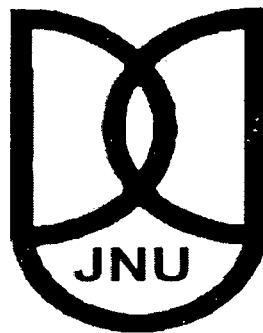


**Managing of Transboundary Water Resources: A Case Study of
Brahmaputra (Yarlung Tsangpo) River Basin**

*Dissertation submitted to Jawaharlal Nehru University in partial fulfilment of the
requirements for the award of the degree of*

Master of Philosophy

Dileep Kumar



Central Asian Studies Division

Centre for South, Central, Southeast Asian and Southwest Pacific Studies

School of International Studies

Jawaharlal Nehru University

New Delhi – 110067

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DECLARATION

I declare that the dissertation entitled “**Managing of Transboundary Water Resources: A Case Study of Brahmaputra (Yarlung Tsangpo) River Basin**” submitted by me for the award of the degree of **Master of Philosophy** of Jawaharlal Nehru University is my own work. The dissertation has not been submitted for any other degree of this University or any other University.

Dileep Kumar
Dileep Kumar

CERTIFICATE

We recommend that the dissertation be placed before the examiners for evaluation.

G.V.C. Naidu
 उपाध्यक्ष / Chairperson
Prof. G.V.C. Naidu
 (Chairperson, CSCSEASWPS)
 Centre for South, Central, South East Asian & South West Pacific Studies
 School of International Studies
 Jawaharlal Nehru University
 New Delhi - 110 067

Tsetan Namgyal
 29.7.13
 Centre for South, Central, South East Asian & South West Pacific Studies
Dr. Tsetan Namgyal
 (Supervisor)
 School of International Studies
 Jawaharlal Nehru University
 New Delhi - 110 067

Dedicated to
My Dearest Mother

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Chapter 1

Introduction

People generally need food, shelter, clothing, water supplies and good health for our lives and natural resources are an important component of it. They include mainly land, water, climatic, biological and mineral resources. Water resources are sources of water that are useful to humans. It is very much important for the existence of life. It is used in different aspects of our lives such as agricultural, industrial, household, recreational and environmental activities. Rivers Basin has been the focal point of people's activities as it provides fresh water. It has been crucial for developing of human civilizations and human settlement. It has developed such as Indus civilization and Nile civilization etc. As the population of the world is growing, it needs more water resources for their consumption.

In recent times many countries have conflict situations in sharing the transboundary water resources. "International water refers to a watercourse or a water body part of which are situated in different states (nations). There are about 261 major international river basins, covering 45 per cent of the land surface of the earth, excluding Antarctica. Altogether 145 nations include territory within the international river basins and 33 countries have more than 95 per cent of their total land is in such basins" (Tiwary 2006: 1684).

The most important thing about Tibetan water resources is a major issue among Asian countries. China controls over Tibetan water resources and uses it for her own utilization without consulting any of downstream states (India and Bangladesh). China has built the dam on the Brahmaputra river basin which has affected the livelihoods of humans and ecological. "The downstream countries suffer from water shortage if a dam is built by upper riparian countries to divert the flow to their benefit without having a proper sharing arrangement to meet various demands for drinking, agriculture, fisheries, navigation and environment. This kind of unilateral diversion without proper consultation, negotiation and sharing arrangements may lead to

a long term dispute and environmental hazard such as desertification” (Ahmad 2003: 180). Tibetan Transboundary water resources are a more important tactical resource in the Asian region for social and economic development. It has the prime importance for energy generation, human security, and environmental sustainability food productions.

In the present world scenario, China and India both are emerging powers. China is the second largest economic power behind United States America, while India goes ahead high economic growth rate. Both of the countries want to utilize Tibetan water resources for their national interest. In 1995 the World Bank vice president, Ismail Serageldin, warned: “many of the wars of this (twentieth) century were about oil, but the wars of the next century will be about water” (IDSA 2010: 2). Similarly UNESCO director-general Federico Mayor cautioned in 1998: “As (water) becomes increasingly rare, it becomes coveted, capable of unleashing conflicts. More than petrol and land, it is over water that the bitter conflict of the near future may be fought” (Chellaney 2011). “Fierce national competition over water resources has prompted fears that water issues contain the seeds of violent conflict. UN Secretary General Kofi Annan, on World Water Day 2002 says, “If the entire world’s people work together, a secure and sustainable water future can be ours” (UN Secretary General Kofi Annan, World Water Day 2002).

