Pollution, sedimentation, erosion and over-damming solutions through policy framework

THE AGONY OF RIVERS

Compiled and Authored by Jalnayak Dr. (Mrs.) Snehal Subhash Donde

> Inspired by Jalpurush Dr. Rajendra Singh

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The profound effect of the words of Jalpurush Dr. Rajendra Singh, Magsaysay & Stockholm water prize winner, dawned my interest in the study and assessment of major river basin and its related social and environmental issues. Issues concerning to the displacement and rehabilitation of people affected by erosion and sedimentation in river Ganga in West Bengal, over-damming in Maharashtra, uncontrolled pollution of water bodies by effluents from Power-looms and dyeing units in Bhiwandi city and many such unfettered work impacted my understanding to venture and explore for the solutions. This book mainly covers the sedimentation and erosion issues of river Ganga, as very few people across India are aware of this issue.

For conducting survey of the areas affected by sedimentation and erosion caused by river Ganga and its tributaries in Farakka, Malda and Murshidabad region in West Bengal, it was our first attempt to bring together experts from three important Central Institutes of India viz. Botanical Survey of India (BSI), Zoological Survey of India (ZSI) and National Environmental Engineering Research Institute (NEERI). This kind of collaborative effort was initiated to get holistic view of environmental degradation and losses happening to the State of West Bengal and Bihar. To work under the guidance and leadership of Dr. Rajendra Singh ji as National Convener for Ganga Mission, I feel myself blessed to get the rare opportunity. My sincere thanks to Dr. Rakesh Kumar, Director NEERI, Dr. Paramjeet Singh, Director BSI and Dr Kailash Chandra, Director ZSI for their timely help, valuable suggestions and providing expertise for biodiversity study of areas affected by Ganga erosion and sedimentations. This assessment was essentially required since issues of Erosion & Sedimentation has remained unresolved for more than four decades due to ignorance of authorities.

I am grateful to young and dynamic Social activist Mr. Mehboob Alamand Block Development Officer (BDO) Shri Kesang Bhutia from Malda region for their interest, kind cooperation and support throughout the survey. Both of their presence during the survey and interaction with the local public was of immense help in gathering relevant information for the social assessment study. I owe the success of environmental assessment study to Dr.Shreemanta Pramanik& Dr Debashish Mukherjee Scientist C of NEERI, Kolkata, Dr Chitra Jayapalan, Scientist C& Dr Viswa Venkat Gantait Assistant Zoologist of ZSI, Kolkata and Dr Onkar Nath Maurya, Scientist C & Shyam Biswas of BSI, Kolkata. I am highly grateful to Dr Kalyan Rudra, Chairman, Water Pollution Control Board Kolkata for sharing information about his studies on related issues.

The book also covers issues of pollution of Kamvari River in Bhiwandi in Maharashtra which was once upon a time port area and now reduced to a size of nallah. Over- damming issues are highlighted in a chapter exhibiting how Western Ghat biodiversity is affected and rehabilitation of displaced people remains unresolved. At the same time, this book explains how Rain Water Harvesting alternative for water availability is not used optimally. I extend my gratitude to all the team members of Jal Biradari and fellow Jal Nayak's for their immense contribution in different activities for resolving issues of river system in Maharashtra and across India. This book would not have been possible without their contributions. It is unique experience to be a Jalnayak, part of Jal Biradari and member of World Water Council. Millions of thanks to Dr. Rajendra Singh ji for showing me the noble path to work for water literacy and conservation programmes and make India a water rich country while remaining sensitive towards international issues.

Prin. Dr. (Mrs.) Snehal Subhash Donde

PREFACE

This book provides glimpses of situation of siltation in river Ganga in Patna, Bhagalpur region in Bihar and upto Farakka in West Bengal. Also, issues of over-damming in Maharashtra are highlighted with special reference to its impact on biodiversity. A case study of Bhatsa River at Khadavli village in Kalvan Taluka provides sights of uncontrolled pollution and mismanagement of river water system. Further explorations of Vaitarna River and various water bodies in Bhiwandi city in Thane District, Maharashtra show the depleting situations due to unchecked pollution by Power-looms and dyeing units. A glimpse of World Water Council is added in this book to give idea about the forum which is working internationally to resolve the global crisis of water. This book is an attempt to draw attention of one and all towards the serious impact of public ignorance and mismanagement of rivers, for immediate cognizance.

The book chapter begins with report on aerial survey of Ganga in Patna, Bihar and is followed by a report of preliminary observations made by the author and her team with regards to erosion and sedimentation of Ganga river basin in Malda, Farakka, and Murshidabad District areas in West Bengal. The Social and Environmental assessment report of the Ganga sedimentation & erosion gives idea about the existing status and temporary measures implied in the region to meet with the crisis. This report also reflects unresolved rehabilitation issues of the affected people, mainly with Muslim community in Farakka, West Bengal. Intention to

publish river survey reports and declarations is only to sensitise public and authorities towards the huge social and economic ignorance which is continuing since more than four decades in Bihar and West Bengal. Unpredictable, extreme Climate change has added seriousness to the erosion and sedimentation issues of Ganga basin as it is causing huge public and private property losses. Another typical issue of national loss is the islands which get created due to erosion and sedimentation (Char) has no policy to keep it safe and most of the boundaries are moving towards the other country on boarder. This intensifies the urgency to work on erosion, rehabilitation & restoration of river Ganga. The islands created due to erosion and sedimentation needs proper assessment to formulate guidelines & policy regulations to resolve the issues of displaced people. Various declarations outlined during river survey is included in this book, to provide guidelines to authorities for genuinely resolving river water related issues. Reports in this book are already submitted to Government authorities and office of Prime Minister and President of India. with a hope that resolutions might be adopted.

Further, this book reveals scenario of uncontrolled habitations on bank of rivers and over-damming in Maharashtra, which has badly affected the biodiversity of the land. The case studies of Bhatsa and Vaitarna Rivers are compiled here to exhibit silence ignorance of local authorities in terms of regular monitoring and facts findings. Flowing of rivers in a regular course is the life line for human sustainability. This book is a simple attempt to draw public attention towards importance of rivers and immediate need to make it healthy. The most essential solution suggested here is to set River Water Commission &take constructive decisions. Joint efforts are needed, as planning in isolation has lead to the cause for disaster of water systems. Thus holistic approach and all stakeholders participation in policy framing is pertinent solution. Hence Forest, Tribal, Sanitation, Water Conservation, Water pollution Control Board, Geological department and others must work in co-ordination with integrated approach.

Final chapter presents glimpses of Jal Biradari members' active participation in World Water Council at Brazil to voice the issue of corporatization of water infrastructure. Hope this book stimulates for conservation of water everywhere.



This book is our tribute *to* **Prof. Guru Das Agrawal ji** (20 July 1932 – 11 October 2018), an environmental engineer, religious leader, monk, environmental activist, and professor, who campaigned to save the sacred River Ganges, the natural mother of Indian

culture and civilization, by insisting on maintaining the uninterrupted flow of Bhagirathi River in its natural form between Gangotri to Uttarkashi.

FOREWORD

This book is complementary for understanding all important aspects of the river, its basin & issues of the siltation. The River basin-wise surveys initiated by the Dr. Rajendra Singh, popularly known as "Waterman of India" are amazing. Prin. Dr. Snehal Donde, Convenor Jal Biradari for Ganga mission has done great job by initiating to bring together ZSI, BSI and NEERI scientists participation for a common goal. The time when government's major forces are fighting to combat Ganga pollution, this team's efforts to conduct social and environmental assessment in Malda. Farakka and Murshidabad Districts of West Bengal for resolving sedimentation and erosion issues of Ganga is highly appreciable. The monitoring with this type of impact assessment with holistic approach (Flora, fauna and topography) of the situation is incredible. This was the first ever effort and also the longest ever social campaign undertaken through the team of Jal Biradari. Since a year this team has been monitoring the follow-up action through on-site inspection and in-depth studies in the identified areas. From time to time, the status has been reviewed and brought to the attention of concerned authorities for necessary action. Though the interest of government towards this issue is negligible, such exercises in operation shall work for a holistic solution. Declarations drafted during the visit for erosion and sedimentation assessment and others, are well documented in this book. This shall provide guidelines to genuinely resolve the similar issues across India. Very diligently issues of over

damming in Maharashtra affecting biodiversity and Climatic change is studied and covered under Agony of river. Deteriorated condition of Kamvari river and other water bodies in Bhiwandi city in Maharashtra, depicts impact of powerlooms and dyeing units and its unchecked pollution. I appreciate efforts put up by Dr Snehal Donde to compile and comprehend about the status of rivers and for sharing here the declarations framed by the Jal Biradari team as guidelines for policy formulations for resolving deteriorating issues of rivers in India. The book ends with information about World Water Council provide insight regarding the global water crisis. My best wishes to the team for future endeavors.

Dr. A. D. Sawant

Environmentalist & Former Vice Chancellor Rajasthan University.

BACKGROUND

Urbanization is one of the 21st century's most transforming trends. Cites are the dominant force in economic growth development and prosperity in both developed and developing countries. Water management is one of the biggest tasks within a city which falls under the responsibilities of local and regional governments. The action of local and regional authority are key for ensuring that the public have necessary access to the basic services and managing water related issues necessary for positive urban transformation. The growing urban population not only increase demands but also growing infrastructure and service provisions create more pollution. Inadequate urban planning particularly when coupled mainly with unpredictability of changing climate possesses challenge and human conflicts. Getting water right will be decisive factor for the future of the people and the planet. Water scarcity and climate change possess challenge of providing excess to safe drinking water and sanitation. For good water management there are several challenges related to resources such as financial, human and natural, including political scenario. Many local authorities struggle to maintain improved water services due to political instability, unclear jurisdiction and aging infrastructure compelling demand on resources. Only when problems are magnified these challenges exert growing pressure resulting in intensified inequality unsustainable resources use and deterioration of environment.

As per global reports there is migrations happening in developed western countries due to scarcity of water. People

from Africa, Syria, Yemen and few others have migrated to other countries due to unavailability of water in their respective country. Water in capitalist era has become commodity and we need to save this natural wealth from corporate clutches. Current water status is that we are using more than what we require without knowing how much we have which is resulting in drought or flood and exploitation of aquifers.

With the scenario of most of the rivers getting dried in India, conflicts regarding inter and intra state-wise sharing of water and interlinking of rivers being promoted by government, it is pertinent to understand what is exactly leading to water crisis. Ground water aquifers are also reported to be depleting, polluted or getting percolated by creek water and leading to health issues. Crisis of water resources is now official, and main cause highlighted is the lack of priority to water management system in India. The National Institution for the Transformation of India (NITI) Aayog, a think tank of Government and successor to the country's Planning Commission has also declared that 600 million Indians face high-to-extreme water stress. Many have opined that the crisis is going to get worse. By 2030, the country's water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions and an eventual loss of around 6% of the country's GDP.As per the recent declaration by NITI Aayog the regulatory agency has been almost totally non-functional since it was set up in 1997. Throughout India, water quality remains a major issue and overall, the think tank believes better collection of data, centre-state and inter-state cooperation are some of the key levers that can help address the crisis.

Hence with the believe that participation needs to start at every level for water resources development, that the author has compiled and pen down her experiences and observations with the thought that it may open eyes of common man, students, and stakeholders. Also, as this book present information about the present status of few water bodies and causes of water crisis, it might lead to such wisdom that readers may come forward to share responsibility to recharge, rejuvenate rivers and restore water bodies by actively participating in save water campaigns.

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Introduction

Water is very essential component of life. All the biological process of living organism requires water in large number; this states how water is important for mankind. Among total water present on earth 4% is available for drinking, from which 3.9% is in the form of glaciers and only 0.1% is in the form of ground water, lakes, rivers and ponds. In India we do not look upon rivers as just water bodies, we see river as life–giving gods or goddesses. River plays an important role in providing large quantity of water for drinking and other purposes. Many small streams meet to form tributaries and many such tributaries come together to form rivers. Not only drinking water but rivers are also great source of aquatic flora and fauna. They are the integrated part of ecosystem. Many civilizations developed and emerged at the banks of rivers.

Rivers play a major role in the economy of a country by sustaining agriculture, industry, energy generation and providing biological resources. However, in recent times in the name of developmental activities which in fact lack proper planning and water management system, the river infrastructures are immensely under threat. In India there are many rivers like Brahmaputra, Ganga, Godavari, Krishna, Kaveri, Tapi, Narmada, etc. These rivers are being exploited and depleting due to anthropogenic activity. Ganga is the holiest river for Hindus and today it is among the dirtiest in the world. The Yamuna, which is its largest tributary and originates from Yamunotri in Uttarakhand, is also drying up. In a recent judgment the Supreme Court has given status of living human entity to Ganga and Yamuna rivers, so that proper care can be taken of rivers.

There are major issues of Pollution of water bodies which is affecting the ground water level, as domestic sewage is getting mixed with the ground water by the decomposition of sewage and by leaching getting percolated in the ground. This is leading further to the contamination of the ground water. Similarly, the industrial setup on the banks of the rivers has caused severe adverse effect to the water bodies. Many industries, textile units, dyeing industries including coal mines, power plants, cement and steel factories, oil industries built on river banks continues to harm directly the water bodies. Major issues are due to lack of monitoring by authorities and ineffective archival government policies. There is urgent need to act for continuous monitoring of water system by the involvement of all stakeholders and establish effective & efficient Water Management system.

Another issue is of over-damming on the rivers. Maharashtra is the only state with 80% of the dams constructed. There is severe loss of Western Ghats biodiversity. Dam constructions across Indian rivers in the name of development project have caused extinction of many spices of flora and fauna without even maintaining records in the repositories. Many people are displaced in the process. There is need to work out effective resettlement and rehabilitation polices for those who are adversely affected due to submergence of their settlements and livelihoods. Many such matters remain unsolved because of obsolete norms. This book is an attempt to compile the survey and study reports of few rivers to draw attention of authorities towards the serious issues of rivers, which has remained unresolved for decades and needs immediate attention for solution.

Some reports of study are included in the following chapters along with declarations, as it may serve as guidelines for regulatory bodies in formulizing polices with appropriate objectives.

Chapter II

Sedimentation in River Ganga at Patna -Bhagalpur in Bihar to Farakka Region in West Bengal

Introduction

Ganga is a trans-boundary river of India and Bangladesh. Ganga is one of the major rivers of the Indian subcontinent, flowing east through the Gangetic plain of northern India into Bangladesh. 2,525 Km river rises in the western Himalayas in the Indian State of Uttarakhand. The Ganges River and its tributaries flow through three countries: India, Nepal, and Bangladesh. Structurally, the Ganga basin comprises of three large divisions of the Indian subcontinent, namely: the Himalayan fold mountains, the Central Indian highlands and the peninsular shield, and the Gangetic plain. Ganges, flows for a distance of about 1450 km in U.P, 550 km in Bihar and 523 km in West- Bengal. The major cities along the River Ganges are Haridwar, Moradabad, Rampur, Allahabad, Kanpur, Patna, Varanasi, and Rajshahi. The Ganges Basin river system remains the main source of freshwater for half the population of India and Bangladesh and nearly the entire population of Nepal. It is the longest river of India and is the second greatest river in the world by water discharge. Ganga has long been considered a holy river by Hindus and worshiped as the goddess Ganga in Hinduism. It has also been important historically as many earlier regional and imperial capitals like Patliputra, Allahabad, Kannauj, Kara, Calcutta and

Murshidabad have been located on its banks. The Ganges Basin drains 1,000,000-square- kilometre (390,000 sq mi) and supports one of the worlds & 39 highest densities of humans. Ganga river water is considered to be pious and life of people is incomplete without taking bath in Ganges at least once in their lives.

However present situation is that, although Ganga is declared as National River, now free flow is an environmental issue. The Gangetic plain in which the main stem of Ganga lies, consists of alluvial formation and is a vast flat depositional surface at an elevation below 300 meters. In 2016, Government has formed two separate committees to prepare the draft of Ganga Act, which aims at expediting implementation of Namami Gange programme and lay down guidelines to rid the holy river of silt. A committee under Justice (Retd) Girdhar Malviya has been entrusted with responsibility of preparing the draft act that should have provisions to ensure cleanliness and uninterrupted flow of Ganga. A four-member committee has been floated under chairmanship of Madhav Chitale, member of National Ganga River Basin Authority, to prepare guidelines for desilting the river stretch. A research paper by Ravindra Kumar Sinha "Ecology of River Ganga: Issues and challenges"(2015) explain interventions in the form of construction of dams, barrages, embankments, hydroelectric projects etc, posed a great challenge to the maintenance of ecological integrity of the river ecosystem and have given recommendations to minimize degradation. Serious adverse impacts on ecological health of the river including water quality, fisheries and other biodiversity have been highlighted.

