In Search of the Pied Piper

Rapid Assessment of Impact of Rat Infestation on Livelihood in the CHT Region

Save the Children UK

Bangladesh

May 2008

In Search of the Pied Piper
Rapid Assessment of Impact of Rat Infestation on Livelihood in the CHT Region

EXECUTIVE SUMMARY

Bamboo is literally the stuff of life for the hillmen; and it is no different for the people in the CHT districts. But the bamboos are known to exhibit mast seedling – depending on the species, the intervals range from 3 to 120 years. The mass deaths of bamboos after flowering causes havocs for humans in the vicinity, which may last three to four years or more. The ecological balance is initially disturbed in two respects – (i) feeding on nutritious seeds, the rodent population increase at a pace far greater than their historical norm; and (ii) in forests with significant presence of bamboos, almost 70 percent of which happens to be of the same specie (*Bambusa baccifera*, or *Melocanna baccifera*, commonly known as *Muli baansh*), death of these plants creates significant open space to induce competition amongst plants as well as humans. The dynamics set in by the initial imbalance affect human lives in more than one ways, and currently, we are possibly at a stage when the size of imbalance is still in the process of getting big and the factors to bring things back to some semblance of 'normal' are yet to set in motion.

In brief, the objectives of the study, undertaken over a period of 15 days (8 – 22 May 2008) were to:

- assess how households' overall ability to access food and income been affected; and
- identify interventions and assistances required so that the affected households may return to normalcy?

The study is based on extensive review of existing knowledge compiled in the published literature, including the scientific journals; cross-checking some of these with local persons and key informants; and undertaking extensive consultations with different stakeholders and probing into secondary survey data in order to arrive at certain parameter. All these are put together to arrive at an average picture on the size and duration of the impact source (bamboo flowering and rat infestation), and impacts on livelihood of affected people in the CHT region, particularly the poor, in the short and medium terms.

It was recognized that the series of interlinked incidents whose impacts were under scrutiny did not allow an *ex facto* impact assessment. The process still continues; and therefore, it was deemed necessary to identify probable future scenario, and assess livelihood implications under the presumed scenario. In the absence of hard data to predict future with certainty, some of the assertions made will remain conjectural and tentative. Noting this limitation, the observations and study findings are summarized below.

While there may have been some sporadic bamboo flowering, reports from all places along the terrain running south from Baghaichhari to Barkal, and further south from Rawangchhari, to Thanchi, suggest that 'gregarious' flowering of the Muli bamboos occurred and the fruits came during January – May 2007. Most reports suggest that about one-fourth of the bamboos flowered during this period; a half flowered by May 2008, which was visible during field

visits; and it is expected that the rest, one-fourth or less, will flower in the coming year (early 2009). For some parts, flowering may continue till 2010.

Rat infestation, that followed bamboo flowering, caused crop damage (in Jum cultivation) in the eastern-most hills (mostly under reserve forests) during 2007. This has spread to the west, and in some instances to the plain land. Since Jum cultivation in 2008 had commenced only in Bandarban (prior to our field visit), reports of seed-damages came only from this district. It is anticipated that more such instances will be reported in the coming days and months in other districts as well, at the least, till the rainy season comes in full swing.

Jum cultivators primarily depend on own production, or on production within the community, for their staple food, rice. In areas where crop was damaged in 2007, there is severe shortfall of food. This is likely to intensify and spread in the coming year. The crop calendar on Jum and other economic activities of the Jum cultivators suggests that June, July and August are the three months food insecurity is at its worst even in a normal year. With crop loss due to rat infestation, there are apprehensions of localized famine.

While the relatively richer households had to face a greater loss, the adverse effects are more on education of their children, healthcare, business, etc. The poor households, in addition to crop loss, have been and will be severely affected because of reduced employment arising from reduced areas under Jum cultivation, and drastic loss in bamboo forest whose harvesting will no more be there for several years. There are reports that the reduced demand for labor has also led to almost 40 percent reduction in daily wage rates in some of the eastern hilly areas. For all households in the area, as well as in the neighboring regions, quality of housing will be adversely affected due to non-availability of Muli bamboos and price increase expected to surface.

Recommendations are grouped into two sets – those feasible over the next three months, and those to be pursued over a longer period. Over the short term, the following actions are suggested:

- Undertake immediate initiatives to **reach out to the affected people with food**. No unique prescription may be made on the modality of supports – cash or kind. The choice amongst the two is contingent upon where the point of distribution is. It is important to assess the choices of the target population within which he/she is indifferent between receipts in cash delivery in one location and delivery of food in another location, and then choose the one that is cost effective from the perspective of the sponsor.
- The need to ensure food supports **is till the next Jum harvest (if there is one), which is September 2008**. No specific suggestion on the size of required distribution is made in the paper in the absence of additional information. However, there is a need to revisit the issue of targeting individuals as opposed to communities. Till now, initiatives have centered on identifying individuals and distributing to those individuals through supports from NGOs. Given the nature of information available and the way these information feed into decision making at

higher tiers, **targeting communities may be a more reliable and cost-effective route to follow, with random independent monitoring in place**.

- Several activities suggested for creating employment opportunities include:
- **Community-level sanitary and livelihood improvement measures, including land improvements**
- **construction of small roads & culverts in RMP style**
- **improve the water distribution lines** (where these exist)

- The most important task in both the short and medium (3 to 4 years) term is to identify and implement schemes to check the growth in rodent population and reduce it to a balanced level. The critical first step is to **institutionalize Surveillance of Rat Population and Tracking their Movements, as well as monitoring of unusual crop damages linked with attacks from rodents and/or other animals**. Participation from scientific community in such initiatives is highly recommended.
- A hypothesis put forward in this paper is: the rats will mostly remain indoors in their burrows during the rainy season. Therefore attempts may be made to **target these rats in their burrows during the coming three months**. One may think of other innovative schemes, and **SCUK may call for such innovative ideas (for a prize-money) through advertisement in local dailies, which will also sensitize the issue**. The pros and cons of providing incentives to local people in the form of **prize-money for tails of dead rats** may also be considered.
- In anticipation of rat plague, there is a **need to build awareness on do's and don'ts in the event of such a plague**. There is also a need to **establish appropriate property rights** to ensure improved management of the forest resources. It is high time that policymakers in Bangladesh **address the issue of a separate bamboo policy** – for sustenance of livelihood in the hilly regions of CHT as well as for running its paper mills and supporting the needs of its housing industry. It is equally important to **review the roles of the Department of Forestry**, which is *de facto* guardian of the reserve forest with no revealed responsibility for managing its resources, and **review the roles of DAE and upazila agriculture offices and their capacity to support improved agriculture on hill slopes**. Over the short term, **SCUK may consider engaging its resources to identify priority policy areas and advocating for adoption (and implementation) of those policies**.

Some of the short-term measures, such as food aid and employment schemes, will have to be continued; and few additional ones have to be addressed beyond September 2008. These include:

- Create employment opportunities by implementing new schemes:
- **construction of roads using local labor** (large scheme)
- construction of small roads & culverts in RMP style
- **excavate streams**, which is feasible only after the rainy season
- Increased **plantation of timber and other remunerative trees**

- There is a need to seriously look into the feasibility of **banning Jum cultivation in limited areas.**

- Continue to build awareness on do's and don'ts in the event of such a plague
- Continue programs to ensure re-generation of Muli bamboos
- Since food is the concern and there will be shortfalls in local supply of rice, there have been recommendations to **promote other food items** in the area though giving away saplings to the Jum farmers. SCUK may consider **giving away cash to buy saplings of banana and papya** amongst affected farmers upon prior consultations. In addition, **cultivation of ginger and turmeric,** which are considered repellent to rat population, may be promoted.
- **Advocacy for a separate bamboo policy may be made and there is a need to review the roles of the Department of Forestry in bamboo forest management.**
- **Review the roles of DAE and upazila agriculture offices and their capacity to support improved agriculture on hill slopes**

In Search of the Pied Piper

Rapid Assessment of Impact of Rat Infestation on Livelihood in the CHT Region

Sajjad Zohir[*]

8 June 2008

> "The bamboo is literally the stuff of life. He builds his house of bamboo; he fertilises his fields with its ashes; of its stem he makes vessels in which to carry water; with two bits of bamboo he can produce fire; its young and succulent shoots provide a dainty dinner dish; and he weaves his sleeping mat of fine slips thereof. The instrument with which his women weave their cotton are of bamboo. He makes drinking cups of it, and his head at night rests on a bamboo pillow; his forts are built of it; he catches fish, makes baskets and stools, and thatches his house with the help of the bamboo. He smokes from a pipe of bamboo; and from bamboo ashes he obtains potash. Finally, his funeral pyre is lighted with bamboo. The hillmen would die without the bamboo, and the thing he finds hardest of credence is, that in other countries the bamboo does not grow."
>
> (Lewin, 1869)

"Across much of South and Southeast Asia, episodic rodent outbreaks in upland habitats are understood by traditional farmers to be triggered by the episodic and synchronised flowering and seeding of bamboos (Parry 1931; Janzen 1976; Chauhan and Saxena 1985; Rana 1994; Singleton and Petch 1994; Schiller et al. 1999). This process, otherwise known as bamboo 'masting', involves the production, usually over a period of one or two years, of large quantities of highly nutritious seed, which is believed to trigger explosive increases in rodent populations within the bamboo forest habitat. Following depletion of the bamboo seed-fall, mass emigration of rodents into adjacent agricultural habitats is claimed, leading in some cases to heavy crop losses and even famine (Singleton & Petch 1994; Nag 1999; Schiller et al 1999). ... To date there has been no detailed study of this important ecological phenomenon."

(Douangboupha1 *et al* 2003)

> "Territoriality, dispersal, reproductive suppression, and infanticide have the potential to limit the rates of population growth, however they appear to play a relatively small role in stabilising or regulating (rodent) populations. Extrinsic factors such as food limitation, predation, and disease (are) likely (to) play a much larger role in population regulation of rodents than do intrinsic factors."
>
> (Wolff 2003)

---

[*] The author is a Director of the Economic Research Group. An early draft of the paper, commissioned by the Save the Children UK, was prepared in May. Current revision benefited from comments and suggestions received during a For , please contact *sajjadzohir@gmail.com*.

Section 1
INTRODUCTION

1.1 Recasting the Focus

The objective of rapid livelihoods assessment, undertaken over a period of 15 days (8 – 22 May 2008) was to address the following questions[1]:

- What were different people doing for a living before the disaster?
- How have each of those activities been affected by the disaster? And therefore, how has households' overall ability to access food and income been affected? What impact is expected to have on children's lives?
- What would be required for households to return to the way things were before the disaster? What will households do to cope by themselves? What assistance would different households need to return to normal?

When an event, identified above as 'disaster' and often considered an external shock, is perceived as a one-shot happening, one may look into the effects of the event by comparing the post-event situation with pre-event situation, controlling for the influences of other variables to which some of the changes may be attributed. The happenings in parts of CHT, termed by some as 'rat infestation', others by 'gregarious flowering' of the bamboos, are still on-going, and therefore, an ex-post analysis of the impacts of these 'happenings' may only be addressed in speculative manners. More importantly, the processes that embody the 'external shock' are largely biological – for both the bamboo specie and the rodents whose demographic statistics changed as a result of feeding on bamboo flowers and fruits. Within the scientific community, inquiries into the relations between the two biological processes and the demographic dynamics within the rodent population largely remain inadequate. For obvious reasons, assumptions on the unfolding reality will remain speculative, and so will the assessment on livelihood impacts and the measures to be suggested for countering and/or reducing the adverse impacts.

The first part of this paper (Section 2), following the introduction, will therefore describe the processes that embody the event associated with 'disaster'. It will also attempt to map the sequence of events as reported by respondents during field visits and based on compilation of information from secondary sources. Section 3 addresses the first two objectives with a view to assess the impacts on livelihood – both current as well as those perceived in the coming months and years. The concluding section recommends ways to ameliorate sufferings of the affected population for outside agencies such as the SCUK. Rest of this section discusses the methods and sources of data.

[1] See the Terms of Reference in Annex 1. The concepts, particularly of 'disaster', are reformulated for the study undertaken.

1.2 Methodology and Sources of Information

Of the three components looked into by SCUK, this paper reflects the works undertaken by the Livelihood Expert, who undertook initial readings of newspaper articles, reports and articles available through the internet, and by accessing scientific journals which are otherwise restricted to onlookers. The reading continued through out the study period, which included eight days of field visit in the CHT region. Several highlights of the field visits are noted below while a list of persons met in Dhaka and elsewhere is included in Annex 2.

- Ali Kadam, Bandarban: (i) Meet and discuss with key informants, officers at Upazila Agriculture office, and Upazila Forest Officer. (ii) Visit a relatively remote area and interview a group of Jum[2] cultivators of Mro origin. (iii) Interview bamboo cutters/sellers.
- Chimbuk and Karpu Para, Bandarban, and along the road to Thanchi: Undertake several group discussions with Headmen, Karbaris and Jum cultivators. Collect information from several market places/bazaars.
- Bandarban Sadar: (i) Undertake group discussion with staffs from several local NGOs, facilitated by GRAUS. (ii) Meet Upazila Agriculture and Forest officers, as well as the BBS officer. (iii) Discuss with executives in local UNDP office. (iv) Interview bamboo traders in the Bandarban bazaar.
- Ruma and along the way: (i) Jum cultivators who were planting seeds in their fields for the current season. (ii) CCDB staffs of Bawm origin. (iii) Staffs of Green Hill and Padakkhep. (iv) Visit a Marma para (Bagan Para) across the Kaikhyan Jhiri Bazaar of Paindu Union and interview several Jum cultivators.
- Rangamati Sadar: (i) Meet WFP and UNDP officials. (ii) Discuss wit the SCUK field staffs many of whom are working with local NGOs and have been exposed to the events in the region. (iii) Meet member of Regional Council. (iv) Visit Barkol bazaar and undertake discussion (both bilateral and in groups) with people from most affected areas – Rakhayang and Ayemachari.
- Due to uncertainties with availability of local contacts, the visit to Khagrachari and to Baghachari (of Rangamati district) had been postponed.

