Situation Analysis Report on Buxa

HighARCS

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Summary

High Aquatic Resources Conservation and Sustainable Development (HighARCS) is set around assessment, analysis and conservation of high land aquatic resources and examination of access and control dynamics of the marginalized communities over them. The project, sponsored by the European Commission, is being implemented in *China, Vietnam and India*. The research follows a multi-disciplinary research framework with longitudinal time series analysis plan. Multi-stakeholders involvement is an essential strategy of the project.

Buxa, in North Bengal, India, has been selected as one of the two project sites in India. One of the essential steps of the project is situation analysis. The process involved:

- Analysis of the geo-physical and demographic characteristics,
- Socio-cultural dynamics,
- Livelihoods patterns,
- Aquatic resources situation,
- Shift in resources availability,
- Ownership and control,
- Ecosystem services and
- Institutional and policy frame work.

Situation analysis is based on:

- The secondary sources data and literature review,
- Focused group interviews and
- PRA exercises using relevant tools.

The project site has been divided into three clusters depending upon its topography, demographic characteristics, physical characteristics and aquatic resources characteristics. It is important to note that the division of the project site into three clusters has been based on the indicators set by the different stakeholders during focused group participatory exercises.

The situation analysis indicates presence of multiethnic population spread, differently, in three clusters. In fact one of the criteria for the division of cluster is demography. Cluster I (Adma) has predominantly Dhukpa community combined with Nepalis. Cluster II (Buxa fort) has mixed communities almost equally divided into Nepalis and Dhkpas. Cluster III (Jayanti) has mixed population of Bengalis, Tribals, Nepalis and migrants from other states. The socio-cultural system demonstrates soft and synergetic culture wrapped in tradition. There is respect for natural resources and conservation seems to be shared societal values. Dependency among the community members is reflected in lack of entrepreneurship and enterprise.

The high undulated terrain offer difficult livelihoods challenges. The small size of land holding and lack of irrigation does not allow planned agriculture. Other inputs for agriculture are also not easily accessible. The community in the two clusters (I&II) have traditionally been dependent upon forest and agriculture has not been the mainstay. The upper part of Buxa had orange cultivation as the main source of livelihoods for years. This has faced termite infestation leading to complete loss of this source of livelihoods. The reserve forest status of the region allows limited access to forest resources. The communities are reduced to labors and menial workers. The situation with regard to livelihoods for cluster III (Jayanti) is adversely effected by land degradation due to flood and soil erosion and also limited access to forest produce.

There has been efforts at accelerating pace of development covering health, education and livelihoods but the agencies –government, non-government-have not been able to effect substantial changes owing to institutional and governance gaps. The communities

in all the three clusters face various vulnerability, natural calamities, heavy rain in the catchment, floods/drought, soil erosion, diseases and lack of credit.

There are rich biodiversity including aquatic resources. However, because of constant degradation of the water bodies (rivers and rivulets) the aquatic resources have witnessed constant degradation. The community members have indicated rich and diverse species of fish which we could also observe in cluster I and II but the community from cluster I and cluster II are not regular fish eaters-fish is not seen as the key menu of their food. During the field survey they indicated that earlier fish occupied important food menu which is not the case now. Whatever small quantity of food they have they use them as their occasional food supplement. A cross section of the community (Bengalis) in cluster (III) prefers eating fish and also catch fish for selling. For them fish and other aquatic resources are a marketable commodity.

The situation analysis indicates that the community is allowed access to and control over natural resources although the government policy prescribes strict regulatory measures. The government officials are reported to be friendly and supportive to the interest of communities. However, lack of awareness about the regulatory provisions often makes the communities vulnerable to over step the permissible limits and thereby fall into legal traps. This is where exploitation and harassment of the communities, at the hands, of the regulatory agencies takes place.

There have been efforts at developing the area through various interventions including both the development of physical infrastructure and social development. Development of drinking water facilities by the boarder area development agency has been a major program. Swaranayanti Gramin Swarojgar Yojana (SGSY) has helped the people in credit availability and development of infrastructure, the district administration has constructed approach road and non-conventional energy sources –solar light. NGOs have facilitated social development programs like education and health. Under the National Rural Employment Guarantee Act the villagers have been claiming and getting assured

employment for 100 days in a year. These have helped the community develop better and mainstream.

The situation analysis exercise has shown some limitations. The analysis is based on limited interaction, related to the project, with the communities. CDHI has been working in the area for long time and it has been possible to have a better understanding of the aspects described in the situation analysis report. However, focused iterated engagement /interaction with the community may help develop deeper analysis and insights. The proposed longitudinal time series data and their analysis would reveal the realities further and deeper.

Situation Analysis Report on Buxa

1. Situation analysis

According to the Project Document of the HighARCS '… the link between environmental degradation and increased vulnerability of poor communities is well known, only limited information is available concerning communities in highland areas, and even less regarding those dependent on aquatic resources and associated ecosystem services in such settings. Moreover, the role of aquatic resources is not well understood in relation to livelihoods among food-insecure households. Given the dynamic nature of aquatic resources particularly in the light of global climate change, there is an urgent need to improve existing knowledge' (Project document HighARCS, 2008). The aspects of knowledge to be understood may include:

- the significance of biodiversity in upland ecosystems in terms of the local ecology and regional socio-economic systems,
- Changing conditions in the upland environment and conflicting demands of those dependent on its resources.

High ARCS is set around the conservation of high land aquatic resources and access and control of the marginalized communities over them. The sustainable livelihoods framework underlines the inevitable role of social capital-association and networks-in the management of sustainable livelihoods. High ARCS is concerned about the marginalized communities getting further marginalized and isolated from decision making process in the need for the conservation and augmentation of bio-diversity. The Convention on Biological Diversity (CBD) has underlined the involvement of marginalized communities as an essential condition for sustainable bio-diversity and there by sustainable livelihoods (CBD, 1992).

High ARCS interventions would require adequate understanding of the situation which would include:

1. Understanding of the local community
2. Bio-diversity
3. Institutions and Policy

This forms the overall environment to understand the dynamics of bio-diversity and conservation strategies. We would first of all present the location where we plan to continue our study. The presentation is based on:

1. Secondary sources data and literature review
2. Participatory strategies and tools including focused group interviews
3. Stakeholders consultation for triangulation and so forth

2. Method

2.1. Location and geo-physical characteristics

Background

Buxa, the extreme north east of Kalchini block under Jalpaiguri district offers contrast of a different kind. While the area has rich natural resources with hilly terrain, the population is a mix of Neplali and Dhukpa origin. The 11 picturesque villages offer diversity of terrain and remoteness-with Adama being the farthest and most difficult of all. Buxa is the centre of the 11 villages with a rich historical identity. All the villages fall under Rajabhatkhaba Gram Panchayat. Considering the remoteness and demography of the area Centre for the Development of Human Initiatives (CDHI), Jalpaiguri, joined hands with the local district administration and drew upon and implemented an integrated development program for the villages with education as the entry point intervention. The interventions brought about comprehensive changes in the life of the people and the government reciprocated the initiative with balanced program inputs. Gradually, CDHI made a systematic phasing out strategy with more and more responsibilities assumed by the local community and the development agencies. All the primary schools that were organized under the CDHI-UNICEF-District administration

initiative brought all the school going age children to schools. The children, now, attend formal schools. Remedial classes are organized, now, to help them compete with the mainstream institutions. The success of the intervention has encouraged other players, including the government, to step up further activities.

