CHAPTER – III

RANGANADI HYDRO ELECTRIC PROJECT AND
THE DIKRONG VALLEY

Hydroelectric projects have been symbols of modern state’s economic progress. They are guarantees to people of an assured supply of power and water besides controlling devastating floods. The budget allocations till the sixth five year plan reveal that 15206 crores have been utilized for large irrigation projects and hydroelectric schemes constitute 15 percent of the national expenditure. For the project building purposes, lands could be forcibly cleared of population in the larger interest of the nation. Rehabilitation and resettlement of people affected by projects were not the primary task or concern. Much has been written, discussed and criticized over the years about dam building and its failures, unfulfilled promises of relief and compensation and the role of state. However, if we are to judge the impacts of projects we will have to be provided with comprehensive data of the social and environmental impacts of the projects which is, in most cases, not done in India. Broadly speaking, we can gauge the impacts from the manner in which dams have been functioning during and after construction. Part of dam building requires creating reservoirs, submerging lands, displacing people, altering and

75 Shekhar Singh and Pranab Banerji Large Dams in India; Environmental, Social and Economic Impacts. Indian Institute of Public Administration, New Delhi
diverting the flow of the rivers, diverting the waters through canals and tunnels, redistribute water to agricultural fields etc. In this chapter we will try to identify the environmental and social impacts of the Ranganadi hydro electric project (RHEP henceforth) on the Dikrong valley. We will proceed by looking into the impacts, which were anticipated and taken into consideration while assessing the feasibility of the project. Every project goes through a project assessment to assess the viability, cost benefit calculations, and the overall feasibility of the project. We will try to find out which of the impacts were anticipated and which all were not and link the effects with the corrective measures taken on the part of the project sponsoring agencies and the state.

As part of the fieldwork, the researcher collects primary data from the field. Informations have been gathered mainly through schedules administered among 22 villages from the Dikrong valley. In addition to that, the researcher collects statistics of damage assessment due to flood and erosion for two separate periods. These periods are divided as pre- Ranganadi Hydel Power Project from 1991-2001 and post-Ranganadi Hydel Power Project from 2002-2010. The researcher’s effort to gather relevant information and statistics from the respondents has been presented in tabular form- Table No-I and Table No II. The table represents the collected data about the affected families, population, loss of land in hectares and loss of property dwelling and houses.

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76 Ibid.
**Hydro Electric Potential of North East India**

The entire region of Northeast India consists of the eight states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. This region has been identified as the future Powerhouse of India. The total hydro electric potential of the region has been estimated at 58,971 MW, of which only a small portion of about 2.04% is said to be harnessed so far. According to the Central Electricity Authority data 2001, the total hydropower potential of the Northeast is 63,257 MW. This amounts to 43% of the total assessed hydropower potential of the country. The state wise estimation of hydroelectric potential are Assam: 680 MW, Arunachal Pradesh: 50,328 MW, Manipur: 1784 MW, Meghalaya: 2394 MW, Mizoram: 2196 MW, Nagaland: 1574 MW, Sikkim: 4286 MW, Tripura: 15 MW. Table 1 shows the hydro power potential of northeast and the extent to which it has been utilized.

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78 Central Electricity Authority data from report of Inter-Ministerial Group on NE Hydro, February 2010. Slight variation with CEA 2001 data.
Table 3.1 Status of Hydro Electric Potential Development in North-Eastern Region (NER)\textsuperscript{79}

<table>
<thead>
<tr>
<th>State</th>
<th>Identified Capacity</th>
<th>Capacity Developed</th>
<th>Capacity under Construction</th>
<th>Capacity yet to be developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meghalaya</td>
<td>2394</td>
<td>185.2</td>
<td>124.0</td>
<td>2084.8</td>
</tr>
<tr>
<td>Tripura</td>
<td>15</td>
<td>15</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Manipur</td>
<td>1784</td>
<td>105.0</td>
<td>0.0</td>
<td>1679.0</td>
</tr>
<tr>
<td>Assam</td>
<td>680</td>
<td>375.0</td>
<td>0.0</td>
<td>305.0</td>
</tr>
<tr>
<td>Nagaland</td>
<td>1574</td>
<td>99.0</td>
<td>0.0</td>
<td>1475.0</td>
</tr>
<tr>
<td>Arunachal Pradesh</td>
<td>50328</td>
<td>423.5</td>
<td>2600.0</td>
<td>47304.5</td>
</tr>
<tr>
<td>Mizoram</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total (NER)</strong></td>
<td><strong>58971</strong></td>
<td><strong>1202.7</strong></td>
<td><strong>2724.0</strong></td>
<td><strong>55044.3</strong></td>
</tr>
<tr>
<td><strong>All India</strong></td>
<td><strong>148701</strong></td>
<td><strong>33222.5</strong></td>
<td><strong>12855.0</strong></td>
<td><strong>102623.5</strong></td>
</tr>
</tbody>
</table>

Source: http://www.cea.nic.in (In terms of installed capacity as on 31.03.2009)

Some of the large hydro electric projects. i.e above 25MW, that are already operating in the northeastern states are Sikkim: Rangit III, Teesta V Assam: Kopili, Khangdong, Lower Borpani (Karbi Langpi) Manipur: Loktak Meghalaya: Umiam Umtru IV, Kyrdamkulai, Umiam Stage I Arunachal Pradesh: Ranganadi Stage I Nagaland: Doyang. These eleven projects have a total installed capacity to

produce 1686MW of electricity\(^8^0\). Among the projects that are under construction include the ten projects with total capacity of 4891MW. These are Sikkim: Chujachen, Teesta III, Teesta VI, Rangit IV, Jorethang Loop Arunachal Pradesh: Kameng, Lower Subansiri, Pare Meghalaya: Myndtu, New Umtru\(^8^1\).

Of all the Northeastern states, Arunachal Pradesh has been identified as the biggest hydropower player in region and therefore it has been allotted 132 hydropower projects with total installed capacity of 40,140.5 MW. By 2010 October, the State government has already allotted private and public sector players to undertake the implementation of the Project. According to available data, among the projects were 92 large hydropower projects (above 25 MW) and 38 above 100 MW. 50 projects were granted Scoping or pre-construction environmental clearances from the Ministry of Environment on October 2010. By the end of 2010, a total of 7 hydroelectric projects in Arunachal Pradesh were granted final environmental clearances by the ministry\(^8^2\).