Aerial Survey Report of Sedimentation Study

The Story of the Ganges, from her source to the sea, is the account of India's civilization and culture, the rise and fall of empires and the development of man in the modern era. Increasing population, rising standards of living and growth of industrialization and urbanization has degraded the Ganga water. Due to pollution in the water body the organism bioaccumulate the pollutants into their body, which is ultimately affecting the human health and the environment at large. The Government has planned and formulated policies to safeguard Ganges water time to time and launched the Ganga Action Plan (GAP) earlier in 1985. This was envisaged as a comprehensive programme of river conservation with the objective of improving the water quality, however very low impact is observed. Moreover, there is rarely any attempt by the stakeholders to monitor and evaluate the government policies for its efficacy.

An aerial survey was conducted by the team lead by Dr Rajendra Singh ji from Bhagalpur, Patna to Farakka in West Bengal in February 2016. Huge amount of sedimentation could be seen accumulated in the upstream and in plains of the Ganga River. The team comprising of Dr Vikram Soni, Dr Rajendra Podar and WALMI officers completed the survey in 5hrs journey.



Team of experts of aerial survey of Ganga in Patna – Bhagalpur region.



Arial view of Ganga sedimentation in Patna – Bhagalpur region

The aerial survey revealed that Ganga River downstream (Bhagalpur, Bihar), is shifting towards its right bank with great effect. Right bank of Ganga is densely populated and has many important structures. In last ten years, riverbank of the Ganga downstream of the bridge was changed by more than 1000 m. Due to the right bank shifting of Ganga; many families are under risk of submergence in flood seasons. Bank protection strategies are required immediately at this place. Form the study of satellite image of 1988 and 2006 using ARC-GIS, it was found that there is significant amount of bank shifting occurred during this period. In Bhagalpur, major city population residing on right bank of Ganga, so right bank of Ganga is the main area of concern. Images (1988 and 2006) analysis clearly indicates that in upstream of right bank Ganga is almost intact. Downstream was getting more erosion than upstream. Rate of erosion was found to be more in between 2003 & 2011 in comparison with 1988 & 2006 satellite image study. At the point around 3.5 km downstream 1100 m erosion in past 8 years (2003- 2011) with respect to 720 m erosion in previous 18 years(1988-2006). Rate of erosion was determined more than twice.

The study was mainly conducted to understand if the legislation policies which are framed to keep check on pollution and sedimentation are actually achieved. This study was undertaken with the view to create awareness and sensitivity among the public towards proper use of the Ganga water and to minimize the anthropogenic activities and sedimentation which affects the ecology. This nature of study is essential to mobilize manpower for safety of Ganga, as almost half of the population of India lives on one- third of the landscape within 500 km of the Himalayan range along the Gangetic plains and depends on the River Ganges. National Mission for Clean Ganga (NMCG), State Ganga Committees and; District Ganga and its tributaries in the states.

National Mission for Clean Ganga (NMCG) was registered as a society on 12th August 2011 under the Societies

Registration Act 1860.It acted as implementation arm of National Ganga River Basin Authority (NGRBA) which was constituted under the provisions of the Environment (Protection) Act (EPA), 1986. NGRBA has since been dissolved with effect from the 7th October 2016, consequent to constitution of National Council for Rejuvenation, Protection and Management of River Ganga (referred as National Ganga Council) vide notification no. S.O. 3187(E) dt. 7th October 2016, under EPA 1986.

The Act envisages five tier structures at national, state and district level to take measures for prevention, control and abatement of environmental pollution in river Ganga and to ensure continuous adequate flow of water so as to rejuvenate the river Ganga as below:

- 1. National Ganga Council under chairmanship of Hon'ble Prime Minister of India.
- 2. Empowered Task Force (ETF) on river Ganga under chairmanship of Hon'ble Union Minister of Water Resources, River Development and Ganga Rejuvenation.
- 3. National Mission for Clean Ganga (NMCG).
- 4. State Ganga Committees and
- 5. District Ganga Committees

The empirical observations and outcome of these committees formation reveal that though there are many policy frame work for the cleaning of Ganga however the work progress is crawling and it continues to be polluted. Rarely there are any guidelines specified for sedimentation related issues. Also the National Waterway Project of the Centre is not well thought as it will affect the free Ecological flow of the rivers. Tempering with the natural ecosystem weakens the civilization and continued degradation of plantations in catchment areas has let to heavy flow of silt in rivers. Lack of policies related to environment and rivers has led to unchecked developmental activities in the rivers and river banks. One such example is the construction of Farakka barrage in West Bengal with probably defect in architectural plan at initial stage itself. This has lead to form Patna up to Malda Murshidabad heavy siltation in the upstream and many places at the downstream also. Modernisation of barrage is urgently needed to give regular course to Ganga and have its ecological flow and curb major erosions happening.

The overview of the policy guidelines and the extent to which policies are implemented with regards to the safety and check pollution of Ganga shows that though there are several policies framed periodically but deficiencies in its effective implementation and lack of regular monitoring by the authorities to ensure achievement of objectives has led to deterioration of the situation. Also rarely any attempt is made to create appropriate mass awareness among public in vicinity. The overall study findings show that existing policy guidelines needs reformulation for effectively handling the issues of pollution and severe issues of sedimentation in the Patna-Bhagalpur region. Based on the outcome of the study it is recommended that to formulate policies for mitigation measures there is an urgent need for coordination between Central, State and Local Government Departments related to Forest, Sanitation, Water Resource, Water Conservation, Rehabilitation departments, Geological departments, Hydrograph Department, etc. and outline policies in an integrated manner. This shall only be a sustainable solution for

Incessant Ganga, finding solution on sedimentation and siltation issues and maintain the characteristic flow of river Ganga. It is recommended that attention be given to following information for new policy formulations:

- Changing pattern of hydro geo-morphological characteristics.
- River behaviour in plain especially with reference to floods and needs of silts management.
- Planning policy, Rules and its implementations for safeguard the river Ganga.
- Impact of Farraka Barrages in Upstream and downstream of river Ganga.

Many other such specifications need to be characterized of the rivers before policy formulations. This way the issues related to rivers also can be brought under control and rivers can be revived for healthy civilization. Already too many policies and guidelines are formulated by planning & regulatory bodies how it's time to ensure that policies are implemented properly with right interpretations. Regular monitoring evaluation provisions shall be made mandatory action against defaulters can only produce rightful students.

In a declaration drafted for government of India during a conference on "SEDIMENTATION, A COLOSSAL IMPEDIMENT TO INCESSANT FLOW OF RIVER GANGA – PROBLEMS AND SOLUTIONS" organized by the

Government of Bihar, Water Resources Department at India International Centre on 18th – 19th May 2017 at New Delhi, to discuss various aspects of the problems caused by Sedimentation such as;

• The flow of the river,

- The purity and natural health of the water in the river and
- The life of the people in the river basin, upstream as well as downstream.

There was a consensus that the problem caused by Sedimentation is gigantic in nature as well as multidimensional and that - to find a comprehensive understanding and to design a set of solutions, in long-term strategy as well as in step by step implementation is the need of the hour.

India's socio-cultural ethos is such that it is impossible to perceive the nation without the river Ganga. The basin of river Ganga consists of 26% of India's land mass and supports 43% of the country's population. The river carries 28% of the nation's surface water resources. The Ganga river basin covers 11 states viz. Uttarakhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, Harvana, Himachal Pradesh, Chhattisgarh, Jharkhand, Bihar, West Bengal and Delhi. With concern for this Ganga River System and population of the river basin at heart, scientists, researchers, policy makers, academicians, social activists, legal experts, NGOs and people's representatives gathered on a common platform to ponder over the issues and to find a common approach and road map to comprehensively understand and then to effectively address, on the field, the problems created by the out-of-control siltation. This Conference was the 2nd Conference in an ongoing series on 'Aviral Ganga', the first conference "Incessant Ganga" having been held on 25th-26th February 2017, at Patna, Bihar. It was recognized in that conference that creating an integrated framework of partnership for the River Ganga Rejuvenation Mission is a priority and that within this Mission the understanding of silt and sediment flows in the entire Ganga

River and her tributaries is, now and henceforth, permanently highlighted and emphasized for inclusion and study in all current and future planning and implementation. The second conference was held to further this study, to follow up on the deliberate emphasis on siltation issues, and the findings and outcome thereof are this DELHI DECLARATION on Incessant Ganga 2017.

The conference, started with a brief documentary highlighting the issue of high sedimentation in the Ganga River and its far reaching ill—effects, was full of lively discussions and brain storming, and was quite successful. The serious unavailability of sufficient data - about all aspects of the siltload on the River Ganga – was improvingly reviewed during the Inaugural, Technical and Open Sessions. Regulation of sedimentation in the Ganga river basin and her sub-basins through a careful silt management policy, considering its healing impact on erosion and floods in the Ganga river system, was identified as a key imperative that needs special attention in the light of

- Rising demographic pressure on the land
- Sharply rising water use
- Dynamic changes in Land Use and Land Cover
- Global Warming & Climate Change and resulting erratic precipitation, extreme flood droughts.

Inadequate carrying capacity in the river, over different return periods in different reaches of the Ganga River, causing sedimentation that brings changes in the river-bed forms, was also discussed.

The following points emerged as key concerns:

- An overview of sediment issues, considering causes and impacts
- Identification of priority issues and areas with respect to inter-basin variation
- Type and scale of sedimentation problems
- Social and Environmental aspects of sedimentation
- Geological and Geo-morphological changes; pre-Farakka and post-Farakka Barrage Scenario

Following strategies and studies for implementations was felt essential:

- Estimation of sediment ingress to Ganga River affecting Bihar
- Spatio-Temporal study of evolution of water depletion in the summer & flooding in the rainy season
- 2-D Bursting Analysis of the Ganga stream flow from Buxar to Farakka (Turbulence Analysis) to comprehend impact of sediment dynamics on critical channel processes of sediment entrainment, transport and deposition.
- Flood and flash-flood inundation area mapping through different time-lines. Hydrologic-Hydraulic Modelling for flood prediction and the propagation of early warning to populations with special accounting for the vagaries of climate change and cloudbursts. These hydrological models to be based on information of climate, soil types, vegetation, precipitation& temperature based on available scientific data and fresh reviews.
- Vulnerability and risk appraisal of the embanked sections of the Ganga river system and network

- Socio-Economic Mapping of the vulnerability of natural resources and human resources
- Sediment Management prospects using Catchment Area Treatment plans, including prevention of erosion and deforestation as well as acceleration of existing efforts in greening through aforestation – for the Ganga and all her tributaries.
- Reduction of sediment input to the river system in concurrence with its local SEE approach.
- Control of the sediment inflows using innovative techniques in high-risk sediment induced flood-prone areas
- Analysis for the prospect of remodeling Farakka barrage system to upgrade its hydraulic performance as well as sustainability by using state–of-the-art design techniques. Special study of alternate and latest technologies and innovations including 'piano-key' modification of barrages.
- Inter River basin impact and treatment management plan, specially other rivers joining.
- Sediment inflows due to sewage and municipal solid waste entry which make sediment unhealthy need to be trapped and managed.
- Innovative ideas such as Piano-key-weir system & other techniques and technologies available may be looked at as remedial measures.

Experts from various institutions of repute like Indian Institute of Technology, National Institute of Technology, NEERI, NIH etc., social and religious institutional forums and individual researchers and personalities of eminence from religious, social, legal, judicial, administrative, river engineering, earth science, climate change and allied fields - participated wholeheartedly in the sessions and expressed their valuable suggestions.

The primary concerns and conclusions presented and shared were:

- 1) Life sustaining ecological purity of the river water is not possible without bringing back the incessant flow in the entire reach of the Ganga River and all her tributaries. A minimum situational flow-velocity is required to keep the silt flowing.
- 2) Need of accepting the inter-national and inter-state presence of the Ganga River Basin System thereby creating and sustaining a collectively agreed mutually enriching relationship of heart and mind, without which a comprehensive inclusive approach to rejuvenate and restore the Ganga will be impossible.
- 3) There is a need for collective Mission-Mode approach of Government and public to evolve an equitable participation to make the Ganga River incessant and pure, Aviral Ganga and, therefore, Nirmal Ganga.
- 4) The Government of Bihar has resolved to take the lead along with the people of Bihar with all the invited experts from various sectors – to together address the issue of understanding silt and sediment flows in every section of the River Ganga and her tributaries – in order to evolve a thoroughly researched practical view to rejuvenate the river Ganga.
- 5) The entire house was deeply moved and inspired to reinforce and renew the intellectual acceptance of the respect for all river systems as well as the critically motivational emotional respect for all river systems of

which the Ganga River System is traditionally considered the highest manifestation. It is agreed that, as we work with nature, we consider the survival and flourishing of the Ganga dolphin as the significant indicator of the health of the river Ganga. It is agreed that, as we give respect to the National Water Mammal dolphin and do our utmost to protect it, we are in effect also giving the highest respect to our National River and doing our utmost to protect her ability to bear and sustain the network of aquatic life which supports the dolphin.

- The Civil engineering syllabus on Water Resources be updated with increased component of River Engineering. Post Graduate courses on River Engineering be started.
- 7) Public opinion of the people living in affected areas be recorded and considered.

The following points emerged as action points in the Delhi Declaration on "Sedimentation, a Colossal Impediment to Incessant Flow of River Ganga – Problems and Solutions" 19th May 2017:

- That an interim steering committee, Ganga River and Basin Rejuvenation Council, should be formed consisting of various renowned experts from different disciplines, including NGOs
- State-of-the-art Integrated Sediment Management in Ganga River System for Bihar flood mitigation should be planned. It should be a threefold integrated framework, namely –
- I. Problem Appraisal-short term, Medium term and long term
- II. Quantitative Analyses on multi-faceted problem domain, and

- III. Analyses for developing sustainable mitigating solutions -intertwined to synthesize solutions for mitigation of floods caused by increasing sediment deposits in Ganga River System, with specific reference to Bihar.
- That the compilation of works under Ganga River Rejuvenation Mission by different agencies should be integrated at one platform.
- 4) That a time-bound comprehensive study be undertaken concerning siltation and its ill-effects due to the Farakka Barrage:
- I. All the gates and sluices should be made functional round the year.
- II. To ensure representation of Bihar Government officers in operation, maintenance & monitoring of Farakka Barrage.
- III. To analyze the remodeling prospects of Farakka barrage system to upgrade its hydraulic performance as well as sustainability using state-of-the-art design techniques in the existing installation and, if possible, an alternative solution may be explored.
- 5) That a compilation of all initiatives of professionals, scientists, environmentalists, ecologists, NGOs be done, keeping in view the health of the Ganga River System.
- 6) That a modular approach with a mapping of every aspect of the Ganga River Basin from source of the river and all her tributaries to the confluence with the Bay of Bengal, be created as shared-reference maps and documents at basin, sub-basin, macro-basin, micro-basin and watershed levels – to enable the setting of grades and Mission Implementation

Priorities with respect to studying everything which positively or adversely affects the goal of ensuring an incessant flow. The maps will be based on remote sensing, geological, geo-morphological and geophysical data. The Data gathering and integration will be guided by a Real Time, Inclusive and Integrative 'Data Driver Decisions' (DDD) Model.

