal point, considering the function and mandates of the different formal and informal agencies and institutes involved in the CHT area. It can have can bridge be a focal point for the different agencies and departments under the Ministry of CHT affairs and the Regional Council.

5.3 Funding Mechanism

The resources management projects and programs are undertaken by the government and implemented by different line agencies, which are have specific funds under the Annual Development Program (ADP) of Bangladesh. In the CHT, these activities are implemented by different agencies as is the case in other parts of the country. All agencies have their own mandate and funds are requested from the central government through the head office. However, often activities are narrowly focused towards a particular sector without giving proper attention to the impact on other sectors. The respective line agencies first conceive and initiate the concept of a project or program. On the basis of the mandated function of the concerned line agencies and the perceived local demands, activities of a project or program are identified. A project proposal is then forwarded to ministry for recommendation after which the ministry reviews the proposals for potential funding. After proposal review the ministry approaches the Planning Commission for approval.

Approved projects and programs are included in the Annual Development Program (ADP) for budget allocation. After inclusion in the ADP, the project becomes an integral part of the government's overall budget and resources allocation framework. The Bangladesh Government has channeled its financial resources through 17 development sectors under ADP, which are classified as the Development Program generally funded by the Government of Bangladesh. The sector budget shown in following table has been derived from the ADP. All the sectors from 2002-03 to 2006-07 have been examined.

Table 5.1: Sector wise allocation for last five years under Annual Development Program (ADP)

Sl. No.	Sectors Programme	Allocation in million BDT									
		2002-3		2003-4		2004-5		2005-6		2006-7	
		Total	%	Total	%	Total	%	Total	%	Total	%
1.	Transport	348.62	19.71	352.30	18.36	323.78	16.12	303.98	14.17	330.88	14.05
2.	Education and Religious Aff airs	295.01	16.68	271.10	14.13	314.16	15.64	329.73	15.37	386.16	16.40
3.	Power	227.54	12.86	322.10	16.79	324.34	16.15	312.00	14.54	340.59	14.47
4.	Rural Development and Institutions	172.05	9.73	233.20	12.15	233.38	16.62	299.61	13.96	313.89	13.33
5.	Health Nutrition Population & Family Welfare	181.19	10.24	161.20	8.40	215.63	10.74	226.94	10.58	249.40	10.59
6.	Physical Planning, Water supply & Housing	121.35	6.86	120.80	6.30	103.58	5.16	129.59	6.04	133.52	5.67
7.	Agriculture	85.27	4.82	99.80	5.20	87.27	4.35	112.51	5.24	185.97	7.90
8.	Water Resources	84.54	4.78	81.40	4.24	105.29	5.24	211.24	5.18	85.25	3.62
9.	Oil, Gas & Natural Resources	56.97	3.22	84.60	4.41	101.97	5.08	99.98	4.66	67.45	2.86
10.	Communication	87.07	4.92	67.20	3.50	73.06	3.64	73.55	3.43	86.06	3.66
11.	Industries	33.44	1.89	28.70	1.50	41.45	2.06	44.56	2.08	45.77	1.94
12.	Social Welfare, Women Affairs & Youth Development	26.87	1.52	25.00	1.30	24.87	1.24	30.50	1.42	37.66	1.60
13.	Public Admission	16.93	0.96	34.30	1.79	18.65	0.93	27.51	1.28	43.93	1.60
14.	Sports & Culture	11.40	0.64	12.10	0.63	14.57	0.73	15.73	0.78	16.07	0.68
15.	Science, Information & Communication Technology	9.18	0.52	11.00	0.57	12.06	0.60	13.09	0.61	14.93	0.63
16.	Mass Media	8.54	0.48	8.20	0.43	7.52	0.37	7.87	0.37	8.52	0.36
17.	Labour & Employment	2.84	0.16	5.70	0.30	6.94	0.35	7.13	0.63	8.38	0.36

The major segment of the development program budget in past five fiscal years is allocated for the Transport, Education and religion, Power, Rural development and the Health, Nutrition, Population & Family welfare sectors which are 69% of the average ADP allocation. The physical planning and water supply, water resources, agricultural, oil, gas and natural resources, and communication sectors had 24 % of government allocation in last five years. It is observed from the data that the transport sector received highest priority in the ADP followed by the education and religion, power, rural development and health, nutrition, population & family welfare sectors. Compared to others, the industry, social welfare, women's affairs and youth development, science, information and communication technology, and labor and manpower receive a low share from the ADP budget.

Under the framework of ADP, general and special bloc budget allocation are also available for CHT, through which line agencies can also request budget with highlighting the need for improvement of natural resources management in the CHT. Apart from the sources of funds from ADP, line agencies and department should also point out the budget and importance of NRM issues during preparation of donor aided project by the Ministry and national and international NGOs.

5.4 Coordination & Monitoring

For realizing the potential improvement of the management of natural resources in CHT, it is of the utmost importance that due attention is required to pay to inter-sector linkages. The CHT economy is not suited for improvement of resources management based on large "stand alone" activities. An integrated approach is required that combines the relatively small activities on NRM issues in the various sectors into sustained and mutually reinforcing activities.

The MoCHTA can plays the overall role in formulation, coordination and monitoring the NRM plan by initiating and processing through maintaining liaison with other agencies of the government, such as -and foremost- the Regional Council, CHTDB, and HDC. The government, semi-government and local government institutions of the CHT region and respective line agencies act as implementers of the plan. The Regional Council is mandated to coordinate all development activities in the region and HDC is responsible for each Hill district in the CHT.

In line with conventional wisdom, the coordination and monitoring responsibility for the management of implementation of the plan rests with an apex body convened of members drawn from a wide range of institutional stakeholders, namely the Inter-Agency Committee. The principle advantage of such an arrangement is that agencies having mutually irreconcilable interests in the sector, temporary or otherwise, can have their difference adjudicated at the highest operational level. This is particularly advantageous in CHT when the apex body in question is served by HDC.

Components of the NRM plan may be primarily assigned to specific line agencies. These agencies may be responsible for further designing the plan in cooperation with the other line agencies where appropriate. The governmental policies, rules and guidelines should be followed to make it consistent with the CHT development framework. Line agencies may also develop their own management plans incorporating the NRM issues and initiate its implementation through the normal administrative process. NRM issues always involve the association of several agencies to for successful and effective implementation. It is emphasized that the upazila level coordination will favor cooperation among government departments and agencies for an overall improvement of the natural resources management in the CHT.

The proposed NRM plan should specify the agencies that are expected to perform a supporting role within particular activities. Many of these roles are strategic in terms of

sustainability or institutional advantage. The proposed plan of the recommended institutions is not alien to the organizations and is related to their main function. The scarcity of resources combined with the complexity and scale of the tasks calls for careful planning and management. For this reason an integrated system of responsible institutions is required, each having a clear defined role which that can be performed independently. The line agencies need to take these potential advantages of partnership relations fully into consideration during the implementation of the plans.

To coordinate these activities, a lead Ministry, MoCHT and a lead agency, HDC may be designated. Inter-Agency Technical Committee constituted at appropriate levels, can assist the lead agency in coordination and monitoring the progress of the activities under the plan.