It is important to note that the ‘biggest hydropower player’ of the northeastern region is located in an extra ordinarily difficult geological set-up. The entire Himalayan mountain system bends acutely around a mountain knot\(^8^3\). The movement of these knots are manifested in earthquakes that rock the land and the rivers

\(^8^0\) Cited in Vagholikar, N. and Das, P.J., 2010. *Damming Northeast India*. Kalpavriksh, Aaranyak and Action Aid India. Pune/Guwahati/ New Delhi

\(^8^1\) Ibid.

\(^8^2\) Ibid.

\(^8^3\) K.S. Valdiya A Geodynamic Perspective of Arunachal Pradesh and its Bearing on Environmental Security and Developmental Planning, excerpts from his keynote address at a workshop in Dec 1999 organised by the Arunachal Unit of G.B. Pant Institute of Himalayan Environment and Development.
devastatingly. “The high seismicity of the area is attributed to the northeastern moving Indian landmass which pushes and presses the Himalayas. Since India continues to move at the rate of 54-62mm per year, the Himalayan ranges are bound to experience the force of squeezing against the Asian continent. Consequently, the land of Assam is siding northward under the Arunachal Himalaya and eastward beneath Indo-Myanmarese ranges. Therefore, very severe deformation and attendant rupturing of the crust or faulting and land displacement is taking place in the geological province of Arunachal Pradesh.”

Given such fragility of the region, it is to be noted that the environmental clearances were issued to project authorities to proceed with hydroelectric project building in the region. In a region which is prone to earthquake, dam building may induce further seismic disturbances. It has been observed that huge mass of water behind a dam may induce seismic activities in the neighbourhood area. Seismologist and geologist have confirmed that dam building in seismic belt is particularly dangerous. In case of a dam burst followed by earthquake of severe intensity has the potential to bring in irreversible damage and disaster. It has been well proved through scientific investigation that northeast in general and Arunachal Pradesh in particular is located in the seismic belt of the earth.

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84 Ibid.
86 According to Independent People’s Tribunal on Dams in Arunachal Pradesh Interim Report February 3, 2008, Arunachal Pradesh falls in Seismic Zone-5 which meant that the dams were likely to be subjected to earthquakes of high intensity. This has immense implications for the safety of the populations in the neighbouring and downstream areas. In particular, the fear of the colossal
Taking the ecological vulnerability into account, the environmental clearances for hydropower projects in the area only points to the strong nexus between the project builders and the environment assessment consultancies. In fact, in an interview with Ashish Kothari who served on the Ministry of Environment and Forest’s Expert committee for river valley projects in 1994-1995, it was revealed that “90% of the dams that have commenced construction between 1978 and 1995 had not complied with the environmental conditions! Hundreds of crores of rupees were being spent on projects that are, by the law of the land illegal! Equally shocking was the fact that the MoEF had not stopped a single one of the projects, or penalized any official concerned.”

In order to tap hydropower from the rivers flowing from the Himalayas, the northeastern region of India was identified as the “future power house of India.” The Central Electricity Authority (CEA) in its Preliminary Ranking Study of the nationwide potential of hydroelectric schemes identified the Brahmaputra river system with the highest potential to generate

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loss of life and property and the destruction that would cost, in case of a dam break haunts the people.

87 Excerpts from the interview of Ashish Kothari founder member of Kalpavriksh, “We Should have Gone to Court” published in Ecologist Asia Vol.11 No.1, January-march 2003. p.38

electricity. However, “in view of the inadequate knowledge base, lack of systemic data over an adequate time span and across diverse terrains and considering the intense dynamism and immense scale of geophysical processes of the Himalayas raises more questions than can be possibly answered.”

It is also important to take note of the supra state character and nature of functioning of the public sector undertaking that implement the project. In case of Arunachal Pradesh, the following observation of NEEPCO shows how project implementing authorities violate basic criteria of environment impact assessment.

The NEEPCO was recently forced by the people to order a survey of the 110 MW Dikrong HEP in Arunachal Pradesh. The first ‘public hearing’ on Pare (Dikrong) HEP was held on March 5, 05. The EIA report of Dikrong HEP and its executive summary was not available in local language by NEEPCO till the day of public hearing. Now the public hearing would be held later. It was decided that a committee

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89 The central electricity authority (CEA) has identified 162 sites, spread across 16 states of India, for hydroelectric projects with an aggregate installed capacity of 50,560 MW. According to preliminary feasibility reports prepared till July 5, 2004, 154 of the 162 sites have a potential to generate 47,190 MW of electricity. The CEA has offered the sites to central public sector units for preparation of detailed feasibility reports. The preliminary reports revealed that of the 16 states, 42 projects in Arunachal Pradesh have a combined capacity of 21,660 MW. Of the 162 sites identified by CEA all over India, the largest capacity of 4,000 MW is proposed at Etalin in Arunachal Pradesh with 16 units of 250 MW each. The second largest project will also be located in Arunachal Pradesh at Demwe(Dibang multipurpose hydro project) with a capacity to generate 3,000 MW of electricity- cited in Independent People’s Tribunal on Dams in Arunachal Pradesh Interim Report February 3, 2008,

would be formed to create awareness about the project. The role of Arunachal Pradesh PCB came in for severe criticism. Most of the people were ignorant about the very nature and purpose of an EIA and what a public Hearing is all about? The Composition of the Panel members was not in compliance with the EIA notification, 1994. Arunachal Citizen’s Right interjected and requested the Chairman of the Panel to ensure that the panel members maintain their neutrality. Rather than each panel members instead of noting down the issues, were allotted time to speak about the Dikrong HEP. The House finally came to know about their rights and the actual nature of a PH on EIA as submitted by NEEPCO before the PCB. As a result, the Chairman, Public Hearing Committee gave time to few legislatures, Panchayat leaders, Gaon Buras and Public. Finally, the panel members unanimously ended the PH with the decision that an Awareness Committee on EIA shall be constituted to educate the people about the project and the Public Hearing shall be held within two months. Many people complained that even the 29 families likely to be affected by the project were unaware of the EIA. The NEEPCO tried to wash its hands off the responsibility of rehabilitation.

