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Original Research Paper

Probable Downstream Impacts of 2000 MW Lower Subansiri Dam in Arunachal Pradesh of North East India

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ABSTRACT

Downstream of River Subansiri showed a biologically controlled healthy ecosystem along with riparian zones and catchment forests which are hot spots of species before the hydel projects were undertaken. This important natural corridor for the energy flow, nutrient cycling and species diversity would certainly be altered due to the construction of 2000 MW lower Subansiri dam in three orders viz., first order impact (hydrology) through alteration in the flow regime, discharge control resulting from damming of river, reduced flow variability and total volume of runoff, and water quality (physical, chemical and biological changes). Second order impacts through changes in sediment transport, floodplain morphology, river water turbidity affecting the biota directly, alteration in primary production (plankton, riparian vegetation), and the third order impact through the habitat degradation due to changes in flow regime, water quality, loss of breeding-ground for threatened fishes like *Tor tor*, *Tor putitora*, fish diversity, fishery production, creating barrier for upstream and downstream migratory fishes as well as endangered aquatic mammal *Platanista gangetica*, loss of genetic diversity of indigenous deep water rice varieties as well as important native species and thereby affecting the food production capacity and livelihood security of the people who depend on the downstream.

INTRODUCTION

Experts place the total hydropower potential of the country at 150,000 MW, out of which 56,539 MW lies in the Arunachal Pradesh of north east India. NHPC has already completed the flow diversion of the Subansiri river, an important phase of the 2000 MW lower Subansiri hydel project besides constructing tunnels, roads, etc. through large scale destruction of forests, wildlife and habitats. The impacts of the dam can be seen on the ecosystem, not just upstream where the river-surrounding valley is inundated, but also downstream where the natural flow and sediments regimes may be substantially altered as the dam creates barrier for stream natural flow and hold back sediment. McCartney et al. (2000) suggested that the dams decrease the flow of river, which means fewer habitats, nutrients, and increased stresses on aquatic life of downstream. Dam can cause massive changes in the ecology and water quality of the river and its tributaries. In addition, dams have huge impacts on downstream floodplain, due to changing in timing and volume of flows of water and nutrients.

River Subansiri, the largest tributary of River Brahmaputra, originates from the western part of Mount Pararu (5059 km) in the Tibetan Himalayas. After flowing for 190 km through Tibet, it enters India. It continues its journey through the Himalayas of India for 200 km and enters into the plains of Assam through a gorge near Gerukamukh of Dhemaji district of Assam. Its total length is 520 km and drains a basin of 37000 sq. km. The total downstream (from the dam site to River Brahmaputra) length is near about 115 km. This tributary plays an important role in distribution of terrestrial as well as aquatic biodiversity, agricultural diversity and socioeconomic aspects of local communities which live in the downstream areas, whose local economies are linked with the river system and wetlands (beels).

The proposed study area is very rich in biodiversity and agricultural diversity (Baruah & Hazarika 2001). Civil society groups have been demanding a detailed downstream impact assessment study and postponement of construction works till the assessments were properly executed. It is noticed that the Environment Impact Assessment (EIA) report based on which the project received environment clearance from the Ministry of Environment and Forests (MoEF) in 2003 is very poor (Vagholikar 2007).

FACT PROFILE OF THE SUBANSIRI HYDEL PROJECT

Project Area: Global Biodiversity Hotspot. The left bank of the dam is in Assam and the right bank of the dam is in Arunachal Pradesh where the power generation will be housed.

Location: 2.3 km upstream of Gerukamukh village in the Dhemaji district of Assam, around 70 km from North Lakhimpur and the midst of contiguous forest comprising of three reserve forests (RF) namely, Kakoi RF, Dulung RF and Subansiri RF.

Total Land Used: 4000 hectares

Height of the Dam: 116 meter

Downstream: 115 km

Total requirement of forest areas for the project: 4,039.30 ha out of which 3.183 ha is in Assam.