In a situation where the events (whose impacts are being assessed) have already occurred and there is *a prior* understanding on the impact pathways, one may rely on the traditional approach that involves: (i) developing assessment tools & guidelines; (ii) undertaking qualitative field exercises and stakeholder consultations; and (iii) compiling findings obtained by using those tools. Initial consultations and readings revealed that there were large gaps between knowledge accumulated over the years with which the present-day professionals are not always up-to-date, and the general understanding of

[2] "Indigenous peoples are traditionally dependent upon swidden agriculture locally known as *jum* cultivation. Jum is also known as 'rotational' or 'swidden' agriculture. To the indigenous peoples of the CHT, *jum* is more than a farming method: it is a source of knowledge, inspiration, and a tangible expression of their struggle to protect their distinct culture and identity. An indication of this important linkage is the term used to describe the indigenous peoples of the CHT. They are collectively known as *Jumma*, meaning 'hill people who practise *jum*'. Although originally used as a derogatory term, it has evolved into a symbol of collective identity and pride in a rich cultural heritage". (pp. 5-6, UNDP 2007).

various tiers of practitioners (local bodies, NGOs, relevant local administration, development partners and policymakers).[3] The current assessment chose to undertake extensive review of existing knowledge compiled in the published literature, check some of these with local people and key informants, and arrive at certain parameter values from consultations as well as from secondary survey data. All these are put together to arrive at an average picture on the size and duration of the impact source (bamboo flowering and rat infestation), and impacts on livelihood of affected people in the CHT region in the short and medium terms. Data on CHT compiled by the national statistical agency are always viewed with suspicion because of both inadequate coverage and inappropriate statistical categories used during surveys. The study however benefited from draft report of UNDP-CHTDF sponsored "Socio-economic Baseline Survey of Chittagong Hill Tracts (CHT)", conducted by Human Development Research Centre (HDRC)[4].

Section 2
UPDATE ON BAMBOO FLOWERING AND RAT INFESTATION

2.1 Brief on the North of the Border

As of March 2006, sporadic flowering of *Melocanna vaccifera* was reported during February-July months in all years from 2002-06 (GOM 2006). While this was confined to fewer locations till 2003 and most in 2004, sporadic flowering was observed in all bamboo growing areas in Mizoram during 2005. Increased rodents populations on the sporadic flowering areas were not observed. A gregarious flowering of *Melocanna baccifera* was first observed during the months of January to July 2005, at Mamit District in the western part of Mizoram, covering an estimated area of 500 hectares. By the year 2006, gregarious flowering is roughly estimated to have covered about 1/4$_{th}$ of the bamboo growing areas in Mizoram (see Table 1).

Survey of rodent incidence and their population, covering all the Agricultural districts in the Mizoram State, was done twice during 2004 – 05; and the intensities of rodent incidence and their population were observed to have been below 'Economic Threshold Level' (i.e. below 15 live burrows per hectare). While no new finding on rodent population is reported, GOM (2006) mentions of several villages where the crop damage was higher than 10% of produce (around 12% in most cases). The scenario had possibly changed drastically by the end of 2007. Goswami (2008) reporting in April 2008 mentions that the rodent population had increased by many folds (from thousands to millions) within a matter of (preceding) four months, and more than 10 percent of the population went without staple food since February 2008.

[3] One may rationalize the failures in inter-generational transfer of knowledge on account of long gestation of around 50 years between two flowering & mast seedling of the particular specie of bamboos. The State of Mizoram in India had however predicted the outcome and had a Bamboo Policy in 2002 and a program to counter possible famine in place by 2004 (see Annex 3 for details). Quite ironically, the CHARM project did not provide any signal on the upcoming event (see Mantel et al 2006). It is however true that the last incidence of bamboo flowering of this scale overlapped with the period of displacement (in Rangamati and Khagrachari districts) due to Kaptai Lake.

[4] The SCUK has commissioned HDRC to do a situation analysis of three districts of CHT based on this data.

Table 1
Year-wise observation of flowering of *Meloccana baccifera* in Mizoram, India

Year	# of locations where **sporadic** flowering observed	Proportion of area where **gregarious** flowering observed
2001	3	
2002	33	
2003	25	
2004	in almost all the bamboo growing area	
2005	in all the bamboo growing areas	Mamit district in western Mizoram
2006	-	¼ th of bamboo growing area in Mizoram
2007	-	

Source: Compiled from information provided in GOM (2006).

2.2 Unfolding events in Bangladesh that largely remained unattended

It is possibly the article by one Hari Kishore Chakma in a national Bangla daily in April 2007 which first raised concern with possible rat infestation as a result of bamboo flowering and on subsequent crop damage and famine that were locally anticipated to follow. The anticipation had a long empirical basis (see Table 2 below) that the people of all colors and shades were ignorant about and had difficulties in accepting other than as myths! The author of this report has been appalled by the level of ignorance at all levels and agencies – ranging from community bodies, NGOs, international agencies/development partners and government agencies. There has not been any attempt towards tracking of events, nor did we learn of any initiative to do so in a coordinated manner.[5] Amongst publicly available documents and articles, we have names of upazilas where UNDP is currently distributing food, there have been reports in the national dailies identifying names of unions and upazilas where there have been reports of bamboo flowering and/or rat infestation. We had also tried to compile

Table 2
Records on Past Flowering of *Melocanna bambusoides*,

Locality	Flowering dates (Years)	Inermast period (# of years)
Lushai Hill, Assam	1864	
	1911-1912	47-48
Greater Chittagong	1863-1866	
	1908-1912	42-49
	1958-1959	46-51
	2006-2010	47-51

Source: Janzen (1976)

[5] Undertaking an initiative on tracking requires coordination among several agencies, both horizontally and vertically. Lack of awareness amongst most relevant agencies, the politics in the hill districts, unfortunate absence of ownership of bamboo issue within government agencies amidst lack of coordination between the department of forestry and the department of agriculture, and inertia within the community of development partners are perceived to be possible reasons for the current state.

information on recalls of respondents on the timing of occurrences. Based on all these, the chronology of events is summarized below.

Bamboo flowerings have been reported and/or observed primarily along two terrains, running north to south. The first covers the high hills that run along the Mizoram and Myanmar borders – Baghaichhari, Barkal, Ruma and Thanchi – much of which are under reserve forest. The second runs along the Chimbuk Hill that lies in-between Sangu and Matamuhari rivers – much of which are non-classed forest given out on lease to communities, or within the jurisdiction of the Community Land. There are recent reports of wide spread bamboo flowering in Khagrachhari district, not recorded by any agency prior to 2007.[6] It is unclear if this is a west-ward extension with lead flowering in Mizoram, or if it is one originating in Tripura State in India.[7]

While there may have been some sporadic bamboo flowering, reports from all places along the terrain running south from Baghaichhari to Barkal, Rawangchhari, Ruma and Thanchi, suggest that 'gregarious' flowering of the Muli bamboos occurred and the fruits came during January – May 2007.[8] Most reports suggest that about on-fourth of the bamboos flowered during this period. Another half flowered, which was visible during field visits made during May 2008, during January – May 2008. It is expected that the rest, one-fourth or less, will flower in the coming year (early 2009).[9] List of upazilas affected is given in Table 3, and the Map in Annex 4 shows the areas and possible route of flowering.

Table 3
List of Affected Upazilas where Bamboo flowering has been Reported

Upazila 1		Upazila 2	
Primary: lead to tail	Secondary	Primary: lead to tail	Secondary
Baghaichhari		Dighinala	
Barkal	Rangamati	Matiranga	Panchhari
Juraichhari	Langdau	Mohalchhari	Khagrachhari
Belaichhari	Rajasthali	Laxmichhari	
Rowangchhari	Bandarban		
Ruma	Lama		
Thanchi	Ali Kadam		

Note: Those identified under Upazila 1 fall in the spread line with a lead in Mizoram. Those under Upazila 2 are less clear and reports on them have been recorded only since early 2008.

[6] Majumdar (2008) reports of 45 villages in eight upazilas. Of these, 15 villages are in Dighinala, 10 in Laxmichhari, 5 in Matiranga, 10 in Mohalchhari and five in remote Panchhari upazila.
[7] The initial UNDP assessment identified only seven upazilas as affected; Baghaichhari, Barkal, Juraichhari, Belaichhari, Rowangchhari, Ruma and Thanchi. Since a visit could not be made to Khagrachhari, no firm assertion may be made on the nature of spread of flowering.
[8] We use Muli instead of Melocanna baccifera or its synonym Melocanna bambusoides.
[9] It is quite possible that much of the remaining Muli bamboos will be harvested before these flower. Moreover, the visual impression in accessible areas suggest that the proportion of standing Muli bamboos that did not flower, particularly in Ruma and Barkal upazilas, could not be more than one-fourth of what was standing dead with fruits. The proportion was higher in the south – Lama and Ali Kadam.

Based on information obtained, it appears that the area is now experiencing the peak period of flowering; and Bhaghaichhari, Ruma and Thanchi are likely to be in the middle of lead and tail, which are normally expected to be worst affected. While the tail is expected to lie in the south bordering Myanmar, the disjointed west-ward expansions may suggest planting of bamboos, over the years, closer to human habitats at the bottom of hill slopes and valleys.

Evidence on rat infestation has generally been indirect; and crop damage (at some normal level) by rats, birds, wild boars, monkeys and wild fowls is a regular phenomenon.[10] Of all reported cases, majority would mention of crop damage and/or show the burrows (rat holes in the fields or river banks), or of whizzing sound they have heard during the nights. Only in few instances have the respondents seen a 'flood of rats' swarm into their paddy fields. There have however been reports of several rats trapped into a bucket of water, people clubbing down hundreds of rats driven down to the banks of rives, and many dropping down from a single tree and vanishing into the night. We looked for answers to two questions: did it follow the path of bamboo flowering – partially, or wholly? And, did the rats attack plain lands as well, or were these confined to Jum cultivation only?[11]

Reports obtained on the eastern-most range running from Baghaichhari to Thanchi all confirm massive rat infestation and almost 100 percent damage of Jum crops during 2007 in several parts of that region – there is no plain land crop in that remote part. Incidence of rat attacks beyond normal level did not possibly spread to the west during 2007. This is however no more true, and we have come across villages in Pandui union (mid-way between Bandarban and Ruma), Karfu Para in north Lama and along the hilly slopes of Ali Kadam where the rat population has increased visibly and there have instances reported on damaging the seeds planted during early May 2008.[12] There have also been reports (in Bagan Para and in some parts of Lama) of rats damaging crops in plain land, particularly at the bottom of hills near the river banks. Incidence of rats engaging in aggressive actions in the homesteads (beyond the usual ones) has also been reported in some of the Jum Ghars (shades where several Jum cultivators rest and store their harvests temporarily) and residence in Kalai Para and Boilpara of Jibon Nagar union, Baganpara in Pandui Union and Barkal area.[13]

[10] BAFFACOS's reports suggest that Mizoram Government considered damage upto 10% to be normal. Respondents in Bandarban Sadar area and those along the Chimbuk Hill also supported this figure. Rodents are major agricultural, urban and social pests across much of the developed and developing world. In Asia alone, the amount of grain eaten by rodents in rice fields each year would provide enough to feed 200 million Asians for a year, with rice providing 50–60% of their daily calorific intake.

[11] Some of the recently concluded assessments spend time on speculating on reasons of rat infestation. Since the literature is available to identify areas of consensus and unknowns among scientific community, we do not discuss this here. One may look into the references mentioned at the end of this report.

[12] Bandarban had early rain this year and Jum planting (of seeds) began late April to early May. This was not so in Rangamati and Khagrachhari districts.

[13] We heard of a single incident of death of a child due to rat biting, which could not be confirmed by any of the NGO/ MFI staffs we met at Ruma bazaar.

In summary, rat infestation and subsequent crop damage (in Jum cultivation) occurred in the eastern-most hills (mostly under reserve forest) during 2007. This has spread to the west, and in some instances to the plain land. Since Jum cultivation this year had commenced only in Bandarban (prior to our field visit)[14], reports of seed-damages came only from this district. It is anticipated that more such instances will be reported in the coming days and months in other districts as well.

A recently completed Joint UN Mission (in April 2008) is said to have **not** identified any additional affected area (upazila) beyond the seven upazilas listed in the previous assessment. One may therefore question the wider coverage of flowering and potential rat infestation mentioned above. During our field visits in May 11-18, we have seen wide spread flowering in parts of Bandarban Sadar, Lama, Ali Kadam and Rangamati Sadar. Moreover, we have interviewed Jum cultivators in Ali Kadam and in Karfu Para (under Lama upazila) where some fields had been attacked by rats whne the Jum paddy was ripe last year (2007). In addition, reports published in national dailies clearly indicate of flowering and rat infestation in parts of Khagrachhari as well. Given the past history of mast seedling to last for two to three years, and the movement from lead to tail (see Janzen 1976), and the limited information obtained from recalls made by people from remote affected areas as well as the more accessible places, it is more likely that sticking to seven upazilas may be too narrow. Moreover, we will fail to appreciate the duration of adverse conditions unless we take into cognizance the reporting from grassroots.