It has been observed by scholars that “the absence of post-construction reviews severely hamper assessments of multi-purpose river valley projects' (MRVPs) actual performance vis-a-vis its claims. Long-term effects like ecological disequilibrium remain unaccounted for due to an absence of comprehensive pre-project environmental impact assessment.”

three projects, namely, Hirakud, Ukai and Indira Gandhi Nahar Project (IGNP), it was clearly demonstrated that “there was the glaring and complete dichotomy between pre-construction projections and post-construction realities. Water-logging, salinity, sedimentation and health hazards have a high possibility of occurrence. Even flood control, irrigation and power generation are not effective as envisaged. These experiences, the article argues, need to be studied in-depth and made to constitute an important part of future planning for MRVPs.”

Patrick McCully says that the long term effects of dams are “huge and largely irreversible” which may be manifested after hundreds of years of construction of dams. Listing specially the impacts on rivers and its associated aquatic species, he mentions that human intervention in the natural flow of the rivers tend to “fragment the riverine ecosystem, isolating population of species living up and downstream of the dam and cutting off migrations and other species movements.” He explains the main environmental impacts of dam as shown in Box 3.1

**Box 3.1 The Main Environmental Impacts of Dams**

<table>
<thead>
<tr>
<th>A. Impacts due to existence of dam and reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Upstream change from river valley to reservoir</td>
</tr>
<tr>
<td>2. Change in downstream morphology of river bed and banks, delta, estuary and coastline due to altered sediment load</td>
</tr>
</tbody>
</table>

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92 Ibid.
94 Ibid.
3. Change in downstream water quality: temperature, nutrients, turbidity, dissolved gases, heavy metals and minerals
4. Reduction of biodiversity due to blocking of the movement of organisms and because change 1.2 and 3 above

Superimposed upon the above impacts may be:

B. Impacts due to Pattern of Dam Operation
1. Change in downstream Hydrology: (a) change in total flows; (b) change in seasonal timing of flows; (c) change in extreme high and low flows
2. Changes in downstream morphology caused by altered flow pattern
3. Change in downstream water quality caused by altered flow pattern
4. Reduction in riverine/floodplain habitat diversity, especially because of elimination of floods.


The River Ranganadi

Let us begin by understanding briefly the river Ranganadi. The Ranganadi river is one of the major tributary of river Brahmaputra and lies in the northeastern part of Assam. It originates at an elevation of 3,440.00m near the border of Lower Subansiri and East Kameng districts. The total 2941 sq km catchment area of the Ranganadi river is divided between Arunachal Pradesh and Assam of which 700 sq km lies in the Lakhimpur district of Assam and the remaining 2241 sq
km lies in Arunachal Pradesh. This river is important for our study because of the Hydel power project that is built over the Ranganadi river which envisaged inter basin transfer of water from Ranganadi river to Dikrong river. In order to find out the impact of this power project on the river Dikrong and its valley we have to look into the issues, prospects, and problems of the Ranganadi hydel power project.

**The Ranganadi Hydro Electric Project (RHEP)**

The Ranganadi Hydro Electric Project (RHEP) is a run-off-river scheme with a Full Reservoir Level (FRL) of EL 567.00m. This project was part of the North Eastern Council (NEC) scheme and was under implementation by the North Eastern Electric Power Corporation (NEEPCO. At stage 1 of the scheme, the 405 MW (68m high dam) of the RHEP was commissioned in 2002 henceforth) in Lower Subansiri district. The NEEPCO mentions that the design of the project is such that it will store water to its full capacity in reservoir. i.e. up-to the level of 567.00m. Hence, if flooding occurs and water rises beyond this capacity, the reservoir will not be able to retain it. The reservoir pondage being small and fully utilized for water storage and having no extra capacity to retain water, the reservoir was bound to overflow. Technically speaking, the working of the project mentions that for the generation of hydropower from the Project, a maximum of 160 cumecs of water from the reservoir will be utilized for operating the 3 units at full load, which will be finally diverted to the Dikrong river from the power house at Hoz\textsuperscript{95} through a tailrace channel. The excess water which the reservoir

\textsuperscript{95} HOZ is a place 40’5 kms U/S of Bridge over Dikrong on NH-52 at Harmutty and 58’5 kms U/S of Sissapathar Bridge
cannot hold beyond 567.00m (FRL) was to be released to the downstream of Ranganadi river over the diversion dam at Yazali\textsuperscript{96} through spillway gates in a controlled manner.

The details regarding approved and revised cost estimates and commissioning schedule of Ranganadi H.E project in Arunachal Pradesh with an installed capacity of 3135=405 MW under execution by NEEPCO are given below:

**Table 3.2 : Cost Estimates and Commissioning Schedule of RHEP**

<table>
<thead>
<tr>
<th></th>
<th>Approved cost Estimates (Feb.1993 price level)</th>
<th>Revised Cost Estimates (March, 1997 price level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Estimates</td>
<td>Rs. 774.12 crores</td>
<td>Rs. 1024.11 crores</td>
</tr>
<tr>
<td>Commissioning Schedule</td>
<td>March, 1997</td>
<td>September, 200</td>
</tr>
<tr>
<td>Cost of Generation</td>
<td>47.20 paise/KWH</td>
<td>65.52 paise/KWH</td>
</tr>
</tbody>
</table>

**Ranganadi Hydro Electric Project (RHEP): Claims of the Implementing Authority**

We need to mention that NEEPCO while responding to the Public Memorandum submitted by the Dikrong Upatyaka Surakshya

\textsuperscript{96} As part of Stage II of the scheme, the Ranganadi will have a 180 MW project with a 134 m high dam across the river at Yazali. S. Sengupta et al ed. (2006) River and riverine Landscape in North East India, Concept Publishing: New Delhi.
Samiti\textsuperscript{97} in the year 2008 claimed that it had discussed a set of concerns with the Ministry of Welfare for Plains Tribes and Backward classes, the Government of Assam, Flood Control Department of Assam, Irrigation Department of Assam, Power Department of Assam prior to the implementation of the RHEP. The chronology of the meetings and discussions were provided year wise starting from 1988 onwards where it claimed to have received and responded to queries of Assam Flood control department on the implementation of RHEP and additional discharge of 160 cumec of water from RHEP to Dikrong river. According to the letter of NEEPCO, all the concerned departments of Assam and the Minister of Welfare of Plain tribes and Backward classes have convened joint meetings to assess the impact that would be caused by the diversion of water from RHEP to Dikrong river and the measures that will be required to compensate the negative impacts\textsuperscript{98}. The following were the impact assessments and the plan of actions of the concerned departments and NEEPCO\textsuperscript{99}.