Water resources are very important to sustain life. People use the water resources for their own daily life activity. These are very much important for all development programs. Clean water is essential for human health, economic growth and a range of other critical uses from food production to navigation. Water is used in many sectors of human activity such as energy generate, agricultural production and increasing water fault due to driven human activities, especially in third world countries. Food production needs they must to irrigate the agriculture area for consistent food production in the twenty first century in order to meet the future challenges. In the current scenario, nearly 55% of all rice and wheat produced in the world come from irrigated areas and most people depends on an irrigated area for their food. Moreover, it is estimated that 80% of the extra food supplies is required to

Earth contains 366 quintillion gallons of water. Only .007% are potable. Today the world have 7 billion populations on the world share this precious resource. “1.2 billion Peoples have no access to clean water in this world. Asia’s per capita freshwater availability is less than half of the global average” (Chellaney, 2011). 151 gallons of water per day is consumed by the United States of American peoples whereas 66 gallons of water per day is consumed by European peoples but sub – Saharan African people consume only 5 gallons of water per day. The Chinese consumption of water per person is higher than India.

Human or states define the political and administrative boundaries. Transboundary River is defined by flow the at least two and more political boundaries within a nation and international boundary. The Brahmaputra River is Transboundary River originated in the Tibetan region. Transboundary water resources have been facing the management problem along with many countries. All people whose uses of water at all levels permanently locate themselves in straight opposition for their life sustaining and economic resource which create tensions in the sharing of water.

Tibetan Plateau

The world is well known about Tibet due to its different features and for its unique culture. Its fresh water glacier is shared by the whole of the south Asian countries and South East Asian countries. Tibet is an autonomous region of the People’s Republic of China. “The People’s Republic of China has divided into 23 provinces and five autonomous regions and four municipalities directly under the Central Government, and two special administrative regions. As one of the five autonomous regions, the Tibet Autonomous Region is established mainly by the Tibetan race. The Tibet Autonomous Region is located in the south-western border area of the People’s Republic of China, and the south-western part of the Qinghai-Tibet Plateau. Lying at 78°25'- 99°06'E and 26°44'- 36°32'N, it abuts the Xinjiang Uygur Autonomous Region in the north, Qinghai Province in the northeast, Sichuan Province in the east, and Yunnan Province in the southeast. It also has a 4,000 km border with the neighbouring

countries of Myanmar, India, Bhutan and Sikkim as well as Kashmir in the south and west” (Facts, July3, 2013, <http://www.china.org.cn/english/tibet>).

The people knew about Tibet plateau as a highest and largest plateau in the world. The Tibetan plateau is almost 2.5 million sq. km in size and it has high of sea level average 4000 meters. The call of the Tibetan plateau is the Roof of the World by most people and has been the subject matter of research for wide range of scholars. Some of them refer of the Tibetan plateau as ‘The Third Pole’ and ‘The Water Tower of Asia’. Hence, the name of Tibetan plateau’s can be named as an Asian fresh water hub, as it has the birthplace of many of Asian river and has a huge glacier which contains more than 46,000 glaciers covering an area of 105,000 sq. Km. It is the most glaciated region on earth after Arctic and Antarctica. Tibetan plateau established to the north by Kunlun Mountain to the south by the mighty Himalayas. In the West it has Pamir ranges and the Hindu Kush. In Many years ago, the plateau held the Hindu Kush Himalayan Ice Sheet which was measured as the largest ice mass outside the poles and is melting away. Tibetan plateau recognizes 34 such glacial lakes on the northern slopes of the Himalayas. South East Asia and South Asian countries’ mostly river began in the Tibetan plateau region to run in this region, Tibetan plateau has begun the largest river of the south eastern Asian countries to flow (<http://tew.org/archived/2010/climatechangereport.pdf> The impacts of climate change, May 15, 2013)

“The Chinese water resources ministry estimates that the Tibetan autonomous region has 448.2 billion cubic meters of water volume, the ministry further estimates that the Tibetan autonomous region has the possible generate 1,800 billion kWh of electricity making it second only to Sichuan province. China’s territorial location of Tibet, it is a significant matter the current and future water issues with India, which is lower riparian state” (IDSA, 2010, p 48).

Due to its varied features, the Tibetan plateau is a unique region in the world which is not prevalent elsewhere. “These snow peaks and glaciers facilitate Tibet to be the source of four major rivers that meets much of Asia’s water demand, for instance as much as 70% of the summer flow in the Ganges and 50- 60% of the flow in other major rivers and the Driчу (Yangtze River) river basin accounts for 40% of China’s freshwater resources, more than 70%

Major river basin of Tibetan plateau:

The Tibetan plateau is known as a water tower of Asia which is a place of many major Asian rivers and it is the life line of Asian populations. Fresh water of Asian people has taken from the Tibetan plateau. "Tibetan plateau originates ten most important rivers in Asia such as the Yarlung Tsangpo (Brahmaputra), the Sengye Khabab (Indus), the langchen Khabab (Karnali), the Dirchu (Yangtze), Zachu (Mekong), Machu (Huang Ho, Yellow river), Gyalmo Nyulchu (Salween), Lodrak Sharchu (Manas), and Phung Chu/Bhumchu (Arun)" (Shakya 2009: 12).

These rivers flow the mostly Asian countries in their wealth of life. Asian countries are growing economic power such as China and India. These countries have gained the fresh water of the Tibetan plateau. Origin of Tibetan rivers gives the water to millions of people of lower riparian countries. The South West Monsoon provides the water to these rivers for a few months but most of the time Tibetan glacier maintains the flow of these river basins on monsoon off season to driven the fresh water in South and South East Asian countries.