2.3 Several Conjectures on Flowering, Rodent Biology and Crop Damage

As noted in Section 1, the events are unfolding every season; and the phenomena involving bamboo flowering and its consequences are expected to continue for few years, and spread to some additional areas not affected yet. In order to assess the implications of these phenomena on the livelihood of local population, it is necessary to make a set of assumptions on how a new ecological balance will be reached, how long it will take, and what will be the new configuration (that is, mix of different habitats, including humans). Dealing with science of ecological changes is beyond the scope of the present study; yet, it is necessary to make these conjectures to identify outcomes and desired external interventions to influence those outcomes.

1. While there is no hard data, we assume that one fourth of all standing Muli bamboos had flowered during 2007, another half or more have flowered in 2008, and the rest (less than one-fourth) will flower during the first half of 2009.[15] While the above pattern is presumed to prevail across most parts of CHT, there are reasons to believe that in parts of Khagrachhari district, and in some areas of

[14] It is learnt that rain came late this year in Rangamati and Khagrachhari.
[15] It is no new discovery that Muli bamboos flower during the dry season – some claims suggest, as early as, November – so that the fruits mature before the rains come. Seeds have the potent to germinate within a period of two months after being plucked or after falling off the dead branches.

Lama and Ali Kadam upazilas of Bandarban, flowering may have started in late 2007-early 2008 and will continue till 2010.

2. All evidence to this date suggests that rats multiply manifolds by eating bamboo fruits.[16] It may not be too off the mark to assume that the rat population in an area of 'mast seedling' may pass away the rainy season (June-August) by remaining indoors (in their burrows) on stored food and by engaging in procreation. This normally conforms well to reports of attacks on Jum/paddy fields during either May (on newly planted seeds), or during the dry season beginning in September, right before the harvest.[17]
3. Most assertions based on past experience suggest that it normally takes around four years to get back to normalcy – that is, some kind of ecological balance. However, past experience, which was fifty years back, was in an ecological setting where there were fewer human habitats near the bamboo forests, and plague was a major cause of depletion of rodent population. In the current setting, while the size of bamboo forest has depleted, sustenance of large rodent population over a longer period (beyond four years) is very likely since possibility of encroachment into human habitat in search of food is high.
4. Most reports suggest that it is the variety of small mice on the hilly forest which have predominantly observed in the affected areas – with white marks in their chests. These are also able to swim, unlike some living in homesteads. Thus, crossing streams and finding new homes, within the hilly region, in search of food is possible. But such instances will arise only when their storage of food dries out.
5. Rodents generally are considered not very long distance migrants, which sets a limit to the sustenance ability due to constraints on food supply in the local neighborhood. It also suggests why policies to counter their livelihood are important determinant of how long the period of bad years last.
6. New seedlings from bamboo fruits will continue to grow (till 2010 at the least) and will provide ample food supply to the enlarged rodent population, but causing potential threat to the future growth of bamboo forest. It will take at least four years after germination for bamboo branches/poles to come of use. Thus, human livelihood dependent on harvesting of bamboos will be adversely affected over a period of at least four years as well.
7. There are animals other than rodents, which regularly damage crops, such as, wild boars, parrots, squirrels, monkeys and wild fowls (*Bon Morog*). Some of these are predators, and are believed to grow in numbers at a greater pace with increase in rat population. Others are believed to go through similar reproductive behavior as the rats by eating bamboo fruits. No scientific evidence on either could be found in the literature.[18] One may propose a third hypothesis: some of these animals are

[16] In a normal year, two pregnancies with upto nine newborns to a pair of rats are expected, of which several are eaten by the elders. The nutritious bamboo fruit is said to increase the number of pregnancies to six or even eight. Note that each pregnancy normally lasts 45 days.

[17] Since the last of the Jum crops is harvested by December, Jum fields may only be targeted till that month; and later in May.

[18] One could possibly establish closer linkages with crows and snakes which are known to live on dead or live mice, and experiences in other countries mention of 'crow floods' which had followed the 'rat floods'. In the CHT, no such event in the past was recalled. Moreover, the visible stock of crow in the hilly areas is very thin, and snakes are delicacies amongst some ethnic groups.

deprived of their traditional source of food due to increase in rodent population, and therefore, are forced to encroach into human habitats and crop fields more frequently than otherwise observed. Some of the old respondents recalled the coming of *Bon Morog* and others of wild boars. While recent incidents of damages caused by monkeys and some of the other animals were reported, none considered this as gross deviation from those observed in normal years. There are however strong apprehensions that 'rat floods' precede a second set of offenders – which will prolong the misery for local people, particularly the Jum cultivators.[19]

8. Humans are important actors in the life cycle links. Many of the ethnic communities, including Marmas and Mros, eat rat-meat. Therefore, growth in rat population increase potential food supply, but unfortunately, available technology does not permit capturing rats in large numbers.[20]
9. There is already a localized shortage of paddy seeds – particularly of local varieties – in affected areas, which can be met out of surplus in other areas. If there is large-scale damage of seeds during current Jum cultivation (beginning in May 2008), there will be severe shortfall in seeds in future. One may also note that local varieties still constitute roughly 70% of seeds sown under Jum cultivation and allow the cultivators to spread out harvests to smooth out consumption as well as labor requirements.

Section 3
IMPACTS ON LIVELIHOOD

3.1 Basic Approach

The focus is essentially on economic livelihood, which addresses sources of income (and/or produce on own farms and homesteads) and associated employment over various months of a year, as well as the use of the earnings for various expenditure heads. While the discussion in the preceding section lays out the basis for visualizing alternative future scenarios, implications for an individual household under each of the alternatives will depend on where the household stands in the pre-event situation and what potentials it has to adjust to changing situations. Since the affected populations live in the eastern hills, and, at least for the short term, live on Jum cultivation, micro level assessment of impacts on livelihood is confined to this group of the population only.

There are broadly two approaches one could take – (i) consider an average household, work out the size of impact on it and aggregate it to a regional level, or (ii) consider two or more types of households on whom impacts will be different and so will the coping strategies. FGD at different Paras across several upazilas in the two districts visited revealed that the once-apparent homogeneous community is under-going changes in asset

[19] One respondent recalled the prediction of one Vikkuk Shashan Raskshit Bhante: "there will be rat flood, followed by the attacks of *Bon Morog*, and then the snakes will arrive before peace is finally established."
[20] One reason why outsiders fail to see collection of trapped/dead rats is because of this food habit – these are dried when there is abundance of other food, but eaten almost on the same day when there is relative food scarcity. May happens to be one such month when the old stock of rice reaches the bottom for many and alternative remunerative employment cannot be sought due to engagements in self-cultivated Jums.

distribution, nature of participation in workforce, and sources of income. While there are wide variations across communities and even across Paras within same ethnic group, most respondents suggested a figure around 30% or less for the non-poor – that is, those who could live on the produce of their Jum land throughout the year. In discussions within a single group, we learnt that there were families who had operated on Jum area of 0.90 acre or less, while there were others who operated on 3.2 acres or more land. The inequality was also revealed in responses from Karfu Para (a Mro village) and from Marma respondents in Sakrachhari, Ruma. Of the 39 families in the former location, 30 were reported to have sufficient food for the whole year while 9 did not have. In the latter case, around 10 to 15 out of 40 families in a Para were reported to be self-sufficient in food. In both cases, others would often work on the Jums of the richer kin, and presence of inter-linked markets (particularly between credit in paddy and labor market) was widely acknowledged. Based on these and secondary information reported in Table 4, we assume that around 30 percent of the population in affected areas were non-poor.[21]

Table 4: Distribution of Survey Households by Poverty Status and by Communities

Community	Hardcore poor	Absolute poor	Non-poor
Indigenous peoples	39.4	65.1	34.9
Bawm	64.8	90.7	9.3
Chak	63.3	83.7	16.3
Chakma	33.9	60.1	39.9
Khyang	59.6	80.9	19.1
Khumi	48.8	60.5	39.5
Lushai	66.7	93.3	6.7
Marma	40.9	61.2	38.8
Mro	30.4	66.7	33.3
Pangkhua	26.0	80.0	20.0
Tanchangya	35.0	63..3	36.7
Tripura	42.2	71.9	28.1
Bangalee	31.4	58.7	41.3
All CHT	35.8	62.2	37.8

Source: HDRC/UNDP 2008.

3.2 Activities in a Normal Year

Source of food, income and expenditure pattern

Various sources of livelihood are listed below.

Sources of Food

- Own Crop Production (rice, maize, vegetables, spices, potato, etc.)
- Livestock Products (meat, milk, eggs from own livestock/poultry)

[21] It is expected that the greater number of smaller communities are living in the high hills

- Fish (fish caught and consumed)
- Market Purchases (all foodstuffs purchased from open market)
- Leaves/tubers/roots from forest.

Sources of Income
- Crop Sales (paddy and vegetable other crops)
- Livestock Sales (sale of pigs, cows, buffaloes)
- Livestock Product Sales (meat, fish and eggs)
- Sale of fuel woods
- Labor (house repairs of others, work in others' Jum land, tobacco fields and for drying tobacco leaves, labor for seedling timber, limited work in market places if these are in close proximity)

Sources of other supports to Livelihood/coping mechanisms
- Loans in kind and cash
- Safety net programs (female stipend, rice, salt, *nappi*, etc.)
- Other Relief
- Sale of property rights (one may only speculate)

There is no robust estimate on the sources of income of Jum cultivators who constitute the bulk of the population in affected areas. Preliminary estimates from the recently completed HRDC/UNDP survey show that 55% of average household income (including transfers received) originated from crop sector – with Jum accounting for more than half of it; 8% from wage/labor equally contributed by agriculture and non-agriculture labor; 10% from petty trade and salaried jobs; 7 % from female stipends and social security programs; and more than 9% from selling forest produce that includes bamboos. The sample included urban population and people from the flat lands as well. One would expect higher proportion of earning from Jum cultivation amongst the Jum cultivators in the eastern hills, negligible on account of non-agriculture labor/wage and petty trade, and almost zero income/receipt on account of salaried jobs and female stipends. It is quite expected that the share of earning attributed to collection & sale of forest resources would be higher. Findings on income sources obtained by interviewing several people in Bandarban and Ruma areas, and measured in terms of months of household subsistence covered, are summarized in Table 5 below.

Summary picture in Table 5 hides large variations one observes across the hill districts. Such variations arise from (i) land productivity, which tend to diminish with decline in fallow period (SANDEE report, 2006) and with increase in distance from water sources; (ii) distribution of user right (for Jum cultivation) over land; (iii) number of able-bodied persons in the family; (iv) proximity to market places for work as opposed to proximity to high-valued timber and other forest products; (v) proximity to streams for fishing, etc. One may therefore consider it to be only an approximation of the average amongst Jum cultivators in the eastern hills of CHT.

Month-wise economic activities are summarized in Table 6. It is quite revealing since rationale for Jum cultivation to smooth out labor use and household consumption needs is

quite evident. With depleted stocks, the worst period in terms of food security, is from mid-June to mid-August.[22] During this period, fish is not readily available[23]; heavy rain restricts mobility and bamboo harvesting is not feasible;[24]

Table 5
Source of Livelihood Supports

Status	Activity	Subsistence covered (months)	Remarks
Non-Poor	Jum	12 +	Has stock of seeds for the following year, surplus to lend out as well
	Control over natural resources – Rent and trade		For business, better education of children and attending to better health care services. There is also investment on business and lending
	Shops/business if in close proximity to market places		
	Poultry, pigs & other livestock		
Average Poor	Jum (own)	7	
	Forest products (including bamboos)	2 (0.5 from bamboos)	
	Labor in (others') Jum	1	Often committed against borrowing of paddy during slack season
	Fishing	0.5 to 1	depends on location
	Labor in other agriculture (including tobacco) & non-agriculture activities	1	Employment in non-agriculture depends on locations
	Procuring food from forest	0.5	

Note: Effective months of household consumption needs met. Note that rice is the staple food (Table 6.5 in the annex).

3.3 Impacts on Household Livelihood

The impact pathways along with the impact areas in the short and medium terms are described in Table 6.4 in the Statistical Annex. It identifies the sources of threats to livelihood as well as probable measures to counter those threats. There are several

[22] The HDRC/UNDP report suggests the period to begin in mid-May. The latter is found to be true in areas where and years when Jum seedling is completed by mid-May – which had been the norm in the past. During recent years, this goes until end May or beyond.
[23] Fishing is restricted in some areas for a period of three months beginning mid-May every year.
[24] Most bamboos felled during the dry season reach the river routes by June. Thus there is very insignificant work available on that count.

impacts whose sizes need to be assessed in order to get better understanding on the size of interventions. Without further elaborating on those mentioned in Table 5, we undertake limited exercises before proceeding to discuss the desired interventions in the concluding section.

This report has repeatedly noted that there are uncertainties with regards to the duration of the crises centering rat infestation, and the latter will depend on policy response. Such uncertainty limits one to assess impacts beyond a period of one year. Noting such limitation, rest of this section looks into the following areas:

- Reduction in employment and income associated with bamboo harvest
- Reduced availability of bamboo and its implications
- Damage to Crops
- Effects on employment in agriculture
- Trade, services and Cottage Industries
- Overall implications for household livelihood

Reduction in employment and income associated with bamboo harvest

Normally bamboos are felled immediately after the harvesting of paddy on Jum land; and in a family with three able bodies (say, father, married son and his wife), one of the males would go out for bamboo harvest. Taking an average of several persons interviewed on the subject, we find such a person from poor households engage in harvesting during two seasons – immediately after sowing/dibbling the seeds in April-May for a period of three months when other members may attend to weeding activities on Jum land; and the second is the peak season during the dry months, after the paddy harvest.[25]

Dry season:
Gross Income = 15 days/month x 70 poles/day x 3 months x Tk. 2.75/pole = Tk. 8662.50
Cost of living (primarily food) @ Tk. 100 per day = Tk. 4,500.
Net Return = Tk. 4,162.50

Rainy season:
Gross Income = 10 days/month x 50 poles/day x 2 months x Tk. 2.75/pole = Tk. 2,750
Cost of living (primarily food) @ Tk. 100 per day = Tk. 2,000.
Net Return = Tk. 750.