Key features of Buxa

State	Bengal.
District	Jalpaiguri
Special Status	Under Tiger Reserve Forest-Reserved forest
Fauna (Animals)	Elephant, Tiger, Gaur, Sambar, Muntac, Leopard,
Flora (Plants)	Sal…
Geographical Location	Lies in the hills of Jalpaiguri District. Approximately 26 degree C 37'N, 91 Degree 53'E
Land Status	Provincial government Longitude 89o25'to 89o55'E
Latitude	23 degree 30'to 23 degree 50'
Altitude	125-1750m
Rainfall	3570mm to 5600 mm
Temperature	Min 15 degree C – Max 39 degree C
Winter	October to January
Summer	February to May
Monsoon	June to September
Nearest Town	Alipurduar (32 km distance).
Nearest Railway Station	Alipur Duar
Nearest Airport	Bagdogra (190 km distance)

Source: District report(s)

2.2. Households and demography

Available primary data from the household survey indicate majority of the 681 households in Buxa practice Buddhism followed by Hinduism. There are good numbers

of Christians. Majority of them enjoy ST status but majority of them do not have official certificate. An interesting aspect of the population, as reveled during the study, is gender ratio which is skewed in favor of women- sex ratio being 1213 female for every 1000 male. This is in contrast to the West Bengal's sex ratio of 934 female per 1000 males and India's sex ratio of 933/1000.

The entire Buxa range, according to the local communities, can be divided into broadly three clusters keeping in view the demography, geo-physical characteristics and extent of dependency on aquatic resources. Since basic focus of the High ARCS projects is on conserving bio-diversity and sustaining ecosystem services in the project area, in the context of high aquatic resources, the climate of this region is of great importance. The climate here comprises mainly four components: rainfall, temperature, humidity and sunshine hours. In the Terai region two types of climate conditions are available: climate nearer the hills and that on the plains. Near the hills rainfall is much heavier and temperature milder. In the plains rainfall is comparatively less and temperature is high.

The year can be divided into four different meteorological and agricultural seasons as under:

Winter – December to February
Summer-March to May
Monsoon- June to Sep
Post Monsoon- Oct to Nov

The average rainfall of over 48 years shows that July experiences the highest rainfall where as December experiences very little rainfall. Throughout the area May-Sep has a continuous rainfall, which is the primary reason for floods in the past years. Average rainfall varies between 2500 and 4000mm in the Buxa area.

Adma **(cluster I)** comprises of the five villages with predominantly Dhupka population. The Dhkpa community has descended from Bhutan and Tibbat. This cluster has seven

rivers crisscrossing the area and the villages. The rivers are not perennial as they get dried up during the three summer months-April-June.

Buxa Fort **(Cluster II)** has eight sparsely populated villages with a mixed population of Dukpa and Nepalis. Villages differ in their caste/community composition. The cluster has six hilly rivers which are dry and shallow during non-monsoon seasons. Three villages under Buxa cluster have 100% Dukpa population where as others are mixed. This cluster is more exposed to the outside world as the tourists often visit the area. The main village of Buxa Fort also serves as the nucleus of all the villages with a post office, the historic Buxa Fort, schools and tourist bungalow of the department of forest. Buxa Fort also serves as the marketing hub for the villagers. Although the rivers have fishes the villagers around the rivers are not great fish eaters. Occasional catch is made using fishing nets, fishing rods and check dams.

Jayanti **(Clusters III)** is at the foot hills of Buxa range with large Jayanti river as the life line of the three villages Bhutiabasti, 28/29 Basti and Jayanti. The population in the cluster is mixed with Nepalis, Benaglis, Tribals and some migrants from Bihar and south India who have permanently settled in the area. Jayanti River used to be a perennial river which has now become shallow because of mining in the upper region and breaking of stones by the strong currents. The villagers reported to have had big catch of fish in the past which has now shrunk because of drying up of the river during dry seasons. There are localized water bodies within the river where fishes are found and the villagers catch them using different traditional methods of nets, rods and embanking. In the Jayanti cluster fish eating habits and dependence on them varies across different communities. While the Benaglis are traditionally the fish eating communities, tribals consume fish to supplement their food. Nepalis and other communities consume fish intermittently. According to the villagers the river has been and continues to be a great source of fish and aquatic products.

Table Demography and households

	No of HHs	Communiâtes	Population
Cluster I			
Adma	43	Dukpa-100%	253
Lamna	13	Dukpa-100%	71
Phulbari	21	Dukpa-100%	129
Sewgaon	24	Dupka-100%	140
Chunbhati	59	Dukpa – 90% Nepali – 10%	333
Total	**160**		**926**
Cluster-II- Buxa Fort			
Sadarbazar	27	Nepali-100%	152
Daragoan	16	Nepali -30% Dupka- 70%	82
Buxafort	5	Dukpa-60% Nepali-40%	23
Lalbangla	28	Dupka70% Nepali-40%	159
Tashigaon	27	Dukpa-100%	135
Khattaline	9	Dukpa-25% Nepali-75%	44
Onchloom	25	Dukpa-100%	129
Lepchaka	45	Dukpa-100%	266
Total	**182**		**990**
Cluster-III- Jayanti			
28&29 Basti	102	Nepali-93% Tribal/Adibasi-7%	512
Jayanti	206	Nepali-25% Begali-25% Bihari-25% Adibasi-20% Others-5% (Muslim- 2 HHs, South Indians-2 HHs)	1104
Butiabasti	31	Nepali-99% Adibasi-1%	153
Total	**339**		**1769**

Source: Household survey and stakeholder's consultation/triangulation

The villages, located in the remote and difficult to reach areas, suffer serious infrastructure and civic amenities deficiencies. The households do not have adequate toilet facilities within their houses and the drinking water is provided from the streams and rivers. Number of formal government schools is limited to four. However, there are schools established by CDHI with local administrative support. Services from the government health centers is scanty both for the prenatal and antenatal services. Recently nine birth attendants have been trained from among the women from the community.