References

ALAM, M. ALIM, M., A. MAINUDDIN, K. & ALAUDDIN, S. M. (2007). Stakeholders' Information Needs for Planning and Management of Natural Resources. CHARM report. Chittagong Hill Tracts Improved Natural Resource Management (CHARM) Project. CHARM reports. Bangladesh Centre for Advanced Studies. Dhaka. p. 32.

BBS (2003). Population Census 2001: National Report (Provisional). Dhaka: Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, GoB.

DO DINH SAM. (1994). Shifting Cultivation in Vietnam: its Social, Economic and Environmental Values Relative to Alternative Land Use. IIED, London.

GOB (1993). Forestry Master Plan. Dhaka: Asian Development Bank, Manila (TA No. 1355 - BAN), Ministry of Environment and Forests, Government of Bangladesh.

ISHAQ, M. (Ed) (1971). Bangladesh District Gazetteers - Chittagong Hill Tracts. Dhaka: December, 1971, Ministry of Cabinet Affaires, Establishment Division, Bangladesh Government Press.

ISLAM, S. M. & ALAM, M. (2006). Review of Landuse Planning and Environmental Control of CHT. CHittagong Hill Tracts Improved Natural Resources Management (CHARM). Dhaka: Bangladesh Center for Advanced Studies (BCAS).

MANTEL, S. & KHAN, M. F. A. (2006). Chittagong Hill Tracts Improved Natural Resource Management. Proceedings of the National Workshop held in Rangamati, Bangladesh 15 - 16 February 2006. In CHARM Project Report 1 p. 50. Dhaka: CHARM.

MANTEL , S. TYRIE, G. R. & OOSTERMAN, A. (2002). Exploring Sustainable Land Use Options for District Planning in the Berau Regency, Indonesia. In International Symposium Sustaining Food Security and Managing Natural Resources in Southeast Asia - Challenges for the 21 st Century - January 8-11, 2002 at Chiang Mai, Thailand Chiang Mai, Thailand: Eiselen Foundation, University of Hohenheim.

MORRISON, E., DUBOIS, O. (1998). Sustainable Livelihoods in Upland Vietnam: Land Allocation and Beyond. IIED, London.

OLARIETA, J. R. RODRÍGUEZ-OCHOA, R. & ASCASO, E. (2007). Report of Work Package 3: Inventory of Land Management Practices and Sustainable Alternatives. CHARM project report. p. 56. Dept. Medi Ambient i Ciències del Sòl, Universitat de Lleida.

RASUL, G. THAPA, G. B. & ZOEBISCH, M. A. (2004). Determinants of land-use changes in the Chittagong Hill Tracts of Bangladesh. Applied Geography 24, 217-240.

TYRIE, G. R. & GUNAWAN, A. (1999). The environmental framework as a basis for forest management planning. In International Conference on Data Management and Modelling Using Remote Sensing and GIS for Tropical Forest Land Inventory (Ed Y. Laumonier, B. King, C. Legg, K. Rennolls), pp. 55-71. Jakarta: European Union, Rodeo International Publishers.

VAN ENGELEN, V. W. P. SHOAIB, J. U. M. & CHOWDHURY, E. H. (2007). Terrain and Soil Resources of the CHT. In State of the Environment of the Chittagong Hill Tracts. Report 2 of the CHARM Project, Dhaka, January Dhaka: CHARM project.

Zahid Hossain, M. 2001. Farmer's view on soil organic matter depletion and its management in Bangladesh. Nutrient Cycling in Agroecosystems, 61: 197-204.

Annex - A: Overview of indicator cluster rating for socio-economic and environmental indicators

Indicator Cluster / Distrcit/Upazilla		Socio - Economic Indicator (SI)							Environmental Indicator** (EI)								Total Weightage	Final Ranking
		Per Capita Income (Tk)	Literacy Rate	Population Density/ SqKm	Number of Ethnic Group	Economic Activities	Pahari (%)	Total Weightage (SI)	Non Agricultural Land (%)	Agricural Land (%)	Fallow Land (%)	Land Degration (%)	Perennial Crop (%)	Jhum & Annual Crop (%)	Forest Area (%)	Total Weightage (SI)		
District	**Upazilla**	**2001**	**2001**	**2001**	**1991**	**1991**	**1991**											
Khagrachhari	Panchhari	3609	31.18	190	4	49.11	58	84	3	30	49	34	6	13	19	128	106	1
Khagrachhari	Khagrachhari Sadar	3181	45.17	305	4	51.49	65	99	6	30	38	42	7	11	26	107	103	2
Bandarban	Bandarban Sadar	2839	43.66	132	8	53.82	52	89	3	30	48	10	9	10	19	108	99	3
Rangamati	Kaptai	2220	65.07	272	8	49.05	30	116	7	23	32	68	7	7	37	78	97	4
Khagrachhari	Dighinala	4047	51.02	132	4	50.46	59	84	3	21	52	67	7	7	23	107	96	5
Rangamati	Rajasthali	2643	31.12	161	5	49.91	76	94	4	29	39	68	8	10	28	97	96	5
Rangamati	Rangamati Sadar	1919	58.67	182	9	48.11	50	121	35	16	36	42	9	6	14	66	94	6
Bandarban	Rowangchhari	5228	23.33	49	9	58.48	89	69	1	23	49	84	8	10	27	118	94	6
Khagrachhari	Manikchhari	3192	47.6	299	4	53.43	32	89	3	41	29	6	7	10	27	93	91	7
Khagrachhari	Mahalchhari	4181	37.1	179	3	49.04	71	87	8	35	33	53	9	10	25	90	89	8
Rangamati	Jurai Chhari	5984	13.19	34	5	70.09	95	49	1	20	48	69	0	18	31	127	88	9
Bandarban	Ruma	6802	21.73	51	10	56.13	88	66	2	12	51	84	0	2	35	105	86	10
Bandarban	Naikhongchhari	3749	35.41	117	6	51.49	23	74	1	18	43	25	3	10	39	95	85	11
Rangamati	Belai Chhari	4599	36.67	146	9	37.74	82	111	6	8	27	92	8	0	60	56	84	12
Bandarban	Alikadam	4766	19.29	41	6	53.11	47	52	1	27	45	55	9	13	27	113	83	13
Khagrachhari	Ramgarh	2631	46.53	222	3	49.98	30	91	5	31	35	19	8	5	30	72	82	14
Rangamati	Langadu	5222	32.23	177	5	47.29	22	76	29	27	30	42	9	11	14	84	80	15
Khagrachhari	Matiranga	3961	40.25	204	3	50.77	26	75	1	38	22	9	14	12	39	82	79	16
Rangamati	Nanner Char	6551	32.37	97	2	46.87	83	68	11	27	34	36	7	10	28	85	77	17
Rangamati	Barkal	6777	33.81	56	3	56.76	69	44	13	14	46	65	1	13	27	105	75	18
Rangamati	Kawkhali (Betbunia)	6004	27.59	39	5	37.74	61	67	3	38	25	0	5	8	33	78	73	19
Bandarban	Lama	4920	21.18	121	5	49.48	26	60	3	28	44	25	10	8	24	84	72	20
Rangamati	Baghai Chhari	6010	34.98	43	6	47.7	72	80	3	9	19	36	3	2	69	58	69	21
Bandarban	Thanchi	6036	5.9	16	7	58.01	90	53	1	6	20	85	4	2	72	73	63	22
Khagrachhari	Lakshmichhari	6464	20.14	98	4	53.51	86	52	1	21	27	22	8	8	51	66	59	23

