

SUSTAINABLE
DEVELOPMENT OF WATER
RESOURCES IN NORTHEAST
INDIA

Edited by

J.B. Bhattacharjee • Abhik Gupta • Niranjan Roy

Northeast India is endowed with abundant water resources and is the wettest place on earth. Two mighty rivers, innumerable tributaries, streams and rivulets, water falls, and wetlands, natural lakes and oxbows are among its precious aqua wealth. The rainfall in monsoons is high, and recurrent flood in rainy seasons is a perennial problem, but there is scarcity of water for irrigating the agricultural fields and providing drinking water to the people in other seasons. The global warming and threats of climate change are already observed in the region. Sensitization of the people about environmental and anthropogenic facts behind floods, droughts and scarcity of water and sustainable development of water resources of the region by involving the people and utilizing indigenous knowledge and technology at the same time, seem to be the urgent needs. The sustainable development of the water resource is the thrust of the book which emerges from an interdisciplinary symposium organized by the Assam University in collaboration with Institute of Northeast India Studies at Silchar in March 2010.

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Institute of Northeast India Studies (estd. 2004), Kolkata, a charitable educational trust for promotion of research in Northeast India Studies, holds endowments for triennial lectures, publishes the annual research journal - Northeast Researches, organizes brainstorming workshop, symposium, colloquium, dialogue, etc. either directly or through its local centres in the Northeast, and has already to its credit five major publications.

Sustainable Development of Water Resources in Northeast India has been jointly edited by

Dr. J.B. Bhattacharjee, Chairman, Institute of Northeast India Studies, Kolkata, retired Professor of History, North-Eastern Hill University, Shillong and former Vice-Chancellor, Assam University, Silchar,

Dr. Abhik Gupta, Professor, Department of Ecology & Environmental Science, Assam University, Silchar, and

Dr. Niranjan Roy, Professor, Department of Economics & Director, IQAC, Assam University, Silchar. The authors in this collection are from across the disciplines relevant to Northeast India Studies.

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**J.B. Bhattacharjee
Abhik Gupta
Niranjan Roy**



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AKANSHA PUBLISHING HOUSE

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Sustainable Water Management in Northeast India with Special Reference to Barak Valley: Some Emerging Issues and Concerns

Shib Ranjan Misra

[**Abstract:** Northeast India has a unique topography and it is endowed with abundant water resources. In the Barak valley of Assam, the river Barak and its tributaries can provide abundant scope for sustainable agriculture and fisheries development, providing a stable economic base for livelihood. But due to poor irrigation facilities and other weak management practices, the region suffers precisely where rainfall is insufficient and irregular, and excess and sudden heavy showers lead to water logging and flash floods. Rainwater harvesting, proper management of existing water resources, watershed development and community participation will help attain sustainable utilization of water for agriculture and uplift the socio-economic conditions of the people. The key words are Sustainable development, Tragedy of the commons, Watershed management, Big dams, Climate change, People's participation.]

Water is the essence of life. The water resources in the world are fast depleting and consequently, increasing water scarcity is a serious threat to life. In many countries including India, water availability is likely to approach the critical stress level soon. It is to be noted that India has an enviable record of engineering

accomplishments in the field of irrigation and those accomplishments deserve much of the credit for the nation's impressive growth in foodgrain production since its Independence. The fact that irrigation is essentially a post-Independence phenomenon is quite clearly recognized from the investment pattern in the successive Five-year Plans. A lion's share (9.78 per cent) of such investment has been on major and medium irrigation projects. But potentials created under different schemes have not been fully utilized.

Water is the limiting factor for crop production, and water management is the key to sustainable agricultural development. Though India gets an average of 75 cm annual rainfall, its distribution in space and time makes Indian agriculture a gamble in monsoon. It is never too late to recognize that land and water form the basis of any sustainable system of agriculture and their improvement should lay the foundation of productive, economically viable and socially acceptable agricultural system. The future of agriculture lies in recognizing the basic truth that most of the food, fuel, fibre and forage will be produced from land and water. The water management technologies are required for continuous enhancement of productivity and sustainability of water.