Total net income is therefore, Tk. 5,250. One may however note that one person relieves the family of one extra mouth during that period, and the cost of food for little more than two months is deducted in the above calculation.[26]

[25] Several bamboo traders reported that bamboos felled during the dry months are stronger and fetch better prices. Moreover, a commodity such as bamboo requiring huge storage space should ideally have less storage time. Since bamboo works are mostly done during the dry season, peak harvest time is also during that period. There are however problems in transporting bamboos from high hills where the streams may dry out. Thus, ease in transportation calls for some felling during rainy season as well.

[26] Several *Kartans* (those who harvest bamboos) were consulted and most suggested that they worked for around two months and their 'income' (net earning) was around Tk. 5,000. They had however noted that

Thus, on the high side bamboo felling provided a poor family 2 months of provisions, and it will be at the least 0.5 months. Since Muli bamboos accounted for roughly 70 percent of total bamboo stock (and more for the affected regions), one may conclude that a poor household will lose 10 days to 45 days of provisions. There is likely to be some substitution (i.e., felling other trees), but this is likely to be made difficult due to absence of a good excuse of cutting bamboos! This scenario is expected to continue for next four to five years.

In the absence of household level information to infer on the monetary value of expected loss, one may use aggregate statistics to draw limited conclusions. Total quantity of bamboos reported varied in the range of 67 to 85 million pieces during the late 1990's.[27] This however dwindled to 57 million during 2001-02 and 2002-03; (DOF website). Such figures are based on those reported by the Customs Department, which may only be a percentage of the actual traffic flow. Moreover, a percentage of bamboos harvested are used locally without having to pass through the customs check points. If the latest figure is considered, a guesstimate on total bamboo harvest may be in the range of 70 million. If 70 percent of this is of Muli variety, total shortfall will be around 50 million, implying a loss of around Tk. 137.5 million to the harvesters! If one assumes 50 bamboos to be harvested per person per day, the loss will amount to 1 million person days of labor. A more conservative estimate would put the latter figure at 0.7 million person days.[28]

As noted in Table 6.4 (in the Statistical Annex), one obvious coping strategy will be to engage in increased logging to make up for the income lost.

---

only a part of it could be attributed to bamboo felling and the rest were on account of (possibly) timbers and other forest products.

[27] As late as 1999-2000, bamboos from the forest contributed 16 percent of government tax revenue earning from forest products. The share of bamboos in government revenue from forest products reduced to 7.8 percent only by 2002-03.

[28] The focus is confined to impacts on livelihoods of households in the affected areas. In the absence of adequate data on household income, agency-level figures were used to arrive at the loss of employment and income. The vanishing of bamboos (Muli specie) will adversely affect the operation of the paper mills in the area – particularly, the KPM. We have not dealt wit such economy-wide impacts.

Table 6: Generalized Jum Crop and other economic activity Calendar

Activity	Dec-Jan	Jan-Feb	Feb-Mar	Mar-Apr	Apr-May	May-June	June-July	Jul-Aug	Aug-Sept	Sep-Oct	Oct-Nov	Nov-Dec
Regular Jum cultivation			Slash & burn		Seeding broadcast/dibbling	Weeding, thinning, insecticide spray (if any)			Rice and maize harvest			
						Vegetables/Marpha harvest			Chili harvest			
					Weeding/ basal fertilizer dose (if any)		Top dressing (if any)			Pumpkin/Cheena harvest		
										Brinjal, flower harvest		
							Melon harvest				Sesame harvest	
							Cucumber, gourd harvest				Cassava harvest	
												Cotton, turmeric, ginger, arum harvest
Plantation		Peanut planting		Peanut harvest	Banana planting			Banana harvest*				
			Fishing									
Bamboo/ Labor	Bamboo harv. (DS)					Limited bamboo harvest					Bamboo harvest (DS)	
						Limited bamboo harvest				Bamboo harvest (US/North)		
Labor for tobacco			Harvesting/drying						Seedling		Transplanting	
Other labor	No work in the fields											
FS***						Extreme food insecurity						
FS status**	2.4	2.2	2	2	1.9	1.8	1.9	2.1	2.3	2.3	2.4	2.5
Months in Marma	Prato	Tabothe	Tabon	Teikhung	Kachchum	Naiun	Wachcho	Wakho	Tochelang	Wajion	Tairungbonk	Naito

* Banana is harvested after about 15 months of planting. ** Average food security status for indigenous communities, reported in HDRC/UNDP draft report.
*** Food security status as reported by respondents from affected areas in the eastern hilly regions. Upstream (US)/North and Downstream (DS)/South.

Reduced availability of bamboo and its implications

Various uses of bamboo are identified in Annex 5. Generally all those areas will be affected by reduced availability of bamboos – more so since Muli accounted for 70 percent or more of the bamboo stock in the eastern hilly regions of CHT. At household levels, the obvious adverse effects will be on housing, which affects all households – but more the rich ones, and in certain communities (such as, Mros). It is reported that there will be limited switching to other kinds of bamboos – but the prices of bamboos have already shot up. We focus only on employment and income of the poor households.

Reduced availability will increase bamboo prices, which may partly increase the return to poor harvesters per pole. [29] It is however unclear if this increase will fully get transmitted to harvesters' return, or it will be shared amongst traders, lease-holders on UCF and rent sought by officials in charge.

Reduced availability will also imply less work for house repairs, fencing, making of support poles for vegetables in Jum land (*Mancha*) and other bamboo-based products. It is learnt that many poor work for the rich households to pay back their borrowing of rice (*Haolat*) by such works. In the absence of such work, the *Haolat* system itself may fall into jeopardy – more so due to pauperization of the rich Jum farmers as well. Traditional microcredit may not be of any help either to smooth consumption.[30]

Limited response on the subject suggest that roughly 15 days of labor of a poor household will be lost for next four to five years. There will however be demand for different kinds of repair with old poles, but it will be insignificant. In monetary term, with Tk. 80 per day stipulated in such interlinked contracts (repay loans in kind by giving labor), a poor household will lose, on an average, Tk. 1,200 every year.

Damage to Crops

Estimates on paddy losses vary – in the three forest reserves along Myanmar border, the loss in 2007 is considered to be very high. Jum land in 'unclassed forest land' has also been affected. In the absence of concrete figures, one may only work towards a minimum figure. We present a hypothetical case in Table 7 where the area under Jum cultivation is assumed to remain as in 1983-84; even though one would suspect that it might have increased. Assumptions on yields are noted under the figures in Table 7 – our figure of 1,2 mt of paddy per acre (which is marginally more than 3 mt per ha) is based on the conservative figures we got from numerous interviews. The loss figures (in percentages) for various reserve forests are arbitrary, but are guesses made on the basis of reports we have received. If a person is assumed to consume 400 gm of rice per day (equivalent to 600 gm of paddy),[31] total loss is estimated to be equivalent to one year of rice

[29] We were told in Barkal that the prices went up to Tk. 7 from Tk. 3 per pole.
[30] One of the MFI Managers informed us that repayment was 25% of the normal years during this time due to crop damages caused by the rats.
[31] See Table 6.6 in the annex.

requirement for almost 1 million persons! If the area under Jum is more than that assumed, and if one includes Jum area outside the reserve forests, total loss will be much higher. And the size of loss on account of cultivation foregone, damage of seeds sown and the likely crop damages during the coming harvest once the seeds germinate and the paddy ripens, will be lot more than these figures suggest.

Table 7
Estimated Aggregate Loss in Paddy

Reserve Forest	Jum area in ha	Average yield (mt/ha)	% loss	Total loss (mt)
Sanghu-Matamuhuri	17135	3	60	30843
Kasalong	35079	3	90	94713.3
Rainkheong	30838	3	100	92514
All Reserve Forest in CHT	83052			218070.3

Note: It is assumed that one 'Hari' of land (roughly equal to 16 decimals of land) produces 20 haris of paddy (equivalent to 200 kg), which implies that the yield is little more than 3 metric tons of paddy.

Effects on employment in agriculture

It was noted in Table 5 that roughly one month of provisions are secured by poor households by engaging in others' Jum land for sowing, weeding and harvesting. We failed to get reliable estimates on the size of reduction in Jum cultivation this year since most responded by saying 'what else can we do?' There are however reasons to believe that the rich cultivators, who normally rely on outside labor, have chosen to cultivate on less land. This is reflected in already reduced wage rates in the reserve forest beyond Barkal (Baro Harin area) – wage rates that were once Tk. 100 or more came down to Tk. 50 per day, and even then, there is not ample work. This will aggravate the food insecurity in the area.

Another aspect to note is the possibility of reduction in area under tobacco cultivation, which has long been a desired goal of the government and social leaders. Yet, tobacco cultivation provided supplementary employment to some Jum cultivators and/or laborers. There were restrictions imposed on the used of forest wood during the last production cycle of tobacco. It is apprehended that the tobacco companies and their agents will reduce the tobacco area in the coming year without promoting a substitute crop. The employment situation may therefore further worsen during the (dry) months of tobacco cultivation unless appropriate measures to ensure cultivation of alternative crops are taken.

Trade, Services and Cottage industries[32]

This sub-sector is largely in the domain of rich cultivators and Bengali settlers. As one said, many of the rich Jum cultivators are the worst affected – they lost their paddy and yet cannot go out to engage in laboring activities due to social standings, maintaining a minimum consumption level forced them to reduce their engagement in trade activities, and the vanishing of large portion of bamboo forest for a while will deprive them of the key trade they could engage in. The opportunities for services are rather limited in the region.

Very little so far had been mentioned of the cottage industries and how this may have been impacted upon by rat infestation. Initially we had thought that bamboo products would be severely affected – but we learnt that those products use Ora(n) bamboo, not Muli. However, general shortfall, as noted already, will raise prices of all bamboos and this is expected to prevail for next four to five years at the least. High prices will obviously dampen the handicraft industry relying on bamboos. No estimate on potential loss could however be obtained.

A more important area is the home-made textiles, which was once very common amongst all ethnic groups in the region. Over the years, however (and we noted during the field visits), most communities, particularly residing near Myanmar border, have shifted their preference towards readymade garments. In most areas we had visited, cotton grown on Jum land are used for stuffing comforters (*Lape-Toshok*) and pillows. And as in the case of housing, the affected people are preparing to live with the old stuffs for some time to come. The situation is different amongst Chakma communities, many of whom produce their own garments at home from yarn they spin from the cotton cultivated on Jum land. It is also an industry that employs women in large number, and will be affected due to rat infestation.

Impact on overall livelihood

Livelihood means not significantly more than bare minimum for many people in the villages and unions affected by rat infestation. Lives for the poor largely revolve around Jum cultivation, harvesting bamboo and other forest products and wild fishing. Basic needs appear to be defined in terms of the first three – food, shelter and clothing – and yet to encompass the other two – education and health care. It is only for the (relatively rich) households where education is increasingly included into the basics, but the rough terrain makes it difficult to avail it in suitable places.

Preceding discussion in this sub-section revealed that there will be an aggregate shortfall of food supply in the region, and during a period of general food crisis in Bangladesh as well as in rest of the world (and also in Myanmar, after the devastation caused by cyclone

[32] Since the focus is on affected areas and on the people in affected areas, we refrain from discussing the implications of withering of bamboo forests on the operational viability of several paper mills, including the Karnaphuli Paper Mill (KPM) and Sonali Paper and Board Mills Ltd.

Nargis), local shortfalls may trigger off famine. Because of the difficult terrain[33] markets hardly exist for most agricultural produce, which rationalizes the *Haolat* system within the community – a kind of inter-temporal barter exchange, sometimes interlinking two or more services. In such communities, even a very localized shortfall can cause severe food shortage and deprivation for days or weeks, with obvious fall backs being the roots and tubers in the forest. Unless the human habitat is relocated (which is beyond feasible discourse) or the rat population is controlled, returning to normalcy cannot be imagined.

The condition of living is expected to deteriorate due to large scale reduction in the bamboo stock, particularly because Muli is used for floors and walls. And, in the absence of alternative employment opportunities and earnings, quality of clothing is also expected to decline. It is quite likely that higher prices of bamboos and other forest products will add further incentives to engage in excessive extraction of natural resources, which will further worsen ecology and aggravate misery.

For the relatively rich (who may be poorer than an average person living in upazila center), the situation is possibly worse. Their livelihood will be more prominently affected since it depends critically on Jum harvests and greater control over forest resources. As Jum cultivators of large tracts of land, engaging labor from the poor in the community, they incurred losses due to crop damage caused by rat infestation. Harvests from Jum and the forests enabled regular surplus that was once used for supporting education of their children, (often sent across the border since high schools or colleges are not available in close-by). In order to cope with the loss, they may have to cut on the expenses for children education. They may also have to cut back on the usual luxuries of life they had previously availed after harvests by undertaking large-scale shopping once a year. The worst part for this group – when there is no food at home, they may not be able to come out of their social status and seek wage employment elsewhere or stand in queues for relief.

Shortfall in food will imply less supply to activate local markets, and reduced income will imply sudden reduction in demand for non-food goods, all of which will have negative multiplier effects on the local economy.

[33] It takes almost two days to reach Baro Harina from Barkal; and a day to reach severely affected areas from Baga Lake, which is another two and half hour drive on a four-wheel jeep from Ruma Bazaar, if you can cross Sanghu river safely after an hour's boat ride!

Section 4
WHAT NEEDS TO BE DONE

4.1 Summary of Programs already undertaken (as of May 18, 2008) by various agencies

Some of the programs so far undertaken are listed below.