Submergence areas: The dam site and submergence zones fall in the eastern Himalayas, which is an important part of the Indo-Myanmar biodiversity hotspot, one of the 25 such hotspots in the world (Myers et al. 2000). Vagholikar & Ahmed (2003) reported that the 3,436 ha of the forest to be submerged comprise crucial wildlife habitats. As the project envisages building over further 70 km of road in the region, the submergence area is likely to include parts of Tale Valley sanctuary, Tale Valley reserve forest (RF), Panir RF, Kamala RF and Jiadhal RF in Arunachal Pradesh and Subansiri RF in Assam. The project comprises the following components:

1. Capacity: 2000 MW (8 × 250 MW)
2. 5 Nos. 9.5m dia horseshoe shaped diversion tunnels
3. 116m high concrete gravity dam on River Subansiri
4. Intake structure
5. 8 Nos. 9.5m dia horseshoe shaped head race tunnels with length varying from 225 to 390m.
6. Surface power house to accommodate 8 units of Francis turbines of 250 MW capacity each.
7. Head Race Tunnel-8 Nos. 9.5 m dia, horseshoe shaped having a length from 630 to 1145m.
8. Pressure Shaft-8 Nos. horseshoe/circular shaped varying dia of 9.5m-7.0m and length 192m to 215m.
9. Tail race channel, 206 m × 35 m (W × L)
10. Underground power house of size 24m × 62.4m × 337m housing 8 units of capacity 250 MW each.
11. 8 Nos. 9.5m dia horseshoe shaped head race tunnels with length varying from 450m to 780m.
12. Annual generation 7421 MU (90% dependable year).

13. Project Cost: Rs. 6285.33 crores (December 2002 price level)
14. Year of commissioning/completion schedule: January 2012 (Anticipated)

Legal violations by NHPC: It has made extensive collection of boulders, stones, gravels and sand from the river bed, and construction of building and roads on the left bank of the river. Thousands of workers working on the dam construction sites depend on the forests of the area for daily firewood and food by large scale destruction of vegetation. The river has been used as a dumping ground for the muck and sewage debris. The elephant corridor has been obstructed by the fencing raised in the Subansiri reserve forest.

RESEARCH AND DEVELOPMENT ON THE IMPACT OF DAMS

Over the last 30 years extensive studies have been made on the impact of big dams on downstream river ecosystem biodiversity, especially phyto and zoo plankton, fish diversity, and socioeconomic aspects of downstream people. Petts (1994) considered impacts of dams on ecosystems within a hierarchical framework of inter connected effects as in following orders (Fig. 1). First order impacts: Changes in flow water quality and sediment load; Second order impacts: Changes of channels and downstream ecosystem structure and primary production, which results from modification of first order impacts and these changes may take place over many years; Third order impacts: These are the long term biotic changes resulting from the integrated effect of all the first and second order changes, including the impact on species close to the top of the food chain.

SOME PRE-DAM ECOLOGICAL ASPECTS OF DOWNSTREAM

EIA Report of NHPC: Environment Impact Assessment (EIA) report claims to have studied an area of only 7 km downstream of the dam. Likewise, the minimum water flows calculated have not been informed by a comprehensive understanding of downstream need since downstream study itself has been minimal (Vagholikar 2007). The EIA report lists only 55 species of fishes in the downstream to the dam (about 115km) as against 128 species reported by Baruah & Hazarika (2008). They also reported the status of river dolphin in the downstream of River Subansiri with good number of residential population of this endangered species. Baruah (2006) investigated the hydrobiology and planktonic diversity in some areas of downstream to the hydel project. The EIA report lists only 10 species of mammals in the submergence area, and 20 in Tale Valley Sanctuary (upstream) and no mention has been made about common species, the *Ursus thibetanus* (Himalayan and Asiatic Black Bear), which is common in that area. In the list of endangered animals, *Manis crassicaudata* has been listed although it is not found in the area. The report mentions an arboreal mammal called Masthesis, when no such species exists (Vagholikar & Ahmed 2003). They also reported that the list has 13 species of birds in an area which has over 200 and there are serious mistakes in this listing too, e.g., the scientific name of the common sandpiper has been given as *Accipi* sp., a small docile wader converted into a bird of prey. In the section on animal-plant relationships, the report mentions a bird called nutchh, while no such species exists.