The situation, by and large, reflect, marginalization of the entire community. However depending upon the remoteness cause by inaccessible terrain Cluster I is severely marginalized. Cluster II manages, somehow, with the existing support system. Cluster III is not so high and their accessibility to the outside world is better than the other two. But all the three remain at the margin in terms of access and control over amenities and support system. Height and remoteness seems to be the determining factors.

2.3. Livelihoods

Livelihoods as the means of living are sparsely distributed. The households depend upon multiple livelihoods sources majority of which are land based. The entire area has suffered environmental degradation and their niche livelihood source, which once used to be orange, has almost disappeared because of pest (termite) attack.

We conducted PRA and FGDs at the three clusters. The exercise evolved top five ranked sources of livelihoods. The following are the ranks:

Ranks of Livelihoods

Livelihoods and their ranking	**Cluster I**	**Cluster II**	**Cluster III**
Agriculture	I	I	I
Livestock	II	II	I
Manual Labor	III	III	III
Jobs outside	IV	IV	IV
Minor forest produce	V	V	V
Local craft	V	V	V
Petty business	V	V	V
Aquatic resources	V	V	V

Ranks apart the livelihood sources and dynamics of access and control are different in the three clusters. Cluster I **(Adma)** is more surrounded by rivers and rivulets and has subsistence agriculture. Although there is no written ownership their control over land is, by and large, well established. Because of their remoteness they also escape public and official gaze. Cluster I also has substantial dependence on livestock. During rainy season they shift to the fields where they rear their livestock.

Cluster II (Buxa Fort), being located at the centre, has multiple livelihoods options including services and shops. They act as potters during the tourist season and several of them are developing eco-tourism which means adding a room or two in their existing dwellings to rent for tourists. Cluster II is also in the middle of the reserved forest and this puts serious restriction on the movement of their cattle and agriculture. The educational level and exposure to the outside world also offers opportunity for jobs outside as migrants.

Cluster III (Jayanti) is not so high (approximately an altitude of 800 ft msl) and has better livelihoods opportunities. Their agriculture and livestock is better placed as also jobs outside. Jayanti River has been a lifeline. The availability of water during rainy season brings fish for the local population.

All the three clusters have serious livelihoods constraints because of an inaccessible terrain, topography and reserved forest which put lot of restrictions on accessing the resources. The villagers, however, seem to be living in harmony with the nature and neither the forest officials nor the local population reported occasions for serious conflict except some occasional minor tiff. The community usually conforms to the local rules. Fishing is freely allowed but except cluster III none of the other clusters are big fish eaters. They catch fish and supplement their food with occasional fishing. Cluster III reported to have been earning some occasional income out of fishing. In Cluster I water is available in the rivers for longer period which gives them fish but fish does not offer much attraction to their food habit. River water supplements irrigation in cluster III. Agriculture on the whole depends on rain water flowing from the hills.

In the Buxa as well as Terai region (Foot hills of Himalayan), two types of pisciculture are practiced: Inland or pond fisheries and riverine fisheries. Fishing had been for a long time a marginal subsistence activity. Only in recent years, with the development of a commercial demand, the rural fishermen have started to practice pisciculture i.e. producing fish regularly by using different techniques, and thereby earning modest income. The pisciculture in Buxa region is not practiced. The following picture shows one of the PRA exercises for situation analysis.

One of the PRA and FGD exercises-Santhalabari village

3. Socio-cultural systems

3.1. Gender and Demographics

As the primary survey result indicates the gender ratio in Buxa is 1213 female per 1000 males. Numerical strength apart the society values women very high who also participate actively in the household decisions. Women are active and hard working and contribute substantially to the economy of the family. Girls attend schools as much as the boys do and there are examples when girls have been sent to Bhutan for higher studies. Buxa,

once had a woman member of the local Panchayat. Women can be seen participating in teaching, management of child development centers and also serving local government offices. There is little tolerance for violence of any type against women. In fact small little girls are worshiped among the Nepali communities. Women are effective in cattle rearing and agriculture on the harder side. On the softer sides (and more important aspects of human development) they participate in attending births, managing ICDS centers and primary schools. There is a no taboo in accessing natural resources including aquatic resources for the women.

The situation is similar among the tribal communities in the Jayanti cluster but situation differs in case of Bengalis and migrant communities in Jayanti. They bring with them their own customs and rituals. Overall, however, the gender relationship is non-interfering based on mutual respect. Nepali and Dhukpa communities both put women at a high pedestal.

3.2. **Cultural Diversity**

Buxa is a perfect example of synergy and unity with rich cultural diversity. People from three religions –Hinduism, Buddhism and Christianity –live in harmony with each one of them maintaining their uniqueness' of identity. The communities are close to the nature and worship it with great devotion. All this make them a very integrated society. This uniqueness is reflected in their daily life. While they maintain their individual cultural beliefs and practices they respect each other's beliefs in similar spirit.

The communities, however, show complacency and contended with their current situation. They do not seem to be asserting their rights and entitlements especially with the state and local government. This is true for all the clusters more so in Adma and Buxa Fort (**Clusters I and II**). They seem to be relaxed and contended. There is no much difference between the Dhukpas and Nepalis on this count. The local Bengali communities, at Cluster (III) Jayanti, show similar characteristics but tend to join the mainstream in demanding their entitlements. Dependency seem to be the cross cutting cultural characteristics of the entire community of Buxa including Jayanti.

The communities enjoy cultural and social events like birth of a child and marriage besides festivals. The celebrations are marked by consumption of liquor, traditional delicacies and meat. Bengalis enjoy fish on such occasions. The communities have inherited rich cultural treasure which they relish and enjoy. Dancing and martial art are quite common and the children are reared to be agile and physically strong. Till recently health related beliefs and practices were quite dysfunctional and unscientific which is being replaced by scientific health seeking behavior.

3.3. Social –system

The social system is woven around strong institutions. The villagers have community level institutions which have evolved over time. For example Lafasangh is the association of Nepalis which deals with issues of the community in case of marital aberrations. Each community had such institutions (oral history). Coming in of the modern institutions of governance has diluted their cutting edge. There are community leaders, informally established, based on their personal virtues and leadership. In our almost 10 years of association with them we observed that the current leadership, at the village level has evolved, following a number of routes. They have different characteristics which may include:

- Knowledge and skill based
- Higher education
- Collective orientation for common good
- Statesmanship and political participation
- Exposure to the outside world

We came across key persons in each of the villages with some special knowledge and skill useful for the communities. For example Indra Shankar (From Sadarbazar) is known and valued for his knowledge of local medicines and natural resources to be used by the people. Then there was Pushpa Raj Thapa (Lepchaka/Khateline) who was educated and offered windows of opportunity for the local people. Pushpa Raj was educated and worked as the village post master. Then there are natural leaders with collective

orientation-they will fight for the villagers in case they are denied entitlements. Also whenever there is a natural disaster such persons would come to mobilize the communities and rescue the larger communities. All educated people are not equally effective. Those with statesman like qualities influence local political processes and influence decisions in favor of the communities. In the recent past there has been emergence of community leadership which has been effective in mobilizing the communities for collective action and also for protecting the natural resources. Ram Kumar Lama is one such person-although he is not from the project villages he represents the communities from all the three clusters and is the moving spirit for their entitlements.