- 7) That release of requisite e-flows should be done by all dams and barrages upstream of Bihar as decided by scientific and systemic assessment
- Dredging of National Waterways-1 is increasing erosion in Bihar. The project should be put on hold until a scientific study of impact of dredging on erosion is done
- 9) To ensure fair share of the water of the Ganga basin, originating from Gomukh and Badrinath, for Bihar and Bengal. It should be a joint responsibility of the Ganga Basin States to provide water to the Ganga to meet India's obligation to Bangladesh
- 10) To ensure discharge at different sub-basin terminal points in the upper riparian States of River Ganga giving due consideration to the needs of population, agriculture, industry and other sectors. A thorough research and review of constitutional provisions with respect to water must be sought and renewed in the drafting of appropriate legislations and amendments as may be needed in the pursuit of Aviral and Nirmal Ganga. We must therefore guide our planning and implementation with supreme respect to guidelines in our Constitution such as:

- i. As envisaged in the Directive Principle of the State Policy, under Article 48 A. Protection of and improvement of Environment and safeguarding of forests and wildlife.
- ii. To discharge Fundamental duty as envisaged under Article 51 A (g) to protect and improve the natural environment including forests, lakes. Rivers and wildlife and to have compassion for living creatures.
- 11) That while de-silting is a major intervention to restore the ecological health of the river we do not lose sight of every anti-pollution measure that can be planned and implemented to prevent the garbage, sewage and effluents of the populations in the Ganga river basin from reaching and polluting the river waters.
- 12) Instead of 'keeping the silt away' the strategy of 'giving the silt its way' should be adopted. Nevertheless, this does not detract from the need to green the catchment areas of the Ganga River and all her tributaries to reduce runoff and soil erosion. There is an equal need to pursue water-efficient agriculture and thus reduce the runoff from fields to the river. There is a need to plant trees from banks of the river to a depth of at least 1 kilometre on both sides of the river.
- 13) In exploring various solutions for de-silting on Upstream of and prevention of erosion Downstream of the Farakka barrage, structural modification measures or decommissioning are the possible alternatives
- 14) A comprehensive National Silt Management Policy is required to be formulated for Himalayan and alluvial rivers, keeping in view the alarming situation prevailing

in Ganga River as well as the effect on the ecological health of the river.

15) That we draft and create policy regarding matters of siltation and sedimentation in the light of UNESCO guidelines as applicable to the rejuvenation of Ganga within the parameters agreed upon in this DELHI DECLARATION on Incessant Ganga 2017.

This conference paved a way forward to take actions on the issues discussed which would help in finding an amicable solution so that a comprehensive and effective silt management policy can be framed to maintain "AVIRAL GANGA NIRMAL GANGA".

Chapter III

Social and Environmental Assessment of Erosion and Sedimentation in Ganga Basin at West Bengal

Introduction

The river Ganga is an important river of India, originates at Gomukh in Uttarakhand and travels through Uttar Pradesh, Bihar, Jharkhand, West Bengal and finally meets in Bay of Bengal after entering in Bangladesh. River Ganga enters West Bengal near Rajmahal and then flows in a southeasterly direction. It divides into two near north of Dhulian in Murshidabad district. One branch enters Bangladesh as the Padma or Pôdda, while the other flows through West Bengal as the Bhagirathi River and Hooghly River in a southern direction. The Bhagirathi is the main river in West Bengal which flows past some of the important cities like Murshidabad. Baharampur, Nabadwip, Chinsura. Chandannagar, Srirampur, Howrah, Kolkata, Diamond Harbour and Haldia. It empties its water into Bay of Bengal near Sagar Island in the South 24 Parganas. Recently, it has been conferred the status of living entity by the Hon'ble Supreme Court of India.

Ganga river basin is the largest river basin in India in terms of catchment area, constituting 26% of the country's land mass (8,61,404 Sq. km) and supporting about 43% of its population (448.3 million as per 2001 census).Erosion, sediment transport and siltation in Ganga is a very complex phenomenon and their estimation has inherent limitations and uncertainties. This is truer in case of large river Ganga, which exhibits large geomorphic diversity as one travels from Haridwar to Farakka.

Sedimentation in rivers has increased due to rapid urbanization in flood plains, encroachment of river beds, changes due to human activity, and deforestation in catchment area of rivers. Dams or barrages constructed on rivers also alter the equilibrium of flow of water and sediment in rivers. Farakka Barrage, a 112gate dam commissioned at Farakka in Malda District, West Bengal is considered to be the main cause of sedimentation and erosion in Ganga in this region. The impact is such that loss of human life and livelihood to loss of coral reef communities, changes in fish migration is obvious.

Ganges is one of the most sacred rivers and a lifeline to millions of Indians who live along its course and depend on it for their daily needs. Hence with a motive to understand sedimentation and erosion issues for river basin management and minimize damage to the river flow a Social assessment and environmental assessment was organized under leadership Waterman of India, Dr. Rajendra Singh in Malda and Murshidabad region in West Bengal.

The visit was planned with following objectives:

- To visit affected areas of Ganga Erosion and silting and interact with local communities and authorities with following objectives:
- To understand impact of Farakka Barrage on the silting and erosion of Ganga river basin
- To find reasons of changing course of Ganga
- Explore the causes of sedimentation and erosion in Ganga

- Botanical changes due to erosion and sedimentation of Ganga
- Zoological changes due to erosion and sedimentation of Ganga
- To carryout survey for ecological and environmental impact assessment with regards to Ganga erosion and silting
- Find impact of erosion and sedimentation on public life
- Explore solutions for Ganga erosion and silting
- Recommend economic and ecological sustainable solutions to curb erosion and sedimentation
- Recommend solutions for rehabilitation of displaced population
- Submit memorandum to government for appropriate action.

Social Assessment Initiative

On 15-4-2017 a meeting was conducted in Municipality hall at Dhuliyan with the intention to understand the experiences of people with the sedimentation and erosion of Ganga River, which was locally termed as 'Bhangon'. About 550 people attended the meeting which included many Female representatives, farmers, primary & secondary school teachers, Gram Pradhans and its members, Secretaries of different social counselling groups. When enquired about the situation of erosion and siltation of Ganga Basin along with its history on Farakka Barrage to the audience, many locals such as Mohd. Umar Haisam, Sahajat Saleem, Tahaseena Khatun, Tarinkul Islam, Sofi Sultan, Lachan who actively participated in interaction informed that 1966 Farakka Barrage construction work was initiated and completed in 1971. They mentioned that though soil erosion usually takes place as natural phenomenon on the banks of the river, but after the construction of Farakka Barrage, the soil erosion became serious issue since 1998. Waheeda Quatoon informed that in the summer bore well does not give water and due to erosion, the water gets drawn towards the river. Tarikul informed that Loharpur is fourth basti due to cutting of Ganga banks. He also informed that cutting started since



Interaction with people of Malda and Murshidabad of Ganga basin related to soil erosion and sedimentation from local residents along with other issues on 15-05-2017

1979 and not from 1998 as being said. Due to floods in 1998 it became more severe. He expressed that there was change in actual plan of Farakka barrage and it needs to be investigated as due to the structural modification that such of erosion happening. He continued to say that due to barrage Ganga flow was restricted and thus it turned to other side and thus the problem started. Farakka gates were showing problems since beginning and silting started which should have been dredged out from that time onwards. As the silt heaped up, it stands in way of slues gate and deteriorated the situation. State and Central government has done nothing for same. Mohammed from Loharpur informed that they have met Water irrigation Minister but nothing has yet been done. Sultan from Vashipur erosion has followed by drying of river. Due to severe siltation and formation of Islands the Ganga bifurcated into channels. Due to heavy loaded sediment and formation of island, either sides of the Bank of the river got eroded severely as the depth river decreasing. And those who stays in banks are the worst affected. They informed that due to Soil erosion, more than 20-25000 families are affected by loss of property, vegetation and many primary schools, and structures have washed away.

The same place is re-established three to four times with its Gram Panchayat and other establishments. When Abhijit Ghosh raised a question for a permanent solution to State and Central government they said we are planning a united mass movement. After the meeting Dr. Rajendra Singh & Dr. Snehal Donde along with team of Scientists visited Loharpur where Brick making small scale furnace on the bank of Ganga River and eroded parts was observed. NEERI scientists observed the affected places from



Interaction with people affected by Ganga erosion

structural and morphological perspectives, ZSI scientists investigated the affected areas and collected soil & faunal samples, and BSI people recorded observations on plants. Further it continued as they visited Parlalpur Ferry Ghat, Malda, where Island formation due to sediment was noticed.

As the team reached Kaliachak gathering of near about 550 people of nearby villages gathered in a Temple place and expressed their turmoil situation and requested to find solution to river bank erosion as the temple may be washed away in erosion which is expected as said by the locals and insisted & requested strongly to save their temple & people livelihood. Additional remark by people was that present MLA Mr. Swadhin Kumar Sarkar- BJP, also lost his house in recent erosion effect. Finally in the night, team visited concrete porcupine of Khulidran at Sujapur near Farakka Barrage; this is installed as a measure to stop erosion of river bank.





Plate 1: The eroded soil of riverbank consumes a sizeable portion of riverbed at Parlalpur

Plate 2: The sinking structure of a mandir at the Ganga riverbank at Parlalpur



Plate3: Close up view of siltation downstream of barrage

Plate 4: View of siltation ownstream of Barrage from a distance



Plate 5: Broken structure (a primary school) that went into Ganga at Parlalpur



Plate 6: The side walls of the mining pit wherefrom sandy deposits from riverbed is mined. The floor of the mine is a mixture of original deposit and

earth that inadvertently comes with trucks from outside.

On 16-4-2017 team started with visit to Maheshpur. The soil erosion on both sides of the river bank was seen to be very severe and scientific investigations were done by gathering information of localities of the village. The team visited residence of General Manager of Farakka Barrage as it was holiday and later GM took the team all around the Farakka Barrage explaining the entire mechanism and engineering aspects of the barrage. He also showed the water flowing through Feeder Canal. Next meeting was held with MLA of Farakka where, the issues on soil erosion and chur were discussed. Also work order of Irrigation department was discussed. As inappropriate Bamboo porcupine setting was seen in Maheshpura, which was happening without the monitoring of any officials and as bamboo was seen floating out of the porcupine structures. Team requested MLA to take measures for permanent solution as the team observed that the concrete porcupines which were installed at other village for more than two years showed positive impact to stop erosion of

the bank and thus felt that it was more reliable than the bamboo porcupines. Ineffective Boulder pitching work was also discussed.

There after the team proceeded to B.D.O. and met Mr. Kesang Bhutia at Farakka office and discussed on the factors involved in soil erosion and siltation and solution towards it. Mr. Bhutia who suggested dredging solution but also expressed that it is expensive affair. However he informed that, as an alternative means and places under his jurisdiction, he has made initiatives for vetiver plantation at Mahadebnagar at Murshudabad. He invited all the members next day to see the plantation. While discussing about the rehabilitation of affected people BDO informed that though some of the affected people are being given alternative shelters at faraway distance places but they are reluctant and refuse to move as their livelihood is near river banks. The number of such people is so high that it is difficult to make alternative arrangements unless some permanent solution is arrived.

On 17th April, the team visited Mahadebnagar to see vetiver plantation. A very good initiative has been taken by the B.D.O. Farakka for the plantation of Vetiver (Chrysopogonzizanioides (L. Roberty) in Mahadeb Nagar village on the banks of river Baghmati. It is a very good step taken by B.D.O. Farakka but it has to be done on large scale and its effectiveness needs to be studied at least in two flood seasons. B.S.I. scientists suggested few measures for watering and plantation techniques to sustain and adjust saplings to grow in natural environment and for its healthy growth. Also suggestions were provided by our team regarding creating

awareness and effective ways for 'Vetiver' plantation and encourage more local people involvement.

Local fishermen were also enquired about the fishing along with the diversity of fishes and their existence of livelihood from fishing. Halder community & Fisherman of nearby villages were involved in fishing & culturing local varieties like Catla& Rohu by cage culture. Baghmati River also adjoins to Ganga River, as per the villagers when the water level rises Gangetic dolphins are noticed. Villagers informed that due to erosion fishery is badly affected and people here are mainly dependent on fishery.

Following to this, the team went to Jangipur to meet with S.D.O. Mr. T. Subramaniam at his office. Here too, there were discussions regarding the solution for erosion and silting and rehabilitation of displacement population. The setting of bamboo porcupine was mainly discussed as the villagers felt that it was wastage of huge amount of money by irrigation department as the laying of bamboo porcupines was not done properly and they also felt that bamboo will rot soon and such temporary solutions are mainly wastage. S.D.O. assured to look into the matter.

Thereafter the team visited District Magistrate office after seeking appointment with Sharad Dwivedi, DM. Additional District Magistrate, and Mr. Mandol met the team and as informed about the inappropriate means of placing bamboo porcupine related matter.

A.D.M. directed to meet anti erosion department officers for discussing the issues and assured to look into the inefficient porcupine setting reported by the team



Plate 7: Night view of the concrete porcupines erected by Farakka Barrage Authority at Char Sujapur village



Plate 8: Bamboo orcupines are being ught in boats for deployment bank

Plate 9: A bamboo porcupine is being. toppled into water from a boat water at the bank



Plate 10: Frontal view of banks near Baghmari rivulet being plated with Vetiver



Plate 11: Side view of bank near Baghmari rivulet being plated with saplings of Vetiver; rivulet of Baghmari is visible on right hand side

On 18th April, a Meeting was conducted in Bangitola gram panchayat, Kaliachak, block no. 2. Executive Members present during the meeting were Abdul Nasir Dewan, Deepak Mandal, Pradhan Murtaza Shaikh, Inamul Haque, Sharab Ali, Manav Chaterjee along with other members. All members expressed about the devastating situation of the people in affected areas. They also informed that as and when any place is submerged in water due to erosion, that place is abolished by a notification by the State Government. Such as Kankri Bandha Jhaubonoa gram panchayat was abolished in year 2003. The team also visited Panchkoditola, Nasrat-tola, Nayagram& many other places; where people have lost their properties & livelihood. The Panchayat members suggested that land abolition policy which is caused due to bank erosion should be reconsidered and reformulated for giving relief/rehabilitation to people.



Plate 12: Soil Erosion on the Bank of River



Plate 13: People Walk across the River at Parlalpur Ferry Ghat



Plate 14: Section of sand bar where dredging process is being carried out near Farakka Barrage, where lot of molluscan shells were noticed in the sand, where feeder canal of river Ganga, Mahadeb Nagar, Murshidabad canal linked with Baghmati river near Pakur where Vetiver planting in the banks of the river is done to control soil erosion

Malda Convention

As per the plan visits of affected areas concluded with Malda Convention, where all aspects of the visit was discussed and views by scientists and stakeholders was presented. Convention was held at Narul Hasan College at Farakka in which mainly 250 localities, activists, ex-MP Shri Hasnat Khan, Farakka, MLA Shri Maniul Haque and his associates, GM Farakka Barrage Shri Amarendra Singh and many others participated.

The convention initiated with the Convention President Dr Snehal Donde briefing the audience about the objectives of the visit by the heterogeneous group to various places across Malda, Murshidabad and Farakka. Also shared relevant information as per the developments observed during the visits by the team. Each Scientist from Z.S.I, B.S.I and NEERI presented an overview of the observations with respect to their field of expertise.

Shri Amarendra Singh, GM Farakka explained about the barrage and the misconception of public and authorities regarding the functioning of Barrage. But public were unsatisfied throughout the deliberations and were agitated. After the GM left they started slogan that they want decommissioning of Farakka barrage or a permanent solution for the erosion and sedimentation which has made their lives unsafe. They emphasized that an appointment must be sought from President of India or the Prime Minister as they wanted solution from them for Erosion and siltation and compensation for their property losses. The intervention is mainly sought as the main issue is that in some affected areas remedial work by setting of bamboo porcupines is carried out by the State government irrigation department without the involvement or knowledge of Gram Panchayat or village Pradhan. And on other side as Farakka barrage is under the control of Central government authorities is setting concrete material porcupines and embankments in patch work. This is causing changing

course of Ganga and acceleration of erosion in adjacent areas along with higher rate of siltation.

Ganga River is swinging to the left which causes the encroaching of the left bank leading to erosion in many villages, roads, fields and causing annual floods. The Irrigation Department West Bengal (Report of the Irrigation Dept for 1997-2001) itself has agreed about this erosion happening due to Farakka Barrage, however no concrete action taken. Tarikool, an activist fighting for the cause of people displaced due to Ganga erosion mentioned that Farakka has extensive erosion in the left bank of the river in the upstream at Bangitola, Panchkoditola, Nasrat-tola, Nayagram. In all these regions, the eroding river has paid little heed to the erosion control measures on the banks. Huge boulders have been swept with the current, destabilizing land and people living on char are not having any facility. He urged all to fight for the cause.