Downstream survey was done only up to 7 km with no record on ornamental fishes, downstream hydrobiology, endangered species, especially aquatic mammal *Platanista gangetica*, endemic plant *Keyia assamica* and endangered birds *Leptopilus dubius* (greater adjutant), *Gypus bengalensis* (vulture) spotted in the downstream. Similarly, no record was made on the three contiguous forests, on agricultural diversity and socioeconomic aspects of downstream inhabitants.

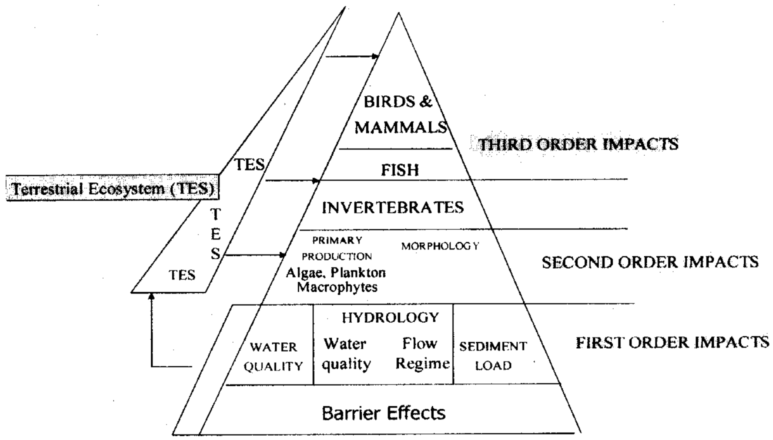

Fig. 1: A framework for assessing the impact of dams on river ecosystems (Petts 1984).

Pre-dam assessment of downstream: Baruah (2006), Baruah & Hazarika (2008), and Hazarika & Baruah (2008) reported that downstream of the river is a biologically controlled ecosystem by assessing different physicochemical properties like air and water temperature, current flow , transparency, pH, total suspended solids (TSS), total dissolved solid (TDS), conductivity, alkalinity, hardness, calcium hardness, chloride, silicate, dissolve oxygen (DO_2), free carbon dioxide (FCO_2) and some ecological/biological parameters like Gross Primary Productivity (GPP), Net Primary Productivity (NPP), and Community Respiration (CR) (Table 1). Altogether, 359 taxa have been recorded and identified from the river system, which include 48 species of algae, 23 species of zooplankton, 25 species of avian fauna and 128 species of freshwater fishes belonging to 9 Orders, 27 Families and 78 Genus. A total of 21 Gangetic dolphins and 134 herbaceous species in the downstream and riparian zone were also recorded. Endangered birds *Leptopilus dubius* (greater adjutant) and *Gypus bengalensis* (vulture) were also spotted in the downstream. Endemic plant *Keyia assamica* and rare species of climbing bamboo (*Bambusa* species) were found to be distributed in the reserve forests of downstream.

ASSESSMENT DURING THE CONSTRUCTION OF DAM

Ecological destruction gradually started from 2006-07 in the upstream as well as in the transitional zone between up and downstream by illegal dumping of muck in to the river in upstream and blasting operation for flow diversion of the river. However, the present downstream impact is mainly due to changes in flow regime in the downstream due to flow diversion in the upstream, which was completed in April 2008, and habitat fragmentation in the downstream due to flow diversion.

PROBABLE DOWNSTREAM IMPACT OF THE DAM ON NATURAL ECOSYSTEMS AND BIODIVERSITY

First Order Impact

Hydrobiology

Alteration in the flow regime: Discharge control resulting from damming of the river reduces flow variability and the total volume of runoff.