This critical mass of local leadership is very useful in evolving local institutions and strategies for articulating and achieving collective goals. In case of aquatic resources these are the interfaces which could be strengthened to catalyze access and control over resources with equity and distributive justice and conservation as the key goals.

The apparent sign of cooperation should not be construed as ideal situation with harmony and synergy. There are areas of conflict and contestation. The resource constrained environment offers opportunity for conflict of interest which is manifested in various ways. Different leaders, for example, have their individual motives as a compensation for their upfront participation in the community based actions. For example election to the local Panchayt positions creates divide based on political affiliation. But the leaders also aim at enhancing their personal /family growth agenda. In case of eco-development committees several leaders have been using their position to corner financial benefits in their favor together with those of their communities. This creates fissures in the seemingly placid community. In case of accelerating livelihoods opportunities for the community such leaders would be effective but care would be required to moderate their personal interests.

The isolation of the community from the mainstream has brought the state and the non-governmental agencies to work with them. There are several agencies at work. For

example Family Planning Association of India, Yugantar Parivar and MESSO are some of the grassroots organizations which are working with the communities. It is seen that the external support without community's own initiative is creating a situation where the community considers these external opportunities as given and for granted. Inaction and laid back tendencies are the natural outcome of such interventions. Their location in a reserve forest does not allow them to take independent actions. As a result they seem to have developed tendencies to look for direction even in the areas where they can independently act and make the difference.

This is revealed more during crisis and disaster situations when the community feels helpless to deal with crisis situations. The remoteness creates delayed actions by the external agencies where as the local community waits for the relief to come. Although there is community level forest protection committee but the committee members have to tread cautiously as the government rules may create avoidable legal complication for them. The forest protection committee has members from the community assigned with the responsibility to protect trees from unlawful felling. However, these committees do not seem to be quite active. Let us consider two extreme examples of community inaction and initiative:

Village Adama, because of its remoteness, attracted the district administration so much that it (the district administration) decided to offer immediate relief to the local communities. They picked up a local woman and doled out Rs.30,0000/00 to start a grocery shop without considering whether the woman concerned had the necessary skill and business aptitude. The villagers informed that as soon as the first installment was spent the shop started depleting its stock and within three months the shop was closed. The district administration did not bother to replenish the stock neither the women was keen to continue her enterprise.

Centre for the Development of Human Initiatives (CDHI),working in the area for the last 10 years has evolved strategies and initiated action which adequately deal with the dependency situation. All the programs are designed on partnership basis with emphasis

over collective action. Let us consider example in contrast to demonstrate how dependency could be proactively dealt with:

While organizing schools in BUXA, teachers were led to discuss ways to deal with uncertainties should the external support was stopped. The teachers decided to make a regular saving and also requested the community to make small contributions to the school fund through Village Development Committees (VDCs). The decisions were implemented and lo and behold the external agency supporting the school delayed release of fund. The schools could function uninterruptedly and the teachers' financial inflow sustained with the combined contribution from the community and teachers' own contribution.

These examples are important to consider any local initiative in the back drop of deep seated dependency among the community members.

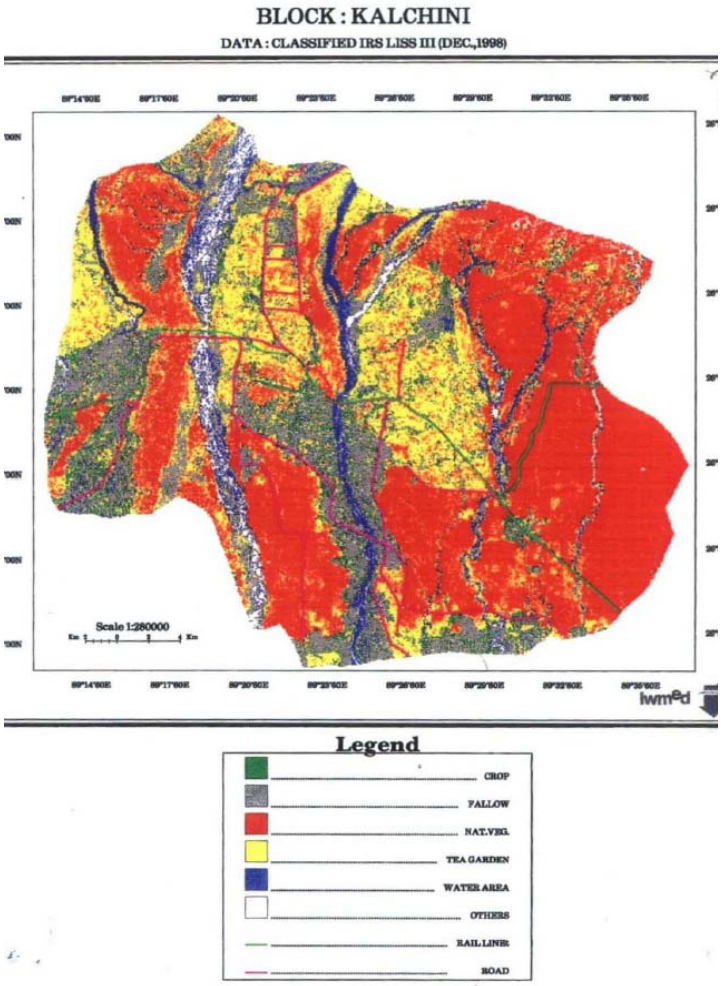
4. Ecosystem goods and services

4.1. Bio-diversity and conservation

The hydrological situation

Buxa has substantial rainfall which contributes to the gross water resources endowment. The water area of Buxa is fluctuating year by year. If we consider the water area of Buxa it includes the entire Kalchini block. As per the satellite data the water area is 6.6 % in January 1991, 4.1% in April 1993 and 8% in November 1994. In December 1998 the area had 7.5% and in February 1999 the area has been decreased to 6.1%. The area of forest, permanent vegetarian etc is 31.6% in January 1991, 23% in April 1993, and 26.4% in November 1994. In December 1998 the area is 34.4% and in February 1999 it reduced to 32.2%. (Please see the Satellite Map of Kalchini, upper part of Kalchini shows the high ARCS project area). The concluding observation is that water area in the HighARCS project region have started reducing after February. This feature stands in the way of development of Pisciculture in Buxa area. (Ref: Decadal Change in Land – use,

Sponsored by NBTDP, Study done by Institute of Wetland Management and ecological Design).