1) NEEPCO was to spend an amount of Rs.835.85 lakhs for raising and strengthening of embankment of Dikrong both bank embankments including anti-erosion works in different reach as required by the Chief engineer, Flood control Deptt. Govt of Assam.

\textsuperscript{97} Letter of the North Eastern Electric Power Corporation LTD( A Govt. of India Enterprise) No: NEEPCO/PER/2/C-10093 dated 1\textsuperscript{st} of August 2008 to Golak Hazarika, The President, Dikrong Uptakya Surakshya Samiti, Bihpuria, Dist Lakhimpur-784161 Assam

\textsuperscript{98} Ibid.

\textsuperscript{99} Ibid.
2) It was stated that a survey carried out by NEEPCO and Flood Department of Assam in Bihpuria, laluk, Narayanpur, Nowboicha revealed that there was already a problem of overtopping of embankment due to floods even prior to the implementation of the RHEP. Existing flood control measures were inadequate to control normal flood waters of the Dikrong river.

3) The NEEPCO prepared a report according to which it agreed to spend 88.61 lakhs for protection works of raising and strengthening of the existing embankment system.

4) The Central Water Power Research Station (CWPRS), Pune was assigned the work of examining the actual flood impact as per prevailing conditions and due to additional 160 cumec of water from RHEP. NEEPCO entrusted this work to CWPRS, Pune which was supposed to carry a mathematical model study of the Dikrong river basin downstream of Hoz power house upto the confluence of Dikrong and Ranganadi river.

5) The CWPRS submitted the impact assessment report with the findings that due to additional discharge of 160 cumec in monsoon months, the water level in different stretches of the course of the river Dikrong in Assam portion from Banderdewa to Sissapathar would raise from 7cm to 12cm.

6) The CWPRS report also mentioned that since the flood discharge of Dikrong river would be 20 to 30 times of the discharge of the Ranganadi Power House, the impact of the additional water would be negligible.

7) The CWPRS report brushed aside any fears that were related to the release of the additional water from RHEP. It concluded
that based on “outcomes of the studies undertaken by CWPRS, Pune, the fears expressed are not real.”

The minister of power while answering questions regarding the outlay of Ranganadi Hydel Project in Arunachal Pradesh asserted the following – “The Ranganadi Hydel Power Project in its report had mentioned it clearly that an inter basin water transfer would take place from river Ranganadi to river Dikrong. This transfer was required because of the discharge of 160 cumecs of tail race water from the power house when operated at full capacity. The Central Water and Power Research Station, Pune at the instance of NEEPCO had revealed that rise in water level will be between 7-12 cm when power house operates at full capacity. The effect of the rise of water will be very marginal in comparison to the observed peak flood of 2500 cumecs of the river Dikrong. The incremental discharge of 160 cumecs is therefore not likely to cause any damage in the lower reach of Dikrong river and will not pose any danger to the population in the area. The North Eastern Electric Power Corporation has carried out a joint survey with Flood Control Department and Irrigation Department of Government of Assam to access the flood control protection work of Dikrong river from the down stream of Banderdewa bridge to the confluence of river Dikrong and Subansiri. Based on the actual survey, the flood protection work as existing without transfer of 160 cumecs of water from Ranganadi basin to Dikrong basin is not sufficient to retain the observed 2500 cumecs discharge of Dikrong river during the peak flood season. NEEPCO has since conveyed to Government of Assam that any protection measures, if required due to additional discharge of 160 cumecs of water from the power house will be fully funded by them against the
project cost.” On queries related to environmental clearances the minister replied – “The environmental and forest clearances were accorded to the project by the Ministry of Environment and Forests. No Memorandum of Understanding (MOU) was signed by the NEEPCO with Government of Assam. All the states in the North Eastern region including Government of Assam will be allocated power from the project in accordance with approved sharing formula applicable to central Hydel Power Stations. Besides, Assam is benefitted in terms of improvement of Pochumara-Kimin road upgraded to the level of National Highway including construction of bridges at the project cost. There was no financial liability on Assam for the construction of the Project.”

**Appeal and Agitation: State and People’s Initiative**

Keeping in view the existing flood problem of the river Dikrong, a number of memorandums have been submitted even prior to commissioning of the RHEP to consider the ecological vulnerability of the Dikrong valley. The feasibility of hydro electric project in a ecologically fragile valley was countered both by the people and the state government of Assam. The then Chief Minister of Assam, Shri Hiteshwar Saikia in his letter to the Prime minister of India in the year 1993 brought to notice the falsity of the claims of the NEEPCO of having consulted the State Government of Assam prior to the execution of the RHEP and the additional discharge of water. In fact, the Chief Minister wrote that it was only after an enquiry that the State Government of Assam could know from the chief engineer

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100 Chief Minister of Assam Hiteshwar Saikia letter to Prime Minister of India. No. D.O.NO. CRD. 2/93/23 dated April 28th 1993
(C) P &D NEEPCO that 160 cumec of water from RHEP will be discharged into the Dikrong river. The letter also mentioned the attitude of NEEPCO in ensuring the safety of the bridges over the river and surrounding valley which was limited to the recommendations made on the basis of the mathematical model study done by CWPRS, Pune. Moreover, NEEPCO committed itself to take responsibility of any negative impacts of RHEP which was subject to the report of CWPRS. Besides, the letter also clearly pointed out the adverse effects of the additional water on flood situation of the Dikrong valley. It was pointed out that the Dikrong river was flood prone and an additional discharge of water would aggravate the existing flood situation of the Dikrong valley. The inundation that will occur with the extra force of water would bring in a major setback to agriculture and overall economy of the state. Two bridges were mentioned in the letter to be in extremely vulnerable position. The Chief Minister expressed concern as he wrote that the stability of the bridges over river dikrong on NH-52 at Harmutty and another Bridge on the state P.W.D at Sissapathar were threatened given the existing vulnerable position of the Dikrong river. Is interesting and important to note that the letter explicitly points out that any decision related to addition or alteration on structures on a national highway and on bridges on it comes under the authority of the ministry of surface transport. It seems NEEPCO bypassed the concerned ministry while taking decisions regarding bridges on the national highway.