An important consideration that should have to be taken care of while formulating the strategy for water resource management in a country like India has been the recognition of the need for production of food, fodder, fibre, fuel, industrialization and urbanization. All these put severe competing claims on land use as well as water use. Further, it will be required to consider the water demand for livestock population. Unless the water use efficiency improves to a reasonable extent, the lack of fresh water is likely to be a major physical constraint for future food production and development in the country. Again, the frequent occurrence of drought and famines in the country has heightened the need to utilize the available water fully and perfectly, particularly for the rainfed farming which is fraught with multiple risks. Farmers operating in arid and semi-arid areas under rainfed conditions face, more than most others, a multitude of perceived and oft-experienced risks of varying severity emanating from the uncertainties inherent in their natural, economic and socio-

economic environments. It is in this context that irrigation becomes important to provide insurance against possible risks in farming. Several forms of irrigation interventions for drought have been widely heralded.

Again, there is a view emerging where it is held that irrigation, surface or ground water, has proved a costly experiment. If one accepts the view, then the immediate question: what are the factors that lead to the emergence of such a view? Till recently, irrigation has been considered synonymous with the construction of dams and canal network. Many irrigation projects have been designed and managed almost exclusively from an engineering point of view (Thavaraj: 1982). The socio-economic and environmental dimensions do not seem to have been integrated with technical design. So, it is sometimes argued that it is not correct to characterize the irrigation projects as purely hydraulic systems to be run according to engineering principles (Misra : 2006). All participants – like farmers, irrigation officials, and politicians - are expected to play their role to maximize their private interests to the cost of social goods (Caruthers : 1987). It is, in essence, an integral part of socio-economic system.

Essentially, the policies of irrigation water distribution and use appear to have not taken into account the responses and understanding of the cultivators. The need for understanding the nexus between the technology *per se* and its operationalisation has a special significance in a democratic system. Caste, class and factional ties and antagonisms have become relevant in the delivery of any goods and services to the community (Srinivas : 1984). The mismatch, if any, between theoretically assumed policies and goals and actual results in a project leads to a chain of adverse socio-economic and environmental problems. Quintessentially, without understanding the interconnection and interdependence of various ecological entities like land, water, flora, fauna and human along with human syndrome, no worthwhile water management system is possible. In fact, the over-domination of the engineering-centred capital-intensive project-oriented approach to water planning is the bane of the crisis. The societal vision is totally missing in the technical and technological solutions that are generally perpetrated. There are

certain issues that should be noted. These are broadly concerning the kind of irrigation works that should be promoted, the relative importance that should be given to quantitative expansion, the means of achieving qualitative improvement, the question of equity in the distribution of benefits from irrigation, environmental aspects, and the societal vision

There is a big question of poor economic returns from major irrigation projects and the negative effects on environments resulting in soil degradation, water-logging and salinization in many areas. In India, the percentage of area damaged by poor water management is very high. The worst problems are the declining water table, rapidly depleting ground water resources. Grave concerns are being expressed about ill effects of poor management of irrigation on ecology of the command areas of many irrigation projects. In all fairness, it is pertinent to see that the irrigation systems should be managed rather than administered. The operation and maintenance of the system should be given priority.

The state of Assam, the largest state of the north-eastern region of India, is highly endowed with large number of water resources. She covers an area of 78,438 sq km and consists of two valleys i.e. the Brahmaputra valley and the Barak valley. The two valleys derived their names from the respective main rivers, the Brahmaputra and the Barak, flowing through the valleys in an east to west direction. River Barak of Assam – the second largest river in the Northeast Region of India - sustains millions of people. It is the perennial source of water to the people of Barak valley, providing various ecological and economic services. Barak is also the main river which maintains the balance of peripheral water bodies including lentic eco-systems and all plans of sustainable water usage that have been initiated. The rivers like the Barak cause major problems during the monsoon period of every year in the shape of flood, bank erosion and drain congestion. Most of the rivers in the Barak valley dry up during winter and due to deposits of silt, their drainage capacities are drastically reduced. The rivers remain navigable only in the rainy season. As such, in summer all these rivers rise up in high spate causing floods almost every year. In fact, the successive waves of devastating