Importantly, for the economic developing country such as India and China depends on the fresh water on Tibetan plateau which is again creates the pressure on this snow tower. There is the need to protect the owner of fresh water and to secure for future generations, which highly important. Asia has a large population in the world include China and India contain world largest population and these countries are growing as an economic hub, these countries people has increased income and living standard to convert rural to urban areas which is the most important thing here will be an increase of utilization of fresh water, water pollution due to industrialization and increase the demand of fresh water of a new society whose are living in urban areas. There is challenge of Tibetan plateau upcoming time (Immerzeel et al 2008: 52). Tibetan plateau flows 90% fresh water as China, India, Bangladesh, Nepal, Bhutan, Pakistan, Thailand, Myanmar, Laos, Cambodia, and Vietnam. 47% world populations gain the water of the Tibetan plateau. (See the Map of the major Tibetan river system):

river. It has run hundreds of miles in Tibetan region and after that enters North-East Indian states of Arunachal Pradesh to the water flow. Brahmaputra River is a Trans -Boundary River, the Brahmaputra river flows through China (Tibet), India (Arunachal Pradesh and Assam), and Bangladesh. It has a drainage area of about 580,000 km².

Brahmaputra is by far the most important river flowing from the Chinese controlled territory into any other country in terms of the sheer volume of the cross border flows, the Brahmaputra's mean annual transboundary runoff volume is nearly equal to the aggregate volume of the cross border flows of all the other rivers directly flowing into India from Tibet (Chellaney, 2011:143). Brahmaputra river basin and her tributaries are very important to maintain the flow of water in South Asian region. This table 1 is shown the Brahmaputra and other rivers status which originated in the Tibetan region.

Table 1. The volume of river waters Flowing out of the Tibetan plateau to countries other than China

River System	Direct Destination	Mean Annual Runoff Volume Out (km ³)
Brahmaputra (Yarlung Tsangpo) and tributaries	India	165,400
Rivers of southwestern and western Tibet	India	181,620
Rivers from southern Tibet	Nepal	12,000
Salween (Gyalmo Ngulchu, or Nu)	Burma (Myanmar)	68,740
Mekong	Laos and Burma	73,630
Tibetan rivers flowing out from western Yunnan	Burma	31,290

Source: Chellaney (2011) 143

China's strategically interested on the diversion of North-South China water project:

China wants to fulfil the goals of the demands of agriculture water supply; it's interested to divert Tibetan water resources for her own purposes. China projected big south-north water transfer project diverting Tibetan waters particular on the Yarlung Tsangpo (Brahmaputra River). Water security will become a major problem in the 21 century in Asia. One of five people does not have access to fresh water. Its problem not only India but also China is, India water sharing with neighbouring Pakistan, Nepal and Bangladesh, India has water treaties with these countries but India does not have water treaty with China. Many Indian River originates Tibetan plateau (part of China). China occupied these river and constructed dam on these rivers. China diverted water south-north which is affected in India and Bangladesh river water, China generates the electricity to make the dam on the Brahmaputra river basin; there is called it as a hydro-hegemony in Asia. China wants to divert the Yarlung Tsangpo water her parts of strategic interest in the western Chinese development program (Jesper, 2012: 31).

The diversion will be a bad impact on Indian water resources and also Bangladesh which will be a threat to water's security and biodiversity. Northern region of China is one of the most heavily populated regions in China and also in the world, including the capital Beijing and other major Chinese cities established there. The soil of the northern Chinese region is very rich, and it is problematic to grow the water scarcity. Many areas such as growing farming sector demands cannot be sustain long time to hydraulic infrastructure, and groundwater also no sustains the longer time. Huge water uses for agriculture sector is becoming the major tension rather than other purposes water demands. Another major problem of water is becoming the uses of industry sector and the uses of urban population whose are growing fast population in the cities to increase water pollution.

For China, Water challenges are not a new phenomenon. For 2,000 years the country's rulers sought to suppress the destructive power of the summer floods, while historians link drought with the demise of several dynasties. But

as China's thirsty economy is stretching the Northern China Plain which accounts for over half of China's production of wheat to its restriction, water is today becoming an uncertain block to the red giant's aspiration for prosperity. The statistics of China speak for itself. Two-thirds of China's 669 cities suffer from water shortage problems and over 300 million lack access to clean drinking water, a severe picture that has been painted as "wherever there is a river, there is no water; wherever there is water; it is heavily polluted". Although use of water for industries has decreased and China has maintained an increase in grain output despite irrigation water decreasing over the last 30 years, and energy sectors water thirst continues to soar unquenchable. Driven by its thirst for energy to sustain its juggernaut growth and china is facing a confrontation between water scarcity and rising energy demand (Svensson 2012: 7-8).