In another letter by a former education minister of Assam, Shri Premadhar Bora in the year 1994\textsuperscript{101} to the then Prime Minister Late

\textsuperscript{101} Letter from Shri Premadhar Bora, Former Education Minister, Assam. Dated 21\textsuperscript{st} Jan 1994
Narsimha Rao, brought to notice that the RHEP was responsible for creating problems for the populations of the district of Lakhimpur by discharging water from Ranganadi river through canal to Dikrong river. The additional waters from Ranganadi, has aggravated the existing flood problem in Dikrong. This diversion of the waters was bound to affect the Ranganadi river too as it would decrease the inflow of water in the river during the dry season. The minister mentioned that around 5 lakh people inhabiting both the river basin i.e Dikrong river basin and Ranganadi river basin will be affected by the diversion of water in Dikrong and resultant decrease of water in Ranganadi. As far as the Dikrong valley is concerned, it mentioned, the diversion effect would additionally burden the already flood affected Dikrong with waters coming from the Ranganadi. As a result, the extra water from Ranganadi would increase the flood level of Dikrong and would inundate Dikrong valley from Harmutty to Badati which are situated in the Lakhimpur district of Assam. The affect on Ranganadi would be that it would turn dry during dry season due to reduction of flow in the river. A dry river was sure to affect agriculture, pisciculture, vegetation, veterinary, problems of drinking water, sericulture, ecology, navigation etc. He even mentioned that the Chief minister of Assam in his letter to the Prime minister\textsuperscript{102} has stated that “The NEEPCO prior to the execution of the project have not consulted the state Government about additional discharge to the Dikrong river”\textsuperscript{103}……moreover……the letter also added that it was specifically mentioned that the chief minister made it clear that “The

\textsuperscript{102}Chief Minister of Assam Hiteshwar Saikia letter to Prime Minister of India. No. D.O.NO. CRD. 2/93/23 dated April 28\textsuperscript{th} 1993.

\textsuperscript{103}Ibid.
State Government is not in a position to allow discharging water of Ranganadi to Dikrong on the above circumstances”\textsuperscript{104}

Highlighting the adverse effects of the diversion of water from the RHEP, the Engineer of the Public Works Department, North Lakhimpur, requested the Government of Assam, to take up the matter to the appropriate authority and NEEPCO of considering the possibility “to divert the ranganadi’s discharge from the outflow tunnel back to the same river by digging out canals in suitable directions.”\textsuperscript{105}

The people living in the lower reaches of the Dikrong sub basin were especially alert to the flood damages of the river Dikrong. They have been constantly struggling to bring to the notice of the state agencies the plight of the flood affected people living in the Dikrong valley in Assam. Some leaders of the Lakhimpur district towns have submitted memoranda to the State and Central Government urging them to take note of the flood conditions of the Dikrong river and its impact on the people and the valley. In its submissions, these memoranda and appeals spelt out the nature of damages caused by the floods, erosion and breaching of embankments. In one memorandum submitted to the leader of Central team, Government of India for assessing flood affect in Assam, the people of Bihpuria town mentioned in detail the damages caused by flood on 25\textsuperscript{th} may 1998. Embankments were breached at Pakadal, the PWD road at jamuguri was breached on June due to erosion and flood disrupting road communication besides

\textsuperscript{104} Ibid.
\textsuperscript{105} Letter to the Chief Engineer PWD (Roads) Assam, Chandmari, Guwahati by B.P. Hazarika, Superintending Engineer, PWD, North Lakhimpur Road Circle dated 7.10.92
affecting the whole of surrounding areas such as jamuguri, Dahgaria, Khakanaguri, Kenduguri, Hamara Kachikata, Maricha Pathar- 1&2, Bagicha gaon, japjup-1&2, Baraikhana and Kholaguri. The paddy fields and dwelling houses were ravaged. In the same week, on the 12th of June 1998, the entire Bihpuria town was submerged under flood waters breaching town protection embankments at Bihpuria revenue circle office and the town protection embankment at ward no 1 and 3. The Maricha Pathar tribal village was also submerged resulting in loss of lives and property. This flood also breached the Bihpuria-North Lakhimpur old North Trunk Road. This affected transport and communication even to the nearest headquarter for a long time. A bamboo footbridge continued to serve as the link between the densely populated town to the district headquarter at North Lakhimpur. The loss were estimated at around 30 crore rupees. In their memorandum the people of Bihpuria town demanded that a permanent and strong embankment to protect the people living from Badati to Bihpuria. They clearly mentioned that the existing pattern of embankment building was faulty and that they needed a strong embankment to prevent flood havoc. Most importantly they pointed that due to tectonic forces, after the great earthquake of 1950, the river bed of the river Dikrong has been raised. Due to the raised river bed, the carrying capacity of the river had decreased. Hence, the river was not capable of holding its own water which resulted in overflowing and flooding. In such a situation, the proposal of NEEPCO to discharge additional water from RHEP was unscientific and dangerous.

Contrary to the recommendations of the reports of the CWPRS, Pune, and the claims of NEEPCO, the people of the Dikrong Sub basin
were convinced that the RHEP and the discharge of the tail water had aggravated the flood situation of the Dikrong river. Flash floods became a major concern. On many occasions there were clear indications that flash floods were caused by the opening of gates by the NEEPCO to release the excess water of the RHEP, which it often did without any warning. On one such occasion on July 16, 2007, flash floods inundated 83 villages in Lakhimpur district of Assam. The Assam's Minister for Flood Control Bharat Narah accused NEEPCO of opening the dam gates and causing floods. The corporation, as usual refused the allegations and instead attributed floods to a cloudburst\textsuperscript{106}. On another occasion, following the release of excess water from the Ranganadi dam in April 2008 and the heavy rains and devastating floods in the subsequent months, a report published in the month of August in the same year in the local newspaper summarized the impacts of the RHEP on the lower reach of the Dikrong valley and on the people therein. The report read as presented in Box 3.2 –

**Box 3.2**

Correspondent NORTH LAKHIMPUR, Aug 6, 2008
The flood situation in Lakhimpur district took a serious turn on Friday with the Dikrong and other rivers submerging a large area and disrupting communication and transport links. The worst-hit areas in the district are under the Nowboicha and Bihpuria revenue circles. Incessant rains since the two days caused a spate in the Ranganadi, Singara, Bokanadi and Pabha, inundating new areas in Nowboicha revenue circle and forcing villagers to take shelter on embankments.