floods in almost every year have virtually destroyed the economy of the valley. People living in the low lying areas are forced to leave their homes. Heavy downpour submerges the villages throwing normal life out of gear. Danger looms large due to overflowing. Thousands of people are marooned as heavy rain lashes the area. Rivers, like the Barak, Khusiara and Langai are recorded flowing in most of the years well above the danger mark. Every year the floods leave a trail of destruction, washing away villages, submerging paddy fields, drowning livestock, besides causing loss of human life and property cost in several billions. For Barak valley, the mighty Barak river, though a life-giving river, has become more synonymous with devastation than with prosperity. In fact, the successive waves of devastating floods in almost every year have virtually destroyed the agriculture-based economy of the region. To remove the backwardness of the region, tackling the flood menace is a must. Otherwise, all efforts to bring this region at par with other mainland states will come to a naught.

The main factors causing extensive floods are the adverse physiography of the region, heavy rainfall, excessive sedimentation, frequent occurrence of the earthquakes, hill land sliding, reduction of forest area and encroachment of the rivers in many areas. Usually, Assam experiences incessant rainfalls during the monsoon season, which normally commence from the month of July and remain till mid-October. Apart from this, occurrence of floods in Assam has direct correlation with rainfall in the catchments areas of neighbouring states of Arunachal Pradesh, Nagaland, Meghalaya, Mizoram, Manipur, etc. Most floodplains in the Barak valley are in the form of low lying areas with numerous hillocks. They get inundated during the monsoon months of June-September. A unique feature of the floodplains is that when they are inundated during monsoon, they are treated as common property fishing grounds by the community; while after the water recedes, private rights are re-established in the agricultural plots. Thus, it appears that the situation is quite paradoxical, because in spite of having an annual rainfall of 2,500-3,000 mm, the floodplains experience water scarcity during dry months of December-March. Again, pre-monsoon rains in April-May often

lead to flooding that destroys the crop. Thus the people are caught in a vicious circle of either too much or too little water.

Thus despite being richly endowed with water resources, the Barak valley region could not utilize this resource for economic development. This resource has created a perennial problem for the entire valley in the form of occurrence of floods. Against this backdrop, there is no denying the fact that sustainable water management appears to be pivotal for improving the socio-economic conditions of the people of this ecologically and economically important landscape of Assam. In fact, the apathy for harmonious use of land and water in accordance with potentiality and capability of soils has given rise to serious problems. They require appropriate management.

Due to the increasing population multiplied by their desire to attain higher economic growth, the Barak river is increasingly polluted through establishment of industries nearby the river. The over-flooding of Barak annually is further aggravated by the deforestation by human activities in the form of soil erosion, sand casting, sedimentation, etc. The problem is primarily of anthropogenic nature. It is the human who in the urge for attaining higher growth and development exploit the very basis of the development. On the other hand, due to the global warming, changes have been brought into the hydrological realm of the rivers and the weather and the climate. Water resources in the Barak valley are facing the similar problems due to the natural and human made forces. The solution lies in realization of the fact that the water is the natural capital which needs to be conserved for the development of the region.

In Assam, more particularly in the Barak valley region, the flood and erosion cause enormous damages to the crops, livestock, land property and bring untold miseries to the people at large. The floods cause large inundation and spread devastation to standing crops, homestead, life and property, disruption of road and rail communication, public utilities, water supply installations, irrigation and flood control structures, etc. The National Flood Commission had estimated the area vulnerable to floods in Assam at 31.60 lakh hectares against 335.16 lakh hectares for the whole

of India. Assam thus accounts for 9.4 per cent of total flood prone area of the country. As a result, the state has not been able to achieve the desired progress and prosperity in spite of having vast natural resources. Floods in three to four waves is an annual feature, which, very often, wipes out major chunks of the fruits of the people's labour. The Table below shows the extent of damages caused by floods in the state of Assam over the years 2000-2004.