Aquatic resources

The area has one Main River and number of small river and rivulets in and around Buxa regions. Then there are chain of small drains and ditches connecting different water sources. They all form aquatic base for the flora and fauna. The area has rich vegetation at various levels. They have various uses and people also have varying perception about them-their use and application. A scientific mapping has been carried out for the local area. The local people have also collected information about them.

List of aquatic Plant Species available in Baxa, Jalpaiguri (scientists collections)

Name of species	Family
1. Oxalis latifolia	Oxalidaceae
2. Xanthim strumarium	Solanaceae
3. Pistia stratiotes	Araceae
4. Eichornea crassipes	Pontederiaceae
5. Azaratum conynjoided	Asteraceae
6. Azaratum haustonianum	Asteraceae
7. Althernanthera philoxeroides	Amaranthaceae
8. Phragmitis karka	Poaceae
9. Typha angustata	Typhaceae
10. Cronopus didymus	Brassicaceae
11. Trochiscuscochleariodes	Brassicaceae
12. Vandellia crustacea	Scrophulariaceae
13. Veronica anagalis-aquatica	Scrophulariaceae
14. Santella asiatica	Apiaceae
15. Plantago ovate	Plantaginaceae
16. Ipomea aquatic	Convolvulaceae
17. Ipomea fistulosa	Convolvulaceae
18. Valisnaria spiralis	Hydrocharitaceae
19. Ceratophyllum demersum	Ceratophyllaceae
20. Sleurya interrupta	Urticaceae
21. Poulszia indica	Urticaceae
22. Imperata cylindrical	Poaceae
23. Sagittaria guayanensis	Alismaceae
24. Riccia	Ricciaceae
25. Lycopodium	Lycopodiaceae

The community members identified the following medicinal plants which belong to aquatic and non-aquatic categories. The communities have also identified their use and application in their day today life. The list indicates local names using their local dialect:

Table showing local medicinal plants and their application (Community collection)

Sl	Local Name	Scientific Name	Used for
1	Dhaturo		Cough
2	Harlong		Biting of insects
3	Totola		Pneumonia
4	Shishuno		High blood pressure
5	Gita		Gastric
6	Dagur		Diarrhoea

7	Anarosh		Stomach
8	Rohoridal		Jandis
9	Ashura		Malaria
10	Halud		Stomach
11	Harora		Cough
12	Gurjo		Sugar
13	Shikari Lohora		Fracture
14	Kalo Halud		Food intake
15	Kalo Nigure		Blood problem
16	Ulto Karo		Breast milk problem
17	Ghoria Shisuno		Weak child
18	Uku		Jandis
19	Akh		Fracture
20	Gito Kumari		All purpose
21	Beth lohori		Jandis
22	Ghontiful		Stomach problem
23	Chatibon		Gastric
24	Lankachani		Pregnancy problem
25	Dubo		White blood of teenager
26	Khamari		Jandis
27	Hachamey Lata		Blooding
28	Timijhar		Pain on neck
29	Obijhal		Stomach problem
30	Pinar		Pneumonia
31	Ghortapre		Pneumonia
32	Ambak		Blood problem
33	Piple		Fear of Fire

Fish and other aquatic products available in the area

Apparently the community does not appear to be dependent on fishes and other aquatic products but couple of focus groups revealed rich reserve of fishes and aquatic products which represent more than of 50 varieties. The following table shows the list of fishes by their local names as given by the local Nepali/Bhutanese population. The fishery department would confirm their scientific names.

Sl	Local Name	Scientific Name
1	Budna	
2	Kodhlay	
3	Crab	
4	Tong fish	
5	Singhi mach	Heteropneustus fossilis
6	Paha	
7	Garji	

8	Rohi	Labeo rohita
9	Snake fish	Mastacmbelus arratus
10	Bal mach	
11	Haluray	
12	Fitkey	
13	Vitkey	
14	Tadpole	
15	Godola	
16	Kabra	
17	Lobter	
18	Paha	
19	Gangata	
20	Lobster	
21	Garele	
22	Hialy	
23	Chepegara	
24	Chapti	
25	Tite	
26	Orua	
27	Indarni	
28	Tarli	
29	Khuti	
30	Pani bigi	
31	Jhila	
32	Pabda	Ompuk bimaculatus
33	Puti	Puntius safore
34	Shaola	
35	Kathley	
36	Bhiti	
37	Bam fish	
38	Kathol	Catla catla
39	Garea	
40	Holude	
41	Tengri	Moistus cacarius
42	Kokkot	
43		
44		

The following table shows the list of local fishes confirmed by the Assistant Director of Fisheries, Govt. of West Bengal.

Sl	**Local Name**	**Scientific Name**
1	Rohu	Labeo Rohita
2	Catla	Catla catla
3	Mrigal	Cirrhinus mrigala
4	Grass Carp	Ctenapharyngodon idella

5	Silver Crap	Hypopthalmicthis molitrix
6	Common Crap	Cyprimus carpio
7	Chaila	Gadusia chapra
8	Chital	Notopterus chitala
9	Falui	Notopterus notopeterus
10	Chala	Chal bacaila
11	Boroli	Barilius barna
12	Darika	Esomus dandica
13	Mourala	Amblypharyngodon mola
14	Bata	Labeo bata
15	Kursa	Labeo gorius
16	Kalbasu	Labeo calbasu
17	Kharaya	Labeo dero
18	Raichang	Cirrhira xeba
19	Pathar Chata	Garra gotyla
20	Sarputi	Puntius sarana
21	Tetputi	Puntius tisto
22	Mahasoul	Tor tor
23	Pabda	Ompok bimaculatus
24	Bowal	Wallago attu
25	Bacha	Eutropichthys yacha
26	Ghara	Ciupibomar goua
27	Tangra	Mystus cacarius
28	Aor	Mystus seenghala
29	Bhgha Aor	Bagarius bagarias
30	Chanda	Ambasis nama
31	Kakila	Xenentodon Cancila
32	Koi	Anabus testudineus
33	Kajli	Ailia coila
34	Bheda	Nandus nandus
35	Singh	Heteropneustes fossilis
36	Magoor	Calarius batrachus
37	Kuchiya	Amphipnous cuchia
38	Sal	Channa marulius
39	Taki	Channa striatus
40	Bam	Mastaecmbelus arratus
41	Gachi	Macroguathus aculeatam
42	Puti	Puntius safore
43	Lal Puti	Puntius chagunio
44	Gutum	Lepiocephalichthys guntia
45	Puinya	Nomachilus ropicila varinglisi
46	Balia	Glossogobius guiris

Other aquatic resources including Plants and Animals include:

Frogs, snake, tortoise, wild medicine, roots & shoots of various aquatic plants which are edible, yellow fish, beer, wolf, bison, wild pigs, honeybee, medicinal plants.