China is the largest industrial water consumer with 120 billion cubic meters a year. China's coal mining and processing and electric generating industries account for a fifth of the national water consumption. By 2020, China's growing dependence on coal for primary energy is projected to grow by an additional billion metric tons annually, representing a 30 per cent increase. This will create a geographical headache for the government. While the coal reserves are concentrated in the dry northern provinces of Gansu, Ningxia, Shaanxi, Shanxi, Xinjiang and Inner Mongolia and the water to develop them is in the south. Since the western line is the only one, of the three routes of the South-North Water Transfer Project (SNWTP) (nanshui beidiao gongcheng), that will deliver water directly to the dry Yellow river to feed the thirsty energy-rich northern and western provinces, it gives the unproven western transfer scheme more momentum for approval. Although SNWTP will ease the imbalance between supply and demand of water resources in the Northern China Plain, water resources per capita will still be at the lowest level about 300 m³/person in China no matter, how SNWTP goes (Svensson, 2012: 7-8).

Diversion of Brahmaputra impact on downstream states:

Water security in India is very important, the Union Ministry of Water Resources of the Government of India has estimated the country water requirement to be around 1093 BCM (billion cubic meter) for the year 2025 and 1447 BCM for the year 2050 (IDSA, 2010). Indian populations are growing; it can be reach 1.4 billion by 2050, so they need to secure water for their future populations. Also Bangladesh has large population whose depends on Brahmaputra river water resources.

IDSA (2010) defines that water is a key component to human life and economic development program, and India require more water for future populations and economic development program which can drive to sustain inclusive growth for it. River water flows to depend on upstream states, so India need equal water distributions between upstream to downstream states. India has water treaties with her neighbour states which share the water according treaties. India is facing the fresh water problem in many Indian states. In North East Indian Rivers do not have any water treaty with China which shares the water according to the law of non-navigation uses of the international watercourses. India and China do not have any such kind of institution to manage for the Brahmaputra river basin to sustain human civilization in this region.

Chellaney said that there is an Asian water security from Japan to Middle East and to central Asia to Indonesia. He has raised the securitization of water and environmental issue, current scenario Asia is emerging powers. It has growth rate very high, so they want to capture two more water, the Asian region has trans-boundary river system, many country share the water each other, for example India-China share the Yarlung Tsangpo river (Brahmaputra river). It points out upstream states to downstream states which is sharing the water. Managing of water conflict among state for instance China, India and South East Asian countries which share the Tibetan plateau water resources. Fresh water scarcities raise the internal and external security to economic growth, social progress, environmental sustainability, food security, public health and inter- riparian relations. Asia is going to become the global power, so it has so

many challenges which water security is most important. Institutional gaps between India and China, it has major concern for them (Chellaney, 2011).

To analysis water is powerfully related to the overall development structure of the Brahmaputra river basin. The absence of transboundary water resources management of Brahmaputra water resources is really tough for integrated water management of the Brahmaputra river basin of riparian countries. The lack of coordination of riparian countries of the Brahmaputra river basin is face of the upcoming threat to prospect expansion plan within the basin. There is the absence of any treaty of Brahmaputra really tough for water sharing between India, China and Bangladesh. They have large populations depend on Brahmaputra water resources and Bangladesh mostly affected flood due to absence of the institutional framework of the Brahmaputra river basin to share the information data about the floods. It is crucial to develop transboundary water resources management approach concerning all riparian to promote regional development and it can defeat the vision of harmful water clash along the Brahmaputra (Rahaman, 2009: 52).

Brahmaputra river basin shares the water along with China, India, Bhutan and Bangladesh. Unluckily, China is not clear and is unwilling to share hydrological data with the downstream countries like India and Bangladesh. China did not sign the 1997 UN Convention on the Law of the Non-Navigational Uses of International Waterways. When China started the damming on the Mekong river basin, it did not give the information of the downstream countries about her work. In the same thing apply by China; when China started work on the Brahmaputra river basin in November 2010 without any concern about it with downstream states (India and Bangladesh). The thought is here that China would be allowed or not a delegation from India, Nepal, Bangladesh or Vietnam to check the sites of projects that it is working on the Indus, Sutlej, and Brahmaputra or Mekong river basin. (Jha, 2011: 3).

Water resources are important for the livelihood, all states know if they want to long term sustain a growth rate it is time in respect of natural resources which can drive the states to achieve their goal. Many governments have bilateral and multilateral water treaty according the law of international

watercourses. They are interested in interstate cooperation which develops to the institutional framework for using equally water sharing among states. There are three approaches to managing of Transboundary water resources which are international watercourses law, institutional theory, and sustainable development theory as well.

Theoretical aspects:

The UN Convention on the law of non-navigation uses of the international watercourses to share the Transboundary water resources:

Many scholars (McCaffery 2007, Obe 2005, Rahaman 2009, and Chimini 2005, Salman 2007), talk about international watercourses law to use the international river water among countries which are sharing the same river water resources. The UN Watercourses Convention, adopted by the United Nations General Assembly on 21 May 1997. It is a global framework agreement, management and protection of international watercourses. It has established for rules for cooperation and basic standards between watercourse countries for the exercise, protection and management of international watercourses. The goals of this law ensure the utilization, development, and conservation, and the support of their sustainable utilization and most favourable for present and future populations.