Table: Damages caused by Floods in Assam

Items	Unit	2000	2001	2002	2003	2004
Area affected	Hectare	966053	239511	674148	932111	13142685
Population affected	Number	38838	54263	755569	342567	634327
Human lives lost	Number	30	-	6	5	343
Cattles lost	Number	1998	142	429	431	6596
Villages affected	Number	509	127	680	756	1229
Area eroded	Hectare	-	748	429432	12539	7629
Value of crop loss	Rupees in lakh	17331	835	17432	14700	-
Value of houses damaged	Rupees in lakh	-	1648	259	4119	1869
Total value of damages	Rupees in lakh	-	19000	1976	18900	16590

Source : Water Resources Department, Government of Assam, 2006

However, in order to prevent the menace of recurring floods, different flood management schemes/projects were adopted in the state. They are generally the embankments, drainage channels, major sluices, anti-erosion work, etc. By adopting short term measures, the water resources department also protected land from flood and erosion in the flood prone areas. For effective management of flood and erosion in the state, long term measures in the form of storages reservoir in the upper catchments areas of the basin and watershed management were initiated. Artificial lakes, like Kurichu Hydrel project at about 30 km upstream of Kurichu in Bhutan gave way to the retention of successive rain water. However, the artificial lake at Kurichu Hydrel project

sometimes created havoc downstream with inundation and evulsions. In Kopili Hydel project also excess water was released downstream. The embankment system overtopped resulting in heavy breaches and causing widespread devastation.

There are some environmental costs of irrigation developments, which should be avoided through proper planning and improvement of water management system all the way from the headwork to the tail end of the canal system to make irrigated agriculture sustainable. Since the main goal of irrigation development is to make agriculture more stable, productive and sustainable,¹ it is all the more important that the factors which reduce the efficiency of irrigated farming should be scientifically controlled. The impact of irrigation on productivity and sustainability of agriculture and environment can be realized only when water use is integrated with efficient soil, water, crop fertilizer and agronomic management system. Drainage is an essential component of irrigation system which has to be designed taking into consideration the soil and climate factors. More gains can be achieved from improving efficiency per unit of water. More gains are also expected from development of minor irrigation and in situ water harvesting and recycling than from building gigantic storage dams. Some of these are policy matters and others of technological and sociological nature.²

It may be feasible to harness the natural systems in biosphere through wet-land conservation and water-shed management as well as ground water recharge through the network of the water canals and rain water harvesting depending upon the geographical characteristics of specific sites, a combination of natural and artificial systems could be selected to meet the water needs of the local community. Scientific information on the assessment and monitoring of ground water resources in the north-eastern region, including Barak and Brahmaputra rivers, needs to be generated. Traditional way of water harvesting for the local community were important successful examples of water harnessing and to provide the aquatic ecosystem benefits to the communities. Water harvesting is suitable to the local climate and its storage is the key factor to adaptability to meet the water demand and the threat of climate change. To deal with the need

of water storage arising out of climate change, it is necessary to prepare a working plan in a comprehensive manner³ (Sharma : 2010).

The critical issue remains then how to store massive quantities of rain water falling in a very short period so that it can be used for the whole year. The issues of rain water management for strategic planning are (a) to retain as much water as possible in the soil profile, keeping in view the soil characteristics; (b) to recharge the ground water; (c) to manage the runoff to reduce erosion of soil and incidence of flash floods; (d) to store the inevitable runoff within the catchments; (e) to reduce stagnation of rain water in the cropped area by providing drainage; and (f) to increase productivity of cultivated lands, grasslands, bush and shrublands and forest and woodlands by extensive research for developing strategies for optimizing cropping pattern, water shed development and associated land treatment for diversification of cropping pattern.