\textsuperscript{106} Independent People’s Tribunal on Dams in Arunachal Pradesh Interim Report February 3, 2008
The overflowing waters of the Singra and Bokanadi rivers flooded 60 villages including No. 2 Borsola, Paandhowa, Mohghuli, Garchiga, Singra, Gossaneebari, Chelengeejaan, Gelahati, Rowdung, Borpothar, Ahomoni, Pokoniya, Salmor, Kaoibhuruka, Duwarahgaon, Gesek, Balijaan, No.2 Sonapur, Ranabari, Habirdoloni, Bokanadi, Bishnupur, Boloma, Haripur, Kutukai, Katahlpukhuri, No.1 and No.2 Deejoo Pathar, No.1 and No.2 Paanchnoi, etc., submerging hundreds of hectares of cropland. The floodwaters of Singara entered through the breached portion of its embankment at No. 1 Borsola, overflowing the Dolahat-Mohghuli PWD Road at No.2 Borsola. About 200 families of BMP Gaon Panchayat have been taking shelter on the embankment of the Singra river and at No. 1 East Borsola LP School and No. 2 East Borsola LP School. The floodwaters have also destroyed hundreds of fisheries in that GP area. The floodwaters of these rivers have also breached the PWD roads connecting NH-52 with Faringajaan-Dolahat, Pahumora-Pokoniya PWD Road and many more, leaving the villagers stranded in different places due to disruption of road transport.

The alleged release of additional waters of the Ranganadi hydro-electric power plant at Yazali, Arunachal Pradesh by the NEEPCO into the Dikrong river flooded many areas under Bihpuria revenue circle. That release of water without any prior information caused the Dikrong river to swell, sweeping away a portion of the Laluk-Bihpuria connecting PWD road near Bihpuria town and snapping road transport between these two important places of Lakhimpur district for several hours. However, the breached portion of the road was repaired and traffic movement was restored in the evening. Dikrong also flooded many areas in Teteliguri, Dongeebeel and Bodoti. The floodwaters of Pichala river inundated several villages under the Deori Autonomous Council in Narayanpur. Twenty villages under Narayanpur revenue circle were affected in yesterday’s flood.
In North Lakhimpur town, several low-lying areas are still reeling under waterlogging. The areas near the Judicial Court under Ward No. 6, the localities behind Lakhimpur Commerce College and many areas under Ward No. 14 are still under water and the outbreak of water-borne diseases is feared\(^{107}\).

In a Public memorandum submitted to NEEPCO\(^{108}\) in the year 2008, the Dikrong Upatyaka Surakshya Samiti of Bihpuria town demanded compensation for damages caused by the flood due to excess water in Dikrong. It further urged NEEPCO to protect life and property of the people of Dikrong Valley of Assam from the downstream effects of RHEP\(^{109}\). However, NEEPCO responded in a five-page letter to the Samiti the manner in which the RHEP was proposed and carried out. With facts and figures NEEPCO denied to have added to the flood problems of the Dikrong valley, mentioning repeatedly that the ecological conditions of the valley were fragile even prior to the implementation of the RHEP and that the project in no way aggravated the situation in any significant way. It particularly mentioned that – “On 13.6.2008 and 14.6.2008 due to torrential rainfall in the adjacent areas there was huge inflow (428 cumec at 2.45 am on 14.6.2008 which increases to approximately 2120 cumec at 5.10 am of the same day) to the Ranganadi reservoir. The excess water was spilled through the spill gates of the diversion dam to the downstream in a controlled manner. During this period the generating units were operating at full load of 405 MW utilizing 160 cumec of

\(^{107}\) The Assam Tribune Correspondent NORTH LAKHIMPUR, Aug 6,2008

\(^{108}\) Public Memorandum Submitted to NEEPCO by, Dikrong Uptakya Surakshya Samiti, Bihpuria, Memo No. NEEPCO/2/08 dated 15-07-2008

\(^{109}\) Ibid.
water, which was finally discharged to Dikrong river. The tail water discharge of 160 cumec is very insignificant in comparison to the observed peak flood discharge of Dikrong river, which is about 2300 cumec at Yayee and about 3500 cumec at Sissapathar (Observed in 1974) and such additional impact on this account is negligible and cannot be the cause of loss of lives and devastations.”

In fact, it was year back in July 2006, when the NEEPCO abdicated all its responsibility in a notice to the villages which said "... during monsoon ... the gates of the Ranganadi Diversion Dam may require opening from time to time .... All concerned authorities, village headmen are therefore requested to bring the same to the notice of all villagers ... downstream of the dam to refrain from going to the river and ... also restrict pet animals from moving around the river/reservoir during the monsoon period. The corporation will not take any responsibility for any loss of life of human, pet animals etc. (ibid)" Thus, in clear words it expressed its callousness and refusal to assume any kind of responsibility or accountability of the situation.

However, public protests and agitation made it mandatory for project authorities to assess the downstream affects of dam building. Another daily recorded the following compulsory assessment of downstream impacts –

**Box 3.3**

Mega dams in Northeast: Downstream impact study made mandatory Spl. Correspondent NEW DELHI, Nov 25

Faced with protests in Assam against big dam projects in upper reaches in neighbouring Arunachal Pradesh, the Ministry of Power
has commissioned a number of study projects, while Ministry of Environment and Forest has made assessment of downstream impacts mandatory.

The Centre has received representations from organizations and Government of Assam protesting construction of big dams for power generation and related impact of hydel power development in downstream areas in the State, admitted Union Minister of State for Power Bharatsinh Solanki in reply to a Rajya Sabha question by Biren Baishya.

To ally the apprehensions of the people over the downstream impact in Assam of upstream projects, National Hydro Power Corporation (NHPC) and NEEPCO have commissioned studies to assess the downstream impact due to Subansiri Lower Hydroelectric Project, Ranganadi Stage – I and Pare Hydroelectric Projects.

Further, the Ministry of Environment and Forest while approving the Terms of Reference (ToR) for construction of big dams, includes the assessment of downstream impacts in the ToR for preparation of Environment Impact Assessment Report, said Solanki.

On studies commissioned by NHPC, a Central government undertaking, the Minister said the Power Company has awarded a comprehensive downstream impact study to Gauhati University last May. The study is being undertaken by the University in association with Dibrugarh University and Indian Institute of Technology (IIT) Guwahati.

NEEPCO, on the other hand, has also entrusted IIT Guwahati for a Detailed Hydrological Study of the Dikrong-Panyor River Basin and its impact in the downstream, which will cover the hydro-
meteorological study of the River Basin and its impact on the flood scenario at the downstream Ranganadi hydel Project and ongoing Pare Project with and without dam.