Annex - B: The priority list of problem clusters obtained from the grass root, union and upazilla level workshops

Union Level Workshop-1

Place: Bandarban Sadar

Date: September 6, 2006

Agriculture

Present	Problem	Future
Jhum	Loss of Production Loss fertility Lack of supply of Fertilizer Lack of financial capacity purchase fertilizer Lack of Jhum land Soil Erosion Loss of jhum land due to increasing reserve forest land	Cropping pattern change Multi crop in jume land Horticultural Kachu, Papya, zinger, turmeric, pineapple.
Agricultural practices	Tobacco, potato, Egg plant, veg., Paddy, Sugar cane, Lack of Fertilizer supply HYV seed, Insect, irrigation, Climate change, Lack of Communication, Market price, and access.	Proper policy HYV seed from BADC (Govt) Stop Tobacco cultivation (Maize) Wood tree in HH, Horticulture development in Medium HH in low slope area.
Forest	Deforestation (natural forest) Increase forest (plantations) Climate change Erosion Landslide Water resources decrease Loss of Flora and Fauna/Wild life	Private plantations or community reserved forest or social forestry development in areas not suitable for agriculture

Forest

Present status	Problem	Recommendations
Forest	Deforestation (natural forest) Increase forest (plantations) Climate change Erosion Landslide Water resources decrease Loss of Flora and Fauna/Wild life	Private plantations or community reserved forest or social forestry development in areas not suitable for agriculture

Water supply and sanitation

Present status	Problem	Recommendations
Source of drinking water (tubewell, ringwell, Chara/Khal)	Lack of water during dry season Waterborne diseases are spread such as Malaria, Diarrhea	Plant more trees to preserve the water Supply water using pipe or GFS from *jhiri,* ring well, pat well etc

Fisheris

Present status	Problem	Recommendations
River/ Pond /Lake/Jhiri	Lack of supply of fishes The supply of shrimp, Singh fish has decreased	Create reserved water bodies such as lake to cultivate fish near charas

Livestock

Present status	Problem	Recommendations
Cow, goat, boar, chicken, pigeon	Lack of veterinary services Lack of grazing land	Cow fattening program should be taken High breed goat should be raised

Infrastructure

Present status	Problem	Recommendations
Roads	The roads are not adequate	More roads need to be constructed Proper maintenance of the roads are required
Primary Schools/ Higher Secondary school (1)	There is not enough schools Lack of school teachers	More schools need to be constructed Proper maintenance of the schools are required More secondary/higher secondary schools are required
Sadar Hospital	Lack of services against the requirement Lack of supply of medicine	Health center is required at union level Create public awareness

Tourism

Present status	Problem	Recommendations
Toursit spots: Boga lake, Tongchingdong	Not yet developed Lack of proper tourist facilities	Development of tourism facilities such as resort and tourism based industry

Special recommendations: Create employment opportunities through the development of small and cottage industries for the local handicrafts, garments industry, agro-based industries, wood processing industries.

Union Level Workshop-2

Place: Tankaboti

Date: September 9, 2006

Agriculture

Present status	Problem	Recommendations
Jhum	Production capacity has decreased Lack of supply of fertilizer Lack of water supply Lack of financial resources to buy fertilizer Fallow period has decreased Soil fertility has decreased	Agro-forestry of mixed fruit and wood trees
Others: Vegetables (eggplant, Kumra, Kachu), Spices (Zinger, turmeric) fruit (Banana, Papya)	Soil fertility has decreased Lack of supply of fertilizer Lack of financial resources to buy fertilizer Lack of water for irrigation No cattle for plain land cultivation	Homestead gardening Protection against lisestock Water from stream using motor pump HYV seeds

Forest

Present status	Problem	Recommendations
Forest area	Number of trees in the forest area has decreased Climate has changed such as rainfall has decreased Illegal logging of forest trees by timber traders Jhum cultivation- area has increased, burning Corrupt practices by the department of forest	Free supply plants to increase forests Setup parawise nursery Training to setup nursery Social forestry in khas land or in land owned by forest department Private afforestation program

Fisheries

Present status	Problem	Recommendations
Fisheries	Low supply of fisheries Water snake (gui shap) and wildcat (utbiral) eat the fishes Lack of fish feed Lack of financial sources	Supply plants to increase forests Nets to protect the fish from water snake Training to cultivate fish in scientific way

Water supply and sanitation

Present status	Problem	Recommendations
Drinking water	Not possible to setup tubewells because of stone Water dry out during the dry season	Supply water using pipe or GFS from jhiri Lack of knowledge on water purification methods Increase forest area through afforestatision program
Sanitation	Lack of sanitary latrine Lack of awareness	Awareness program Lack of water to use sanitary latrine Community latrine I

Infrastrueture Development

Present status	Problem	Recommendations
Health and family planning center: Govt. Health Care centre1 (UFWC) and NGO health care center 2 (GRAUS)	Lack of health officer Lack of health care service	Increase health centre Increase medicine supply Increase health service
School: Govt. Primary school 2, Registered primary school 2 High school: There is no high school	Lack of teachers Poor condition of schools Low salary of school teachers	Create public awareness Provide for teachers Increase the number of primary schools

Tourism

Present status	Problem	Recommendations
Tourist spot	Not developed	Bottola jhiri - waterfall from 200 ft Marking para Singman para

Disaster management

Present status	Problem	Recommendations
Flood	Flood occurs in the plain land	
Landslide	Landslide occurs in the hilly areas	Plantation of trees in the steep slope of the hills to prevent the occurrence of landslide

Union Level Workshop-3

Place: Shualok

Date: September 12, 2006

Agriculture

Present status	Problem	Recommendations
Jhum/Jhum cultivation is not profitable	Land for jhum cultivation has decreased Production capacity has decreased Lack of supply of fertilizer Improper use of fertilizer Lack of financial resources to buy fertilizer Fallow period has decreased Soil fertility has decreased	Alternative agricultural practices such as agroforestry including fruit trees, spices, wood trees Adopt crop cultivation according to soil suitability Agricultural planning if different crops on short and long term basis Resolve land ownership issue for long term planning
Others: Vegetables (Cucumber, Shim, barbate), Spices (Zinger, turmeric) fruit (Banana, Papya), paddy	Soil fertility has decreased Lack of supply of fertilizer High cost of fertilizer Lack of financial resources to buy fertilizer Lack of water for irrigation during boro season No supply of ground water source	Training on different crop production including pesticide and fertilizer use, pest management Scientific research on cultivation of crop Create water reserve by damming the charas Provide fertilizer at low cost

Forest

Present status	Problem	Recommendations
Reserved forest, Private forest/ Plantations, Para reserve forest	No reserved forest area Land ownership problem Harassment of FD in selling trees from private forests/ getting permit Unplanned monoculture plantations such as segun, gamari causes soil erosion and decrease of fertility	Environment friendly tree plantations such as karai, jarul, garjan, champa, gudguddia Increase community/ samabai samity based para reserve forest area in each para Handover the govt. owned forest to the communities Workshop to create awareness on conserving forest resources