- The Bandarban Hill District Council provided 766 families BDT 1,000 and a blanket in 3 Upazilas
- Ministry Of Chittagong Hill Tracts Affairs distributed 1,200 Metric Tons (MT) rice, for 7 Upazilas of Bandarban and Rangamati (700 M.T. for Rangamati; 500 MT for Bandarban); and BDT 1,000,000 in GoB Vulnerable Group Feeding (VGF): 221.4 M.T. rice provided to 4,925 families in Rangamati, 15 kg. rice per family per month for the next three months.
- In Barkal Upazila: 77.895 M.T. for 1,731 families; Baghaichari Upazila: 130.905 M.T. for 2,909 families; Bilaichari Upazila: 12.6 M.T. for 280 families
- GoB VGF in Bandarban: 135 M.T. for 6 Upazilas (out of 9.1 million M.T. of VGF
- distributed nationally).
- BDT 3,600,000 allocated as cash for work by the central government through the District Commissioners.
- Green Hill (a local NGO) in Sajak Union: 350 families each received 10 kg rice, 1 kg. salt, one half-liter cooking oil.
- BGD Army in Ruma: 25 kg rice to 850 families; 10 kg paddy seed to 44 families.
- UNDP/CHTDF provided 7,000 families in the border zones 20 kg rice, 1 kg salt, 1 kg sidol, 1 kg shrimp paste, and two rat traps, as well as a travel stipend of BDT 100. Local people have little or no faith on the efficacy of the rat traps.
- WFP is reported to be mobilizing funds for ensuring food distribution to 128,400 beneficiaries for five to six months. Currently, WFP is in the process of identifying the target population and has made commitment to supply food for two months only.
- USAID has made limited commitment, of around $ 100,000 to support WFP initiative. They are keen on coming in big way provided the focus is on nutrition, and a nutritional surveillance is undertaken under HKI – the rationale of such moves in a critical situation that the region will face in the coming months is unclear.

4.2 Suggestions for returning to normalcy

Defining the Setting

There is an immediate crisis – people needing food to survive. The coming months (June to August) have always been the 'Monga' period for the region where agriculture is based on Jum cultivation, and the food security level has always been at the seasonal worst.[34] With crop damages last year, the chances of a local famine, in the absence of timely measures, cannot be ruled out.

[34] Jum essentially involves a single composite crop, and the stock runs low before the new harvest. Moreover, employment opportunities are also limited during the rainy season (see Table 5).

There is also another immediate concern – to support or not to support Jum cultivation this year. A large majority of the Jum cultivators feel that there is no choice, and they ought to sow the seeds and hope that the rats somehow refrain from damaging their sown fields. Any event of massive damage of seeds (which so far has been sporadic since sowing started in only parts of Bandarban during our field visit) in the coming weeks may signal mass hysteria with nothing to look forward to.

While we know that it will take at least four to five years for the Muli bamboos to be a part of our life again, no one knows with certainty whether the requisite number of seeds will remain unharmed by rats and other animals (including humans) and germinate, and whether the seedlings will get the opportunity to grow of age to ensure a minimum size of the new stock. It is true that bamboos are very fast-growing plants and therefore have the potential to occupy space after ecological crises, but there is no hard evidence to assert that it will happen that way this time.

The critical element determining the duration of crisis and return to normalcy is the demographic dynamics of the rodent population. As Wolff (2003) notes, extrinsic factors such as food limitation, predation, and disease are likely to play a much larger role in population regulation of rodents than do intrinsic factors such as, territoriality, dispersal, reproductive suppression, and infanticide. If that is the case, what measures do we take to activate/promote the extrinsic factors? There are discussed below for the very short term, next three months or so, as well as for the period beyond.

What may be done?

Proposals for next three months

The very obvious first hypothetical choice is to **remain passive and let nature take its course**! Posing it this way may sound odd, but it helps us to build counter-factual; rationalizing the interventions that one takes. Given our understanding that flowering will continue into next year (2009), rodent population is unlikely to show a declining trend in the current year. Thus, crop damage will continue. With Jum cultivators still dreaming of a magic to protect their land from the rats are likely to engage with greater vigor to recoup past losses (except possibly in the worst hit areas in 2007), and face a greater loss. Indebtedness will have increased by then eventually leading to asset (rights over land) loss and political instability. Before all these may happen, the food shortage (since we assume no action) will be severe enough to make people desperate – and there is no bound to the actions desperate people can take.

Actions recommended over the next three months include the followings:

- The immediate task, as explicit in on-going initiatives of several agencies, is to **reach out to the affected people with food**. There are two alternatives that have been raised in this context – should cash be provided to the target population who may then source their needs from the markets? Or, should they be provided with food grain? And, if so where? In several FGDs, we raised the issue, and the

following consensus was reached. In remote areas, far off from the closest human habitat, markets do not function. If they are given cash, they would have to come long ways to buy and there would be no assurance that they would get those in the market when they arrived (the mobiles do not operate in those parts!). I contrast, if they are give in kind far away from their homes, there are extra costs. The choice amongst the two is contingent upon where the point of distribution is, and this was nicely revealed by a respondent from Chuknachhari (Baro Harin). He came to Barkal on the previous day to collect UNDP provided 20 kg of rice. for this, he took two boat rides, spend on two meals and an overnight boarding all of which cost him Tk. 215. In addition, he had to walk for a day from his village to get on the first boat. The small market in Barkal was responsive to the sudden jump in the supply of rice because many had to sell their rice – the price went down to only Tk. 20 per kg on that day from Tk. 25 to Tk. 27 on regular days. He sold 5 kg of rice at Tk. 100, got cash of Tk. 100, and returned home (the same long journey) with 15 kg of rice. His preference was clear: if you give in kind, do so at Khogichhara bazaar when the streams are dry, or at Srinagar bazaar when the water level rises. However, if you want to give cash, give it at Baghoichhara bazaar wherefrom I can buy my needful! It is therefore important to assess the choices of the target population within which he/she is indifferent, and then choose the one that is cost effective from the perspective of the sponsor.

For how long should the food supports continue? The discussion in the text made it obvious – **the need is till the next Jum harvest (if there is one), which is September 2008**. As for the size of coverage, no specific number may be suggested without additional information. However, there is a need to revisit the issue of targeting individuals as opposed to communities. Till now, initiatives have centered on identifying individuals and distributing to those individuals through supports from NGOs. Given the nature of information available and the way these information feed into decision making at higher tiers, **targeting communities may be a more reliable and cost-effective route to follow, with random independent monitoring in place**.

- Create employment opportunities by implementing new schemes. Since employment opportunities are limited in the hilly regions, some time was spent in FGDs in identifying potential schemes that will improve the livelihoods of the locality and will at the same time provide temporary employment during these hard days. The bottom line is to create employment during the coming months so that people can make living with dignity (in stead of being relief-dependent) and certain essential infrastructure to improve the living condition in the area may be put in place or improved. The specific suggestions are:

- **Community-level sanitary and livelihood improvement measures, including land improvements**
- **construction of small roads & culverts in RMP style**
- **improve the water distribution lines** (where these exist)

- The most important task in both the short and medium (3 to 4 years) term is to identify and implement schemes to check the growth in rodent population and reduce it to a balanced level. The critical first step is to **institutionalize Surveillance of Rat Population and Tracking their Movements, as well as monitoring of unusual crop damages linked with attacks from rodents and/or other animals**. Participation from scientific community is essential in such undertakings. If needed, such persons should be given adequate exposure through study tours to neighboring Mizoram state of India. Ideally, PDCs under UNDP's CHDF program and local and international NGOs should partner along with FRI (Forest Research Institute) and Pest Control department of BARI.
- A hypothesis put forward in this paper is: the rats will mostly remain indoors in their burrows during the rainy season. Therefore attempts may be made to **target these rats in their burrows during the coming three months**.[35] In undertaking this or any such initiative, Pest Control Department of BARI and other relevant agencies may be consulted. One may think of other innovative schemes, and **SCUK may call for such innovative ideas (for a prize-money) through advertisement in local dailies, which will also sensitize the issue**. The pros and cons of providing incentives to local people in the form of **prize-money for tails of dead rats** may be considered. Such declarations may not necessarily depend on decisions of a government agency. Bangladesh had past experience in dealing with controlling house rats (possibly early 1980's), when prize-money of Rs. 0.50 per tail was set to reduce rat population. Mizoram government was prompt to declare Rs. 1.25 to Rs. 2 for every rat killed (tail to be shown as proof). One of our respondents however recalled that in one occasion in the past, he had colluded with the Agriculture officer to claim more money than his bounty would give. In order to avoid such leakages, the suggestion was to burn all collected tails after counting them in public at the end of each day. Even though there are inhibitions against killing of animals among Buddhists (mostly Chakmas), this may be overcome through persuasion. However, the odds lie in potential involvement of children in rat-hunts.

- Build awareness on do's and don'ts in the event of a rodent plague. As noted in one of the quotes in the first page, bamboo is literally the stuff of life for the hilly people. It is therefore important to ensure its re-generation. For the latter to happen, there is need for **awareness building** amongst people, relevant government officials and general public. There is also a need to **establish appropriate property rights** to ensure improved management of the forest resources. State of Mizoram anticipated the flowering and had formulated the Bamboo Policy 2002 well ahead of time. It is high time that policymakers in Bangladesh **address the issue of a separate bamboo policy** – for sustenance of

[35] Upon return to Dhaka, the author of this report was informed by one of his guides in Bandarban that some of the Marma people have a long practice of catching live mice, have them dressed strong colored fabrics – glued to their bodies, and have their rectum glued before allowing them to return to their groups in the jungle or burrows. It is told that these returnees will eventually die in painful deaths, which will create panics amongst others. It is unknown if these intimidated mice stay indoors without food and die, or, the deaths of some lead to plagues. But the story deserves to be probed when the known options are limited.

livelihood in the hilly regions of CHT as well as for running its paper mills and supporting the needs of its housing industry. It is equally important to **review the roles of the Department of Forestry**, which is *de facto* guardian of the reserve forest with no revealed responsibility for managing its resources, and **review the roles of DAE and upazila agriculture offices and their capacity to support improved agriculture on hill slopes**. Over the short term, **SCUK may consider engaging its resources to identify priority policy areas and advocating for adoption (and implementation) of those policies**.

- One probable extrinsic factor that will eventually reduce rat population is a rat plague. In anticipation, there is a **need to build awareness on do's and don'ts in the event of such a plague**.

Measures beyond September 2008

Some of the short-term measures, such as food aid and employment schemes, will have to be continued; and few additional ones have to be addressed.

- Create employment opportunities by implementing new schemes:
- **construction of roads using local labor** (large scheme)
- construction of small roads & culverts in RMP style
- **excavate streams**, which is feasible only after the rainy season
- Increased **plantation of timber and other remunerative trees**
- State of Mizoram has reportedly banned Jum cultivation during next three years in certain areas. This is believed to deter expansion of the rodent population and restrict the exiting stock remain within a perimeter. There is a need to seriously look into the feasibility of such an action **(banning Jum cultivation in limited areas), which may however be realized through persuasions and provisioning sufficient incentives**.[36]
- continue to build awareness on do's and don'ts in the event of such a plague
- Continue programs to ensure re-generation of Muli bamboos
- Since food is the concern and there will be shortfalls in local supply of rice, there have been recommendations to **promote other food items** in the area though giving away saplings to the Jum farmers. Two fruits were noted by several respondents – banana, and papaya. Even though the fruits will come after one year or more time, these are considered ways to supplement the shortfalls in food supply with potentials to cash them if needed. The major obstacle to engaging in their plantation is the high price of these saplings – Tk. 50 per piece in Bandarban district. SCUK may consider **giving away cash to buy these saplings (of banana and papya)** amongst affected farmers upon prior consultations. The timing for papya may have passed, but banana can be planted round the year (as one DAE official informed). In addition, short duration leafy or non-leady vegetables may be promoted for homestead gardening.

[36] Since the time for taking such measure has run out this year, it was not included in the list of short-term measures. The policy advocacy may however be initiated immediately.

- **Promote cultivation of ginger and turmeric,** which are considered repellent to rat population.
- **Advocacy for a separate bamboo policy and review the roles of the Department of Forestry in bamboo forest management**
- **Review the roles of DAE and upazila agriculture offices and their capacity to support improved agriculture on hill slopes**

Concluding note on the Pied Piper of Hamilton

The rats of Hamilton were drowned in the river/water, even though the children marched into the hills through a cave whose opening closed forever. We had searched for clues in those stories with no luck. The rats in the burrows are good swimmers and can cross the streams, though it is unknown (to the author) if they can do so when the torrential rainwater runs through these rains in the coming months. These rats had to be hit with heavy clubs to catch and eat – the poisons were less effective. The field reports however mention of another specie, the hill/forest mice, which allegedly live on tree branches and by making holes in the trees. The latter specie may lack the skill of swimming, and one ought to find a way to wash them out by driving them into water when the rainwater rushes through the streams and rivers in the coming Monsoon. And, possibly take the skillful swimmers to 'drown' in deep cave-like trenches wherefrom they cannot climb out!

References

AELGA (2008). Rodent update - Bangladesh and India, February 22, 2008.

Bhatt, B.P., L.B. Singha, K. Singh and M.S. Sachan. (2003). "Some Commercial Edible Bamboo Species of North East India: Production, Indigenous Uses, Cost-Benefit and Management Strategies", Bamboo Science and Culture: The Journal of the American Bamboo Society 17(1): 4-20.

Bounneuang Douangboupha1, Ken P. Aplin and Grant R. Singleton (2003). "Rodent outbreaks in the uplands of Laos: analysis of historical patterns and the identity of nuu khii", in Singleton et al (2003).

Eindur Daman Babasthyapona (Management of Rat Control), Upazila Parishad, Ruma, Bandarban, 2 February 2008.