Table 1: Physicochemical, ecological parameters and biodiversity of downstream of Subansiri river during 2005-2007.

S. No	Parameters	Observation	Comment
A	**Physicochemical**		
1	Air temperature	20.4-33.2 °C	Ideal for aquatic biota
2	Water Temperature	14.3-31.2 °C	Ideal for aquatic biota
3	Current flow	136-289 meter/sec	More during wet season
4	Transparency	19.5-88.7 cm	Ideal for aquatic biota
5	pH	7.0-7.9	Ideal for aquatic biota
6	Dissolve oxygen	7.1-13.1 (mg/L)	Ideal for aquatic biota
7	Free carbon dioxide	2.9-9.4 (mg/L)	Ideal for aquatic biota
8	Total dissolved solids	132-201 (mg/L)	Ideal for aquatic biota
9	Total suspended solids	18-55 (mg/L)	Ideal for aquatic biota
10	Conductivity	90.4-160.3 (μmho)	Ideal for aquatic biota
11	Alkalinity	70.4-119.1 (mg/L)	Ideal for aquatic biota
12	Calcium hardness	26.7-43.8 (mg/L)	Ideal for aquatic biota
13	Chloride	3.0-9.8 (mg/L)	Ideal for aquatic biota
14	Silicate	4.8-9.4 (mg/L)	Ideal for aquatic biota
B	**Ecological**		
1	Gross Primary Productivity	0.21mg C/L/hr -1.09 mg C/L/hr	Ideal for aquatic biota
2	Net Primary Productivity	0.16mg C/L/hr -0.47 mg C/L/hr	Ideal for aquatic biota
3	Community Respiration	0.11mg C/L/hr -0.62 mg C/L/hr	Ideal for aquatic biota
4	NPP/GPP	0.86-0.39	Ideal for aquatic biota
5	Respiration (% of GPP)	14.29-65.22	Ideal for aquatic biota
C	**Biodiversity**		
1	Algae	48	Rich
2	Zooplankton	23	Rich
3	Avian fauna	25	Rich, endangered
4	Fishes	128	Rich, rare, endangered
5	River Dolphin	21	Rich, endangered
6	Herbs in Riparian zone	134	Rich, economic values

Minimum and maximum values of physicochemical and ecological parameters of four different sectors.

Water quality: Physical, chemical and biological changes occur in stored water. So discharge water has a different composition and pattern than natural water. Reservoirs act as thermal regulators and nutrient sinks for which seasonal and short term fluctuations in water quality are regulated.

Water temperature: Thermal changes caused by water storage have the most significant effect on in-stream biota (Petts 1994). So, it is an important parameter for the assessment of downstream impact of dam because it influences many physical, chemical and biological processes.

Dissolved oxygen: During summer the water remains well oxygenated, poor in nutrients, warm temperature, and in winter, just the reverse. Low oxygen content and alteration in nutrients and salinity will affect the aquatic organisms supported in riverine and riparian ecosystems.

Sediment Transport

Changes in sediment transport: Reduction in sediment transport in the downstream will impact on channel, floodplain morphology and river water turbidity affecting the biota directly. Selective release of highly turbid water from a reservoir is a technique often used to reduce sedimentation before it has a chance to settle. Sudden release of tonnes of sediments can be disastrous for some biota. For example, introduction of large quantities of fine silt and clay into permeable gravel substrates can

Table 2: Proposed hydel schemes above 25 MW installed capacity (I.C.) in the Subansiri river basin.