Fisheries

Present status	Problem	Recommendations
Fish is captured from open waterbodies, khal, charas	Fish supply has decreased Unplanned use of pesticides and fertilizers	Supply plants to increase forests Supply of fish fry according to the season Encourage fish cultivation through committees and union parishad Stop capture of fishes using the leaf of Mel tree Training on fish cultivation is required Integrated development of fisheries utilizing ponds in the plain land, creating artificial lake which can be used as source of irrigation water Create local hatcheries

Water supply and sanitation

Present status	Problem	Recommendations
Drinking water source: Tubewell, Jhiri, Jharna	The water quality is not tested Lack of tubewells The water of jhiri is polluted during the wet season The dried and rotten leaves pollutes the water	Testing of the water quality by the government Number of tubewells has to be increased Extraction of stones from jhiris should be stopped and the trees surrounding the jhiri should be preserved Jhum cultivation should not be conducted around the jhiri The water supply should be improved
Sanitation coverage in 60% area	Latrines are left unused due to lack of water	

Infrastructure

Present status	Problem	Recommendations
Roads	The roads are not adequate	More roads need to be constructed Proper maintenance of the roads are required
Primary Schools Higher Secondary school (1)	There is not enough schools in ward no. 7 Lack of school teachers	More schools need to be constructed Proper maintenance of the schools are required At least 3 secondary/higher secondary schools are required

Annex- B

Health

Present status	Problem	Recommendations
Primary Health service	Lack of services against the requirement Lack of public awareness	At least 3 health center is required for each union Create public awareness

Livestock

Present status	Problem	Recommendations
Cow, goat, boar, chicken	Lack of veterinary services Lack of grazing land	Cow fattening program should be taken High breed goat should be raised

Tourism

Present status	Problem	Recommendations
Toursit spots: Prantik lake, Shailo propat	Lack of proper management	Development of tourism facilities and tourism based industry Built up a resort in the belt of Chimbuk mountain

Natural disaster

Present status	Problem	Recommendations
Landslide		Encourage plantation of forestry Afforestation program in barren and erosion prone land Stop rock mining Stop cutting of mountains

Union Level Workshop-4
Place: Rajbila
Date: September 13, 2006

Agriculture

Present status	Problem	Recommendations
Jhum	Production capacity has decreased Lack of supply of fertilizer High cost of fertilizer Lack of water supply Fallow period has decreased Soil fertility has decreased Change in climate such as low rainfall	Alternatice practices such as agro-forestry of mixed fruit (mango, Banana, Pineaaple) and cash crops, wood trees instead of jhum Supply of fertilizer at low cost
Plainland Paddy, vegetables Others: Vegetables	Change in climate such as low rainfall Pest and disease of crops	Integrated pest management
(eggplant, Kumra, Kachu), Spices (Zinger, turmeric) fruit (Banana)	Soil fertility has decreased Lack of supply of fertilizer Lack of financial resources to buy fertilizer Lack of water for irrigation No cattle for plain land cultivation Improper pricing mechanism Marketing of products is difficult	Homestead gardening Training on horticulture Water from stream using motor pump HYV seeds

Forest

Present status	Problem	Recommendations
Reserved forest	There are no trees in the reserved forest area Corrupt practices by the department of forest	Social forestry in khas land or in land owned by forest department with the involvement of both local people and government will help conserve forest and save the environment Private afforestation program
Private forest (Segun, Gamari, Jam)	No others tree grows in segun planted areas Soil degradation is caused in segun planted area	Fruit trees instead of segun trees such as Mango for both wood and fruits Research on indegenous forest practices Bamboo trees help stop soil degradation Garjan cannot be used as its growth is slow
Rubber plantaions	Mountain rats create problem Biodiversity is lost	Profitable for production Increase plantation area of rubber through local ownership

Annex- B

Fisheries

Present status	Problem	Recommendations
Pond (20 nos.)/Lake	Low supply of fisheries Lack of fish feed	Create reserved water bodies such as lake to cultivate fish near charas Nets to protect the fish from water snake Training to cultivate fish in scientific way
Khal	Fish cultivation is not possible as pesticides used for agricultural production kills the fishes No water in the khals	Stop use of pesticides Training on integrated pest management

Water supply and sanitation

Present status	Problem	Recommendations
Source of Drinking water (tubewell, Chara/Khal)	Not possible to setup tubewells because of stone Lack of tubewells and GFS Lack of water during dry season	Supply water using pipe or GFS from jhiri, ring well, pat well etc Increase forest area through afforestatision program
Quality of water	Impure water of khal/chara causes different diseases	Lack of knowledge on water purification methods
Sanitation (20% pit sanitary latrine)	Lack of sanitary latrine Lack of awareness	Awareness program on hygienic sanitation practices Lack of water to use sanitary latrine

Infrastructure Development

Present status	Problem	Recommendations
Roads and communication	Access to schools, bazar, healthcare centres is difficult	Development of communication system from paras to schools, bazar, healthcare centres
Bazar	No communication from Tankhali bazar to Bandarban sadar	Construction of bridge in shilok khal Start the bazar
Education (Primay 11, High school 2)	Tankhali bazar is not working Lack of school facilities Lack of students	Create awareness
Health and family planning center 2	Lack of health officer and doctors Lack of medicine	Increase mouzawise health centre Increase medicine supply

Tourism

Present status	Problem	Recommendations
Tourist spot	Not developed	Tourist spot may be created using artificial lake

Disaster management

Present status	Problem	Recommendations
Natural disaster	No disaster occurred since 1998 Fire occur due to jhum burning	Precauitions for controlled burning during jhum cultivation

Livestock

Present status	Problem	Recommendations
Cow, goat, boar	Lack of manpower Lack of awareness Lack of livestock officer	Training on livestock development

Special recommendation: Provided electricity to 30 families by using chara water in Monjoy para of Nara Mauza by a local farmer. This endeavor should be extended to other areas.

Union Level Workshop-5

Place: Kuhalong

Date: September 14, 2006

Agriculture

Present status	Problem	Recommendations
Jhum (10%): Cotton, Marfa, Paddy, Vegetables	Lack of owned land for jhum cultivation as Forest department acquired land Production capacity has decreased Soil fertility has decreased Fallow period has decreased Lack of water supply Jhum burning create forest fire	Alternative practices such as agro-forestry of mixed fruit (Banana, Pineapple, Papya) and cash crops, wood trees instead of jhum
Plain land: Paddy, vegetables (Barbati, Kachu, Cucumber) Cash crops (Tobacco, Nuts), Spices (Zinger, chili) Banana, Sugarcane	Lack of irrigation water Lack of supply of fertilizer Lack of financial resources for purchase of fertilizer Lack of knowledge on suitable soil for crop cultivation Pest and disease of crops Lack of HYV seeds for cultivation No other crop cannot be grown where tobacco is grown also soil fertility is decreased	Integrated pest management Training on crop production according to soil Create dam for irrigation as per requirement Training on cultivation using modern technologies Proper supply of fertilizer and in low

Remarks: Tobacco cultivation is carried out because they get all the facilities such as loan, fertilizer, etc. The farmers face problems due to monopoly market.