Hasnat Khan, ex MP, Farakka appreciated the team's spirit and tireless work done to find solution to Ganga erosion. He informed that in his tenure he had raised the issue in parliament as more than 40 thousand people are affected. Various committees have been formed at different times and reports were made suggesting some recommendations but unfortunately none of them has been implemented nor published. Each report needs to be accessible to the public for clarity. Farakka Barrage was formed to protect the Kolkata port. But the purpose has not been fulfilled. Unfortunately it creates erosion at both banks of Ganga and more than 40,000 people are landless, homeless and ruined. Immediately both Central and State Government have to take responsibility of such severe erosion, money shall be sanctioned and remedies

for this erosion should be started. Due to imaginary border between our neighbouring countries so many hectares of lands are engulfed by those countries. Permanent border-line between India and neighbouring countries viz. Bangladesh Pakistan and China should build and this way engulfing of lands by Ganga River will be stopped. During the convention assembled people decided to march to Rashtrapati Bhavan and Parliament on 16th May, 2017 to draw attention of Central Government to the unending devastation situation and sufferings of Farakka, Malda& Murshidabad region people, due to severe silting and erosion of Ganga river banks for years.

Environmental Assessment Report

Given below are reports prepared during the survey: Report of National Environmental Engineering Institute (NEERI)

The Google images below shows the shifting pattern of basin and siltation.



Plate 15: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.1986]



Plate 16: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.1990]



Plate 17: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.1994] Plate 18: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.1986]



Plate 19: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.2002]



Plate 20: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.2006]



Plate 21: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.2010] Plate 22: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.2014]



Plate 23: Farakka Barrage vis a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.2016] Plate 24: Farakka Barrage vis a vis water flow, Erosion and

a vis water flow, Erosion and siltation pattern at Char, Sujapur and Parlalpur. [Imagery date: 31.12.2017]

Former provincial or imperial capitals (such as Kannauj, Kampilya, Kara, Prayag or Allahabad, Kashi, Pataliputra or Patna, Hajipur, Munger, Bhagalpur, M urshidabad, Baharampur, Nabadwip, Saptagram, Kolkata and Dhaka) located on its banks. The Ganges and its all tributaries, especially the Yamuna, have been used for irrigation since ancient times. Dams and canals were common in Gangetic plain by fourth century BCE. The Ganges-Brahmaputra-Meghna basin has a huge hydroelectric potential, on the order of 200,000 to 250,000 megawatts, nearly half of which could be easily harnessed. As of 1999, India tapped about 12% of the hydroelectric potential of the Ganges and just 1% of the vast potential of the Brahmaputra. Human development, mostly agriculture and siltation, has replaced nearly all of the original natural vegetation of the Ganges basin. More than 95% of the upper Gangetic Plain has been degraded or converted to agriculture or urban areas.

Major Cause of siltation issue is being blamed to commission of Farakka barrages in 1972 which was opened on 21 April 1975, It is located close to the point where the main flow of the river enters Bangladesh, and the tributary Hooghly (also known as Bhagirathi) continues in West Bengal past Kolkata. This barrage, which feeds the Hooghly branch use of the river by a 42 km (26 mi) long feeder canal and its water flow management, has been a long-lingering source of dispute with Bangladesh signed in December 1996 addressed some of the water sharing issues between India and Bangladesh. The Ganges and Brahmaputra Rivers (Figure 1) originate on the northern and southern slope of the Himalayas respectively. They traverse thousands of kilometers through India, Nepal, Bhutan, Tibetan China and Bangladesh and finally discharge into the Bay of Bengal after meeting at Aricha, about 200 km upstream in central Bangladesh. Their total drainage basin area is about 1D62 ð 106km Every year, the Ganges and

Brahmaputra Rivers in Bangladesh together transport about 1 ð 109t of suspended sediment. Of this suspended load, about 49% is deposited on the river bed and on the deltaic plain (Islam et al., 1999). There is considerable evidence that siltation in these rivers has increased in recent years (Khalil et al., 1995) and is causing severe problems. Owing to heavy siltation, numerous channel bars are formed which hinder the rapid passage of flood water and ultimately increase the inundation of the flood plain. Excessive siltation also leads to the shrinking of navigation channels, reduces fish production and degrades the aquatic environment.

Another big problem is the frequent slumping of river banks. Sedimentation of channel forces the river to form a new channel, which finally leads to bank failure. To address these problems, a better understanding of the temporal and spatial variation in sediment transport, deposition and erosion is required.

About 49% of sediments are discharge on river bed every year on deltaic plains. There is considerable evidence that the siltation in these rivers has increased in recent years after 1995 and is causing severe problems. Owing to heavy siltation, numerous channel bars are formed which hinder the rapid passage of flood water and ultimately increases the inundation of flood plain. Excessive siltation also leads to shrinkage of navigation channels. Reduces fish's production and degraded the aquatic environment. Another big problem is the frequent slumping of river banks. Sedimentation of channel forces the river to form new channel, which finally leads to bank failure. Apart from studying Google earth images for evaluating the course of Ganga River over last 30 years, the other observations made during the field visit are outlined below.

Report of Botanical Survey of India (BSI)

The soil of Malda district is alluvium in nature and is found on both the sides of Mahananda river which flows from North to south of the district. The southern part of the district, on the other hand, is enriched with slit of Ganga and considered to be the most fertile area of the district. The physiography of the district is mostly plain barring a few pockets of mild slopes here and there The soil of Murshidabad district comprises of two distinct regions separated by the Bhagirathi River. To the west lies the Rarh, a high, undulating continuation of the Chota Nagpur plateau. The eastern portion, the Bagri, is a fertile, low-lying alluvial tract, part of the Ganges Delta comprising of Loam, sandy loam, silty loam.

The climate of the Malda district is rather Extreme-very hot and sultry during summer season, with plentiful rains and moisture in the air throughout the year. Basically, there are four seasons in the year. The cold season start about the middle of November and continues till the end of February. The period from March to May is the summer season. The rainy season starts in June with the coming of south - west monsoons and continues till the middle of September. October and the first half of November constitutes the post monsoons season. The normal rainfall is 1453.1 mm. The maximum precipitation occurs during the period from June to September.

Murshidabad has a tropical wet-and-dry climate. The annual mean temperature is approximately 27°C. Summers are

hot and humid with temperatures in the low 30° C and during dry spells the maximum temperatures often exceed 40° C during May and June. Winter tends to last for only about two and a half months, with seasonal lows dipping to 9° C – 11° C between December and January. Rains brought by the Bay of Bengal branch of South-West monsoon lash the city between June and September and supplies the district with most of its annual rainfall of approx 1,600 mm (62 in). The highest rainfall occurs during the monsoon in August approx 300 mm.

The surrounding area of Ganga riverbank is inhabited by villages, agricultural field and the sporadic plantation by the Forest Department. The natural vegetation is of mainly herbaceous plants like Grangeamaderaspatana, Heliotropiumindicum, Dentellarepens, Achyranthes aspera, Alternanthera sessilis, Cyperusrotundus, Fimbristy lisbisum bellata. Ranunculus sceleratus etc. with few trees like Mangiferaindica, Azadirachtaindica, Ficusbenghalensis, Phoenixsylvestris, Ziziphus sp. etc. Few shrubs like Tamarixdioica are also present but in very less quantity. Following is the detailed sampling report:

On 15.4.17, all the team members visited Loharpur village under Sikadarpur police station (Murshidabad) and collected plant samples and recorded vegetation. From, Loharpur, the team visited the Parlalpur Ferry Ghat area (Malda) after crossing the river Ganga near Dhuliyan and collected plant samples and recorded the vegetation. On 16.4.17, all the team members visited the Maheshpur village under Farakka block, 10 km downstream from Farakka barrage and observed the soil erosion and sedimentation by Ganga and also collected plant samples along with photographs and G.P.S.

data. From Maheshpur village, the team visited to B.D.O. office, Farakka and met with BDO, Farakka and took information regarding erosion, sedimentation and preventive measures being taken from Govt. of West Bengal. On 17.4.17, all the team members visited the Mahadebnagar Gram Panchayat under Farakka block on the bank of river Baghmari and collected plant samples and recorded vegetation along with photographs and G.P.S. data. On 18.4.17, all the team members visited the Bangitola Gram Panchayat and Panchkuritola, Kaliachak-2, Malda and plant samples were taken and vegetation was recorded along with photogrphs and G.P.S. data. Thereafter, the four day survey tour ended in Malda Convention at Nurul Hasan College, Farakka, and Murshidabad in which Shri Amarendra Kumar Singh, General Manager, Farakka Barrage Project, many local people and social workers participated. The G.P.S. data of the visited areas are given in the below table (See Google Map).

Sr. No.	Location	G.P.S. Reading	Altitude	District
		24°38′34.90″N		
1	Loharpur, P.S. Sikdarpur	87°59′41.78″E	75 feet	Murshidabad
		24°41′10.59″N		
2	Parlalpur Ferry Ghat	87°57′57.67″E	63 feet	Malda
		24°41′10.39″N		
3	Parlalpur Village	87°57′59.52″E	54 feet	Malda
		24°41′41.30″N		
4	Maheshpur Village	87°56′41.04″E	92 feet	Murshidabad
	Maheshpur Village	24°41′49.76″N		
5	North	87°56′41.14″E	62 feet	Murshidabad

	Riverbed Maheshpur	24°41′55.80″N		
6	Village		59 feet	Murshidabad
		87°56′42.94″E		
	Mahadebnagar Gram	24°41′34.48″N		
7	panchayat		97 feet	Murshidabad
		87°56′15.67″E		
	Panchkuritola	24°58′33.65″N		
8	Village, Kaliachak-2		96 feet	Malda
		87°58′50.23″E		
	Bangitola, Near	24°58′46.37″N		
9	Panchkuritola		106 feet	Malda
	Village, Kaliachak-2	87°59′32.88″E		

All the specimens collected in the field, were treated with Formalin and Alcohol solution in the field only. All the collected specimens were identified with the help of standard keys from relevant floras, monographs and were reconfirmed by matching them with the type / authentic specimens present in Central National Herbarium (CAL). After completion of identification, field data incorporated in herbarium label and deposited in Central National Herbarium (CAL).

Important Finding: As a result of the present study, a total number of 47 species of angiosperms belonging to 45 genera of 26 families have been identified .Among the total species, dicotyledons comprise 21 families, 34 genera and 35 species and monocotyledons comprise 5 families, 11 genera and 12 species. Out of the total 26 families, dicotyledons represent 80.76 % and monocotyledons represent 19.23 %.Out the total 45 the dicotyledonous genera, of and monocotyledonous genera are 75.55 % and 24.44 % respectively. Out of 48 species, dicotyledons represent 74.46 % and monocotyledons represent 25.53 %. The ratio of dicotyledons and monocotyledons is nearly 2:91:1. The genus

to species ratio is 1: 1.04 which is almost equal and confirms the low diversity of plants in the study area.

Plant	Number of Genera	Number of
		Species
Dicotyledons	34	35
Monocotyledons	11	12



Plate 25: Google map showing surveyed are as

The team during the course of survey found out that many villages like Panchkuritola, Bangitola along the bank of Ganga in Kaliachak-2 P.S. of Malda District; Maheshpura village and Loharpur village in Farakka P.S. of Murshidabad have witnessed heavy soil erosion and loss of vegetation, human lives and livestock during the recent flood. The main reason of flood seems to be formation of sand islands (chur) in the middle of the river due to siltation, which bifurcated the course of river at many places downstream of Farakka barrage. Due to island formation in the middle of river, more water pressure created on both the banks of river resulting into the heavy erosion which is also witnessed by less diverse vegetation in Ganga basin area. (See Map1)Many anthropogenic activities like sand mining and brick production activities along river bank are also responsible for soil erosion. Due to the soil erosion and annual flood, both the population and productivity of Mango, Coconut, Areca nut, Ber plants have drastically been reduced in the Ganga basin area. The Jhau (TamarixdioicaRoxb. ex Roth) population has very much reduced and is on the verge of extinction in the river basin area. For preventing the soil erosion, many measures have been taken by the government agencies like applying boulders, concrete and bamboo porcupine at the eroded areas. Another important measure for preventing the soil erosion is being taken in the Mahadebnagar along the bank of river Baghmari is the plantation of Vetiver (Chrysopogonzizanioides (L.) Roberty) by Farakka Block Office which effectiveness needs to be tested in at least two flood seasons.



Map 1



Plate 4 A. Clerodendrum infortunatum L.; B. Erythrina suberosa Roxb..; C. Ficus benghalensis L.; D. Heliotropium indicum L.; E. Mecardonia procumbens (Mill.) Small; F. Grangea maderaspatana (L.) Poir.; G. Hemigraphis hirta (Vahl) T.Anderson; H. Dentella repens (L.) J.R. Forst. & G. Forst.



Plate 5: A. Bagmari river; B. Plantation of Chrysopogon zizanioides (L.) Roberty C. Chrysopogon zizanioides (L.) Roberty; D. Alternanthera paronychioides A. St.-Hil.; E. Rumex dentatus L.; F. Ranunculus sceleratus L.; G. Xanthium strumarium L.



Plate 6: A. Mollugo pentaphylla L.; B. Gnaphalium indicum L.; C. Mallotus nudiflorus (L.) Kulju & Welzen; D. Holoptelea integrifolia (Roxb.) Planch; E. Ammannia baccifera L.; F. Cyperus compressus L.; G. Leucas cephalotes (Roth) Spreng.; H. Mangifera indica L.

List of species recorded during the present study.

- 1. Achyranthes aspera L.
- 2. Alternantheraparonychioides A.St.-Hil.
- 3. Alternanthera sessilis (L.) R.Br. ex DC.
- 4. Ammanniabaccifera L.
- 5. Arecacatechu L.
- 6. ArgemonemexicanaL.
- 7. AzadirachtaindicaA.Juss.
- 8. Chrozophorarottleri (Geiseler) A.Juss. Ex Spreng.
- 9. Chrysopogonzizanioides (L.) Roberty
- 10. Clerodendruminfortunatum L.
- 11. Cocosnucifera L.
- 12. Croton bonplandianusBaill.
- 13. Cynodondactylon (L.) Pers.
- 14. CyperuscompressusL.
- 15. CyperusrotundusL.
- 16. Daturametel L.
- 17. Dentellarepens var. serpyllifolia (Wall. ex Craib) Verdc.
- 18. Ecliptaprostrata (L.) L.
- 19. Eichhorniacrassipes (Mart.) Solms
- 20. Eragrostisgangetica (Roxb.) Steud.
- 21. ErythrinasuberosaRoxb.
- 22. Evolvulusnummularius (L.) L.
- 23. FimbristylisaestivalisVahl
- 24. Gnaphalium indicumL.
- 25. Grangeamaderaspatana (L.) Poir.
- 26. Heliotropiumindicum L.
- 27. Hemigraphishirta (Vahl) T.Anderson
- 28. Holopteleaintegrifolia Planch.

29. Hydrilla verticillata (L.f.) Royle 30. Ipomoeacarnea Jacq. 31. Leucascephalotes (Roth) Spreng. 32. Lippia Alba (Mill.) N.E.Br. ex Britton & P.Wilson 33. Mangiferaindica L. 34. Mecardoniaprocumbens (Mill.) Small 35. Mollugopentaphylla L. 36. Persicaria hydropiper (L.) Delarbre 37. Phoenixsylvestris (L.) Roxb. 38. Phyla nodiflora (L.) Greene 39. Polygonum plebeium R.Br. 40. RanunculussceleratusL. 41. Rumexdentatus L. 42. Senna occidentalis (L.) Link 43. Sesamumindicum L. 44. TamarixdioicaRoxb. ex Roth 45. Mallotusnudiflorus(L.) Kulju & Welzen 46. VallisneriaspiralisL. 47. Xanthiumstrumarium L.

Report of Zoological Survey of India (ZSI)

Soil and zooplankton samples from surface water were collected from 7 sites in the localities of Malda and Murshidabad and studied in ZSI Laboratory for identification. Soil samples were under studied for nematodes and other microorganisms.



Soil erosion on the bank of river Ganga at Loharpur



People involved in boating in transport for crossing the river & fishing were noticed at Parlalpur ferry ghat



Birds sighted at from the river Ganges at Loharpur



Birds (cormorants and cranes) noticed near Farakka barrage



Molluscan shell in algae and locals shows the algal mat from the river Ganges at Loharpur



Banks were severely eroded and were deposited by sediment and formation of sand bar between the rivers.