The above list, presented by the communities in the three clusters and authentic by the official agencies indicates the current status as existing in the local communities' memory. This would subsequently help in analyzing and projecting how these can be used/ optimized for offering sustainable livelihoods.

Though the Buxa region as well as Terai region has considerable potential for pisciculture, certain problems (both natural and artificial) impede the development of pisciculture. The scope for the development of pisciculture needs to be further explored by the excavation and de-silting of village ponds. The occurrence of flash floods is a major stumbling block to the development of pisciculture. The wet lands and water bodies overflow during floods and most of fishes move out along with flood waters. The fishermen suffer great losses as a result. (Water resources Assessment, Dr. Kundu and Mr Soppe, Jan 2002)

4.2. Ecosystem services and PES schemes

Ecosystem services offer livelihoods opportunities for the poor and their sustenance. The focused group discussion and resource mapping exercises revealed four types of ecosystem services and included:

- Provisioning services
- Regulating services
- Cultural services and
- Supporting services

The entire Buxa region and its community depends on provisioning services such as –(1) natural products,(2) Fuel wood (3)Fodder and (4)Water. The rain, rivers and rivulets and other water sources meet the basic water needs of the community which include household and irrigation. Rivers also offer natural habitation for fishes and aquatic plants. Seasonal variation in the availability of water however affects the life of fishes and plants. In Adma **(Cluster I)** water is available almost year round except three dry months. In Buxa (Cluster II) availability of water is scanty as the shallow rivers dry up

soon. In Jayanti **(Cluster III)** the river is getting dry immediately after the monsoon adversely affecting the aquatic species and also consumption for human beings. Drinking water is an issue in the region as they contain several soluble and insoluble impurities besides bacterial contamination. Some storage systems have been developed at high elevations which are connected with pipes for water supply to the villagers.
Fuel wood is adequately available from the forest and the villagers depend largely on this freely available source. None of the three clusters reported scarcity of fuel wood. Similarly, forest department allows timber and woods for the construction of houses at fixed intervals. The villagers did not make any complain against restrictions. They, rather showed, concern for the forest.

Availability of fodder for the livestock is also available for the villagers. The villagers have identified stocks of fodder. There is awareness about nutritional quality of different fodder resources. Villagers also identify plants and leaves for fodder which can be used differently for the lactating and pregnant cattle.

The area suffers serious soil erosion, due to flood and heavy rain. There is no definite regulating service which is planned to protect the local soil and land slide. There is no proper ecosystem management strategy in place to strengthen the regulating services. The villagers have to use their resources and technologies as regulating services.

Interestingly the tourism potential of the region is found to be increasing. The sharp rivers, mountains, forest and biodiversity is attracting tourists from outside. Both Buxa and Jayanti are attracting large number of tourists and the villagers have started developing rural housing where the tourists come and stay. The local flora and fauna offer great attraction to the tourists.

The bio-diversity of the region offers wide range of resources required by the people in the three clusters. These resources are saved and kept reserved for the time when the eco-system is under stress. The villagers use roots and shoots of plants as supplementary food or food and fodder during drought and heavy rain.

The villagers' responses suggest that the ecosystem services are getting adversely impacted because of rainfall and changing climate. An example often being sited is the loss of rich oranges which used to be greatest source of livelihoods. Since the scientists have not been able to diagnose the real cause of losses it is assumed that changes in the environmental conditions is responsible for this. There is a feeling among the members of the community that surging tourists may spoil the local environment –both physical and social. Government policies are not encouraging appropriate technologies and an environment friendly approach which brings alien technologies and experts .This may prove disastrous as they are non-compatible to the local ecology. This would require awareness building and sensitization of the local communities toward the adverse impact of unregulated tourism. There is also a need to explore/project the impending consequences of this service-tourism.

Eco-system services: Changes overtime

In order to see the changes in the eco-system services we participated in a PRA exercise and facilitated historical transect with the community. They recalled the situation some 25 years back. Following table presents a summary of the outcome depicting changes in the eco-system services over time.

Table showing situation of ecosystem services-1985-2010

1985	2010
• Sufficient water in the rivers-fishes were in plenty • Dark forest, water source , wild animals, were available • Water resource, natural resource, wild animals were more • River water was clear • The river bed was 30-40 ft low,	• Due to scarcity of water now the quantity of fish is decreasing • Now getting scarce • But now these Resources are decreasing. • Now the river water is getting polluted • River bed is getting high and

the river was deep, water used to stay all around the years , • There was no breaking of ribs in the river • Water availability was more so, agriculture was more. • Various kind of the wild animals like Royal Bengal Tiger, Beer, Wolf, Wild Buffalo, Gurol, Deer as Cheetal, Rein Deer etc Different type of birds(Pakhi) such as Pali Hash (Duck), Pani Wood etc and fishes like Kodlay, Chaptey, Bhitey, Kalurey, Hillay etc, insecticides, reptiles like different type of snakes as paithon, cobra, etc were available. • Crabs was less • Rivers were narrow • Bolder collection was done, but the river bed was high, it was stopped.	the water do not stays all through the year. • Breaking of the ribs is common in every year; as a result the depth of the river is decreasing. • Now water is less and the agricultural work is also diminishing day by day. • Its only 40% of the natural resource sustained in this area • Rivers are wide • Collection of stone bolder has started again.

Source: Historical transect with the communities

In most of the rivers of Jalpaiguri district including Buxa area, the availability of fish has declined for several reasons included:

-Increasing use of pesticide for agriculture cultivation. Cleansing of pesticide containers in the river along with ***pesticides used in the river bed are most likely the highest contributions to pollution***. Endosulphan (Thiodan) is the most used pesticide and very damaging to fish.

-Use of ***pesticide to kill and catch the fish***. On the regular basis fisherman pour these chemicals into rivers at night to poison and catch fish. The poisoned fish is sold at the local markets. Reports from several villages show that the practice is widespread. One or two km downstream others are waiting with nets to catch the dead or numbed fish that come floating down the river.