The UN convention on the law of non-navigation uses of the international watercourses developed in during 20th century. The most important thing approving this law is equitable and reasonable for integrated water resources water resources issues. This law came from their minds from interstate water disputes in the western part of the USA of initial stage around the 20th century. Another example of this law has taken to originate from riparian rights developed in Wales and England which contain a rule of rational use of water. This kind of thinking has taken riparian rights into the original settlers in the United States of America. United States of America central court have given the decision with water disputes exposed that the rule of equitable sharing out

to be the deciding aspect in most cases. There is understand point about this law, it is easier uses to domestic cases like less than one country which is ruled by one government, and same law and order in the whole country, it is really tough for applying transboundary water resources in international level which contain many countries. The main problem is the view of reasonable and equitable use of the waters of Transboundary Rivers is broadly adopted by many countries have many views for this kind of thinking. They can be different view to not agree or agree with utilization of water. After that main problem of this is how to convince of every country which share the transboundary water resources for their own utilization (Beaumont 2000: 478). Many countries share the water of same river basin water and they have some problem with each other to maintain the flow of the river basin.

Water is natural resources which are part of the environment. International environmental law has given the ideas of international water law which grow up in twenty centuries. 1972 Stockholm Declaration statements is the basis of the international environmental law and it has gained the some features of the 1992 Rio Declaration about it. Statement of Principle 21 of the Stockholm Declaration 1972 is the main base of several international environment law conventions (Beaumont, 2000: 478-79). (See below the principle 21)

Principle 21

“States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction” (Beaumont, 2000: 478-79).

Helsinki rules of international watercourses law define an international drainage basin as a geographical area which cover the two or more countries share the water which called it transboundary water resources, as well as

underground and surface water flowing into common territory which also part of transboundary water resources. International Rivers are free for their navigation, equitable utilization of the waters of international drainage basins, and pollution free navigation each country which shares the water for it. There is describing efficient and equitable water distribution among competing users in the river basin by it. Two main principles were formulated by the law of Non-navigational uses of international watercourses are first one is the principle of equitable and second is the principle of non-significant harm. The anxious relationship between these two principles and the try to settle them very much in facts in the draft of the International Law of Commission leading to the 1997 convention (Obe, 2005: 31).

Convention of non navigation international watercourses law is significance for the management of transboundary water resources. Article 5 is very important to understand the law. “It has contained in Part II, reflects the principle that is widely regarded as the cornerstone of the Convention, and indeed the law in the field: equitable and reasonable utilization and participation. It requires that a State sharing an international watercourse with other States utilize the watercourse, in its territory, in a manner that is equitable and reasonable vis-à-vis the other States sharing it, in order to ensure that their utilization of an international watercourse is equitable and reasonable, States are to take into account all relevant factors and circumstances” (McCaffrey, 2008: 2). Article 6, is Factoring relevant to the equitable and reasonable utilization, article 7, Obligation not to cause significant harm Article 8, is the General obligation to cooperate, Article 9, is Regular exchange of data and information, Article 10, is the relationship between different kinds of uses. There is part two with article 5, 6, 7, 8, 9, and 10 define general principles of convention of non navigation international water courses law. We mention here only three article article five, ninth, and ten. This is very important for transboundary water resources management (United Nations report: Supplement No. 49 (A/51/49), 2005).

Article 5

“Equitable and reasonable utilization and participation

Watercourse States shall in their respective territories utilize an international watercourse in an equitable and reasonable manner. In particular, an international watercourse shall be used and developed by watercourse States with a view to attaining optimal and sustainable utilization thereof and benefits therefrom, taking into account the interests of the watercourse States concerned, consistent with adequate protection of the watercourse.

Watercourse States shall participate in the use, development and protection of an international watercourse in an equitable and reasonable manner. Such participation includes both the right to utilize the watercourse and the duty to cooperate in the protection and development thereof, as provided in the present Convention” (United Nations report: Supplement No. 49 (A/51/49), 2005).

Article 9

“Regular exchange of data and information

Pursuant to article 8, watercourse States shall on a regular basis exchange readily available data and information on the condition of the watercourse, in particular that of a hydrological, meteorological, hydrogeological and ecological nature and related to the water quality as well as related forecasts.

If a watercourse State is requested by another watercourse State to provide data or information that is not readily available, it shall employ its best efforts to comply with the request but may condition its compliance upon payment by the requesting State of the reasonable costs of collecting and, where appropriate, processing such data or information.

Watercourse States shall employ their best efforts to collect and, where appropriate, to process data and information in a manner which facilitates its

utilization by the other watercourse States to which it is communicated”(United Nations report: Supplement No. 49 (A/51/49), 2005).

Article 10

“Relationship between different kinds of uses

In the absence of agreement or custom to the contrary, no use of an international watercourse enjoys inherent priority over other uses.