Frogs and toads were seen in high population at Parlalpur ferry ghat



People Walk across the River at Parlalpur Ferry Ghat



Collections during the field visit at Maheshpur, Murshidabad



Maheshpur of Murshidabad is severely affected zone in soil erosion in the bank of the river at Maheshpur, Murshidabad



Section of sand bar where dredging process is being carried out near Farakka barrage, where lot of molluscan shells were noticed among the sand which show the population of aquatic organisms were reduced due to siltation





Collection of molluscan and zooplankton samples in river Ganga near Farakka barrage





Zooplankton collection and interaction with local fisherman about the fish availability in Ganga River






Farakka terminal ghat, inland water ways authority where the dredging is carried out Feeder canal of river Ganga, Mahadebnagar, Murshidabad canal linked with Baghmari river near Pakur where Vetiver planting in the banks of the river to control Soil erosion

Photographs of Zooplankton and Molluscan from the Investigation of Collected Samples from the Sites Copepoda:



Mesocyclopsleuckarti



Brood female Heliodiaptomus sp.





Mesocyclopsleuc karti male

Cyclopoid nauplii

Calanoid copepodite

Protista:







Volvox sp

sp Difflugiaoblonga

vulgaris

50 un

Calanoid

nauplii

Difflugia sp.



Pyxicola sp. Difflugia corona

ı Cen uta

Centropyxismin



Rotifera



Brachionusquad

ridentalusclunio

rbicularis



B. angularis



B. patulus



Platyiasquadri cornis



rceolaris





Lecane (Monostyla)

bulla

100 µm

Euchlanisdi latata

Brachionusu Keratellatropica

Cladocera



Chydorusfaviformis



Bosminopsisdeitersi

Bosminalongirostris



Chydorussphaericus

Diaphanosomasarsi



Chydorus sp.



Macrothrixlaticornis



Alonarectangula

Aquatic Insects





Hemiptera larvae **Phytoplanktons**



150 um





Microcystis sp

Synedra sp.

Pediastrum sp.





Merismopedia minima



Algal mat of Spirogyra sp

Mollusca



Thiarascabra



Melanoidestuberculata



Bellamyabengalensis

Tarebia lineate



Brotiacostula



Novaculinagang Indoplanorbis etica exustus

Investigation reveals 11 species of Mollusca, among zooplankton 12 species of Rotifera, 8 species of Cladocera, 2 species of Copepoda, 8 species of Protista along with insect larvae eggs and fish scales were also noticed. Few phytoplanktons were also identified. Nematodes were occurred from the samples subjected to analysis. Among birds eagle, cranes and cormorants were observed from the investigation. Among fishes, Labeobata, Rita rita, Catlacatla, Labeorohita, Eutropiichthyssp. Wallago attu, Ompokpabda, Mastacebelus sp. Tenualosailisha, Mystusvittatus, Heteropneustesfossilis, Ophiocephalus (Chana) striatus etc., were reported from the fishermen of the sampling sites during the field visit. River bank erosion is a complex geomorphologic process of landscape development by which soil is detached or deflected, transported and deposited at a relatively distant place resulting of exposure of land at the origin and siltation in river bed (Florsheim et al., 2008; Mondal and Satpati , 2012, Rosgen, 1993). Das (2016) assessed the bank susceptibility and bank stability of a selected reah of Ganga, mainly left bank of Ganga near Panchanandapur. Here the channel is braided which characterised by numerous braids, bars shoals etc. being a brided channel, flow path of water is continuously changing its position which ultimately results huge bank erosion.

Aquatic Organism occurrence in the Ganga basin in the selected sites were less may be due to the season selected for the study or due to heavy siltation. The heavy silt load in the river Ganga due to various anthropogenic activities causes mechanical injury to the fish scales and gills. The unavailability of the fish food and blocking of migration path are also destroying the fish breeding grounds. Even the fish scales in the water may be used as reliable bio-indicators assessment of water pollution and may also initiate the conservation of river system (Khanna et al., 2007). Rice (2012) stated that pollution threatens not only humans, 140 fish species, 90 endangered species and endangered Gangetic dolphin. Most of the condition prevails in the sites of Ganga basin were highly silted, dead and reported by the people that only flow in river in rainy season. This depth of water decreased due to heavy siltation which leads to decrease in

aquatic organisms especially disturbance in fish breeding and feeding grounds in the river.

Among the seven sites selected for the investigation, All the sites does have depth of water was very less, when compared to the sampling site near Farakka Barrage. Zooplankton and molluscan samples were also highly noticed near Farakka Barrage. Birds were also sighted. This may be due to hydraulic pressure in Farakka barrage where the depth of water was higher when compared to the other sites where the food web were enriched based on the observation and analysis of samples collected nearby Farakka barrage. In other sites the algal mats were observed along with high soil erosion on the banks and siltation were noticed which are highly influenced and linked in the health and aquatic biodiversity of riverine ecosystem. Among the observation few records of fauna may come out to record for the first time from these areas and may have new records to state.

The bank erosion creates alteration in depth, multiple channels of river due to high siltation. Braids and Bars shoals were also leads to big threat to living resources in Ganga Basin due to changes in depth of the water level. Siltation also causes the submerging of free living organisms of water in sediment. The soil dwelling organisms viz., protozoan, annelids and molluscs may interrupt along with the environmental regime leads to alter in survival which in turn linked in the food web in riverine ecosystem. Dredging and boulders are highly recommended to improvise the faunal wealth of River Ganga and to save aquatic biodiversity of our Country. This assessment report is at preliminary level and stills more microfauna of soil samples to be explored which is still in analysis.

Declaration submitted by locals during the convention for Jan Andolan:

The affected masses submitted the following declaration as they intended to do mass movement:

We, the people of Farakka, Malda and Murshidabad, decide to seek attention of the Government of India and West Bengal for immediately stopping the continuous displacement of people and soil due to erosion in Ganga caused by Farakka Barrage. Every worker of every political party, social worker, media, teachers and students take an oath to continue peaceful and constructive work until achieving solution for stopping of erosion and silting and rehabilitation of the affected families. They decided to do Jan Andolan on 16th May, 2017 in Delhi by walkathon by more than 500 people from Jantar Mantar to Rastrapati Bhavan and Parliament.

Executive Summary of visit to Farakka, Malda and Murshidabad

The Farakka-Malda Ganga Bhangon Pratiraksha Committee including scientists during the five days visited various affected areas and offices of concerned authorities of respective areas. The prominent observation was that in the name of anti-erosion initiatives, a huge amount is used only for patch work (porcupines setting in 300-400 meters bank area) which is not useful. This may stop erosion at one place and shift it at other place. Hence it needs a complete study and in an integrated way work shall be carried out. General public feel that on name of emergency and relief, a lot of amount is spent without any output.

During the visit almost unanimously public had a view that due to the Farakka barrage the islands (Chur) are formed which is leading to Ganga erosion. Chur is reducing the flow of Ganga and also changed the original course of Ganga. Chur has devastated people lives and livelihood and hence many have either migrated to Delhi and some are staying on railway platforms and such other odd places. Some public representatives suggested that Central government, West Bengal Government and Bihar government must come together and find solution to the situation arise due to sedimentation in Ganga.

As per discussion with local people of the areas visited Panchayat Pradhan, B.D.O. Farakka, G.M. Farakka Barrage, SDO, local MLA & former MP. The following observations were recorded:

- 1. Siltation process existed before the formation of Farakka Barrage (in 1972) but with slower pace.
- 2. 1978 onwards erosion and siltation speed up, but after1998 onwards erosion and siltation occurred on a large scale.
- 3. Due to siltation process, many islands (chur) have been formed in the middle of the river which is of loose sand type. These islands of sand in the middle of river divided the river flow in two and somewhere more than two channels.
- 4. Due to heavy erosion, many villages have become affected and people got displaced. Rehabilitation of displaced population is must.
- 5. Concrete porcupines have been used in many parts in patches near Farakka Barrage. Its effectiveness needs to be studied in detail.

- 6. Bamboo porcupine is also being used in Maheshpur village by the irrigation department which needs to be studied in detail for its effectiveness at least up to first monsoon.
- 7. A very good initiative has been taken by the B.D.O. Farakka for the plantation of 'Vetiver'. However more local people should be made aware and involved.
- 8. Erosion matter is of fine sand which is of no use and the plantation done on such areas are not able to hold the soil.
- 9. In Farakka block, Maheshpur, Arjunpur Nayansukh, Malda Parlalpur, Shobhapur and Sujapur, all people livelihood is mainly dependent on fishing and are worst affected.
- 10. Due to State Government land abolition policy (area affected by Ganga river erosion) people of affected areas are badly suffering.
- 11. Erosion has affected economic and socio-cultural aspects and created drastic change in many places over the period in Farakka Malda and Murshidabad.
- 12. As Dhulian town in Laxminagar, Samsarganj block is safe for nearly 30 years due to the spur. Hence in same manner it must be replicated at other places for safety purpose. For immediate relief from erosion, Spur (500m boulders) must be laid four at each place in Farakka to downstream Maheshpur and Farakka to Parlalpur.
- 13. The concrete porcupines set by Farakka barrage project of Central government and bamboo porcupines setting by Irrigation department (Anti Erosion Engineering dept) of State Government used as measure to curb silting and erosion needs proper coordinated work for effective solution.

14. The abolition of land policy (area affected by Ganga river erosion) by the government is unjust and it must be reformulated in favor of the displaced population who lost their land and property due to Ganga erosion caused by Farakka Barrage.

Conclusion:

After the Patna, Bihar aerial survey of Ganga basin which was then followed by visit to Farakka Malda and Murshidabad in West Bengal to study issues of Ganga erosion and sedimentation under leadership of Jalpurush Dr Rajendra Singh the following points are suggested along with action plan:

- As Farakka barrage has intercepted flow of Ganga and in absence of incessant flow the maintaining of the life sustaining eco-logical purity of river is impossible.
- We need to accept international and inter-state Ganga river system and with inclusive and collective mutual approach.
- There is need to involve NGOs and Experts to carryout field visits for diagnostic experiences.
- With long term vision history of Ganga in relation to Farakka Barrage, its biodiversity and integrative vision, Ganga rejuvenation mission must be taken up involving NGOs and experts.
- Wide range of studies of Ganga river basin, its tributaries needs to be conducted to evolve response to climate change and its impact on human population.
- Investigative field study is imperative to understand the socio-economic loss from the barrage and suggest measures to resolve it.

- Dredging for national water ways and other benefits whether in Bihar or West Bengal must be thoroughly studied in context to its role in Ganga river bank erosions.
- Integrated and joint efforts must be taken by Bihar and West Bengal Government for Ganga rejuvenation mission, so as to get their fair share of Ganga water and share national responsibility of fulfilling obligations to provide water to Bangladesh.
- Organic farming must be promoted and adopted in entire Ganga basin.

Immediate Action Plan:

- Ganges is the largest perennial water body of the country and carries nearly 33% of total discharge of water in all river system of India, hence need proper mechanism for management of river system.
- Since 42 years, the issue of Ganga sedimentation and erosion is existing both in Bihar and West Bengal hence it requires urgent attention for sustainable solution. For this reason joint efforts needs to be taken up to bring out significant change in lives of affected population and stop ecological losses.
- A Jan Andolan and memorandum submitted to President of India and Central Government, emphasizing to formulate integrated policy framework involving Central and State Government of Bihar and West Bengal together.

The four-day survey concluded by visits to different villages, meeting people and collecting plant and aquatic samples from 15.04.2017 and ended on 18.04.2017 and finally conducting a public meeting 'Malda Convention'. The overall visit implied that the environmental impacts of sedimentation

include loss of important aquatic habitat, decrease in fishery resources, loss of recreation attributes, loss of coral reef communities, changes in fish migration, increases in erosion, loss of wetlands, nutrient balance changes, circulation changes, increases in turbidity, loss of submerged vegetation, and coastline alteration. Major concern is human health and livelihood as well as rehabilitation of people displaced due to erosion. All of the above needs serious attention as its more than four decades that the solution remains to be found.

Chapter IV

Impact of Anthropogenic Activities and Over-Damming on Biodiversity of Bhatsa River in Maharashtra

"Enhanced environmental degradation and climate change is "not the work of ignorant people"- Orr (2004)

Introduction

India's most prolific dam builder- with 1845 dams, Maharashtra has more than 35% large dams from the entire country, more than double and second largest dam builder in India. Sustainability study is important considering the current state of the planet. Climate change is drastically affecting biodiversity around the globe as forest is declined by 1991 sq km between 2011-13 and 24% there is inadequate regeneration (Forest Survey of India report). Environmental degradation is cause for economic loss and perpetuation of poverty (in India 147 million hectares soil has become degraded, eroded and thus unproductive-66% essential cereals loss as per IGIDR report). There is an urgent need to bridge the gap between research and people movements-a synergy of a vibrant civil society backed by robust science can go a long way in saving the biodiversity.

A. Impact assessment of anthropogenic activities on biodiversity of Bhatsa River

India is very diverse country in all aspect. It also has great river biodiversity. Thus Bhatsa River is also a part of such a great biodiversity which originates in a valley of north mountain streams draining the northern slope of those hills which are part of the Sahyadri range of the Western Ghats in Maharashtra. This river flow from Kalyan, Padgha, Vashind and Khadavli village towards Arabian Sea. This river also has great aquatic diversity with variety of species in it. But nowadays fresh water pollution is increasing everyday rather than diminishing due to interventions in freshwater sources.

It is disturbing the ecological parameter of this water bodies.

Bhatsa dam and it's near by area



Pic: Uncontrolled anthropogenic activities in Bhatsa River at Khadavli Maharashtra was first to bring comprehensive River Regulation Zone policy-now scrapped & faster clearance by Environment Ministry for development projects





Due to unchecked activities such as urban expansion, industrialization, pollution, tourism and other activities aquatic biodiversity is continuously under server threat. A study conducted by the author revealed prominent impact on the organisms which are sedentary, filter feeder as they were severely affected. The observation was more impactful in terms of reduction in quantity and quality. There has been a lot of emphasis on study related towards abundance and distribution of species as biodiversity in the last two decades as there is an indirect impact on economy and livelihood of mankind in this area. Thus, it has become now important to understand the link between biodiversity and benefits of mankind.



Lack of efforts by Water resource department and Water Pollution Board :



Physico-Chemical assessment of Bhatsa river water

Parameters (desirable limit)	Pre-monsoon	Post- monsoon		
Temperature	28.3 ⁰ ₀ C	27.0°C		
Conductivity	0.402×10^{-3} mhos	390 μmhos/cm		
Transparency	99.99%	97%		
pH (6.5-8.5)	8.43	8.2		
Dissolved oxygen	5.7 mg/l	5.2 mg/l		
Free CO ₂	4.40 mg/l	3.20 mg/l		
Total alkalinity (200)	175.0mg/l	169.0mg/1		
Total acidity	72.5 mg/l	53.5 mg/l		
Inorganic phosphorous	511.00 µg/l	2.8mg/l		
Nitrates (45)	7.28 μg/l	6.97 μg/l		
Silicates	118.13 µg/l	30.16mg/1		
Sulphates (150-200)	0.603 mg/l	110 mg/l		
Hardness (300)	173 mg/l	357 mg/l		
Chlorides (250)	119.32 mg/l	57.60 mg/l		
Gross Primary productivity	3.10 mg/l			

Direct pollution of Bhatsa River is a large problem due to contaminants diffuse from non-point sources, Electric Power station and with increase in house constructions. There are several issues of human activity which is depleting the habitat and biodiversity of the river. Due to lack of data of previous scientific study of biodiversity the extent of degradation of Bhatsa River is not known completely. Present paper was the first-time reporting and recording of data to understand how anthropogenic activities have impacted biodiversity and how these could be mitigated. The multiple dam constructions without proper assessment (social and environmental) and maintenance of records of flora and fauna have caused a huge gap in ecosystem. Survey of fisheries and forest departments revealed that there is no record maintained of the plant or animal species before the Bhatsa dam constructions, though it is mandatory.