- The third reason is ***overfishing due to higher population***. Nets with very small holes / mosquito nets are used; even the tiniest spawns are caught, depleting the fish stock. (Amendment to the West Bengal inland Fisheries Act: Minimum mesh size should be 12mm in any part of the year and 15 June to 30 Sep not use mesh size smaller than 25 mm)

-Less water in the river and some of the rivers dried up in the summer.

-The 5th reason is ***Deforestation and mining*** upstream results in more sand / stone being deposited downstream.

(Micro Planning, based on the Experience of CDHI and NBTDP, Wouter Schaap, 2003)

Access to the eco-system services

The ecosystem services are regulated under the relevant government rules. The area has come under the Reserve Forest (1972) with an eco-development project having been implemented in the area. The government has put stringent rule prohibiting willful picking and marketing and damage of plants and animals live or dead (Chapter III A of the Act). . However, tribal communities are allowed to pick and possess the plants and animals for their subsistence personal use (Chapter IV of the Act). The community in

the three clusters revealed that they were not constrained by the Act and they were allowed to use the various eco-services within safe consumption limits. They are supposed to promote and protect the natural resources including aquatic ones and they realize their responsibilities in protecting them (Gadgil, Prasad and Ali, 1983). The forest officials are also friendly and supporting to their basic needs. For commercial use there are strict rules requiring permits and licenses.

5. Natural resources dependence and livelihoods

5.1. Livelihoods and market networks

The livelihoods of the local community are dependent upon the local level natural and physical resources combined with the external markets. The land is used for agriculture and horticulture including cultivation of maize, millet, ginger, turmeric and vegetables. The minor forest produce including aquatic products such as roots and shoots of various plants used as food and medicine, fishes, etc, supplement their routine food requirements. Communities depend upon external markets for other essentials. Rice, pulses, fruits, eggs, fish (large quantity) are procured from the outside market. The market link is also limited and located at the foothills-Santhalabari, nearby Alipurduar and in rare cases Siliguri. Some families have access to national markets through their relatives and kith and kin who have migrated to different cities. There is not much to sell outside except orange during season, honey, brooms and local crafts. With the loss of fertility of the soil the farmers have to buy fertilizers, nutrients and pesticides from the local market-(oral statements of the community). People recalled that there was no need of any fertilizer or nutrient earlier as the regulating eco-system services took care of the needs of soil.

Improvements Scope in Pisciculture Activities. There is considerable scope in the project area that needs to be further explored with the following action plan:

-Scientific knowledge in respect of pisciculture has to be inculcated in a planned way.
-Awareness building programme for pisciculture development

-Incentives for pisciculture as also marketing facilities need to be ensured.

5.2. Community resilience and vulnerability

The communities suffer serious vulnerabilities on account of natural disasters like heavy rain, flood, land slide, drought, epidemics like Malaria and diarrhea and other diseases. They seem to have developed adaptation/ built their resilience in their own appropriate way to deal with the above vulnerabilities but that is not enough to help them deal with the vulnerabilities of the magnitude they are faced with. For example they would store woods for the rainy season or the local practitioners of natural cure would suggest remedials to take preventive measures against certain diseases. The disaster situations require state help and support which is weak and poorly organized. Since the communities are minority in nature with their distinct world view, belief and value system they are not properly appreciated by the mainstream governance system. Till recently the birth of the child was attended by the male members (often the husband) using unhygienic tools and methods which are now attended by trained birth attendants.

This is not to suggest that the government system has completely failed to help them deal with vulnerabilities. There is locational and topographic constraint which impedes reach of agencies to build their resilience. We have observed children collapsing after a bout of a few lose motions and dehydration. Malaria, diarrhea and birth related problems effect people’s life miserably.

6. Local planning and projects

The federal governance strategy emphasizes local planning as tool for sustainable development. Government of West Bengal also follows similar strategy. Under the local governance (through Panchayati Raj Instituions) the villages planning of Buxa is done by the Gramsabha and Gram Unnyan Sammittee (GUS). All plans are to be locally done and organized. Since the area falls under the reserve forest governance of the area is combined with the forest department on subjects related to forest and natural resources management. This makes things little complex. On the one hand there is possibility of resources optimization there is always an avoidable conflict between the forest

department and other local agencies including department of Panchayat. Suppose the local planning indicates construction of a fish tank at a common place the same cannot be done unless ratified by the department of forest. The coordination takes lot of time and energy and several useful local initiatives are sacrificed. This is the context for relating local actions related to aquatic resources management taking community as the anchor.

6.1. **Past and current projects**

Community members recall number of project initiated in the past as well as being implemented now. The past projects include an ambitious project of the World Bank- 'Eco-Development' project to build a friendly interface between the community and forest to reduce the biotic pressure on the forest. The project components included alternative livelihoods options for the local communities including formation of self-help groups to access credit, enterprise development, promotion of alternative cropping pattern like intercropping to optimize the productivity of the land. Large tract of land was used to develop joint agriculture on profit sharing. The project also offered technical support to help the local communities develop fish culture and goat rearing.

Another project is integrated livelihoods development project of the government under SGSY. The community members felt that the project was mechanically implemented and there was no active involvement of the community members in the design and implementation of the project. Under the project, which is still continuing, the villagers received some financial support, no doubt, but that is not sustainable.

The area had and continues to be covered for Malaria eradication under which Para-medical staff have been recruited to take blood sample and conduct pathological analysis of blood. The houses are also disinfected using DDT and awareness regarding preventive and promotive aspects created.

District administration, with the support from the Planning Commission of India, launched and successfully implemented Nava-Disha (the new direction) to reform and

rehabilitate the youths in conflict. The project included training and counseling of the local youths who were in conflict with the state using violent routes and financial support to them for enterprise building. The initiative of the government proved very effective in creating a peaceful environment in the region which had turned violent couple of years ago. As per the latest report there has not been any violent action in the region and the trained youths have started leaving a life of dignity and enterprise.

As one of the components of the government project local women were trained to act as trained birth attendants. 42 of them underwent rigorous technical training with a Christian Mission hospital of North- Bengal. Back home they helped pregnant women to manage their ante-natal and post –natal problems.

CDHI, district administration and local government jointly facilitated Buxa Shiksha Jyoti Abhiyan (BSJA) to respond to the problems of primary schooling of the children in the school going age. The project components included need assessment, community mobilization and community involvement in the planning. Local youths were identified and trained to act as teachers and supervisors. The project could create sustainable impact and the government and the local community has taken over the responsibility of implementing the school program. The program combines other program components related to awareness building of the community on their entitlements.

Food and Agriculture Organization (FAO) of the UN implemented their tele-food program to enable the local community (school children) learn the arts and science of organic farming useful for their environment. The project attracted the community members who donated part of their land for trial of different crops. This has opened a new window of opportunity for the farmers and the second generation farmers have been sensitized toward the use of environmentally sustainable farming.