Again, in a situation when there is water scarcity, efficiency of flood water management could be achieved in several ways, like (a) to retain precipitation in situ and minimize the run off; (b) to reduce evaporation in relation to transpiration; (c) to use drought resistant crops that fit in the rainfall patterns; (d) to recycle the run-off water after harvesting and drainage: and (e) to use watershed concept for maximization of rainwater in situ. It is a combination of all these that ensure best results with minimum degradation of environment.

The Barak valley of Assam has a unique topography and it is endowed with abundant natural water resources. Apart from the river Barak and its tributaries, the ponds, oxbow lakes, temporary pools, *beels*, *haors* and other small aquatic systems can provide abundant scope for sustainable agriculture and fishery development. Oxbow lakes are remnants of the meandering flood plain rivers, which are physically isolated from the respective rivers and generally capture small relic drainages. These are present throughout the Barak valley. These are used as highly productive fisheries by fishermen. All these need care for sustainable management for the sustenance of human life locally and, in turn, globally.

Let us now make an attempt to reflect upon some of the plausible technical designs and management interventions to ensure an efficient and sustainable water management system in areas like the Barak valley. The irrigation system should be designed for protective, and not productive, purposes.⁴ This calls for a balanced cropping pattern. Otherwise, being guided by the profit-maximization objectives, it may generate income inequality among the farmers through adoption of water intensive cropping pattern and commercialization of agriculture at the cost of the small and marginal farmers. Attention should be given to the achievement of inter-personal and inter-spatial equity. It is imperative to regulate the cropping pattern through control of water supply. As observed, in some areas in the Barak valley water becomes a common property during the flood situation and leads to a case for free-riding problem. Therefore, systematic management of common property necessitates interventions by an authority. This is because common property is largely being overused and hence rapidly depleted by the self-seekers or free-riders. The situation is known as 'The Tragedy of The Commons'.⁵⁵

Quite often, farmers appear to be locked into their own variety of the Tragedy of the Commons. The abundant issue of water through gravity flow system and consequent flooding remove any option for a farmer to grow anything but paddy. Possibility of a change to a more productive, more profitable and more water sparing cropping system is practically difficult.

What is desirable is to try a potentially feasible cropping pattern on a limited area and then to promote collective decision to change.

Fishery development is undoubtedly very important for the economy of the region like the Barak valley. But the uncontrolled growth of capture fishery is likely to adversely affect other forms of aquatic bio-diversity, even though it may mitigate the livelihood requirements of the fisherfolk on a short term basis. It has been found that the sector specific management interventions are not able to take care of cross-cutting issues like maintenance of ecological integrity of aquatic eco-systems. Therefore, integrated water resource management attempts are recommended to address

these problems by recognizing that different uses of water resources are interdependent (Gupta : 2010). It is particularly important in this region which faces problems of excess of water during some period and lack of water at some other timeframe. Due to poor irrigation facilities, agriculture suffers when rainfall is insufficient and irregular. In fact, this is the area where rain water management should be given priority for different reasons. It appears that the small and marginal farmers generally prefer field bunding. However, in the water-shed management programme, the only thing that has changed is the name. It is emphasized that the highest priority should be given to runoff storage to recharge the ground water, reduce the fury of flash floods and to provide for supplemental irrigation.

It appears that the Barak valley region at times gets flooded with water; while during other times, it suffers from water scarcity, both drinking and irrigation. This is further aggravated by the deforestation, unplanned urbanization, and the associated input of sewage and municipal wastes into the rivers, besides picnicking, quarrying activities, disposal of industrial effluents and other human activities. All these anthropogenic activities result in the impairment of water quality, habitat destruction and loss of biodiversity in the riverine systems in the form of soil erosion, sand casting, sedimentation, etc. in the region which is one of the biodiversity hotspots in the world. Only government action will not be sufficient to meet this challenge unless it is accompanied by proactive co-operation of the local people, because the predominant reasons for such state of affairs are the unplanned urbanization, human disturbances, and ignorance of the people regarding ecological services the rivers provide. For this, it is important to sensitize the people about the ecological services provided by the rivers and how the people themselves are responsible for environmental degradations. In the meantime, there should be a long term policy for the management of the river system by integrating ecological and social factors. Panchayats or local administrative bodies should have to be involved and given adequate resources to undertake grass root level pragmatic policies like the construction of series of reservoirs and other protective measures. It is also desirable to utilize the potential of indigenous knowledge

of watershed management along with scientific knowledge to bridge the gaps concerning mechanisms of harnessing and storage of water successfully (Sharma: 2010).