S. No.	Name	River	Probable I.C.(MW)	CEA ranking
1	Oju-I	Subansiri	1,925	B
2	Oju-II	Subansiri	2,580	B
3	Niare	Subansiri	1,405	B
4	Naba	Subansiri	1,290	B
5	Hegio	Kurung	250	A
6	Kurung-II	Kurung	200	B
7	Tammu	Siu	55	B
8	Milli	Kurung	75	A
9	Sape	Kurung	38	A
10	Chomi	Kurung	80	B
11	Chela	Kurung	75	A
12	Nyepin	Payam	32	A
13	Hiya	Payam	41	A
14	Kurung-II	Kurung	115	A
15	Middle Subansiri	Kamala	2,000	B
16	Par	Dikrong	65	A
17	Dardu	Dikrong	60	B
18	Ranganadi-II	Ranganadi	180	B
19	Duimiukh Storage	Dikrong	170	B
20	Lower Subansiri	Subansiri	2,000	C
21	Upper Subansiri	Subansiri	2,500	B
22	Tago	Kale	55	A

Total proposed installed capacity 15,191 MW. Source: Central Electricity Authority (CEA) ranking study 2001.

have a catastrophic effect on fish population. Thus, even though reservoir operations result in extreme and unnaturally high concentrations of sediment, they may produce a major stress on downstream aquatic ecosystem as suggested by Petts (1994).

Second Order Impacts

Channel and flood plain: Channel bank erosion occurs while sediment transportation is reduced which alter the characters of floodplains. Depletion of fine suspended solids reduces rate of over bank accretion so that new flood plains take longer to form and soils remain unfertile. Channel bank erosion results in loss of floodplains (McCartny et al. 2004).

Primary Production: There will be alteration in plankton and aquatic macrophytic population.

Riparian vegetation: It is controlled by dynamic interaction of flooding and sedimentation. Riparian forests are dependent on river flows and shallow aquifers. The direct loss of annual silt and nutrient replacement because of upstream impoundment is thought to have contributed to the gradual loss of fertility of formerly productive flood plain soil as suggested by McCartney et al. (2004), resulting in loss of plant diversity.

Third Order Impacts

Fishes: Habitat degradation due to changes in flow regime, water quality, loss of breeding ground for threatened fishes like *Tor tor*, *Tor putitora* (golden mahasheer), loss of fish diversity and loss of fishery production, all create barrier for upstream to downstream migratory fishes.

Mammals: Loss of habitat for the endangered species like *Platanista gangetica* (Gangetic dolphin) may result in its loss.

Birds: Loss of habitat for endangered birds *Leptopilus dubius* (greater adjutant) *Gypus bengalensis* (vulture) and migratory birds.

PROBABLE NEGATIVE IMPACTS OF DAMMING OF RIVER TO DOWNSTREAM

Agricultural Diversity

Changes in crop yields: Degradation of crop fields due to changes in flow regime, water quality and nutrient supply.

Loss of indigenous rice variety: Loss and changes of habitat results in loss of indigenous crops specially the deep water rice.

Socio-Economic Aspects

Some economic benefits are also gained by the downstream river bank inhabitants through fishing, collection of driftwood, economically important plants such as *Imperata cylindrical, Saccharum munja, Vetivera zizanoide, Tamarix diocia* and dairy farming, etc., which maintain a balance between human use and the ecology of the river. Floodplain grazing communities and cultivable lands are also very productive due to seasonal flood. River bank inhabitants use river water for drinking, washing ,bathing and cultivation. Dam will curtailed these through creating barriers for drift wood, causing down stream habitat fragmentation, degradation, changes in water quality and quantity, loss of species, etc. and will make a negative impacts on the flood plain inhabitants whose social and economic status is related to the river.

Flooding

Damming of Subansiri river will disrupt crucial natural flood cycles leading to widespread damage to ecosystems affecting flora, fauna, regional economy, and food production affecting the people who depend on the river and its flood cycles. Seasonal flooding is essential for re-fertilizing the banks and surrounding flood plains. A dam will decrease the water flow and change the rate, duration and timing of flooding.