The government has also implemented renewal energy development program under which identified households have been provided with solar panels to light their homes.

The project supported by government of India has proved wonderful initiative as the available light offers opportunity for work and study for the children.

Some of the above interventions have proved sustainable while some are partially sustainable. Buxa Shiksha Jyoti Abhiyan (BSJY) has been a sustainable program with the local communities taking over the organization of primary education (CDHI-2007). Eco-development project has helped the community evolve sustainable agriculture. The sustainability seems to have been achieved through community involvement, participative strategies and tools for planning and implementation and stakeholders' involvement (CDHI, 2006).

To propose a tentative summary one can suggest that Buxa has a rich biological diversity and the local communities are in reasonably good harmony-their potential needs to be optimally utilized. There has been synergy of efforts and stakeholders toward sustainable livelihoods based on local biological diversity. The area has witnessed successful implementation of some important conservation and development programs using appropriate strategies. The learning can add to the sustainable implementation of HighARCS project.

6.2. Development and infrastructure plans

The area is quite vulnerable to natural calamities especially heavy rain and soil erosion. The existing topography and terrain makes it inaccessible. Considering the above the government has undertaken substantial infrastructure development plans. To begin with the connecting road between Santhalabari and view point (Close to Sadarbazar) has been constructed to facilitate better movement and also to promote tourism. There has been substantial work on embanking of the water channels and rivers. Under regular program of improving the primary schooling school buildings have been renovated.

7. Policy frameworks and stakeholders

The Bio-diversity Act (2002) of government of India is the over arching policy framework for the promotion and conservation of bio-diversity and regulation of eco-

system services. The policy framework envisages a broad base of stakeholders which includes government officials, local government, people's representatives and community. The 2004 Rules, following the 2002 Act undermine both communities' dependent on bio-diversity, and conservation itself. They also dilute the Biodiversity Act (2002) in letter and in spirit, weakening the already inadequate provisions of the Act relating to rural community rights and powers.

Until recently in India, bio-diversity was something held entirely in common by local communities of people. Resources and knowledge about forest or agricultural properties were freely shared. Whether it was seeds of the farm or plants of the forest, all were clearly understood to be part of the cultural, spiritual, and biological commons. The new Act undermines the community right. The Act tightened the Government control over bio-diversity and is somewhat stringent to the interest of the community.

Some of the Salient provisions of the Bio-diversity Act (2002) include:

i)Conservation and sustainable use of biological diversity.

ii) Conservation and development of areas important from the standpoint of biological diversity by declaring them as biological diversity heritage site.

iii) Protection and rehabilitation of threatened species.
iv) To respect and protect knowledge of local communities related to biodiversity.

v) Regulation of access to biological resources of the country with the purpose of securing equitable share in benefits arising out of the use of biological resources, and associated knowledge relating to biological resources.

vi) To secure sharing of benefits with local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources.

vii) Involvement of institution of self-government in the broad scheme of the implementation of the Act through constitution of committees.

The communities in Buxa do not seem to be adequately informed of the implications of the new Act/rule. Their access to the bio-diversity, according to them, is unrestricted. Similarly the government officials, concerned with the implementation of bio-diversity Act and Rules are also not clear about the implications and follow this as a bureaucratic process. The policy framework and the stakeholders need to be compatible with each other in relating to the issues and potentials of bio-diversity and in appreciating the long term implications of the policy framework viz-a-viz the community and their rights. The HighARCS project exploring the potentials of aquatic resources of for sustainable livelihoods can build on this framework and evolve mechanism for strong community and multiple stakeholders' involvement for ensuring bio-diversity and its conservation.

The situation analysis: Limits and gaps

While looking at the implications of the findings of the situation analysis one is faced with the dilemma of whether the information help understand the issues and potentials adequately. We realized that there is a need to look at the situation further deeper.

The macro-realities are fairly clear. The area is rich in bio-diversity and aquatic resources, whether plant or animals, are diverse and rich. Access to the resources for subsistence purposes, as indicated by the community members, is smooth. There are seasonal variations in their availability. What still needs to be understood are:

1. Whether the local institutions are aware of the implications of the Act and whether they have the capacity to proactively integrate the provisions of the Act into sustainable livelihoods and development strategies in cooperation with the state and non-state agencies,

2. We have taken the information based on collective response. However, there are intra family/intra-community variation in understanding and use of the bio-

diversity. The family members would also differ in their perception of the use of the species depending upon their level of education, gender and orientation. This intra-family/intra-community variation needs to be further analysed,

3. The three clusters taken in the situation analysis present different scenario. They would call for evolving different strategies while dealing with the bio-diversity issues in the respective areas.

4. Apparently aquatic resources do not figure substantially and prominently especially during dry season People used to fish 20 years ago is clear. Some of them still do it .There are aquatic pockets with aquatic resources. It seems to make an interesting reading in contrast –a location which seems to have dwindled its aquatic resource base can it not be revived? The people do not have fish eating as their popular habit. How has it changed?

5. At our project area, during the last flood, embankments got filled up with silt. The sedimentation of transported materials reduced the storage capacity of the water bodies. During the 1993 floods at the fringe of Buxa and Jayanti caused a reduction in capacity and over flowing of water from the water bodies which caused reduction in the fish production. More over the forest law restrict the locals to collect silt from this river bed resulting in the rise of river bed and reduction in the possibility to increase the fish breed in the rivers. Further analysis of the relationship needs to be carried out.

The situation analysis is indicative and the research phase taking a longitudinal view would be able to make comprehensive analysis of the potentials of aquatic resources for the livelihoods of the local communities.

"A farmer in the Jayanti cluster (III) just in the bed of the river Jayanti. According to him Jayanti used to be and even continues to be the life line of the people. Aquatic products abound in the river which serve as important livelihoods".

References

CDHI (2006) Ecology and Development: An evaluation of Eco-development project of Buxa. Kolkata: Care India.

CDHI (2007) Education for action, initiative and self-help: Community led primary education in Buxa-Internal evaluation. Jalpaiguri: CDHI

Convention on Biodiversity (1992). United Nations Organization.

Gadgil, M., Prasad,S.N. and Ali Rauf (1983).Forest management and Forest Policy in India: A critical review. Social Action, 33(21).

Government of India(2002). Bio-Diversity Act. Delhi: Government of India publication.

Government of India (1972).National Forest Act. New Delhi: Government of India.

Kundu,N. and Soppe.Jan (2002).Water Resources and wetland management. Kolkata:Wetland Management Institute.

Schaap,W (2003). Micro-planning exercise. Jalpaiguri:CDHI.