In the event of a conflict between uses of an international watercourse, it shall be resolved with reference to articles 5 to 7, with special regard being given to the requirements of vital human needs”(United Nations report: Supplement No. 49 (A/51/49), 2005).

The importance of this law is very crucial. “The Convention and its preparatory work have had significant influence. Four months after it was concluded, the International Court of Justice referred to and quoted from the Convention in its judgment in the Gabcikovo-Nagymaros Project case (I.C.J. Reports 1997, paragraph 85). In part because of its provenance, the Convention is widely viewed as a codification of customary international law with respect to at least three of the obligations it embodies, namely equitable and reasonable utilization, prevention of significant harm, and prior notification of planned measures. These and other provisions of the Convention have influenced the negotiation of treaties concerning international watercourses, as can readily be seen from even a cursory review of recent agreements, for example, the Revised Protocol on Shared Watercourses of the Southern African Development Community (SADC) of 7 August 2000” (McCaffrey, 2008: 3).

The United Nation convention on the law of the non-navigational uses of international watercourse has given the most important thing for our society for the development of equitable utilization of transboundary water resources. It is potential for protection of conflict between the states which would be

going to war due to lack of sharing transboundary water resources. It has played the important role in these kinds of conflict situations. This time growing the water scarcity problem in whole World, no one escape this problem, and the hope that the convention would be affected for the sharing of transboundary water resources (McCaffrey, 2008 4). In case of China no clear accepted international law on shared waters, and when on such was attempted, China was only among the three countries that voted no to favour of the convention on the law of the non navigation uses of international watercourses in the UN General Assembly in 1997 (IDSA, 2010: 49). The Brahmaputra river basin such an affected lack of the convention on the law of the non navigation uses of international watercourses acceptance in Asia's region.

India is so many treaties with her neighbouring countries such as Pakistan, Nepal and Bangladesh; it has the Ganga and Mahakali agreements with Bangladesh and Nepal (Chimini, 2005). Many upstream countries do not respect of equitable utilization with downstream countries, it is a violation of the law of non-navigation uses of the international watercourses. In case of Brahmaputra river basin downstream states did not have any treaty with China according the law of non-navigation uses of the international watercourses.

Molgosa Fitzmaurice and Gerhard Laoibl explain that the water's problem is one of the major problems of the contemporary world is facing on. The world is facing on widespread water scarcity, gradual destruction and increased pollutions of fresh water reserves in many regions of the world. They also point out fresh water as limited and vulnerable natural resources, which on all social and economic performance are highly depended. They said that there are four major problems relating to fresh water in the world (Subedi, 2005: 78):

- (a) Scarcity of water of no renewable resource supply
- (b) No equal distribution of water supply
- (c) Problems of water quality and health
- (d) No restriction for making the dams and reservoirs

This time world is growing economic powerhouse which must want to secure fresh water supply. India and China also are emerging country in the world. Many countries have limited water supply for instance Middle East, North Africa, Central Asia and Sub Saharan Africa including North China. Many people in developing countries do not have access to drinking water in sufficient quantities and quality to cover the basic needs (Chellaney, 2011: 4).

The Institutional Approach:

Many thinkers (Keohan 1995, Chellaney 2011, Rahaman 2009, Ostrom 1990 and Jesper) describe as institutional approach is very essential for management of water resources because the institution has certain rules and regulation which distribute the resources. "Transboundary water resources management is the management of surface and subsurface water in a qualitative and quantitative and environment sense of a multi-disciplinary and perspectives" (Jaspers, 2002: 79). Institutional approach is important to develop of transboundary water resources management. Frank G.B. Jesper describes that "Institutions are organizations or establishments founded for a specific purpose base on a set of working rules originating from an established custom, law or a relationship in a society or community" (Jaspers, 2002).

IDS (discussion paper 372) discuss about the natural resource management literature, institutions are considered to be key in sustainable livelihood adaptation and natural resources management, and an understanding of institutions is now seen as central to successful policies in this area. Ostrom describes that "Institutions are sets of working rules that are used to determine who is eligible to make decisions in some arena, and what actions are allowed or constrained, further the rules describe what procedures must be followed, what information must or must not be provided and what payoffs will be assigned to affected individuals" (Ostrom, 1990: 7). Kohnan talk about the logic of institutionalize theory with its focus on the information role of institutions appears solid. In case of which countries share the common water their territory on a certain institutional umbrella, they can use the water of that institution law and rules. India and China both are sharing the Tibetan plateau

water of Brahmaputra River. They do not have any kind of institution which can go ahead.

Nile riparian which contains ten countries adopted transboundary water resources management, it has example of sharing the water as a mutual benefit platform which is respect each other countries flow and supply of water resources (Nile Initiative, 2000). As well as if India, Bangladesh and China will make the certain institution which shares the Transboundary water resources for their national purposes. India and China both are economically competitive in the Asian region; they are emerging power in the world. Defiantly they will secure the water for their national purposes from Tibetan plateau water. There should be an institution mechanism of Brahmaputra River (Yarlung Tsangpo) between the two big countries.