Forest

Present status	Problem	Recommendations
Reserved forest (Rubber, Segun, Gamari, Garjan)	Private forest land near reserved forest area face problems in selling their trees FD acquires forest land	Social forestry in khas land or in land owned by forest department with the involvement of both local people and government will help conserve forest and save the environment Private afforestation program
Private forest: Wood trees (Garjan, Gamari), Fruit trees (Mango, Lichhi, Jackfruit, Guava, Jambura, Pineapple), Rubber plantations	No other tree grows in segun planted areas Soil degradation is caused in segun planted area	Fruit trees instead of segun trees such as Mango for both wood and fruits Create awareness against Segun plantations Training on cultivation of different fruit trees

Fisheries

Present status	Problem	Recommendations
River	The medicine used to capture fish destroys the fingerlings Navigability of river has decreased	Stop the use of such poisonous medicine by giving punishment and also create awareness Dredging of rivers
Pond (20 nos.)/Lake	Low supply of fish fingerlings Lack of fish feed Water storage capacity is low	Provide fish fingerlings Training to cultivate fish in scientific way Provide training and loan on fish cultivation
Jhiri	Too much rain washes away the fishes	Stop use of pesticides Create reserved water bodies such as lake to cultivate fish near charas

Water supply

Present status	Problem	Recommendations
Source of drinking water (tubewell, ringwell, Chara/Khal)	Not possible to setup tubewells everywhere because of stones Lack of tubewells, ringwell and GFS Lack of maintenance of ringwell Lack of water during dry season	Supply water using pipe or GFS from jhiri, ring well, pat well etc

Infrastructure Development

Present status	Problem	Recommendations
Roads and communication	Access to schools, bazar, healthcare centres is difficult	Development of communication system from paras to schools, bazar, healthcare centres
Bazar	No communication from Tankhali bazar to Bandarban sadar Tankhali bazar is at present closed	Construction of bridge in shilok khal Start the bazar
Education: Primary school 13 (Govt. 9, Non govt. 4) Junior High school 2, Vocational Technical school	Lack of school facilities Lack of students Lack of communication facilities to come to schools	Create awareness Provide stipends for students Increase the number of schools Provide additional facilities to the teachers to encourage them Appoint local area wise teachers
Health and family planning center: Govt. 1, NGO 4	Lack of awareness Lack of financial capacity to send children to schools Lack of health officer and doctors Lack of medicine Lack of communication facilities	Increase mouzawise health centre Increase medicine supply Provide housing facilities for the doctors

Annex- B

Tourism

Present status	Problem	Recommendations
Tourist spot	Not developed	Tourist spot may be created using artificial lake

Disaster management

Present status	Problem	Recommendations
Flood	No flood occurred since 1998	
Landslide	The roads are blocked due to land slide The agricultural land is destroyed	Plantation of trees in the steep slope of the hills to prevent the occurrence of landslide
Jhum burning	Fire occur due to Jhum burning	Precautions for controlled burning during Jhum cultivation

Livestock

Present status	Problem	Recommendations
Cow, goat, boar, chicken, duck	The grazing land for the livestock had decreased because of increased agricultural practice Lack of veterinary services Lack of training Lack of livestock officer	Training on livestock development Arrange veterinary services for the livestock

Remark: A local farmer provided electricity to 30 families by using chara water in Monjoy para of Nara mouza. This initiative should be replicated to other areas.

Upazilla Level Workshop-6
Place: Parjatan Motel, Bandarban Sadar
Date: September 14, 2006

Livestock

Present status	Problem/ Issue	Recommendations	Responsible Organizations
Jhum/Jhum cultivation is not profitable	Shortage of suitable land Loss of Production Lack of supply of Fertilizer Lack of financial capacity to buy fertilizer Lack of Jhum land Soil Erosion Loss of Jhum land due to increasing reserve forest land Production capacity has decreased Improper use of fertilizer Fallow period has decreased Soil fertility has decreased Declining biodiversity. Low Marketing of Jhum products Acquisition of land by the govt. Production capacity has decreased Lack of supply of fertilizer	Ensured Land ownership Adopt crop cultivation according to soil suitability Agricultural planning if different crops on short and long term basis Resolve land ownership issue for long term planning Training to Jhumias Improved seeds Alternative agricultural practices such as agro-forestry including fruit trees, spices, wood trees Land policy should be changed & permanent entitlement to the jhumia. Alternative practices for short, mid & long-term farming (cash crop). Low cost fertilizer supply. Improved fallow management. Conserve biodiversity Improved Marketing Stop unnecessary acquisition of land. Ensure Community Ownership Training, Motivation Introduction of LCC (Training, Motivation, Demonstration) To encourage for using the organic fertilizer	GoB, District administration, Traditional Institute, SRDI, HDC, BARI, DAE, BADC, Forest Department, NGOs

Agriculture

Present status	Problem/ Issue	Recommendations	Responsible Organizations
Plain land: Paddy Vegetables -Cucumber, - Kachu -Shim,	Soil fertility has decreased Lack of supply of fertilizer Lack of financial resources to buy fertilizer Lack of water for irrigation during Boro season Limited ground water source	Training on different crop production system including pest and disease management, fertilizer use, seed production, and storage etc. Training on crop production according to soil	GoB, SRDI, DAE, BADC, BARI HDC, DoF,

Present status	Problem/ Issue	Recommendations	Responsible Organizations
-Barbate) Spices -Zinger, -Turmeric - Chili Fruit -Banana, -Papaya -Sugarcane Cash crops -Tobacco, -Nuts	No other crop cannot be grown if tobacco is grown due to fertility declination Change in climate such as low rainfall Low Marketing facilities Lack of irrigation water Lack of knowledge on suitable soil for crop cultivation Lack of HYV seeds for cultivation No other crop cannot be grown where tobacco is grown also soil fertility is decreased High cost of fertilizer Non availability of quality seeds/saplings Lack of Knowledge on improved technology	Scientific research on cultivation of crop Preservation of Water by different means for harvest water for irrigation. Create water reserve by damming the charas Cultivation of Tobacco should be discouraged & alternate crop to be introduced Timely availability of different agricultural inputs like fertilizer, pesticide at reasonable cost Homestead gardening Integrated pest management Create dam for irrigation as per requirement Training on cultivation using modern technologies Proper supply of fertilizer and in low cost Supply of better quality seeds Easy access to financial support. Develop community based marketing facilities.	CHTDB, Hill District Council, BWDB, NGOs

Forest

Present status	Problem/ Issue	Recommendations	Responsible Organizations
Reserved forest, Private forest (Segun, Gamari, Jam)/ Plantations, Para reserve forest	Reserved forest area is not significant in the area Land ownership problem Harassment of FD in selling trees from private forests/ getting permit Unplanned monoculture plantations such as Teak, Gamari causes soil erosion and decrease soil fertility No reserved forest area Deforestation Forest cover destroyed due to poor forest mgt. Land ownership problem	Environment friendly tree plantations such as karai, jarul, garjan, champa, gudguddia Increase community/ samabai samity based para reserve forest area in each para Workshop to create awareness on conserving forest resources Social forestry in khas land (USF land) Promote private afforestation program Supply of improved planting material Free supply plants to increase forests Setup para-wise nursery and training to setup nursery Handover the govt. owned forest to the communities	Forest Department, BFRI, NGOs Land Administration, HDC, FD DoF