Moreover to forewarn the people in the downstream areas in case of approaching floods in the future, NEEPCO has entrusted the task of developing a model for flood forecasting in the downstream of the commissioned Ranganadi hydroelectric project (Stage – I) and ongoing Pare Project, to North Eastern Space Applications Centre (NESAC), Umiam Meghalaya.

In April 2008 release of excess dam water by NEEPCO and heavy rains in neighbouring Arunachal Pradesh caused flash floods in Lakhimpur district claiming 21 lives.110

As far as people protest are concerned, a major grassroots social and political movement against the mega dams in the past few years has been witnessed by the the region (particularly in downstream Assam). The Krishak Mukti Sangram Samiti (KMSS) took the lead and submitted a memorandum signed by 1,12,000 signatories to the Indian Prime Minister seeking his urgent intervention and action on dam issue. Among its demands, the KMSS listed the following as the urgent concerns of the people and the samiti. These are –

1. A complete moratorium on all clearances (including pre-construction clearances) by the MoEF to large dams/hydropower projects in Northeast India.

2. Immediate withdrawal of clearances granted to the 2000 MW Lower Subansiri project, 1750 MW Demwe Lower and 1500 MW

110 Mega dams in Northeast: Downstream impact study made mandatory Spl Correspondent NEW DELHI, Nov 25
Tipaimukh which were granted environmental clearance without downstream impact assessment and public consent.

3. Commission of a special study group consisting of Independent Reviewers (including scientists, people’s representative) to study the environmental and social impact of all the existing dams in Assam.

4. A complete review of pre-construction clearances granted to projects in the region.

5. Future steps on hydropower projects and dams to be taken only after full, prior and informed consent of the people of the Brahmaputra & Barak river basins.

6. The Brahmaputra River and its tributaries to be protected as a cultural and ecological endowment of the people of the region and the country as a whole. Development plans will need to respect the environmental and cultural sensitivity of the region.\footnote{Press Release Krishak Mukti Sangram Samiti, Assam 23rd November 2010, New Delhi}

\textit{Damages Prior to the Ranganadi Project}

During our fieldwork, we have noticed that a large number of people were victims of flood and erosion. Flood and erosion was major threat to the people living in and around the Dikrong Valley. Even prior to the construction of the Ranganadi hydel power projects, the valley had witnessed a series of activities that compromised its ecological functioning. Felling of trees, denuding mountains, digging of hilly area and extraction of gravels, stones, rocks and sands from river catchments area were done much before the construction of Ranganadi project. However, the flood and erosion affected areas
were relatively less during that period. It is evident from our data, that out of the total 1354 families of the 22 villages, two villages were completely wiped out and 1060 families were affected due to flood and erosion. These were the condition of the people in the pre Ranganadi hydro power project. The percentage of damage prior to the dam building was 78.28 per cent. It also depicts that 886.4 Hectares agricultural land and 222.02 hectares of built up land were damaged due to flood and erosion. Similarly 501 houses were fully lost and 599 houses were partially lost.

**Table 3.3**

**Damage Assessment due to Flood & Erosion, Pre Ranga Nadi Hydel Power Project from (1991-2001)**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of Villages</th>
<th>No. of family in the village</th>
<th>No. of family affected</th>
<th>Total populatio n</th>
<th>Loss of land(hact)Due to Erosion</th>
<th>Loss of property(Dwelling House)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Agricultur e</td>
<td>Built up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fully loss</td>
<td>Partial loss</td>
</tr>
<tr>
<td>1</td>
<td>Kapichala</td>
<td>73</td>
<td>73</td>
<td>418</td>
<td>90.73</td>
<td>21.56</td>
</tr>
<tr>
<td>2</td>
<td>Bangalmara Grazing</td>
<td>90</td>
<td>90</td>
<td>622</td>
<td>29.77</td>
<td>12.21</td>
</tr>
<tr>
<td>4</td>
<td>Dongibil</td>
<td>60</td>
<td>28</td>
<td>278</td>
<td>38.26</td>
<td>13.35</td>
</tr>
<tr>
<td>5</td>
<td>Keyamara</td>
<td>105</td>
<td>105</td>
<td>585</td>
<td>65.23</td>
<td>29.77</td>
</tr>
<tr>
<td>6</td>
<td>78/81 No Merbil Majgaon</td>
<td>36</td>
<td>36</td>
<td>185</td>
<td>32.66</td>
<td>4.2</td>
</tr>
<tr>
<td>7</td>
<td>Kalabil Mornoi</td>
<td>33</td>
<td>33</td>
<td>183</td>
<td>45.86</td>
<td>6.26</td>
</tr>
<tr>
<td>8</td>
<td>Badati Alimur</td>
<td>87</td>
<td>47</td>
<td>592</td>
<td>68.52</td>
<td>32.13</td>
</tr>
<tr>
<td>9</td>
<td>Badati</td>
<td>50</td>
<td>50</td>
<td>202</td>
<td>89.21</td>
<td>28.14</td>
</tr>
<tr>
<td>10</td>
<td>Botumchuk</td>
<td>93</td>
<td>33</td>
<td>610</td>
<td>26.10</td>
<td>23.90</td>
</tr>
</tbody>
</table>
Damages in the Post Ranganadi Project Period

In the post Dam period, damage assessment calculated through our field work shows that 1004 family out of total family 1004 of twenty two villages were badly affected. The percentage of damage is 100% in this period. It also depicts that total affected population of 4603 had to lose 656.88 hectares of agricultural land and 283.56 hectares of built up land due to flood and erosion. Again 741 dwelling houses were completely ruined where as 260 dwelling houses were partially lost. In addition to that, we gathered information that in the post dam period, soil, stones, and sand were mined and quarried from around the dam site and dried riverbed. Such extractions have been carried out without considering the adverse environmental effects of such activities. Excavation of construction material has been pursued vigorously with no restrictions imposed by the state. A visibly polluted atmosphere greets those crossing the dam sites and areas
even farther away from it. The environmental effects of such excavation include dust pollution, disturbing wildlife, and destroying vegetation. Moreover, there has been no attempt to restore the surroundings of the project area affected by dam and related activities.