Therefore, it is pertinent to find missing factors in biodiversity and find reasons that is affecting environment in terms of irregular climatic changes. Unfortunately, all these aspects of biodiversity are very much in the realms of the unknown at present. India is rated as one of the megabiodiversity centres of the world. However, the priorities being industrial development and poverty alleviation, assessment of the biodiversity has generally had a lesser importance. The net result is that we know still little of what biodiversity we have and, alarmingly, what fraction of it we are losing. In the current context of environmental degradation it is important to understand the present status of River biodiversity. Also we must understand what is needed to enhance this knowledge (What tools and capacity building is required) and how to design principles of sustainable utilization for those species that have economic value (food fishes and bivalves, for example). Continuous monitoring of the western ghat regions along the rivers needs to be done to set the process in action

and to develop plans to improve the network in the future. The outcome will help to generate record of available and threatened biota from Bhatsa River, Maharashtra and same can form baseline study for further riverine studies. There is lack of repository related to riverine ecosystem and hence there is meager attempt to develop any riverine biodiversity management system.

Data bank generated through the monitoring shall support in the conservation measure and revamping of such systems and further similar strategies can be duplicated at other places. The hydro-biological parameters and physicochemical changes in riverine water and proximate composition of sampled fish fauna has shown the deteriorating conditions of this ecosystem during a study conducted for two years, related to impact assessment (environment and social) of biodiversity of Bhatsa river system. There is urgent need to workout the measures for management of riverine ecosystem to conserve the endangered species.

Most of Indian rural population depend on rivers, wetlands, floodplains, estuaries, ponds and tanks for subsistence and market-based fisheries. The riverine fishery is very crucial component in livelihood and nutritional security of the rural poor. Bhatsa River is one of the vital river of Maharashtra, which originates near Kasara and get extended



Plankton species identified from Bhatsa river water sample

To Shahapur in the Thane district. River basin covers the major area from Shahapur to Titwala. Along the river stream many villages such as Bathsai, Shera, Vaveghar, Nadgaon and Rang are located. Titwala onwards, Bhatsa River confluences with Kalu River which flows through the Murbad district. From Kalyan onwards, stream of the river flows towards Diva and Mumbra and finally it empties into the Thane creek.

Bhatsa River is one of the major source for riverine fishery to nearby fisher folks as well as it act as major water supplying river for Mumbai and Thane, Maharashtra, India.

With declining health of rivers, riverine fisheries are declining and collapsing rapidly. This is indeed worrisome and needs to be ameliorated. Understanding of the role & regulation of aquatic biodiversity lies far behind, to such an extent that we do not have enough scientific information to manage issues such as conservation & sustainable use of fresh water resources. A greater variety of species are affected & exploited in the aquatic system than on land. Pollution from air & land ultimately enters river water & therefore, its biodiversity is most exposed to the pollutants. The impact of pollution by industries on the bank of Bhatsa river is so severe that the faunal biodiversity is severely affected. Below given picture show the few species which could be recorded.



PilaglobosaLymnaeastagnalis (snail)



Viviparabengalenensisfreshwater mussel



Spongillalacustris(freshwater sponge)



Gharaspecies



Anguliaspp, Eesmocarispinosa

Macrobrachiumrosenbergiiand



OreocromismosumbicusRasboradaniconeus



MelicertusmarginatusNematopalaemonsp.

Abundance & distribution of planktons, fishes & shellfishes were already recorded by researchers from Bhatsa River. But the combine study regarding changes in proximate composition of available fishes & shellfishes, physicochemical changes in water body and there co-relation with human activities was not available yet. The new data set generated is expected to support in conservation measure, as parallel study planned for secondary data collection from nearby fisher folks. Convention on biodiversity is necessary to take the initiatives, need to be more focused & specific on this vital subject as the water bodies around us hold so much that are intrinsically beautiful & valuable & cannot be allowed to suffer for short term gains. Study will be beneficial to conserve the endangered species.

B- Over-damming impact-environmental and social- economical assessment with regards to Bhatsa river biodiversity



During a community involvement program secondary data collection from local fisher folk regarding fishing practices and available species, their views clearly revealed the impact of developmental projects in the vicinity. Survey tools developed with the help of experts and administered to generate opinion of local public with regards to social assessment also revealed depleting conditions. The environmental assessment through various physio-chemical parameters supported the same. Further it unfolded that the developmental work such as dam construction meagerly upgraded life of people in that area and the biodiversity (flora and fauna) in said area is affected beyond repair. The overall study of economical factor assessment concluded with identifying the economic forces leading to the loss of biodiversity, this was essential to determine the trends that support depletion. Such a study is important elucidate the principles operant in cases of



successful development and conservation; and help to develop and test economical viable mechanisms for slowing resource depletion and stimulating conservation.



Developmental gains will crumble if India follows a model of growth that is resource and energy intensive- forest covers thinning, rivers degraded, pollution growing. The term sustainability is complex. However such a study help to conceptualize, operationalize, contextualize, or synthesize sustainability. Findings provided a theory for understanding sustainability within the context.

Findings revealed;

- a. The relationship between humanity/communities and the environment,
- b. The ways in which people come to understand those relationships;
- c. The responsibilities individuals have because of those relationships.

Sustainability study is important considering the current state of the planet. Climate change is drastically affecting biodiversity around the globe. Forest declined by 1991 sq. km. in between year 2011-13 and 24%. There is inadequate regeneration (Forest Survey of India report). Environmental degradation is cause for economic loss and perpetuation of poverty (In India 147 million hectares soil has become degraded, eroded and thus unproductive-66% essential cereals loss as per IGIDR report). There is an urgent need to bridge the gap between research and people movements-A synergy

Sr. No.	Name of the Source	Year of Completion	Qty of Water Supply (MLD)	Total Qty of Water Supply (MLD)(Cumulative)	
1	Vihar Lake	1860	110	110	
2	Tulsi Lake	1879	18	128	
3	Tansa Lake	1892 to 1925	455	613	
4	Lower & Upper Vaitarna	1957	1095	1703	
5	Bhatsa				
	I Mumbai	1981	455	2158	
	II Mumbai	1989	455	2613	
	III Mumbai	1996	455	3068	
	III A MUMBAI (Partial)	2004	452	3520*	
	* Including 120 MLD enro	ute supply			
R. M.	* Including 120 MLD enro	oute supply			

Existing Water Supply Sources

of a vibrant civil society backed by robust science can go a long way in saving the biodiversity.However in the real situation it is observed that whenever there is scarcity of water in Mumbai metropolitan city a dam construction is opined instead of exploring alternative source such as Rain water harvesting. Below give charts show the status of existing water supply sources.

Dams in Western Ghats

More dams are planned- Maharashtra Water Regulatory Authority act. Strange exclusion in the EIA Notification 2006, Dams for Drinking Water and Industrial Water supply are excluded from any Environmental Clearance processes like Environment Impact Assessment, Public Hearing or Environment Management Plan. Hectares of Prime Western Ghats Forest are being destroyed, even without a study of the species diversity, No Impact Assessment study. Region falls in ESZ I (Eco Sensitive Zone) where large dams should not be allowed. Individual and cumulative impact study of this very

Water supply & demand	l from (1996 -	2030)
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Basin	Availab	Demand for									
	le water	Domestic	Agriculture		Industry		Others (hydro		Total use		
				(Irrigation + livestock)				+ thermal power)			
		1996	2030	1996	2030	1996	2030	1996	2030	1996	2030
Godavri	38882	874	2066	16653	40384	192	678	250	318	17969	43446
Tapi	9324	350	731	4126	10562	35	766	20.20	175	4531	12234
Narmada	343	3.50	6.46	29.40	245.20	0	0	0	0	32.90	251
Krishna	18356	603	1428	9471	27438	138	415	3112	3112	13324	32393
WFRK	72322	938	1952	1811	12030	877	1395	0.90	2.90	3626	15380
Maharas htra	139227	2768	6184	32091	90660	1241	3254	3394	3617	39484	103705

high density of dams in ecologically rich and socially vulnerable area is still not done. Forest Rights Act is routinely violated by officials- Settlement of community and individual forest rights not completed. Archaeological departments no clearance sought before project begin- Kondhane dam on Ulhas River. 216 hectares of forest include Kondhane Caves, a Nationally Protected Monuments of Archaeological Survey of India



Closeness of Dams in same site Decisions comes in the backdrop of massive projects

National Board for Wildlife (NBWL)-approvals given under Section 2 of Forest (Conservation) Act, 1980 for diversion of forest land required. State cabinet scrapped River regulatory Zone (RRZ) policy (20/1/2015)- as an industryfriendly measure. Rampant pollution cannot be prevented as Maharashtra Pollution Control Board (MPCB) show pollution by industry only 20%- "Make in Maharashtra campaign". Forest (Conservation) Act (FCA) is violated - giving Forest Clearance (FC) by Forest Advisory Committee (FAC) under MoEF without proper assessment and records. MOEF just take undertaking to show adherence to norms, before giving clearance even in biodiversity hotspots. National Green tribunal- MPCB take action against industries along river which discharge effluent beyond admissible limits, only after NGT order.

Genuine Environmental and Social Impact Assessment prior to the construction of a dam rarely happen. Mumri Dam

is given approval which will submerge hectares of land, including dense forests destroying thousands of trees, displacing 34 hamlets fully or partially and affecting a population close to 175. (Sarangpuri, Khaire, Kotare and Aukar pada) Kalu dam cleared by FAC in April, 2013- will submerge 11 villages, 2,100 hectares land, 1.5 lakh trees will be felled, displacing 62 hamlets affecting population close to 20,000, 28 shrines and temples, including the ancient Hatkeshwar temple believed to be built by the exiled Pandavas in Chasole village. Although Konkan Irrigation Development Corporation (KIDC) while seeking Stage-I FC in 2010-11 for Shai dam from MOEF which is less than 25 km from proposed Kalu dam, assured that no new water source will be required till 2031. Pinjal Dam will submerge 2100 hectares of forest land in 11 villages in Western Ghats. will be submerging 11 villages in Jawhar and Mokhada talukas in Thane district, predominantly a tribal region. Gargai Dam will submerge 6 villages and 750 hectares of Tansa Sanctuary. Tansa Sanctuary is already scarred by many developments, including the Middle Vaitarna Dam.

Dam projects approved without:

- Need-based study
- Impact (Cumulative) assessment-drinking water and effect on flora fauna
- Technical clearance
- Gram Sabha resolutions- passed supporting the project
- Options assessment about water supply- options to Mumbai/Suburban



The general effects can be summarized as:

- Reduction of morphometry and hydrography of river
- Loss of biodiversity and aqua cultural potential
- Poor water quality and loss of recreational potential
- Breeding of vectors and spread of water borne, related and carried diseases

Recommendations/Remedial Measures:

- Introduce a management action plan creating awareness among the local gram panchayat,
- Maintain morphometry and hydrography by establishing conservation committees
- Demarcations of boundaries and garland roads necessary to prevent encroachment
- Take measures for aforestation of catchment and development of greenery in the peripheral zones of the river body.
- Prevent solid waste dumping, vehicles and washing of clothes on river bank
- Proper management of recreation activities and introduction of boating facility

• Maintenance of river by making budgetary provision by regulatory authorities

Promoting alternatives for water supply

The kind of destruction that authorities are inviting through advocacy for more and more such unjustifiable dams to satisfy water supply to Mumbai and surrounding urban areas is unimaginable. The way unaccountable way they are destroying the natural resources, is disastrous for all. The approval for Mumri dam without furnishing Rehabilitation Plan, Environment Impact Assessment report, Technical Report on Wildlife Status, Gram Sabha resolutions and compliance of Forest Rights Act, is unjustified. There is necessity to curb the irresponsible initiatives and encourage involvement of NGO's, local public, BMC officials and others in mass awareness programmes for conservation purpose. Instead of strategizing new dams as alternative to satisfy increasing demand of water supply in city, Government Resolution of Rain Water Harvesting must be effective implemented and monitored regularly.

A study conducted to check efficacy of RWH policy implementation in various areas under jurisdiction of Mumbai Municipal Corporations revealed poor or no measures to for implementation of RWH policy. Despite of non-compliance new building constructions are issued completion certify in violation of norms.

Sustainable Remedy

The water supply to the Mumbai city is through Vihar, Tulsi, Tansa, Modak Sagar, Upper Vaitarna and Bhatsa water sources. According to Brihan Mumbai Municipal Corporation, the city's demand is 4,200 million liters water daily (MLD) but the BMC supplies 3,400 MLD. There is a shortfall of 800 MLD for the city's 13 million people and the population is projected to grow to 16 million by 2021. Hence for future needs water sources have to be identified.

- Mumbai city average rainfall is 2,146.6 mm, & 2,457 mm in the suburbs, and has the potential to harvest 2394.52 MLD of water during monsoon seasons; unfortunately there is least efforts by authorities to explore alternative sources.
- There is need to set river management system and establish monitoring mechanisms for effective policy implementation
- Imperatives drawn by NITI Aayog must be based on potential impact assessment strategy

Mitigation measure:

By the year 2025 two thirds of the world population will live under severe water stress conditions as determined by studies of the World Meteorological Organization (WMO) and India is at its absolute water limits (Bryson., 1989). Therefore;

- Intelligent Utilization of the available Water Resources
- Rainwater Harvesting

New source of artificial water use must be minimized:

- Artificial Rain Making i.e. Cloud seeding- is actually a very complex process. In the simplest terms, it introduces other particles (CCN's) into a cloud to serve as cloud condensation nuclei and aid in the formation of precipitation.
- Weather modification technology-Silver Iodide ground generators release microscopic particles in or below cloud

base which act as a nucleus to form ice crystals to form precipitate development.

Overview of few Acts to adopt mitigation measures for social assessment

• Panchayat Extension to Scheduled Areas Act 1996:

PESA mandates that Gram Sabha consent is a mandatory pre-requisite for any project being considered in scheduled region. In addition, PESA lays stress on local self-governance of tribal regions by tribals.

• Forest Rights of Tribals as per the Forest Rights Act 2006:

Lives of the tribals in this region are inextricably linked with their forests. Their community and individual Forest Rights on their forests have to be recorded or settled.

 Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (2013), section 42 (i) says: "As far as possible no land acquisition shall be made in scheduled areas". It also says: Section 42 (3) prior informed consent of gram sabhas is mandatory in Schedule 5 regions.

In violation of fulfilment of above norms no dam project should be considered from the region, that will affect tribes and their livelihood. Rampant construction work on river beds, creeks, tributaries and estuaries needs to be immediately stalled to work towards maintaining ecological integrity (physical structure, water quality and biodiversity).

- Imperative to set up:
- Centralized river monitoring authority.
- State Government must set up a river management authority as there is no centralized authority.

Chapter V

Vaitarna River at Wada Taluka in Palghar District (MS)

Introduction

Constructing barriers on rivers is causing irreparable damage to the ecosystem is being felt by developed countries. Europe is demolishing its dam to restore ecosystems was reported recently in Nature article (May 2018). Dams were built with little regard for the impacts they might have on ecosystems, says Carlos Garcia de Leaniz, an ecologist at Swansea University, UK, in the same report. Similarly, in India Prof. Madahav Gadgil report on Western Ghats Ecology popularly known as Gadgil Committee report -Facts and concerns of March 2013 and Dr K. Kasturirangan high level working group of MoEF in 2013 report with regards to the preservation of ecology, environmental integrity and holistic development of the Western Ghats has already mentioned about the unprecedented threats to natural landscape of western Ghats region by developmental projects and urban growth. Their recommendation to non-tolerance policy with respect to highly interventionist and environmentally damaging activities and about assessment before clearance within Ecologically Sensitive Area (ESA) is very well documented. The reports have at the same time suggested creating an enabling process to incentivize environmentally sound development that benefits local livelihoods and economies. It is important for planners and policymakers to understand the scale of issues caused by

river fragmentation. In Maharashtra most of the dams continue to be constructed without proper social and environmental assessment and ignoring the long term impact.

Hence from this point of view Vaitarna river condition in Wada at Palghar district in Maharashtra and proposed dam constructions are discussed in this chapter. This is also essential, in cognizance with previous chapter where it is described how biodiversity and people are affected by Bhatsa dam construction in the same region. And above all another Mumri dam construction is given approval very close to Bhatsa Dam.