Present status	Problem/ Issue	Recommendations	Responsible Organizations
	Reserved forest area is not significant in the area Land ownership problem Harassment of FD in selling trees from private forests/ getting permit Unplanned monoculture plantations such as Teak, Gamari causes soil erosion and decrease soil fertility No reserved forest area Deforestation Forest cover destroyed due to poor forest mgt. Land ownership problem Harassment of FD in selling trees from private forests/ getting permit Lack of access of knowledge No others tree grows in Segun planted areas Soil degradation is caused in Segun planted area	Environment friendly tree plantations such as karai, jarul, garjan, champa, gudguddia Increase community/ samabai samity based para reserve forest area in each para Workshop to create awareness on conserving forest resources Social forestry in khas land (USF land) Promote private afforestation program Supply of improved planting material Free supply plants to increase forests Setup para-wise nursery and training to setup nursery Handover the govt. owned forest to the communities Recognition & Promotion of Village common forest (Mouza Reserve) Training on sustainable mgt. Ensure supply of quality material. Promote economically profitable plant such as agar, medicinal plants etc. Extend nursery development programme. Fruit trees instead of Segun trees such as Mango for both wood and fruits Research on indigenous forest practices Bamboo reduce soil degradation Garjan growth is slow	Forest Department, BFRI, NGOs Land Administration, HDC, FD DoF
Rubber	Mountain rats creates problem Biodiversity lost.	Rotten control Enhance biodiversity through establishing conservation plots.	
Tea	Lack of knowledge about tea cultivation.	Allot of suitable land Financial assistance. Capacity building.	

Fisheries

Present status	Problem/ Issue	Recommendations	Responsible Organizations
Fish is captured from open waterbodies, khal, charas	Fish supply has decreased Less supply of quality fingerlings Unplanned use of pesticides and fertilizers Low supply of fish fingerlike. Decrease water bodies	Establishment of local hatchery Construction of Dam in the natural stream for fish cultivation Establishment of sanctuary in the river Training on package based fish cultivation Supply of fish feed Ensure Supply of fish fry Encourage fish cultivation through committees and union perished Stop capture of fishes using the leaf of Mel tree Integrated development of fisheries utilizing ponds in the plain land, creating artificial lake which can be used as source of irrigation water as well as fisheries. Increase Marketing facilities. Dredging of the river.	DoF, Hill District Council, CHTDB, NGOs

Water supply and sanitation

Present status	Problem	Recommendations
Drinking water source: Tubewell, Jhiri, Jharna, Ringwell, Chara/Khal	The water quality is not tested The water of Jhiri is polluted during the wet season The dried and rotten leaves pollutes the water Lack of water during dry season Waterborne diseases are spreading such as Malaria, Diarrhea Not possible to setup tube-wells because of stone Water dry out during the dry season The water quality is not tested Lack of tube-wells, ring-well and GFS Lack of maintenance of ring-well Lack of knowledge on water purification methods.	Testing of the water quality Tube-wells installation Stop the extraction of stones from Jhiri and preserve the trees surrounding the Jhiri Jhum cultivation should not be conducted around the Jhiri The water supply should be improved Create surface water source through cross dam or other intervention Plant more trees to preserve the water Supply water using pipe or GFS from Jhiri, ring well, pat well etc Increase forest area through afforestation program Afforestation with right species in catchments area Rain Water Harvest

Present status	Problem	Recommendations
Sanitation coverage in 60% area Sanitation (20% pit sanitary latrine)	Lack of awareness Latrines are left unused due to lack of water Lack of sanitary latrine	Awareness program Introduce Community latrine I Ensure supply water by GFWSS Awareness Training, Motivation Awareness program on hygienic sanitation practices

Infrastructure

Present status	Problem	Recommendations
Roads	The roads are not adequate	More roads need to be constructed Proper maintenance of the roads are required
Education Sadar Hospital Health and family planning center Govt. Health Care centre1 (UFWC) and NGO health care center 2 (GRAUS) Health and family planning center: Govt. 1, NGO 4	There is not enough schools Lack of teachers Poor condition of schools Low salary of school teachers Lack of school facilities Lack of students Lack of communication facilities to come to schools Lack of awareness Lack of financial capacity to send children to schools Lack of services against the requirement Lack of supply of medicine Lack of health officer Lack of health care service Lack of doctors Lack of communication facilities	More schools need to be constructed Proper maintenance of the schools are required More secondary/higher secondary schools are required Proper maintenance of the schools are required Create public awareness More teachers needed Provide stipends for students Provide additional facilities to the teachers to encourage them Appoint local area wise teachers Health center is required at union level Create public awareness Increase health center Increase medicine supply Increase health service Increase mouza-wise health center Increase medicine supply Provide housing facilities for the doctors
Bazar	No communication from Tankhali bazar to Bandarban sadar Tankhali bazar is at present closed	Construction of bridge in shilok khal Start the bazar

Annex- B

Health

Present status	Problem	Recommendations
Primary Health service	Lack of services against the requirement Lack of public awareness	At least 3 health center is required for each union Create public awareness