Forests play a critical role in regulation of flooding by absorbing high flood waters during rainy season and slowly releasing the stored water in dry season. With extensive deforestation, there is an increased severity of flooding as the water rushes into the river, taking with it valuable topsoil. Furthermore, dams, when overfill, may release much larger than natural amounts of water in very short periods causing more damaging flooding than previously known in the river basin. This was experienced by the people of Assam in the rainy period in 2004 by sudden release of water by Kopili Hydel Project in 2005, 2006, 2007, 2008, and sudden release of water by Ranga Nadi Hydel Project of Arunachal Pradesh in 2007.

Physical Changes

For several hundred kilometres, the free flowing river would be changed into a deep, slow/still moving water system. This major change influences the physical and chemical characteristics of the water like pH, clarity, oxygen level and temperature.

Decaying organic matter will create eutrophic conditions in the reservoir, leading to algal blooms, further oxygen depletion, and massive destruction of aquatic organisms. When this happens, the water of dam reservoir, which directly flows to the downstream, may be often unfit for human and animal consumption for years after the project is completed.

The proposed dam is too big with height of 116 meter and would submerge 3,436 hectare of forest, while the whole area lies in a highly seismic zone, i.e., earthquake prone area. So, the reservoirs increase the risk of earthquake by adding immense pressure to the earth from the large volume and weight of the stored water (Vagholikar 2007). After the 1950 earthquake, extensive landslides blocked the Subansiri river resulting in devastating floods in the downstream due to rising of riverbed by deposition of sediments from upstream.

Dams upset geological processes of erosion and deposition. Rainforest soils are often extremely delicate; their thin layer of topsoil is highly vulnerable to erosion. Eroded soils are washed into the dam reservoirs causing a build-up of siltation that eventually leads to loss of the reservoir's storage capacity over time. Moreover, the soil deposits that are trapped behind the dam's barriers deprive the riverbanks downstream of seasonal nutrient replenishment. Loss of the source of silt and soil from upstream also causes serious erosion of riverbanks. Especially, the fertile areas stop growing, start disappearing, and lose their source of fertility. This loss of annual nutrient deposits and water-based oxygen reserves can affect and disrupt productivity of the downstream forests miles away from the dam site. There will be an increased dependency on chemical use in agriculture with the loss of natural refertilization, which in turn may lead to further environmental degradation.

Habitat fragmentation and dry like situation could be possible in the downstream courses resulting in changes in the terrestrial and aquatic ecology, especially to the wetlands (locally known as beel) of downstream floodplain whose ecology and species diversity are related to the river.

Changes in Riparian Vegetation

Vegetation also depends upon these regular cycles of flood. Quite often, people will decide that they can spare no water at all and no flooding will occur. Alternatively, they may build dams specifically to stop flooding so that they can build houses in the floodplains. When this happens, riparian vegetation, the vegetation bordering the river, changes forever. An example of this may be found in much of the Southwest United States, where enormous floodplains of cottonwood and marsh have been replaced by dry barren areas of tamarisk and grass (Adams 1985).

Starving the River

Dams hold back not only sediment, but also debris. The life of organisms including fish downstream depends on constant feeding of the river with debris. This debris includes leaves, twigs, branches, and whole trees, as well as the organic remains of dead animals. Debris not only provides food, but it also provides hiding places for all sizes of animals and surfaces for phytoplankton and microorganisms to grow (microhabitat). Without flooding and without a healthy riparian zone, this debris will be scarce. Adding to the problem, although debris might come from the river above the dam, it is instead trapped in the reservoir. The bottom level of the food web is removed. Overall, the loss of sediment and debris means the loss of both nutrients and habitat for most animals.

Loss of Species

This hydel project can have serious impact on survival of some species that live and depend on areas in the river basin. All systems are delicately balanced and interrelated. Therefore, disrupted food chains and other systems will have serious impacts, affecting both the terrestrial and aquatic species.

Biodiversity is lost with the building of dams because habitats are drastically reduced with the clearing of forest, thereby endangering many species. Vast areas are flooded drowning and displacing many animals. Reservoirs created by the dams can also block cross-river animal migrations. Aquatic habitats will also be destroyed. The threatened hill stream fishes ***Tor tor*** and ***Tor putitor*** were found to occur in the downstream for spawning and feeding in the present observation. Dam will make a hurdle for these fishes to reach downstream grounds. Adams (1985) suggested that in tropical floodplain rivers, the impacts of dams on natural flood regimes can drastically reduce fish populations in both river channel and floodplain.