Table 3.4

**Damage Assessment due to Flood & Erosion, Post Ranganadi Hydel Power Project from (2002-2010)**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Villages</th>
<th>No. of family in the village</th>
<th>No. of family affected</th>
<th>Total population</th>
<th>Loss of land (hact)Due to Erosion</th>
<th>Loss of property (Dwelling House)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Agriculture</td>
<td>Built up</td>
</tr>
<tr>
<td>1.</td>
<td>Banga</td>
<td>93</td>
<td>93</td>
<td>519</td>
<td>58.73</td>
<td>19.39</td>
</tr>
<tr>
<td>2.</td>
<td>80 No Solmari</td>
<td>65</td>
<td>65</td>
<td>360</td>
<td>35.19</td>
<td>18.66</td>
</tr>
<tr>
<td>3.</td>
<td>2No. Dikrong Chapori</td>
<td>65</td>
<td>65</td>
<td>402</td>
<td>46.66</td>
<td>18.13</td>
</tr>
<tr>
<td>4.</td>
<td>Ahom Gaon (Bihpuria Town)</td>
<td>24</td>
<td>24</td>
<td>192</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Merbil Silikhaguri</td>
<td>95</td>
<td>95</td>
<td>497</td>
<td>61.13</td>
<td>38.44</td>
</tr>
<tr>
<td>6.</td>
<td>Dongibil</td>
<td>41</td>
<td>41</td>
<td>278</td>
<td>55.71</td>
<td>13.71</td>
</tr>
<tr>
<td>7.</td>
<td>Kathalguri</td>
<td>13</td>
<td>13</td>
<td>81</td>
<td>17.06</td>
<td>4.53</td>
</tr>
<tr>
<td>8.</td>
<td>Bangalmara Grazing</td>
<td>78</td>
<td>78</td>
<td>391</td>
<td>63.22</td>
<td>21.45</td>
</tr>
<tr>
<td>9.</td>
<td>Santipur Kaiwarta Gaon</td>
<td>13</td>
<td>13</td>
<td>80</td>
<td>8.63</td>
<td>2.19</td>
</tr>
<tr>
<td>11.</td>
<td>Pithaguri</td>
<td>29</td>
<td>29</td>
<td>219</td>
<td>22.6</td>
<td>3.13</td>
</tr>
</tbody>
</table>
The above table shows the number of families in a village and total number of population affected due to flood and erosion. It also documents the loss of land and loss of dwelling places in the post Ranganadi project period. While it is important to take note of the quantum of land and families affected, it is significant to understand what this loss implies in practical terms. Loss of land as we have already stated implies as series of loss in terms of livelihood, shelter, health, property and most importantly one’s claim as a citizen. The effect of flood and erosion has its own class and gender dimension. Environmental degradation have disproportionate effect on the rich and the poor. The poor bear the brunt of any kind of environmental disruption, as they are the ones greatly dependant on communal resources. The gender dimension of the problem stems from the fact

<table>
<thead>
<tr>
<th>No.</th>
<th>Village</th>
<th>Families</th>
<th>Total Population</th>
<th>Land Loss (Acres)</th>
<th>Dwelling Loss (Acres)</th>
<th>Total Claim (Acres)</th>
<th>Fleeing Families</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Badati Miri Gaon</td>
<td>185</td>
<td>185</td>
<td>132.55</td>
<td>68.45</td>
<td>185</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>Badatialimur</td>
<td>40</td>
<td>40</td>
<td>209</td>
<td>52.11</td>
<td>25.13</td>
<td>40</td>
</tr>
<tr>
<td>14</td>
<td>Botumchuk</td>
<td>60</td>
<td>60</td>
<td>273</td>
<td>21.77</td>
<td>18.23</td>
<td>60</td>
</tr>
<tr>
<td>15</td>
<td>Lega Chung</td>
<td>110</td>
<td>110</td>
<td>590</td>
<td>29.21</td>
<td>20.12</td>
<td>35</td>
</tr>
<tr>
<td>16</td>
<td>Badalpara</td>
<td>30</td>
<td>30</td>
<td>172</td>
<td>30.85</td>
<td>19.32</td>
<td>30</td>
</tr>
<tr>
<td>17</td>
<td>Kathiabari</td>
<td>25</td>
<td>25</td>
<td>151</td>
<td>24.62</td>
<td>17.32</td>
<td>25</td>
</tr>
<tr>
<td>18</td>
<td>Banikanta Para</td>
<td>28</td>
<td>28</td>
<td>163</td>
<td>27.46</td>
<td>19.14</td>
<td>28</td>
</tr>
<tr>
<td>19</td>
<td>Rakhal Para</td>
<td>120</td>
<td>120</td>
<td>711</td>
<td>92.33</td>
<td>68.21</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1004</td>
<td>1004</td>
<td>4603</td>
<td>656.88</td>
<td>283.56</td>
<td>741</td>
</tr>
</tbody>
</table>
that in poor households, women and children engage in much of the food gathering activities for example collecting fuels, fetching water from rivers and wells etc. When the environment that provides the fuel and fodder of poor household is disturbed, it is the women and children who suffer in the process. They come to be burdened with the responsibility of finding newer ecological places from where to collect food, water and fuel. Because women and children have marginal positions in the labour market their source of alternative livelihood id also constricted. They are forced to live within their traditional settings and make optimum use of the environment in which they live. Hence, when the environment degrades in the form of land loss and erosion it is the women and children who suffer the most. The effect of environmental degradation takes a toll on the health of women and children. Agarwal has shown that women and children are more prone to water borne diseases and river pollution due to use of fertilizers and pesticides.\textsuperscript{112} It is also important to take note of the social support systems that are affected as result of displacement due to environmental reasons. A number of scholars writing on the consequences of environmental degradation have highlighted changed circumstances in the post displacement period. Displacement has painfully eroded the social support networks of communities especially of women. Women are closely woven into their communities where they depend on the members of their communities. Their dependence range from activities that include daily simple exchanges to crucial borrowings and lending at the

times of urgent need. On scholar has put these simple and complex dependencies in the following words- "Social relationship with kin, and with villagers outside the kin network, provide economic and social support that is important to all rural households but especially to poor households and to the women. This includes reciprocal labour-sharing arrangements during peak agricultural season; loans taken in cash or kind during severe crises such as droughts; and the borrowings of small amounts foodstuffs, fuel, fodder, and so on, even in normal times. Women typically depend a great deal on such informal support networks, which they also help to build through daily social interactions, marriage alliances that they are frequently instrumental in arranging, and complex gift exchanges"113.

113 Ibid. pg.341