Natural disaster

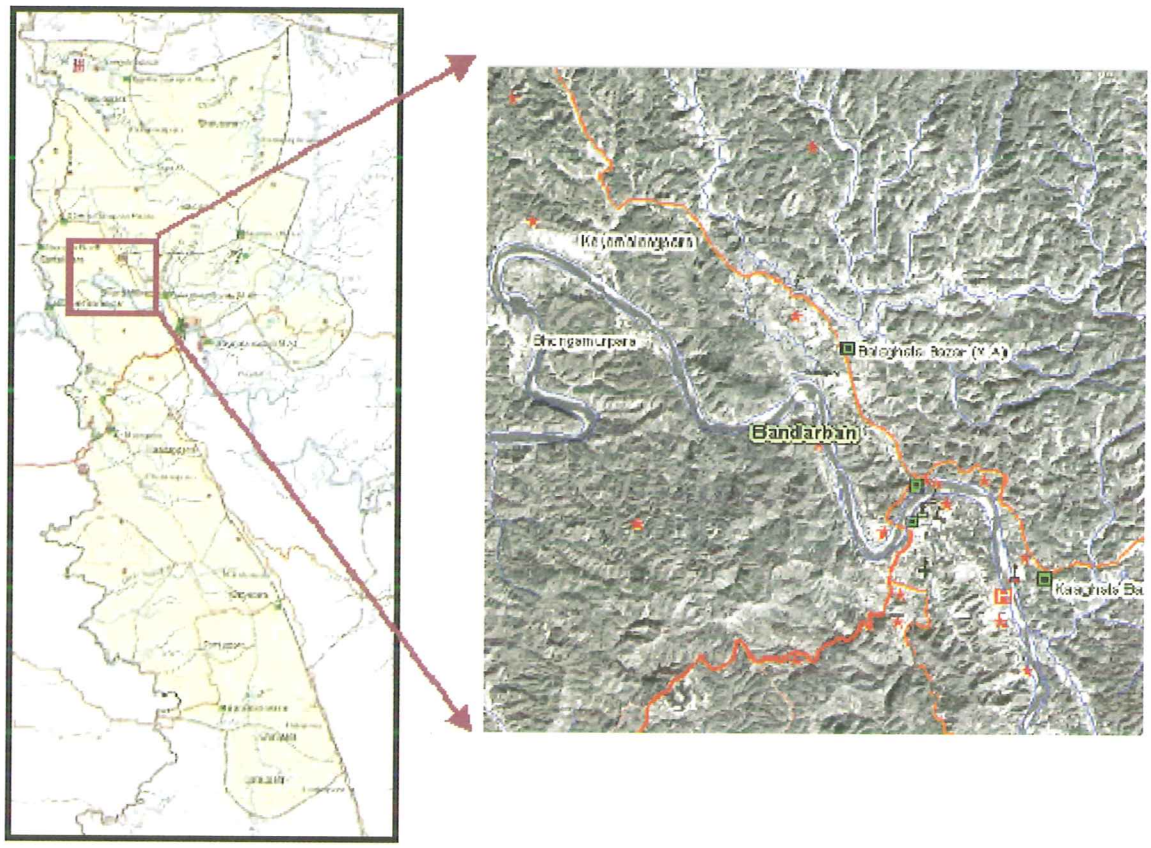
Present status	Problem	Recommendations
Landslide	The roads are blocked due to land slide The agricultural land is destroyed Landslide occurs in the hilly areas	Encourage plantation of forestry Afforestation program in barren and erosion prone land Stop rock mining Stop cutting of mountains Plantation of trees in the steep slope of the hills to prevent the occurrence of landslide
Flood	Flood occurs in the plain land	
Landslide	Landslides, Earthquake	Encourage plantation of forestry Afforestation program in barren and erosion prone land Stop rock mining Stop cutting of mountains Building Awareness

Livestock

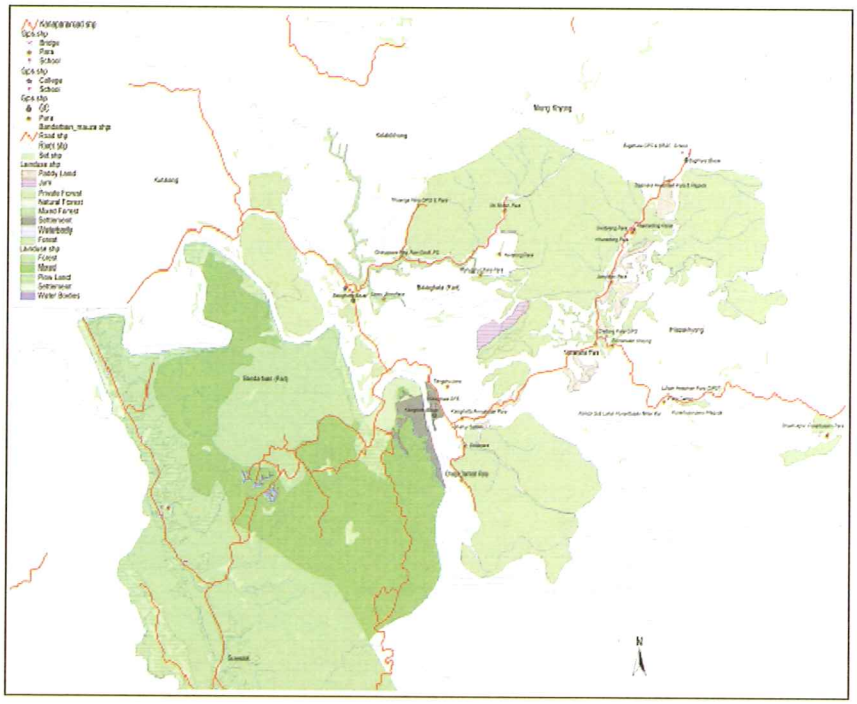
Present status	Problem	Recommendations
Cow, Goat, Boar, Chicken, Duck	Lack of veterinary services The grazing land for the livestock had decreased because of increased agricultural practice Lack of training Lack of livestock officer Lack of manpower Lack of awareness	Cow fattening program should be taken High breed goat should be raised Capacity building for livestock rare Provide veterinary services. Training on livestock development Arrange veterinary services for the livestock

Tourism

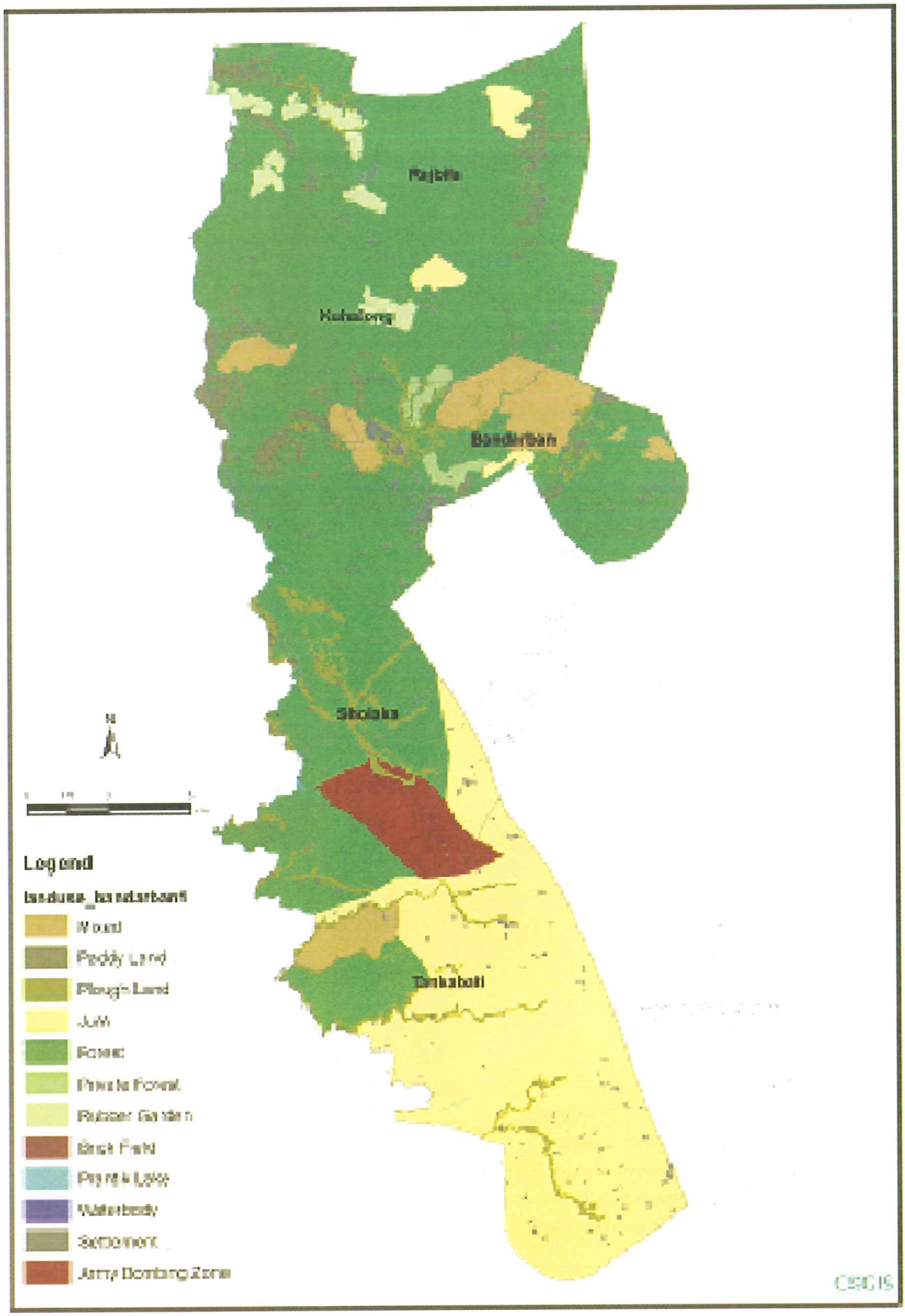
Present status	Problem	Recommendations
Toursit spots: Prantik lake, Shail propat	Lack of proper management Lack of Infrastructure and communication, media exposé.	Development of tourism facilities and tourism based industry Built up a resort in the belt of Chimbuk mountain Development of Eco tourism facilities and tourism based industry Built up resort.
Toursit spots: Boga lake, Tongchingdong	Not yet developed Lack of proper tourist facilities	Development of tourism facilities such as resort and tourism based industry
Tourist spot	Not developed	Bottola jhiri - waterfall from 200 ft Marking para Singman para Tourist spot can be develop by creating artificial lake
Jhum burning	Fire occur due to Jhum burning	Precautions for controlled burning during Jhum cultivation