Deerghya O Shalpo Meyadee Fauler Abad Paddhyati (Cultivation Methods for Long and Short Maturing Fruits), CHT Integrated Development and Rehabilitation Project, DAE, CHT Region, Rangamati.

Grant R. Singleton, Lyn A. Hinds, Charles J. Krebs and Dave M. Spratt, edited, *Rats, mice and people: rodent biology and management*, Australian Centre for International Agricultural Research, Canberra 2003.

Goswami, Namrata (2008). Mizoram on the Verge of Another Mautam?, April 1, IDSA, http://www.idsa.in/publications/stratcomments/NamrataGoswami010408.htm

Government of Mizoram (2002). The Bamboo Policy of Mizoram 2002

Government of Mizoram (2004). Comprehensive Action Plan for Bamboo Flowering and Famine Combat Schemes (BAFFACOS) (2004-2005 to 2008-2009), Planning & Programme Implementation Department.

GOM (2006). Government of Mizoram, Achievement Reports on Bamboo Flowering & Famine Combat Scheme (BAFFACOS) during 2004 – 05 & 2005 – 06.

Jerry O. Wolff (2003). "Density-dependence and the socioecology of space use in rodents", in Singleton et al (2003).

Janzen, Daniel H., "Why Bamboos wait so log to Flower, Ann Rev. Ecol. Syst., 7:347-91, Annual Reviews inc., 1976.

Jashim Majumder, Hill people fear food crisis as bamboo clusters flowering, The Daily Star, 17 March 2008.

Makundi, R.H., B.S. Kilonzo and A. W. Massawe Interaction between rodent species in agro-forestry habitats in the western Usambara Mountains, north-eastern Tanzania, and its potential for plague transmission to humans.

Mantel S & Khan, Malik Fida A. (Eds) 2006. Chittagong Hill Tracts Improved Natural Resource Management. Report on the National Workshop held in Rangamati, Bangladesh 15 - 16 February 2006. CHARM Project Report 1.

Ole K. Borggaard, Abdul Gafur, and Leif Petersen, Sustainability Appraisal of Shifting Cultivation in the Chittagong Hill Tracts of Bangladesh, pp. 118-123, Ambio: A Journal of the Human Environment, vol. 32, Issue 2, 1998.

Saikia, Anup. Indigenous control and sustainability of common resources in the hills of North East India, Department of Geography, Gauhati University.

Saikia,A. and Mipun,B.S. 2000. Delineation of Shifting Cultivation Areas and Forest Cover Mapping in the Eastern Region of Arunachal Pradesh using Remotely Sensed Data. Final Technical Report submitted to the Ministry of Environment & Forest, Government of India.

Stefan Anitej, The Amazing Bamboo, http://news.softpedia.com/news/The-Amazing-Bamboo-82013.shtml**.**

UNDP 2007. Community Dialogue: Bangladesh, Natural Resource Management and Indigenous People, CHT, September-October.

Annex 1

Terms of Reference of Livelihood Expert on Rapid Livelihoods Assessment in Rat Infested CHT Areas

Background

The Chittagong Hill Tracts(CHT) is a region situated in the south-eastern part of Bangladesh, bordering India and Myanmar. The CHT covers about 10% of the land area(144,000 km2) of Bangladesh.

The CHT is comprised of three administrative districts: Rangamati, Bandarban, and Khagrachari. The population of the region consists of more than 11 different indigenous minority groups and Bengalis, and totals approximately 1.3 million people. Approximately 50 percent of the population is from indigenous minority groups. The population density of CHT is 98 to 843 per square km. The indigenous minority groups are distinct from each other and from Bengalis in terms of their social and cultural customs, language, agriculture, dietary practices and religion.

Most of the land in the CHT is unsuitable for cultivation but natural vegetation remains widely. People live mainly in small valleys and adjacent areas and practicing both plough and *jum* (slash and burn) cultivation though some groups practice plough cultivation.

Jum cultivation is being practiced on the hill slopes although methods adopted by indigenous minority people vary from place to place and also among the category of farmers as jum forms an integral part of their life. The main crops generally grown include rice, maize, millet, sesame, cucumber, pumpkin, melon, string bean, cotton, banana, ginger, turmeric, etc. Bamboo is also a rich natural resource of living in the area.

In 2007, bamboo flowering occurred in the CHT and it happens once every 35-50 years, and along with it comes rats. The last rat plague hit in 1959 causing devastation just over the border in the Indian state of Mizoram (BBC, 2008). The seeds are high in protein and, when the rats eat them, they breed four times faster than normal. After the numbers swell and they finish eating bamboo seeds, they eat up rice and other food crops. It is reported that the farmers and residents in the CHT are being hit by a large infestations of rats that has destroyed their crops. Moreover, after fruiting, the bamboo withers away.

According to national and international media reports and development agency reports, an infestation of rats is creating severe food shortages in the CHT. It is also reported that the jum cultivators are affected by shortage of seed as they could not keep those due to rodent attacks. Moreover, continuation of withering of bamboo forests adversely affects several ways, for example, threatens livelihood of the people who are based on bamboo, shortage of housing materials and raw materials to paper mills, etc.

The extent of affected villages and households are as follows:

District	Upazila	No. of affected villages	No. of affected households
Rangamati	Baghaichari	181	7,240
	Barkal	166	6,640
	Jurachari	20	800
	Bilaichari	25	1,000
Banderban	Rowangchari	80	3,200
	Ruma	100	4,000
	Thanchi	70	2,800
Total	**7 upazilas**	**572**	**25,680**

Source: UNDP (2008).

Moreover, 15 villages in Dighinala, 10 in Laxmichhari, 5 in Matiranga, 10 in Mohalchhari, and 5 in Panchhari upazila of Khagrachhari Districts are also affected (The Daily Star, April 17, 2008). The infestation has been reported rapidly spreading in other upazilas of Khagrachari as well(personal communication with UNDP contact).

Rationale

According to the published and unpublished documents and media reports, the adverse effects, such as, acute food shortage, rat plague, diseases, can last up to 3-4 years. Several agencies (MOCHTA, UNDP, Caritas, etc) have responded to emergency assistance of affected households of Rangamati and Banderban districts. However, there is a dearth of information in existing literature regarding following issues:

Local knowledge and perception of bamboo flowering and rat infestation;
Short and long term consequences of rat infestation in the CHT;
knowledge on the above mentioned issues of the service providers (e.g. agriculture, livestock department, NGO, donor agencies) and local leaders (e.g. karbari, UP chairman);
Type of measures taken by the stakeholders prior and after the event has occurred;

However specific information related to food security, nutrition, health and livelihood issues are lacking. Save the Children UK plans to further analysis the livelihood situation of CHT population and its impact on children in particular. This assessment will help Save the Children UK to design livelihood, food security, nutrition and health interventions for the CHT areas to respond short term emergency needs, long term livelihood interventions and for policy advocacy.

Purpose

To conduct a representative rapid livelihoods assessment of the population in CHT affected areas (rat infestations causing food scarcity). This assessment will look at the present and potential future impact on livelihoods caused by severe food scarcity, malnutrition and other aggravating factors.

Objectives

The objectives of rapid livelihoods assessment should be to answer the following questions:

What were different people doing for a living before the disaster? This baseline is needed to interpret what has happened following the disaster. Ideally we should get a sense of the relative importance of the different activities that people did (e.g., proportion of income earned from different activities);

How have each of those activities been affected by the disaster? And therefore, how has households' overall ability to access food and income been affected? What impact is expected to have on children's lives?

What would be required for households to return to the way things were before the disaster? What will households do to cope by themselves? What assistance would different households need to return to normal?

Outputs

1. The expected output is a chapter on Livelihoods with causal analysis, issues, and gaps, possible high impact feasible food security and nutrition interventions/package for emergency response and long term programming.

2. Submission of final report

Annex 2
List of Persons Met

Mr. Shamsuddin, Upazila Agriculture Officer, Ali Kadam, Bandarban
Mr. Monindra Tripura, Social Worker, Ali Kadam
Mr. Ching Nue, GRAUS
Ex-Headman and several others in Chimbuk Para, Bandarban
UP Cahirman, Karbari and others in Karfu Para, near Nilgiri, Bandarban
Mr. Abdullah Ibrahim, Deputy Director, DAE, Bandarban
Mr. Vabotosh Chakroborty, Upazila Agriculture Officer
Mr. Nur Mohammad, Zila Training Officer, DAE
Mr. Maung Seing Phrue, GRAUS, Bandarban
Mr. Churna Bahadur, District Coordinator, UNDP, Bandarban
Mr. Md. Yusuf, Assistant Forest Conservator, Bandarban
Mr. Taum Thang, Organizer, CCDB, Ruma
Ms. Nem Kim, Trainer, CCDB, Ruma
Mr. Moi Thiong, Bagan Para
Mr. Sumitra, WFP, Rangamati
Mr. Janolal Chakma, CPID, Rangamati
Mr. Biplab Chakma, UNDP, Rangamati
Mr. Rob Stoelman, Chief, CHTDF, UNDP, Rangamati
Security Officer, BDR, Ruma
Mr. Swapan Chakma, Sakrachari
Raimohan Chakma, Dighalchari Para, Aymachara
Ajit Kumar Talukdar, Secretary, Aymachara Union
Mr. Menong Rakhayan, Trader, Ruma Bazaar
Mr. Chirong Chakma, Chuknachari, Baro Harin
Mr. Prasenjit Chakma, UNDP, Dhaka
Mr. Rupayan Dewan, Member, Regional Council, CHT
Mr. Babudhan Chakma, Manager, Padakkhep, Ruma Bazaar
Dr Khaled Mezbahuzzaman

Annex 3
Time Lost: Responses across the border

The Bamboo Policy of Mizoram 2002 clearly acknowledged that bamboo flowering occurs at a periodic interval of 48-50 years in Mizoram[37]. It also noted of past experience - bamboo flowering was followed by famine which is locally known as 'Mautam', after the flowering of *Melocanna baccifera* (Mautak) and Thingtam after Bambusa tulda (Rawthing). As per record Mautak flowered in 1815,1863, 1911, and 1959. The Policy predicted that the next flowering cycle of Mautak would come in 2007. As for Rawthing, flowering was observed in 1739, 1785, 1833, 1881, 1929 and 1977 and the next flowering is expected in 2025. It was no new knowledge thrust upon the policymakers in Mizoram that gregarious flowering and seeding of bamboo causes an increase in rat population, and the massive rat population feeds on standing agricultural crop, causing its destruction and results in acute food scarcity.

It is in this context that North-Eastern Regional Policy Workshop on Bamboo & Cane was held at the Assam Administrative Staff College, Khanapara, Guwahati on 22-23rd January, 2002, jointly sponsored by UNDP, DST, UNIDO, INBAR, NEC, IFAD & CBTC. Subsequently, the Rain Forests Research Institute organized an Expert Consultation on Strategies for Sustainable Utilization of Bamboo Resources subsequent to Gregarious Flowering in the Northeast, with supports from UNIDO. Thus, professionals and policymakers in the neighboring country were discussing some of the following issues, while their counterparts on this side of the border remained oblivious – even till now!

- To create awareness amongst the local populace about the problem of gregarious bamboo flowering
- To take remedial steps to counter the problem of gregarious flowering
- To highlight the problem of gregarious bamboo flowering amongst the policy makers/ Governments of the region so that something substantial can be done in order to mitigate and offset this problem once and for all.
- To gather indigenous knowledge, belief and practices of communities associated with bamboo management.
- Recording of past incidences of Bamboo Flowering, the pre and post flowering effects on ecology.
- To workout minimum possible time frame and means to replenish the crop.
- Evolving future strategies based on past experience and modern package and practices on management over the impact of flowering of bamboos.
- It's optimum utilization; storage technology for sustainability till fresh produce comes up.
- To decipher the integrated, practical and feasible suggestive frame work to this national problem on large-scale forest resource destructions to the media for remedial measures.

[37] There is a good reason for this early awareness amongst policymakers. Mizo Famine Front to negotiate massive famine caused due to massive rat invasion due to bamboo flowering in 1959 which was afterwards turned into MNF (Mizo National Front) for their armed movement led by Lal Denga. Bamboo flowering and the famine is known in Mizoram as Mautam, ('bamboo death'), which triggered over 22 years of violent guerilla unrest in Mizoram and surrounding areas.

- To formulate necessary precautionary and management measures so that the enormous bamboo resources can be best put to economic utilization on or before flowering.
- To bring together professionals having adequate knowledge in the field of bamboo production and utilization and evolve suitable strategy across the table.