For water scarcity of Mumbai city around five years back Brihanmumbai Municipal Corporation (BMC) had proposed constructing a dam on Vaitarna River in Palghar district's Wada area (Gargai project) and another on Pinjal River at Jawar area of the same district (Pinjal project). After repeated attempts to start work on the project failed, the civic body finally scheduled it for 2018. In 2016 December, the civic body had appointed a consultant - WAPCOS limited, an enterprise of the ministry of water resource - for preparing a detailed project report (DRP) of the Gargai project within 18 months. The civic body is spending around Rs 4.64 crore on the consultant. After completion the Gargai dam would provide an additional 440 million litres of water daily and Pinjal 865 million litres on a daily basis to the city. Currently the BMC provides 3,780 million litres of water daily against the demand of 4,300 million litres. Thus, BMC have rehabilitation plans for more than 1,000 tribal families to pave way for these projects and would spend a total of Rs 300 crore for the purpose. A proposal of rehabilitation plan for the project-affected people is

before the collector. According to the plan, 191 families of six villages would be affected by the Gargai project and 865 families of 11 villages would have to be shifted for the Pinjal project. Rs 54cr for rehabilitating villagers affected by the Gargai project and Rs 246cr for rehabilitating villagers affected by the Pinjal project is proposed. The dams will submerge surrounding areas, including 750 hectares of the Tansa Wildlife Sanctuary. A biodiversity report by BNHS is obtained and proposal is sent to MoEF for approval of dam construction.

Present situation is that there are companies set up on the bank of Vaitarna river flowing through Wada village as seen in the picture below and river is almost dried in several patches.



Pollution of Vaitarna river stream by release of effluents in the river

Fisheries status in Vaitarna River at Wada in Palghar district

India has a rich biological background that show it is one of the nation with mega diversity of the world. There are 1000 of Small & big rivers in India. Rivers are place of freshwater and are dynamic in environmental conditions. Rivers are areas of physical and biological transition between the lands. Importance of rivers is well understood in many parts of the world as breeding and nursery grounds for a wide variety of fishes. The mangrove ecosystem of river in India act as a nursery ground for a variety of shrimps, crabs and finfishes. River environments are among the most productive on earth creating more organic matter each year than comparably sized areas of forest, grasslands or agricultural land and have important commercial value with providing economic benefits for fisheries, tourism and recreational activities.



Water body at Khadipar that is reducing its aquatic system

Fishes form one of the most important groups of vertebrates influencing life in various ways. Fish plays an important role as it is not only useful for food but also used in recreation and biological control. The Thane district (now divided into two districts; Thane and Palghar) alone shares about 23.6% of the total fish landing from Maharashtra. Today rivers are heavily exploited and are among the most threatened ecosystems. Hence it is necessary to carefully asses the diversity status in these ecosystems. Study of biodiversity has

become very essential for scientific data banking as unexpected abrupt climatic changes occurring regularly. This is mainly due to unchecked anthropogenic activities happening in the name of development. Riverine fishery is livelihood of many and also fish diversity of any region has great significance in environmental assessment of that region. A study was carried out to assess the fish diversity in Vaitarna River flowing in Wada Taluka region of Palghar district in Maharashtra. River water analysis of six villages and its fish diversity was accounted in context to the developments in the area such as industries, warehouses, etc.

The finding of the study revealed that the quality of the river water is affected due to establishment of industries on the river bank and least attention of the authorities and nonadherence of the policies by the industries to compulsorily treat effluents. The fish fauna study unfolded the depleting conditions, as the survey conducted in the fish market and among fishermen community revealed disappearance of many species and deteriorating quality of existing species. Only four species were identified and among this Actinopterygii was a major class of fish observed. Overall study revealed that Fish diversity along this region was less in comparison to previous years. Due to reduction in overall catch of fish from the rivulets, as most of the patches is dried, the social assessment study conducted in the region revealed that most of the fishermen community has switched to other occupations for their livelihood. Most of them now work in agriculture fields. And another prominent observation was that due to unavailability of fish, as rearing grounds are affected, fish consumption is reduced in the region. As there is not much

study reported of Wada region with regards to fishery status, hence comparison with previous reports could not be done. Possibly the reduction in fishes as stated by the fisher folks during informal interactions, it may be mainly due to the hindrance in smooth flow of river which is caused due the unplanned improper constructions for development. As also reported in Nature article (2018) recently in context to decommissioning of dams in Europe, "Dams alter the natural characteristics of a river system," says Jeroen van Herk, a project manager with Dam Removal Europe, a group that promotes river restoration in the continent. "Long stretches of rivers, which once flowed freely from source to outlet, become a series of pools, hindering migrating fish from reaching spawning grounds in the upper reaches."Therefore, from this conclusion it is suggested that instead of Gargai and Pinjal Dam constructions on Vaitarna River, at several spots check dams (bandhara) shall be constructed in various stretches for recharging and revival of the river ecosystem. This shall also improve the lifestyle and livelihood of the local fishermen and economy as well of the Wada taluka. And for Mumbai city water supply, as an alternative Rain Water Harvesting and reuse and recycling of domestic water shall be encouraged and ensured by the BMC.

Study of this nature must be encouraged as it is important for restoration of water bodies and revival of fish diversity and improving livelihood of poor fisherman community in the rural region.

Chapter VI

Kamvari River and Other Water Bodies in Bhiwandi, Thane District: City of Textile-Looms and Dying Units

Introduction

Water is the most prime factor for sustenance of life. It exists in different forms such as rainfall, river water, ground water, ponds and lakes etc. Water-bodies play important role in the maintaining the ecological balance of the aquatic system while providing benefits like natural resources, ground water, fisheries, migratory birds, habitat etc.Bhiwandi is a city in the Thane district of Maharashtra state in Konkan division, located 20 km to the north-east of Mumbai and 15 km to the north-east of Thane city.



Bhiwandi city's total population was about half a million in 2001. The bulk of the population forms the

workforce for a number of textile and other industry. This city is known for its textile industry. It has the largest number of Power looms in the country and is dubbed as 'The Manchester of India'. Bhiwandi is well connected to all parts of India through railways, roadways, airways.NH3 highway passes through the city of Bhiwandi which makes seamless connectivity to each corner of India. Bhiwandi is well connected through the neighbouring city's Mumbai, Thane, Navi Mumbai, Kalyan and all other parts of Maharashtra. The bulk of the population forms the workforce for a number of textile and other industry. Anthropogenic and unplanned developmental activities have severely affected the ecosystems and sustainability of almost all water-bodies here. Due to severe pollution by effluents and solid waste dumped in water bodies directly that the number of water bodies, there surface area and water quality has declined. Physico-chemical and biological observation done across the city have shown deteriorating conditions.

Lakes are getting dried and polluted due to anthropogenic activities. The ecological biodiversity is also affected in this area. The only river which flows through the city is Kamvari River. This river was once upon a time port area and was instrumental for transport of commercial goods, is now converted into nallah. Due to effluents being directly released into the Kamvari from the power looms and dyeing units, the Physico- chemical parameters of this water body is lowered extensively. The pH is one of the important factors that serve as an index for pollution, and disposal of industrial water and domestic sewage has severely affected pH. A local researcher, Dr. Amte, has reported in a study conducted with power-loom effluent pollution of water body with Biochemical Oxygen Demand (BOD) of effluent as 158.00 mg/l to 226.00 mg/l, Chemical Oxygen Demand (COD) in the range of 548.00 mg/l to 816.00 mg/l and Total Suspended Solids (TSS) were maximum 192.00 mg/l and minimum 128.00 mg/l. Oil and Grease in effluent was 2.1 mg/l to 4.9 mg/l. Further the study reported that probability is that about 60% of water bodies have declined between the years 1990- 2017.



Water cleaning and conservation awareness campaign organized



Kamvari river is mainly affected by the improper drainage system across the city. Also pollution due to direct release of blood from slaughter house and effluents from textile and dyeing industry is affected heavily affected the river ecosystem. Unplanned development, illegal constructions of warehouses and looms and dyeing units have added to the complexities to the conditions of pollution. Dyeing units and power-looms without having any toilets and treatment plants, continue to pollute the ground water too. Unlawful constructions of the dyeing units on the bank of river violating the norms of distance to be maintained from the river, has affected the Bhiwandi city beyond repair. Major hindrance to resolve the river restoration is that the stretch of the river is partly in Mumbai Metropolitan Region Development Authority (MMRDA), Gram Panchayat, Zilla Parishad and some part in Bhiwandi Nizampur City Municipal Corporation (BNCMC). Maharashtra Pollution Control Board (MPCB), Kalyan which needs to conduct proper monitoring and reporting of the treatment plants to curb the damage, is ineffective. Due to construction debris, industry waste, washing vehicles



(Trucks, Tankers, Rickshaw, bikes, etc), washing clothes and domestic solid wastes being directly dumped in the Kamvari and silt flowing from the upstream, the river has almost dried completely. Only during high intensity rainfall that water is seen in the river.



To keep flowing Kamvari with its natural course desilting is urgently needed. Another typical issue is of the ground water increase which can be seen in the region but it is due to the brackish water percolation. Kamvari meets with the ocean at the Thane creek (khaadi). As Kamvari is all the time dry and loaded with silt and most of the places with illegal constructions that the ground water recharge is almost nil during the rainy season. The ground water reading shows more than 3000 TDS at many places. Water is unsafe for drinking or bathing. The recent Kerala like floods situation may arise anytime if the corrective measures are not taken timely.

Author being Jalnayak attempts are being made to mobilize public for the restoration purpose by conducting awareness programmes, survey studies for water analysis and approaching authorities for timely action. Initiatives are being taken for involvement of local civic bodies, people of the city, NGO's and the educational institutes to conserve, restore and rejuvenate these water bodies for the ecological balance of the Bhiwandi city.

Following measures are recommended for rejuvenation of Kamvari River, lakes and other water bodies:

- Public mobilization- Water literacy and awareness programmes for Schools colleges, housing societies, villages and corporators in the area.
- BNCMC needs to ensure installation of Rain water harvesting units in schools colleges, hospitals, industries by providing expert help and monitoring of old units (if any) for effective working.
- BNCMC to install full capacity sewage treatment plants (STP) and solid waste treatment plants
- BNCMC to ensure health sanitation maintenance in the area of jurisdictions.
- BNCMC gardening department to do tree plantations on the river banks and on other water bodies for maintaining cleanliness.
- All respective authorities to display boards for awareness and penalty for violation of norms.
- MPCB to ensure functional effluent treatment plants and take strict action against defaulters.
- BNCMC and MMRDA to ensure illegal constructions of dyeing units and other structures on river bank to be demolished.

- Thane Collector office to ensure the cleaning and maintenance of Kamvari river by providing resources available.
- Thane collector Hydrogeology department and agriculture department to ensure supply of related information and expertise.
- Regular monitoring by respective authorities for restoration of polluted water bodies, recharging ground water and revival of Kamvari.
- Regular awareness programmes for local public for sensitization.
- To ensure installation of water treatment & recycling plants in textile dyeing units, power looms.
- Proper water management system for conservation & water supply from Vaitarna, Tansa, and Ulhas rivers.
- Encourage people involvement and various Government/Public agencies for co- ordinated efforts for rejuvenation, restoration of the water bodies.
- Create buffer zone & sewage treatment mechanism.
- Involve school & colleges, research institutes and community to create scientific database/ repository.
- Water supply and Health and sanitation department departments of BNCMC needs to be proactive.

Chapter VII

Declaration Drafted by Jalbiradari in Search of river Survival Solutions: Policy Guidelines Initiative

Several workshops, trainings, conferences, Water Literacy Yatras were conducted from Kanyakumari to Kashmir and from Goa to Guwahati (Assam) by Jalbiradari members. Based on the recommendations, conclusions and declarations, it is suggested that NITI Aayog, Parliament and State assemblies should deliberate on the provisions contained in the following declaration.

Summary of the proceedings is given below to evolve the river basin rejuvenation plans:

1. Importance of Water

Water is the most important issue drawing the attention of governments and the public in the World today. Historically, 4500 years back, the first war over water was between the public of Lagash and Ulma towns on the banks of river Tigris in Iraq. As per United Nations, 180 disputes are reported from 1950 till now at International levels. Many experts have voiced their opinion saying that, the next World War will be on the issue of water. Today, in India, a war is raging at the inter-state and district levels on the issue of water. Hence water has become the most important issue of the Indian States, Districts, Taluka and villages as well.

2. Water Disputes

With the raising of public opinion on sharing of Mahadayi/ Mandovi, Cauvery and Yettinahole water between coastal and upland regions, river restoration is emerging as an important approach for addressing water resources issues across the Maharashtra, Goa, Karnataka, Telangana, Andhra Pradesh, Tamil Nadu and Kerala which are now considered as part of the peninsular ecosystem. The thrust should be, to improve the relationship between rivers and human beings within the larger frame work of biodiversity and human environment.

3. Hydrological cycle

Certain amount of precipitated rain water on Sahyadri hill range flows along the coastal region directly into the sea through porous rocks and fractured hard rocks and sediments. This component is designated as Submarine Groundwater Discharge (SGWD).Attempts at quantifying the extent of this SGWD loss, in the western and the eastern coasts of India have not so far been successfully established.

4. River Forums

It is emphasized that the approach to water resources management in the River basin should consider "catchment reservoir- command area-continuum" and suggested to form a River Forum (Parliaments) to take up Resource Mapping

5. Finance

Rural development funds should be allotted with a clear picture to develop natural resources of water, mineral and forests demarcating micro basins on village scale maps with 5(m) interval contours to demarcate contour bunds superposed by high resolution satellite imagery (Quick Bird satellite data on 0.6 m resolution). Officers of the Department of Mines and Geology & Central Ground Water Board in co-ordination with minor irrigation engineer, Pollution Control Board, Forest and Agriculture officers in each state should prepare maps on war footing enlisting the services of undergraduate and graduate students of colleges situated within the sub-basin and micro basins. This will also be a part of water literacy program. Committee headed by CEO ZP with local MLA, Parliament members and Panchayat Board members of the River Basin should meet two times in a year before the rainy season (June) and after January to review the work done in the Basin, subbasin and micro basins with the help of subjects experts of Geomorphology, Irrigation, Hydrology, Agriculture and Environment, nominated from Earth Science associations connected with these basins.

6. Institutions

Water is now controlled by different departments e.g., major irrigation, minor irrigation, major tanks, minor tanks, ground water; watershed development, Forest Department, Urban Water Supply, Corporate Water Supply, Rural Water Supply, etc. Funds distributed in different departments will not solve the problems of time bound progress and optimum utilization of funds. There is an urgent need to approach the problem taking "catchment-reservoir command areacontinuum" at each of the hydro-geomorphological unit and entrust responsibilities to appropriate institutions and make them accountable to one agency like Zilla Panchayat to be reviewed periodically at regular intervals by a Committee headed by In-charge District Minister and Secretary to Government at State level. It is suggested to take up natural resource management by an institute with emphasis on water in a River basin and allot funds from different sources at one outlet for decentralized development of sub-basins, macro and micro basins management. Management of water resources in these areas shall be participative with necessary legal and institutional changes with an ultimate goal to transfer operation, maintenance, management and collection of water charges and royalty on other resources by user groups at village level.

River basin as a whole should be taken up for basin management and mapped on scale 1:250,000 based on topographic maps and satellite images. Sub-basins, tributaries of river should be mapped on 1:50,000 scale showing cropping patterns, forest areas, solar and wind power areas, different soil and mineral zones. Macro basin of tributaries should be further broken up and mapped on scale 1:25,000. Further 1st, 2nd and 3rd order streams of micro-basins should be mapped on cadastral scale 1:8000 with survey numbers to demarcate aquifers, cropping pattern and rural drinking water supply schemes. These maps should be overlaid on Cartosat images to prepare action plan.

7. Aquifer Management

An accurate and comprehensive picture of surface and ground water in River basin through aquifer mapping in different hydro-geological settings will enable preparation and implementation of surface and ground water plans at the appropriate scale to be devised and implemented for this common pool Water resource management. This, in turn, will help in achieving drinking water security, improved irrigation facility and sustainability in water resources utilization in large parts of River basin. It will also result in better management of ground water in vulnerable areas. Keeping in view the existing and future challenges in surface and ground water relationship in River basin, Aquifer-Management has to be implemented jointly by the Central Ground Water Board, and State Ground Water boards, under scheme on 'Ground Water Management and Regulation' during XII plan period. The major objectives should be to

- i. Delineation of aquifer disposition in 3-dimension along with their characterization on 1:50,000 scale in identified priority areas in River basin.
- ii. Quantification of surface and ground water availability and assessment of its quality to formulate Aquifer Management Plans.
- iii. Facilitating sustainable management of rainwater ground water resources at appropriate scales through participatory approach with active involvement of stake holders.