The Sustainable Development Approach to Transboundary Water Resources Management:

Sustainable development theory is very essential in the contemporary world. Theory of sustainable development came from the ideas the 1987 report of the World Commission on Environment and Development generally known about that (WCED, 1987). Brundtland Commission has given the sustainable development theory. The Brundtland Commission report has given the ideas of Our Common Future: From One Earth to One World. It has given the new ideas of the world to secure the resources for our future generation, everyone exploited the natural resources, this commission has given the view for next generation whose are not part of your enjoyment this time, it has protected their rights whose did not born yet.

The World Summit on Sustainable Development define “integrated water resources management as a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem, and emphasized that water should be managed in a basin-wide context under the principles of good governance and public participations” (WSSD, 2002). Sustainable

management is very important for water resources because water is the main component of livelihood.

Bruntland report, defines “sustainable development as a process of change in order to create a harmony environment between resource exploitation, investment, technological and institutional changes to enhance the current and the future potential of human needs” (Corina maria en, et al, ND: 1). It understands that world population growing, World has limited natural resources, should respect of natural resources because many natural resources are not renewal which will create to problem for our future generations whose are not here. Preecha Rengsomboonsuk, Thailand Minister of Natural Resources & Environment said that Good governance is required for establishment of strategies on sustainable management of international river basin (Mekong River, November 2, 2012, The Hindu).

Scarcity and misuse of water are growing the problem of sustainable development described by The Dublin statements. It is also a threat of environment protection. Water is a key component of natural resources, if upstream states divert the river water for their own interest and build the many dams which diverted the water either side because of short flow water of the downstream states, it shows that they do not respect to the downstream states' water rights. There is call it violation of downstream state's water rights. China has made the Zangmu dam and construction other dams on the Brahmaputra River in Tibetan plateau for diverting the water south to the northern Chinese region.

Tashi Tsering describes that Water scarcity will be a threat to China's economic growth, its crisis not only surface but also ground water. China water crisis has grown; China will be facing the problem of water scarcity for potential economic development and social stability. China has designed a big project for her national strategy to divert from rivers in the south and west to drought suffering northern areas (Tashi Tsering, 2002). Anton Earle in his book says that “clearly how vital it is to cooperate effectively over the management shared waters to unlock their contribution to regional sustainable development” (Anton Earle, 2010).

The important thing about water that it is the most important issue among countries especially transboundary water resources. In 1995 the World Bank vice president, Ismail Serageldin, warned: many of the wars of the twentieth century were about oil, but the wars of the next century will be about water. Yes, 21st is most significant for water resources. In particular Asian region, China, India, Pakistan and Bangladesh most populated states, they share the Tibetan water resources which control by the Chinese government which will be a critical issue for these countries. Same thing Chellaney mention his book (Water Asia's New Battleground, 2011) that the new battle lines being drawn in Asia over transboundary water resources highlight the risks of greater water conflict. Mostly Asian river basin shares the water with a Chinese territory which in the Brahmaputra / Yarlung Tsangpo is very important for Indian and Bangladeshi populations; they depend on this river for economically, culturally, and socially. The Brahmaputra has given the many benefit of riparian countries.

Chapter 2

China's strategic interest of the diversion of North- South Chinese water project

Tibetan Water is a core issue between India and China and other South Asian countries (Bangladesh, Pakistan, and Nepal). The primary cause for this is due to the water availability statistics and sharing by different countries in the future. China controls over the whole Tibetan water resources which is headway of Asian river system. Tibetan water resources are the lifeline of Asian people whose are depend on fresh water resources in this region.

The utilization of water in China is very high due to its growing industrialization, high economic growth and growing of Urbanization. Water resources would provide for the livelihoods of millions of people in the world in the 21st century. Water is one of the key factors for Chinese development. However China has huge water scarcity. Tibetan plateau fresh water resources are not only important in china but also Asian countries. India and China will be needed per capita water availability 1700 and 2100 cubic meters by 2025 (IDSA, 2010).

Northern and south-western region of China are facing the water scarcity problem. It is one of the biggest problems in this region. Shortage of water effected public health, social welfare program in many parts of China. In the case of Northern China, there is already a place of water scarcity. The per capita water availability of natural fresh water is less than other western develop countries in this region. China wants to divert the Tibetan water for the northern Chinese region for her own utilization. China constructed Zangmu dam on Brahmaputra River and it will be brought power to Northern and Western China, it is designed as a "run of the river" dam which is planned by Chinese government. In future it will be played the burgeoning role with India.