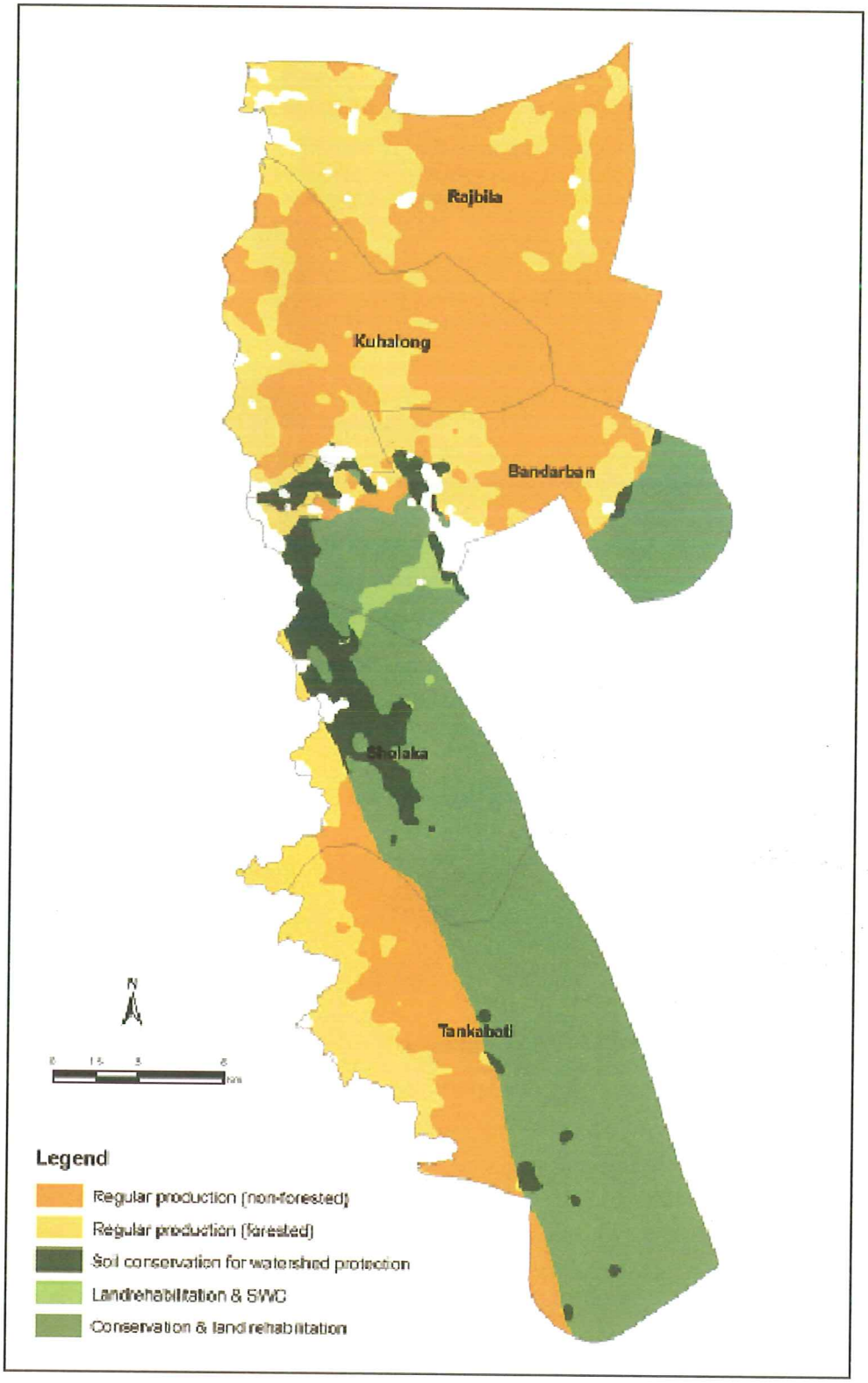
Map- 01 : Illustration of the creation of the Bandarban Sadar base map.



Map- 02 : Union level participatory land use map.



Map 03 : Participatory land use map of the Bandarban Sadar area.



Map 04 : Regional conservation and production priorities

Picture 01 : Educational Institution in selected areas

Picture 02 : Jhum land and plough land

Picture 03 : Discussions among participants on participatory resource mapping in Union level workshop

Picture 04 : Group discussion on NRM issues at union level workshop

Picture 05: Presentation and update of land use map at Union level

Picture 06: Hazaribak soil (photo: V.W.P. van Engelen)

Picture 07 : Deep Kaptai soil over siltstone in landscape of medium gradient hills (photos: V.W.P. van Engelen)

The environment in the Chittagong Hill Tracts (CHT) is under pressure. New methods must be developed, applied, and tested for sustainable management of the natural resources. Practical information is required at both the field and policy level. The Chittagong Hill Tracts improved natural Resources Management (CHARM) project aims at building capacity of different stakeholder groups for promoting sustainable natural resources management in the Chittagong Hill Tracts (CHT). CHARM targets a better understanding of sustainable management of the natural resources and the provision of an improved information basis for decision making with involvement and participation of target groups.

Center for Environmental and Geographic Information Services (CEGIS)
Bangladesh
Internet: http://www.cegisbd.com

Bangladesh Centre for Advanced Studies (BCAS)
Bangladesh
Internet: http://www.bcas.net

ISRIC - World Soil Information
The Netherlands
Internet: http://www.isric.org

Universitat de Lleida
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