About 70 fish species living in the Subansiri river are ornamental, two, ***Tor tor*** and ***Tor putitora***, are threatened, and one newly discovered fish may be endemic to a particular wetland in the downstream floodplain out of the recorded 128 species (Baruah & Hazarika 2008). The downstream (last 80 km) up to the confluence of the mighty Brahmaputra is a suitable habitat for endangered Ganges river dolphin ***P. gangetica***. A total of 21 individuals of this species were recorded in 2006-2007 (Baruah 2006, Hazarika & Baruah 2008). The survival of these species will greatly jeopardize with building of the dam. The native fish species in the downstream and adjoining wetlands have adapted to live in a riverine system as well as in wetlands, and their environment would be abruptly changed, leading to potentially serious problems. It is probable that they will not be capable of adapting quickly enough to the changing environment. This will lead to a loss of important native species.

Climate Change

Dams also contribute to global warming. Trapping of nutrients behind the dam decreases fertilization of oceanic plankton, which play a major role in taking carbon dioxide out of the atmosphere, hence, affecting and contributing to the serious issue of global warming. Methane, released in significant amounts from anaerobic decomposition of flooded plants, is also a major greenhouse gas. Accumulation of water in large reservoirs may also have affect on the local climate.

Disease Occurrence

Most of the areas of Lakhimpur and Dhemaji districts of Assam and the adjoining areas near to the dam in particular are malaria prone. Every year hundreds of lives are lost in this epidemic disease. There is an increased risk for disease with the formation of stagnant pools in the downstream courses. Diseases, especially malaria, would thrive as stagnant water is the prime breeding ground for malarial mosquitoes.

Water Diversion

With water diversion projects, the decreased water flow in the river will change ecology and water quality. It could also impact small-scale irrigation systems of agricultural communities, restrict cultivation of crops, and disrupt seasonal fish migrations. The diversions will interrupt the natural seasonal flows, and thereby disrupt the nutrient supply cycles and habitats. Water diversion projects and decreased flow volume to downstream areas can lead to creation of dry like situation. This will have effects on drinking water, could destroy paddy fields, and will alter the aquatic balance for communities and their ecosystems. Threatening to lowland paddy fields will lead to a loss of genetic diversity of indigenous deep water rice varieties as well as important native species, and decreased fish populations will thereby affect the food production capacity and livelihood security of the people who depend on the downstream.

ENVIRONMENT IMPACT ASSESSMENT

Proper study and findings of pre-impact study or Environmental Impact Assessment (EIA) can help in protecting environmental degradation due to other proposed hydel projects, especially in this part of the region as the northeast India has been identified as India's 'future power house'. According to study of the Central Electricity Authority in 2001, 168 large hydro projects totalling 63,328 MW have been identified in the Brahmaputra river basin. This includes 22 projects totalling 15,191 MW in the Subansiri river basin. The proposed hydel schemes above 25 MW installed capacities in the Subansiri basin are presented in the Table 2. EIA studies are utmost necessary to evaluate the total ecological scenario before construction of dams because EAI report is a vital document in the process of environmental decision-making (Vagholikar & Ahmed 2003). The data required to asses the impact of hydel project on various aspects of different ecosystems can be gathered from various sources and can be treated as guard data against the changing environment.

RECOMMENDATIONS

1. There should be in-depth studies (Environment Impact Assessment), which are critical to evaluate and quantify potential project impacts.
2. There is a need of Subansiri river vision for the proposed other hydel projects, especially on this river.
3. There should be a plan for ecological restoration of the Subansiri river.
4. Pre-dam, present and post-dam ecological survey of Subansiri river should be put into public domain and made easily available for common people and researchers.

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