Existing approach to irrigation is looked upon only as a technological input in production. But for all practical purposes, it is to be recognized that these technological considerations are required to be placed within the context of socio-economic relations and conditions of production and exchange. It is not the technological feasibility that alone matters. The creation, maintenance and utilization in totality are contingent upon these relations. Efforts should have to be made to evaluate the interaction between the irrigation technology and social relations. In effect, rainwater harvesting, proper management of existing resources, watershed development and community participation together can help the successful attainment of sustainable development of agriculture and upliftment of the socio-economic conditions of the people.

It has been observed that setting up of big dams at Tipaimukh and Subansiri as a solution to the problem may cause new problems, since these are located at the confluence of Indo-Burma, Indo-Malayan and Indo-Chinese Biodiversity hotspot zone which are characterized by the presence of a large number of plants and animal species. Precisely, it would create extensive detrimental downstream environmental impact. There is a maximum likelihood that once the dams are constructed, different species which are categorized as endangered and threatened may become extinct. Eventually, the impacts are likely to be serious on different areas, such as crop production, navigation, siltation, ecological imbalance, river pollution, extinction of river aquatic life, etc. In fact, social and environmental impact of the large dams on land submergence and people's resettlement remains an important issue in the Northeast, as it is anywhere else.

Water, being a finite resource, requires an appropriate management intervention. The water resource in Barak valley, in particular, is characterized by excess water during monsoons (and sometimes, in pre-monsoons) and scarcity during the lean months. This is a specific situation requiring reconciliation

between seasonal variations and can be resolved only by appropriate management intervention. There is a need for comprehensive water resource management for its conservation and sustainable utilization, because sectoral priorities are often at conflicts with each other. In view of all these, how to utilize water in a sustainable manner by ensuring equitable and efficient allocation of the naturally available water in the valley at different timeframe has been a major concern. In the absence of well-articulated mechanism to ensure efficiency in water management, mal-distribution also tends to take place with all its attendant socio-economic and environmental consequences. The sustainable development is the only answer to the ills and apprehensions.

NOTES

1. A system can be considered sustainable if it ensures that today's economic development is not at the expense of tomorrow's development prospects (World Commission on Environment and Development 1987). There are certain aspects of sustainable agriculture. They are (a) meeting the changing needs of today and tomorrow; (b) economic viability of enhanced productivity level; (c) successful management of resources - internal, external, renewable or non-renewable; (d) maintenance, preferably enhancement, of quality of environment; and (e) conservation of natural capital.
2. Even though water is appropriated by the farmers as common property, the users themselves have to take care of different activities like construction of additional channels, maintenance of physical works within their jurisdiction, etc. It requires a good understanding amongst them systematically. This may be termed as 'co-operation for co-operative common property management'.
3. Irrigation water is an input used for agricultural production. It has certain characteristics. One, irrigation is transformed from a free good to an economic good and in the process as a public good, although there is no change in either its quality or morphological characteristics. Two, irrigation water is divisible for its users. Three, it is a leading input for technological progress in agriculture. Four, it helps to improve the permanent nature of land. Finally, it bears a strong relationship to social organization.
4. Many traditional societies have evolved over time codes of conduct which result in a sustainable use of these resources.

5. Quite often, farmers appear to be locked into their own variety of the Tragedy of the Commons. The abundant issue of water through gravity flow system and consequent flooding remove any option for a farmer to grow anything but paddy. Possibility of a change to a more productive, more profitable and more water sparing cropping system is practically difficult. What is desirable is to try a potentially feasible cropping pattern on a limited area and then to promote collective decision to change.

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