Government of Mizoram undertook a Comprehensive Action Plan for Bamboo Flowering and Famine Combat Schemes (BAFFACOS) (2004-2005 to 2008-2009). The Plan included the following components:

Component 1: Rodent Surveillance and Control: (i) Survey of Sporadic Flowering Areas, (ii) Surveillance of Rodent Population/Incidence in the Jum/WRC Fields, (iii) Awareness campaign, (iv) Pest Control Management
Component 2: Promote crop diversification for Bamboo shoot production to eliminate micro-nutrient deficiency
Component 3: Introduce early maturing varieties of rice in jum cultivation areas.
Component 4: Introduce improved varieties of alternative crops like Ginger, Cotton, Potato, Sugarcane, Sweet Potato, Maize and oilseeds/pulses.
Component 5: The farming system will be mechanised as far as possible for crop production by using tractors with its attachments, planters, power tillers, oil expellers, seed dryers, etc.
Component 6: Construction of rain water harvesting ponds
Component 7: Construction of infrastructure for market connectivity
Component 8:

The following surveillance activities were reported to have been undertaken: -
I. Rodent Surveillance
a. Collecting and examining death of rodents
b. Monitoring rodent activity
c. Trapping rodents for population data, serum, tissue samples and ecto-parasite collection
II. Vector Surveillance (Rat Flea)
a. Calculation of flea index.
b. Determination of species
III. Carnivore (cats, dogs, foxes, etc.) Surveillance
a. Dogs develop antibodies which may be detected in case of plague.
b. Surveillance of cats, foxes in similar manner
IV. Human (Clinical) Surveillance
a. Health functionaries and community to be alert
b. Case definitions to be made in local language
c. Case investigation in suspected cases.
d. Notification to health authority by health personnel and the community.
e. Regular reporting and analysis of surveillance data
V. Laboratory Surveillance & Diagnosis
a. Strengthening in terms of equipments and capacity building
b. Diagnosis and regular reporting of rodent borne diseases
c. Culture & sensitivity

Annex 3
Various Synonyms of Muli Bamboo

Source: http://www.plantnames.unimelb.edu.au/Sorting/Melocanna.html#baccifera

Melocanna baccifera (Roxb.) Kurz (GRIN,PROSEA,Wang)

SYNONYM(S): **Bambusa baccifera** Roxb. (GRIN,PROSEA), **Melocanna baccifera** Skeels (IPNI), **Melocanna bambusoides** Trin. (GRIN,PROSEA), **Nastus baccifera** Ras. (Masman)

ASSAMESE : তৰাঈ Tavai (as Bambusa baccifera), Wati.

BENGALI : বিশ Bish, মেটুংগা Metungaa, মুলী Mulii (Muli), Paiyya, Payu tullu.

BURMESE : ကရင်ဝါး Kayinwa, တဝင်တိုင်ဝါး Ta bin daing wa, Tabinwa ?

CHINESE : 梨竹 Li zhu, 梨果竹 Li guo zhu (Taiwan).

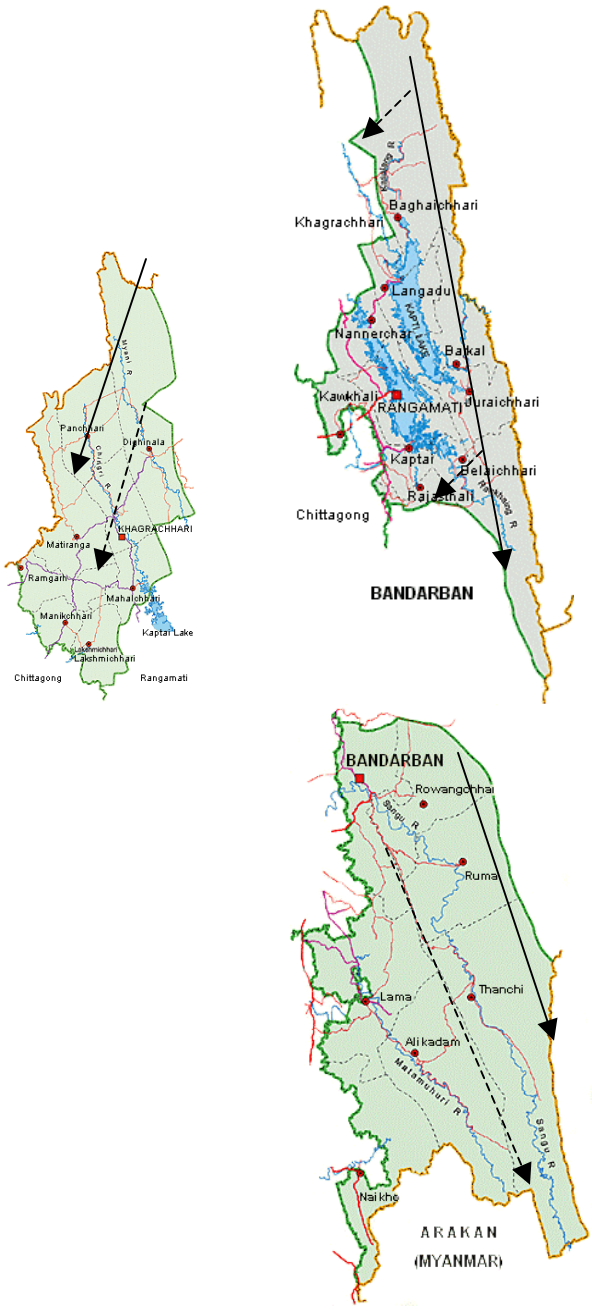
ENGLISH : Pear bamboo, Berry bamboo, Muli, Muli bamboo, Terai bamboo.

FRENCH : Bambou de Birmanie à fruit comestible.

HINDI : Mautak, ताडी Taadii , Tarai, Tari.

OTHERS (unid) : Philim bans, Lahure bans, Mautak, Payu tullu, Watri.

Annex 4
Map of three CHT districts and Conjectured Lines along which Bamboo Flowering may have Spread



Note: Bold lines show the path of flowering in remote hilly areas reported to be most affected. The dotted line in Bandarban runs along Chimbuk, the hilly region running north-south in between Matamuhuri and Sangu rivers.

Annex 5
Various Uses of Muli Bamboo

Melocanna baccifera (Roxb.) Kurz is a commercial edible bamboo specie in the CHT as well as in the north-eastern states of India. Along with three other edible species, it is cultivated in home gardens besides their occurrence in forests. Edible shoots are harvested from first week of June to first week of September every year for consumption. However, market days for selling it varies. A study in Meghalaya, Mizoram and Sikkim found that 3,610.61 q of edible shoots of M. baccifera are harvested and consumed every year. On an average, it contributed 35.14% to total monetary benefits earned, irrespective of states (see Bhatt et al 2003). Besides food value, these species also have a very important role in the life of tribal folk, particularly for providing materials for various other quotidian needs, as well as for paper-pulp industries. Melocanna baccifera is rich in nutritive value. It has a food energy of 15.80 MJ per kilogram; with a moisture content of 75.5 % DM, protein content of 3.62 % DM, fat content of 0.57 % and carbohydrates of 6.12 %DM. The following Table summarizes the various uses of Muli bamboo.

Table 5.1: Uses of Muli Bamboo

Various Cuisine from Muli Bamboo shoots		
English name	Mizoram name	Preparation
Boiled Vegetables	Chum/Mizo	Small pieces of edible shoots boiled with only salt in plain water.
Fried vegetable	Kang/Mizo	Bamboo shoots fried in oil and spices along with other vegetables.
Fried curry/ soup	Vaipaden/Mizo	Young shoots cooked with vegetable or non-vegetable components along with spices
Pickle	Um/Mizo	Small pieces of bamboo shoots are put into vinegar, mustard oil, spices, chili etc.
Fermented product	Rep/Mizo	Bamboo shoots are boiled, squeezed and stored for fermentation for several months. They are used as vegetable throughout the year.
Other Uses		
- Winnowing tray - Rice carrying baskets - Betel vine and betel nut baskets - Vegetable containers - Carrying and storing baskets - Mat - Weeding implements - Stool - Firewood - Rodent traps - Fishing rod - Rain shield - Chick baskets and feeder - Bridge - Cattle trough - Piglet carry baskets - Duckling carry baskets	- Hen coop and chicken baskets - House pole ceiling, partition wall, fencing, water pipe, etc. - Bridge and supporting materials for concrete building and bridge construction. - Implements for handloom craft - Handicraft, animal cage and farm house, etc. - Food container for long term preservation and use. - Musical instruments - Paper and pulp industry - Tool handles and agricultural implements - Traditional hockey stick and ball - Used for making pegs for hanging crabs to trap *gundhi* bug (*Leptocorisa oratorius*) of rice crop.	- For making *Nal* to feed aqueous feed/solutions to livestock. - Bait station for keeping poison in rodent management. - Leveling stocks. - For making drip irrigation. - For making *Machan* used as shelter to protect crops in jum fields. - For making coat. - Branches are used to provide support to climbers and twiners and also to make brooms, map pointers and firewood. - Leaves are used as fodder for cattle and goat, house roofing and as partition wall in huts. Leaves are also used to produce smoke as insect repellent in the cattle farms.

Note: Compiled from Bhatt et al (2003).

Annex 6
Statistical Tables

Table 6.1 Distribution and area (ha) of different forest types

	Reserved forest	Acquired forest	Protected forest	Vested forest	Unclassed state forest	Khas	Total
Hill forest	5,94,383	11,004	32,303	2,636	7,21,344	--	13,61,670
CHT(North)	1,59,379	--	--	--	1,53,063	--	3,12,442
CHT(South)	82,161	--	--	--	1,72,721	--	2,54,882
Bandarban USF	40,198	--	--	--	78,592	--	1,18,790
Pulpwood Bandarban	--	--	--	--	58,236	--	58,236
Lama	--	--	--	--	75,149	--	75,149
USF Rangamati	12,801	--	--	--	89,694	--	1,02,495
Jum Control	12,903	--	--	--	9,600	--	22,503
Pulpwood Kaptai	29,279	--	--	--	--	--	29,279
Khagrachari USF	1,409	--	--	--	82,073	--	83,482

Table 6.2. Distribution of Households by Types of Dwelling Units*

Material used	Chittagong Hill Tracts	Rest of Bangladesh
Mud/earth	13.3	20.8
Bamboo (ordinary)	73.4	18.5
Bamboo (high quality)	11.6	-
Semi-pucca/tin	0.6	15.7
Bricks	1.0	3.9
Others	0.1	41.1

Note: (1) Material used in walls of the primary dwelling unit has been considered; (2) others include thatch, jute sticks, etc., which are comparable to ordinary bamboo walls; (3) high quality bamboo houses are comparable to semi-pucca houses.
Source: Sample surveys.

Table 6.3
Severely affected communities by rat infestation Rengkhyong reserve forest
(beyond Farua)
District: Rangamati Hill District, **Upazila**: Bilaichari, **Union**: No. 3 Farua
Data as in April 2008

Sl	Village	Household	Population	Ethnicity	Ward
1	Aarif Para	10	58	Mro	9
2	Hatichara	14	66	Tripura	9
3	Dhup Panichara	13	57	Tripura	9
4	Sheprue Para	14	75	Tripura	9
5	Sharjing Para	31	150	Tripura	9
6	Prayang Para	46	274	Tripura	9
7	Pukur Para	55	285	Tripura	9
8	Barthali Marma Para	76	398	Marma	9
9	Barthali Tripura Para	71	387	Tripura	9
10	Shalbagan	38	226	Marma	9
11	Sadarichara	17	90	Tanchangya	9
12	Kengoychara	24	125	Tanchangya	9
13	Saijang Para	26	97	Bawm, Khiyang, Tanchangya	9
14	Bilchari para, Barthali	14	74	Tanchangya	9
15	Tiger Para	53	314	Tanchangya	9
16	Jarulchari	33	207	Mro, Khumi	9
17	Jamunachari Bawm Para	72	384	Bawm	9
18	Tinban Panho Para	13	70	Pankhua	9
19	Sukkurchari	37	139	Tanchangya, Marma	9
20	Mandirochara	54	269	Tanchangya	9
21	Bharekkyachara	18	112	Tanchnagya	8
22	Ramyongchara	62	295	Tanchangya	8
23	Taikutang Para	171	851	Tanchangya	8
24	Tarachari	143	679	Tanchangya, Tripura, Marma	7
25	Panchari Thuma Para	30	150*	Chakma	7
26	Sabatoli	37	206	Tanchangya	6
27	Chongrachari	32	147	Tanchangya	5
28	Gabochari	40	177	Chakma	5
29	Panchari	59	268	Tanchangya	5
30	Dumdumya Tripura Para	22	153	Tripura, Chakma	5
31	Dumdumya Chakma Para	28	136	Chakma	5
	31	1,353	6,919		

*Population is approximate.

N. B. Data responsibility goes to Rupayan Dewan, Councillor, CHT Regional Council.

Table 6.4
Household level impacts by different Pathways

Source	Direct effects	Affected Groups	How Affected	Duration	Ways to return to normalcy	Possible constraints
Bamboo flowering and subsequent death of parent plants	Bamboo stocks reduced by 70% over three years	Poor households	Reduced employment and income for the poor, with possible decline in wage rates	>= 4 years	Provide alternative employment opportunities	Large scale schemes tend to use outside labor
			Reduced supply of cheap alternative food (see annex)	1-2 years	Supplement food needs with relief/FFW	
		All households	Housing (see annex)	>= 4 years	Temporary poly sheets inside existing structure to substitute major repairs	Possible environmental hazards and may be against local culture
			Housing	<as above>	Ensure protection of seeds and their germination for regeneration of new bamboo plants	*lack of awareness *damage by rats and other animals *selling away seeds to other places – more than a threshold level *food insecurity leading to eat the new bamboo shoots
			Trade & services around bamboo harvest, marketing & construction	>= 4 years		
			Reduced quality of life due to non-availability of readily available raw materials (see Annex)	>= 4 years		
		Environment and subsequent effects on livelihoods of all	Expected increase in logging in response to non-availability of Muli	long term	Provide suitable alternatives to major uses of Muli – possible mix of incentives and punishments	
		Regional & National	Increase in bamboo prices, KPM	>= 4 years	<Not addressed>	

Table 6.4 (continued)