8. Community Management

Water security in River basin calls for community based decentralized solutions to planning, rejuvenation, conservation and management of River water resources, whether it is on a river basin management framework or revival of water bodies and aquifers. Agricultural sustainability in River basin commands ecological agriculture as an important resilience tool for climate adaptation and mitigation, based on local community's wisdom, traditional knowledge and bottom up solutions. Increased public investment is urgently called for, with convergence among the state, civil society, communities and private sector institutions at the policy and implementation levels. Environment and Ecological Sustainability of water, air, soil, land, forest and all natural resources are critically interwoven with life in River basin and calls for urgent public awareness and joint action of all stake holders to ensure environmental and ecological sustainability.

9. Water Resources of Sahyadri Hill Range

Based on the drainage pattern of east and west flowing rivers originating in Sahyadri hill range, a detailed study has to be undertaken, to estimate the total quantity of surface and ground water that can be economically harnessed without disturbing the ecology of Western Ghats. As per one estimate, there is a precipitation of 2.99 bcm per km2 in western drainage in 13% of the geographic area of Peninsular India as compared to 0.88 bcm precipitation per km2 in 87% of geographic area of eastern drainage of Peninsular India. Out of the total annual water resources of 2.99 bcm in western drainage, how much is discharged by surface flow and how much escapes by underground flow into Arabian Sea is not yet correctly understood / estimated. There are many rivers on Sahyadri hill range, such as Kali, Bedthi, Agnashini, Sharavathi which were originally flowing east and have been diverted to west by head ward erosion which carry excess water and fertile silt into Arabian sea, with the total planning of entire Sahyadri river system, the Peninsular India can be converted to a prosperous water blessed region. Science cannot set policy, nor can policy do without science. The atmosphere, the surface water, soil moisture and groundwater are the four interlinked components that dynamically interact from time scale of days to thousands of years. Balanced erosion and nutrient cycle are vital for survival of life and depends on adapting to hydrological cycle at times of

unprecedented demographic change, concentration of population in cities and appropriate use of surface and groundwater.

10. Special Publications

The special publications on Rivers covering geological origin of rivers and evolutions, palaeo lakes, land use and land cover changes, cropping pattern, conflicts in river basins with estimated resource assessment of wind, solar, mineral resources and optimum utilization of Sahyadri Water Resources with emphasis on environment will generate mass awareness. Hopefully this type of study in selected basins will serve to solve the disputes in Cauvery (Karnataka and Tamil Nadu) Mahadayi (Karnataka and Goa) Mahanadi (Jharkhand and Orissa) Yettinahole (within Karnataka State) Bhima (Karnataka and Maharashtra) as a model for all other river basins, sub basins, micro basins for all rivers of India.

Chapter VIII

About World Social Forum & World Water Forum: A Report of Participation

The Indian delegations comprised of Magsaysay and Stockholm water prize winner Dr. Rajendra Singh ji, Maulik Sisodia, Director, Tarun Bharat Sangh, Rajasthan, Dr. Snehal Donde, Principal Oswal College, University of Mumbai, Mr Kishor Dharia, Hirwal foundation, Mr Sudhir Rathod, OSD Forest and Finance Ministry Govt of Maharashtra; Shri Narendra Chugh, Jal Biradari, Pune; Shri Ankit Lohiya, Manvlok Foundation and Mr Sudarshan Das, Mahanadhi Bachao Andolan, Odisha participated in World Social Forum (WSF) and World Water Forum (WWF) from 13th to 23rd March, 2018. The objective of participation in WSF was to understand about human rights issues and attendance in WWF was to find solution to several issues related to rivers in recent time. World Water Council (WWC) & WSF areinternational forum which provides a platform to debate and discuss for sustainable solution.



Indian Group of Delegation in World Water Forum at Brazi

About World Social Forum (WSF)

The World Social Forum (WSF), the biggest platform of civil society across the world had started its international submit at Salvador Bahia, Brazil from 13th to 17th March, 2018. WSF believes that, "the systems that rule the world have not worked for the people and the people and the planet and hence there is need of every one to join in the construction of another world" WSF has a glorious history of one and half decade in uniting the like-minded people and organizations across the world on the above concept.

While attending the 4th WSF at Mumbai in 2004, Nelson Mandela stated, "We owe a huge dept. to future generation in the form of better world. That world is definitely possible. Through efforts like the one engaged in now, this world will be a reality". This statement of Mr Mandela made the world sit and take note of the WSF. The last WSF held at Montreal, Canada was attended by 15 thousand people from 125 countries. The WSF at Salvador was represented by all most all continents and deliberated upon many subjects to find solutions to the problem of present time. The 5 days long WSF was held at Bahia Central Universities, Salvador. There were many thematic groups which discussed about many problems that the humanity is facing today. Many leaders of Latin American Countries including Lula, former President of Brazil attended this. Indian delegation led by Rajendra Singh, waterman attended the WSF and actively participated in the sessions.



Pic: Welcome in Brazilian traditional way at World Social Council





Jalbiradari participating in deliberations during World Social Forum at Sarvador

About World Water Forum

The WWC is an international multi-Stakeholder platform organization whose mission is to on critical water issues at all levels; mobilize action including the highest decision- making level, by engaging people in debate challenging and conventional thinking. The Council focuses on the political dimensions of water security, adaptation and sustainability. Through collaborative efforts, members commit to advancing the water agenda. Their skills, experience and involvement help solve the complex water-related challenges found all over the world. Members help build the Council's strategy and shape its programs by taking an active part in its various working bodies. Urbanisation Water is cross cutting theme that realities to all aspect of development, from health to education, gender equality to employment, water, management, urbanisation is one of the 21st century's most transforming trends. Cites are the dominant force in economic growth development and prosperity in both developed and developing countries. Water management is one of the biggest tasks within a city and getting its right for cities and their inhabitant for survival and pride. Water management falls under the responsibilities of local and regional governments the action of local and regional governments the action of local and regional authority are key ensuring that all have necessary access to the basic services and rights owed to public. .in particular the provisions of basic services, represents a huge portion of municipal budgeting and programmer this empower local government s to confidently take more actively role in managing water related issues necessary for positive urban transformation. The growing urban population not only increase demands but also put growing infrastructure and service provisions and create more pollution. In adequate urban planning particularly when coupled with the mounting unpredictability of changing climate possess challenge and

human conflict, mean that getting water right will be decisive factor for the future of the people and the planet. Water scarcity and climate change possess challenge of providing excess to safe drinking water and sanitation. For good water management there are several challenges related to resources such as financial, human and natural, including political scenario, Many local authorities struggle to maintain improved water services due to political instabilityuncleared jurisdictional aging infrastructure competing demand on resources. Only when problems are magnified these challenges exert growing pressure resulting in intensified in equality unsustainable resources used and deterioration of environment.

The world water forum is the foremost platform for the coordination of global efforts ion water related issues. And has lead the way in enabling the dialogue between authorities and general people to guide on existing commitments and respond

to greater clarity and on what global frame works mean in terms of water managements which can support for sustainable development World Water Forum started at 8 am (after two

hours from now in ISD) on 17th March. The WWF is the biggest water related event of the world. As we know, this century in which all of us are born/living, is going to face the acute water related crisis that humankind never faced before. Water is going to be the most precious wealth of the earth and to possess it, there will be ugly competitions which will lead to war like situation in different parts of the globe. The place

where this water congress was organized is having biggest water aquifer of the world under its soil but is facing the water crisis and water is not free of cost. A glass of water cost here more than 100 rupees. The water wealth is captured by the big

corporate houses and this free good which is the gift of nature is so much commercialized which Indians can't believe. All by now know about situation of Cape Town in South Africa where zero Day was declared from 22nd April, 2018. Zero Day means the local Govt of Cape town is helpless in supplying water from that day. Just imagine the situation pertaining to the crisis of water in the present world. In the places around us in India, water crisis has become so acute and we all need to come forward to protect this precious commodity for our future generation. We who are born and lived in the last century has been responsible for such situation for which the young generation of this century is going to pay the price. It's the time, that all of us should come forward, rise, awake and act to protect and conserve this natural gift for the future. I think nothing could be more important than this for all of us to act and act fast, before we realize the crisis of such acute in nature. So attending proceedings of the WWF was worth.



Jalbiradari Team with participants from across the globe



At World Water Forum discussing MoU's



Pictures of preparations for Water peace march



Resolution of the Indian delegations

Resolution of the Indian delegations under the leadership of Waterman Dr, Rajendra Singh at the World Social Forum 2018 in Salvador Bahia, Brazil on 17th March 2018. On the concluding day of the World Social Forum, held between March 13 and 17, 2018 in Salvador Bahia, Brazil the 9- member Indian delegation called upon the global social community to set up a world River forum with immediate effect. In a resolution, the Indian delegation stated that the world river forum will further strengthen the world Social Forum by making it efficient and more capable as it will lead to a comprehensive dialogue process within the civil society for better understanding of river related issues. The resolution further stated that trans- boundary river conflicts and forced migration are posing great threat to world peace and it is high time for the civil society to get involved in mitigating a crisis.

We live in the two worlds for sure. The one belongs to few, who own the natural resources of this earth and in another one live millions and millions who do not have access to the resources of the earth. This naked truth is seen today at Brasilia where the World Water Forum is taking place. The event around water here exposes the character of two worlds. In one, at WWF, events are organized in a huge way with eye catching arrangements, sophisticated logistics in place and in another, the alternative water forum, events are organized in a low key with humble arrangements, modest logistics and simple proceedings. This is obvious as the first one was organized by those who own the water resources or are doing huge business out to it and the later one was organized by those who do not have access to it. With this reality in front of us, we need to seriously think about taking our positions on those two worlds pertaining to water. Whether we should be with those who owns the water wealth or with those who fight to ensure equitable access over it? We shall be prompted to be the side of millions who cry for water and protecting our rivers.

At World Water Forum, Brasilia there were thematic sessions, expo and Citizen's villages. In a topic for the discussion on, "Investment in water infrastructure" speaker from Harvard University presented how financial institution should come forward for investment in this sector which is booming now. This was confronted by many with opposition. The meeting of Indian Delegates at the end was quite fruitful in launching World River forum in the future to come.

"Every accomplishment starts with the decision to try".

Bibliography

- Berga, L. (2006). Dams and Reservoirs, Societies and Environment in the 21st Century. Proceedings of the International Symposium on Dams in the Societies of the 21st Century, 22nd International Congress on Large Dams (ICOLD). Barcelona, Spain: Taylor & Francis. ISBN 978-0415404235.
- Chakrabarti, Dilip K. (2001). "4 The Archaeology of West Bengal: The Bhagirathi Mouth and the Midnapur Coast". Archaeological Geography of the Ganga Plain: The Lower and the Middle Ganga. Permanent Black. ISBN 978-8178240169.
- Colombi, B., Stephen; Bradnock, Robert W. (2003).
 "Geopolitics, water and development in South Asia: cooperative development in the Ganges–Brahmaputra delta". The Geographical Journal. 169 (1): 43–64. doi:10.1111/1475-4959.t01-1-00002.
- Das, R.T. 2016. Assessment of channel bank susceptibility and bank stability of a braided reah of river ganga near Panchanandapur, Malda. Int. res. J. of Earth Sci.,4 (3). 11-23.

- Dhungel, Dwarika Nath; Pun, Santa B. (2009). The Nepal-India Water Relationship: Challenges.
 Springer. ISBN 978-1402084027. Retrieved 27 April 2011.
- Florsheim J.L., Moun J.F. and Chin, A. 2008. Bank erosion as a desirable attribute of rivers, Bioscience58 (6) 519 – 527.
- Gupta, A (2007). Large rivers: geomorphology and management. Wiley. ISBN 978- 0-470-84987-3. Retrieved 23 April 2011.
- Islam, R. M. (1987). "The Ganges Water Dispute: An Appraisal of a Third Party Settlement". Asian Survey. 27 (8): 918–934.
- Jain, S. K., Agarwal, Pushpendra K.; Singh, Vijay P. (2007). Hydrology and water resources of India. Springer. ISBN 978-1402051791.
- Khanna, D.R., Sarkar, P. Gautam, A and R. Bhutiani.
 2007. Fish scales as bio- indicator of water quality of River Ganga. Env. monitor. And Asssessment, 134 (1-3): 153 – 160.
- 11. Mondal, M, and Satpati, L.N. 2012. Morphodynamic setting and Nature of Bank erosion of the Ichamati

River in Swarupnagar and Baduria block. Indian Journal of Spatial Sience, 3(2): 35-43.

- Merriam-Webster (1997). Merriam-Webster's Geographical Dictionary. Merriam- Webster. p. 412. ISBN 978-0-87779-546-9. Retrieved 23 April 2011.
- Rice, E (2012), The Ganges River, Mitchell Lane Publishers, Incorporated, pp. 25– 30, ISBN 978-1-61228-368-5.
- 14. Rosgen, D. L. 1993. Stream classification, streambank erosion and fluvial interpretations for the Lamar River and main tributaries. Technical report for USDI Park service, Yellowstone National Park. 82.
- 15. http://spml.co.in/business/bootppp/waterprojects/waterp roject01.htm.
- https://weather-and-climate.com/average-monthly-Rainfall-Temperature- Sunshine,bhiwandi-maharashtrain,India.
- https://timesofindia.indiatimes.com/city/thane/alarming
 -drop-in-underground-water stock-thane-district levels-at-5-year-low/articleshow/61896672.cms.
- Ramachandra, T.V., Mahapatra, D.M., Samantray, S., Joshi, N.V. (2013). Biofuel from Urban Wastewater:

Scope and Challenges. Renewable and Sustainable Energy Reviews. 21:767-777.

- Mahapatra, D.M., Chanakya, H.N., Ramachandra, T.V. (2013). Treatment efficacy of Algae based sewage treatment plants. Environmental Monitoring and Assessment. 185:7145-7164.
- 20. Mahapatra, D.M, (2015). Algal bioprocess development for sustainable wastewater treatment and biofuel production, Ph.D Thesis, IISc, Bangalore, 2015.
- http://sandrp.in/Mumbai_Dams_Draft_Report_Dec_20
 13.pdf.
- 22. Report of the Working Group on Urban and Industrial Water Supply and Sanitation for the Twelfth Five-Year-Plan (2012-2017), Nov 2011, Planning Commission, http://planningcommission.nic.in/aboutus/committee/wr kgrp12/wr/wg_indu_sani.pd f.
- 23. Stott, R. and Smith, L. 2001. "River recovery Project, restoring rivers and streams through dam decommissioning and modification." Outdoor Recreation Council of BC, 48 pp.
- 24. http://paper.hindustantimes.com/epaper/viewer.aspx.25.

http://timesofindia.indiatimes.com/home/environment/d evelopmental-issues/Planned-for-urban-needs-12-damsto-hit-tribals- hard/articleshow/27548259.cms.

- 26. ABP: ttp://www.youtube.com/watch?v=WpGPcEpL9eI
- 27. Rishi Aggarwal & Janki Pandya, Why is there a drought of Rainwater Harvesting in Mumbai? Observer Research Foundation, March 2013.
- Indian express reported on Friday March 20 2018 indianexpress.com > India.
- 29. http://iasscore.in/ias-prelims/sedimentation-in-gangariver.
- home.iitk.ac.in/~rsinha/Publication/2014_Effective%20 discharge_Geomorphology. Pdf.
- 31. International Conference on 'Incessant Ganga' The Advent of a Holistic, Inclusive and Comprehensive, National River Rejuvenation Approach. Vinod Bodhankar, Jalbiradari, Pune (E: parvatara@gmail.com); and R. H. Sawkar, Geological Society of India, Bengaluru (E: sawkar35@gmail.com).
- Laxman Singh Apr 12, 2017, Gargai And Pinjal Dam Projects To Displace 1,000 Tribal Families https://www.mid-day.com/articles/mumbai-news-

gargai-and-pinjal- dam-projects-to-displace-1000tribal-families/18157176.

- 33. Europe is demolishing its dams to restore ecosystems. https://www.nature.com/articles/d41586-018-05182-1.Nature International Journal of science, Nature 557, 290-291 (2018).
- 34. D K Kasturirangan Chairman, Report of the high level working group on western ghats Vol I, Ministry of Environment and Forests Government of India, 15th April 2013.
- Dr V S Vijayan, Chairman Gadgil Committee Report -Facts and concerns – Salim Ali Foundation. Trichur.3rd March 2013.