Source	Direct effects	Affected Groups	How Affected	Duration	Ways to return to normalcy	Possible constraints
Rat Infestation	Damage of Standing Crops in 2007	All households	Reduced food supply leading to food insecurity	Till September /October 2008	Food relief	Reaching remote areas in cost effective ways
			Reduced stock of seeds for planting in 2008 Jum season	Till mid-June 2008	Institutionalize monitoring & coordination cell and negotiate on lending across communities and districts	*Lack of trust *Lack of awareness on the severity of the problem
	Reduced area under Jum in 2008	Poor households	Reduced employment prospect along with reduced wages	May-June & Sept-Oct, '08	Design alternative employment schemes for Sept-Oct season	Large scale schemes tend to use outside labor
					Plantation of fruits and timber	*inadequate supply of seedlings *Property right issues *May not be feasible till the dry season arrives
	Damage of Seeds sown in 2008 Jum	All households	In the absence of seed markets, difficult to find new seeds for re-sowing		Institutionalize monitoring & coordination cell and negotiate on lending across communities and districts	*Lack of trust *Lack of awareness on the severity of the problem *Possible intrusion of hybrids may be detrimental to the environment
			Food insecurity to continue till 2009 harvest – famine	Till Sept-Oct 2009		

	Damage of other Jum crops	All households	Decline in nutrition intakes, and increased dependence on markets	At the least till October 2008 – possibly few years beyond	Identify appropriate short duration home gardening that can withstand rat attacks	*Lack of adequate understanding among agriculture extension on appropriate technology for the hilly area
		Those engaged in spinning and weaving at home, particularly, Chakmas	Reduced supply of local cotton	Till the rodent population remains high	Supports to the specific cottage industry through cash transfers	Identifying the target group may be difficult
	Damage of *Jamin* (plain land) crops	Expanded affected areas	Local level food supply will further deteriorate affecting all households	Potentially, 2008 Aman crops onward	Take measures to control rat migration into *Jamin* land and institutionalize tracking of their movements	*Absence of surveillance on rat movements *Absence of appropriate scheme
	Ecological imbalance with increased rat population	All households	Thriving rat population will damage crops and may eventually attack homesteads in search of food, causing menace to children, tearing clothes and other essentials	3 to 4 years, or more?	Promote killing of rats through incentives (such as price for rat tails) and making people aware about effective techniques through sharing of knowledge between communities	*Absence of trust *Possible leakage in distributing incentives *Religious inhibitions among Buddhists *Concerns that children may get involved
	Attacks on Homesteads	All households	<as above>	<as above>	<as above>	<as above>
Repeat Jum Cultivation	Sustain rat population	All households	<as above>	<as above>	Discourage Jum cultivation for 2 to 3 years in selected areas	*Lack of awareness *In the absence of alternative livelihood, it is difficult
Food	What is available	All	<as above>	now till such	Design and provide	*Lack of awareness

supports to affected areas	for humans may also be accessible for rats	households		supports continue	appropriate storage facilities which will protect the food grains from rats	*Difficulties in transporting unless locally produced
Second round of flooding from other animals	Crop damage, including fruit plantations	All households	Crop damage leading to further food insecurity, delaying return to normalcy	Possibly after the rains in 2008 and beyond	Institutionalize tracking of their movements and engage scientific community to suggest probable outcomes ahead of such events	*Lack of adequate sensitivity on the issue among policymakers *Scarcity of funds and human resources
Contemporaneous events						
Reduction in tobacco area[1]	Will reduce alternative employment opportunity	Poor households	Unless alternative crops are grown on this land, size of available employment will reduce substantially	Next crop cycle, 2008-09	Alternative crops to be grown in the erstwhile tobacco areas should be identified, farmers should be made of aware of these, and appropriate property rights should be enacted on those land to allow the shift to those crops	*Current rights on land having strong linkages with the tobacco companies may be hindrance * Lack of adequate understanding among agriculture extension on appropriate technology for the hilly area
Lack of awareness and trust	On all initiatives to act promptly for eradicating abnormal rat population and containing the adverse effects	All households	Increased food insecurity over a prolonged period with potential to cause famine in the area, and hurting the cause of establishing peace in the region		Undertake programs to allow and encourage all groups within and outside the government, and between all communities to exchange experiences and knowledge on the issues related to rat infestation and remedies	*Some development partners may be less enthusiastic to put money on such exchanges

Note: 1. During the last production cycle of tobacco, it is reported that the BAF imposed restrictions on felling trees to make fire for drying tobacco. The instruction was to confine to using only dead wood and branches. Moreover, anti-tobacco campaign was seen organized during our field visits. The tobacco

companies and their agents fear that such restrictions will be more severe in the coming year raising cost of drying. Thus, there are apprehensions that the tobacco area will reduce in the coming year.

Table 6.5: Reported Food Items Consumed by Households (%)

Food items	Indigenous people	Bawm	Chak	Chakma	Khyang	Khumi	Lushai	Marma	Mro	Pangkhua	Tanchangya	Tripura	Bangalee	All
Rice	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Flour/wheat	5		4	10				1				2	15	9
Puffed rice	25	4	8	31	28	2		28			43	19	69	45
Fish	89	91	100	95	94	72	33	97	81	14	95	73	98	93
Dry fish	88	93	100	85	98	81	93	90	91	96	87	87	75	82
Meat	67	91	67	78	75	51	27	65	28	18	72	48	63	65
Napi	95	96	98	98	98	100	100	91	100	96	82	89	1	53
Egg	35	32	57	34	32	9		53	6		35	22	64	48
Oil	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Pulse	41	22	47	47	49	14	7	49	7	2	35	29	77	57
Bamboo shoot	66	91	2	73	28	91	100	52	91	100	72	66	7	40
Vegetable	96	98	98	98	98	100	87	99	65	84	100	96	100	98
Potato	81	89	86	88	68	95	40	92	20	18	88	68	95	87
Arum	69	87	55	75	81	95	67	67	22	42	68	61	53	62
Dry vegetable	25	76	47	33		72		14		2	37	15	3	15
Onion/garlic	95	96	78	99	98	95	100	96	88	90	98	84	99	97
Milk	18	24	16	26	15	2		17	1		13	6	31	24
Spice	85	76	96	94	89	70	27	92	54	22	77	65	97	90
Fruit	36	83	35	51	6	47		25	20	2	40	18	40	38
Salt	99	98	100	99	96	100	100	99	100	100	98	99	99	99
Sugar	40	87	33	42	62	54	47	38	9	38	53	28	75	56
Molasses	14	19	8	18	15	7		15			10	6	13	13
Chili	20	52	55	24	17	12		18	1		23	8	24	22
N	**1786**	**54**	**49**	**731**	**47**	**43**	**15**	**469**	**69**	**50**	**60**	**199**	**1452**	**3238**

Source: HDRC/UNDP Report.

Table 6.6: Per capita daily food consumption of the household (gm)

Food items	Indigenous people	Bawm	Chak	Chakma	Khyang	Khumi	Lushai	Marma	Mro	Pangkhua	Tanchangya	Tripura	Bangalee	All
Rice	396	333	385	405	343	380	349	399	389	458	412	374	423	408
Flour/wheat	1	0	2	1	0	0	0	0	0	0	0	0	5	3
Puffed rice	3	1	2	3	4	0	0	3	0	0	6	3	17	9
Fish	24	15	13	30	20	18	7	24	22	2	19	16	39	31
Dry Fish	10	9	9	9	8	10	8	11	16	10	8	8	7	8
Meat	11	17	8	13	12	12	5	11	7	4	10	9	11	11
Napi	11	9	8	12	7	11	13	9	18	13	10	10	0	6
Egg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil	1	0	0	1	1	0	0	1	0	0	2	1	0	1
Pulse	4	2	2	4	2	1	1	4	2	0	2	3	8	5
Bamboo shoot	50	20	0	55	24	83	46	54	54	46	31	49	4	30
Vegetable	147	114	130	141	164	95	183	170	97	126	146	153	163	154
Potato	37	16	15	43	32	32	11	43	7	5	35	33	47	41
Arum	25	12	5	28	66	31	23	24	7	14	18	27	14	20
Dry vegetable	4	9	8	5	0	6	0	2	0	0	6	4	1	2
Onion/garlic	11	8	5	12	7	6	10	11	8	9	10	9	15	13
Milk	3	2	2	5	3	1	0	4	0	0	2	0	7	5
Spice	3	1	8	3	2	2	1	4	2	1	3	2	4	3
Fruit	7	6	3	12	1	3	0	4	4	0	3	4	7	7
Salt	14	11	11	14	11	14	14	15	16	18	16	16	16	15
Sugar	4	8	3	3	5	4	7	4	1	6	3	3	11	7
Molasses	1	2	0	2	2	0	0	1	0	0	0	1	1	1
Chili	2	4	5	3	1	1	0	2	0	0	3	1	2	2
All food	765	596	623	801	711	708	675	798	649	712	743	726	800	781
N	**1786**	**54**	**49**	**731**	**47**	**43**	**15**	**469**	**69**	**50**	**60**	**199**	**1452**	**3238**

Source: HDRC/UNDP Report 2008.

Table 6.7: Per capita daily food consumption of the household (K. cal)

Food items	Indigenous people	Bawm	Chak	Chakma	Khyang	Khumi	Lushai	Marma	Mro	Pangkhua	Tanchangya	Tripura	Bangalee	All
Rice	1368	1150	1332	1401	1185	1316	1206	1380	1347	1584	1424	1293	1464	1411
Flour/wheat	2	0	7	3	0	0	0	1	0	0	0	1	18	9
Puffed rice	10	2	7	11	14	1	0	11	0	0	19	11	59	32
Fish	26	17	14	33	23	20	7	27	24	2	21	17	44	34
Dry Fish	33	31	31	30	28	36	28	38	54	33	28	29	25	29
Meat	12	19	9	14	13	14	6	12	8	4	11	10	12	12
Napi	34	27	25	38	20	34	40	27	57	41	30	32	1	19
Egg	10	7	19	8	12	2	0	16	2	0	8	7	18	13
Oil	6	3	4	6	7	1	0	6	1	0	15	9	4	5
Pulse	2	1	1	3	2	0	0	3	0	0	1	0	5	3
Bamboo shoot	2	1	2	3	1	1	0	3	2	0	2	2	5	4
Vegetable	97	39	0	106	46	160	89	104	104	90	61	95	8	57
Potato	5	4	3	6	4	3	5	5	4	4	5	5	8	6
Arum	52	40	46	50	58	33	64	60	34	44	51	54	57	54
Dry vegetable	36	15	15	41	31	31	11	42	7	5	33	32	45	40
Onion/garlic	29	14	6	32	76	36	26	28	9	16	21	31	16	23
Milk	10	24	21	14	0	16	0	4	0	1	17	10	2	6
Spice	2	1	6	2	1	2	1	3	1	1	2	2	3	2
Fruit	4	4	2	7	0	2	0	2	2	0	2	3	4	4
Sugar	14	31	12	13	18	14	26	15	3	24	13	11	42	27
Molasses	5	7	1	7	7	1	0	4	0	0	1	3	3	4
Chili	2	4	5	3	1	1	0	2	0	0	3	1	2	2
All food	1762	1440	1565	1831	1547	1722	1509	1793	1659	1850	1770	1658	1842	1798
N	**1786**	**54**	**49**	**731**	**47**	**43**	**15**	**469**	**69**	**50**	**60**	**199**	**1452**	**3238**

Source: HDRC/UNDP Report 2008.

Table 6.8: Ethnic minority and Bangalee Population Distribution in the 25 Upazilas of 3 CHT Districts

Sl. No.	Districts & Upazilas	Population Distribution (Ethnic minority and Bangalee)											
		Bawm	Chak	Chakamas	Khyang	Khumi	Lushai	Marmas	Mro	Pangkhua	Tanchangya	Tripuras	Bangalee
1	**BANDARBAN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.1	Alikadam	-	-	409	-	-	-	5198	9058	-	1368	2721	17230
1.2	Bandarban Sadar	1468	14	1744	825	-	26	22223	3990	-	2662	471	32597
1.3	Lama	-	-	169	221	-	-	14485	5023	-	52	2680	58530
1.4	Naikhongchhari	-	2137	1168		-	-	4569	1923	-	1364	-	43014
1.5	Rowangchhari	958	-	918	619	74	-	13271	985	-	1150	1318	2373
1.6	Ruma	4985	-	267	158	342	267	10270	3346	128	434	1156	3927
1.7	Thanchi	817	-	652	-	1055	-	5864	3784	-		2132	1856
2	**KHAGRACHHARI**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2.1	Dighinala	-	-	52249	-	-	-	130	-	-	-	5978	33555
2.2	Khagrachhari Sadar	-	-	25700	-	-	-	11123	-	-	-	18869	35454
2.3	Lakshmichhari	-	-	12287	-	-	-	5087	-	-	-		4017
2.4	Mahalchhari	-	-	18403	-	-	-	7510	-	-	-	2330	15259
2.5	Manikchhari	-	-	819	-	-	-	11290	-	-	-	2474	15132
2.6	Matiranga	-	-	5521	-	-	-	6121	-	-	-	21419	72779
2.7	Panchhari	-	-	28556	-	-	-	1808	-	-	-	9603	15316
2.8	Ramgarh	-	-	2500	-	-	-	12775	-	-	-	6669	37047
3	**RANGAMATI**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
3.1	Baghaichhari	-	-	50750	-	-	63	2	-	492		3075	28967
3.2	Barkal	-	-	30623	-	-	-	326	-	241	-	23	11447
3.3	Belaichhari	1022	-	5518	4	-	-	3544	-	631	8110	501	6370
3.4	Juraichhari		-	19981	-	-	-	40	-	55	1082	11	2431
3.5	Kaptai	-	-	300	82	-	-	15978	-	52	5360	21	48587
3.6	Kawakhali	-	-	11275	-	-	-	17356	-	-	902	-	20015
3.7	Langadu	-	-	17149	-	-	-	2	-	53	-	-	51636
3.8	Naniarchar	-	-	31448	-	-	-	1488	-	-	-	25	5276
3.9	Rajasthali	-	-	61	778	-	-	9091	-	1	6475	1764	8210
3.10	Rangamati Sadar	-	385	39544	-	110	339	1189	-	915	1618	1082	54084

Source: HDRC/UNDP Report 2008.