Water plays the important role between India and china diplomatic relations. China and India both are a big power in Asia. They are competing in the world to capture of the water for their utilization. Many Chinese scholars had said about Chinese water diversion projects. Zhang Boting, the deputy general secretary of the China Society for Hydropower Engineering, told the *Guardian* that “a massive dam of the great bend of the Yarlung Tsangpo research had been carried out on the project, but no plan has been drawn up. But documents on the website of a government agency suggest a 38 gigawatt hydropower plant is under consideration that would be more than half as big again as the Three Gorges dam, with a capacity nearly half as large as the UK's national grid. This dam could save 200m tonnes of carbon each year. We should not waste the opportunity of the biggest carbon emission reduction project. For the sake of the entire world, all the water resources than can be developed should be developed. That CO2 saving would be over a third of the UK's entire emissions” (Chinese Engineer, The Guardian, May 24, 2010)

China's concentrated agriculture needs watering. It is growing more than other sector in China's north-eastern arid region for which it depends on concentration of water hub of the Tibetan plateau. China focuses the most importantly on two things to reduce the northern arid problem. First is damaging on the Brahmaputra river basin. Second is projected big south-north water transfer project transferring Tibetan water which will be filling the gap Northern Chinese arid region. China made the Zangmu dam on the Brahmaputra River. It has been working since 2010, which capacity 510 MW. China also began construction three most important hydropower dam on the mainstream of the middle reaches of the Brahmaputra River; it's called Dagu, which less than 18 Km upstream of Zangmu. It has capacity 640 MW. Another 320 MW dam will be built at Jiacha, which is middle reaches of the Brahmaputra downstream of Zangmu. A third dam name is Jiexu which 11 Km upstream of Zangmu. It has capacity yet not confirm. These three dams are part of Chinese 12th five year plan (2011-15) strategy (Three new dams, The Hindu, April 5, 2013).

South to North water transfer project:

Diversion of South to North water project has most important water transfer project for the Chinese Northern arid region. There are three rivers in China is part of south to north diversion project most which are Yellow River, Huaihe and Haihe river basins flow most important region of China of the national economic development program of China, this region is very important for refined area and also for Chinese GDP which contain one third of those of the country. In the period of 1990 to 1997 is growing grain production due to these river basins, Grain production is almost 79% of total grow of China. These river basins gain 7.2% total of Chinese river basin, there is per capita water availability are 465 m³, it is lower than of international perspective which is logic of international acceptance. These river basins are facing the problem between water supply and water demands for this region. The main problem of water scarcity is maintained of socioeconomic development program due to lack of management of water resources for this region (Pei Yuansheng, et al 2009).

The government of China is projecting the south-north water diversion project. There will transfer 44.8 billion cubic meters of water per year to the Yellow river basin from the Yangtze River basin for the northern Chinese arid region. There will be displaced hundreds of thousands people in this region. "The great south to north water diversion project was visualized by Mao when he reportedly said in 1952; 'the south has a lot of water, the north little, it is okay to lend a little water'" (Chellaney 2011: 60). This idea comes from Mao mind and China has been working on the south to north water transfer project. This Mao statement was considered by the Chinese government since the beginning of the southern north diversion project. There was not considered by Ministry of water Resources till December 1979 (James E. Nickum). It is a well known fact that if one has sufficient fresh water than he or she would sustain it for development programmes. This idea gives the best opportunity for the Chinese for their development program, where the country China stands.

The water transfer project from the southern part of China to the northern part of China is proposed to resolve this problem. There are three routes of water

Benefit of the eastern route project:

- “Water supply of living industry, navigation, irrigation for Jiangsu, Anhui, Shandong, Hebei and Tianjin.
- Ensure navigation capacity of Grand Canal.
- Ensure the grain production capability of western Shandong and Northern Tiangsu.
- Promote economic development in around Bahai-Sea area and eastern Huang-Huai-Hai plain” (Wang et al 2004: 76).

Middle route project:

The Middle Route starts at the Danjiangkou reservoir on the Han, a major left-bank tributary of the middle Yangtse. The dam was built in 1974 to 162 m but was designed to be raised to 176.6 m. This will increase gross storage from 17.5 km³ to 29.1 km³, flood 370 km² and displace 225,000 people. The canal runs through the upper Huai and then the Yellow River below Xiaolangdi Dam. It proceeds to Beijing along the foot of the Taihang Mountains. Its total length is 1230 km, with a branch in Tianjin of 142 km. Canal works would displace a further 50,000 people. Natural channels were rejected in favour of a new canal to preserve water quality and command the full area by gravity. More than a thousand structures include a 7.2 km tunnel under the Yellow River. The first stage will divert 9–13 km³ /yr or 25–35% of Han flows in Danjiangkou, though the heightened dam will also have important flood and water control benefits in the lower Han and to the city of Wuhan. The first stage costs some US\$7000M, with a further US\$3000M in accessory costs, mainly for resettlement but also for Han replacement works. A second stage could increase diversions to 20 km³ but is only feasible with compensating transfers from the Yangtse to the lower Han (Jermerkoff 2003: 5). (See below a map of the middle route project)

Chinese sustainable socioeconomic development is more affected due to water resource scarcity in the northern Chinese region. Yellow river, Huaihe River, and Haihe river basins are gaining the water from the Changjiang river basin which is connecting a good network for these good geographical areas, it will be gaining the water resources for over a long period of time (Yuansheng 2009: 5). This will not possible for a long period of time, Tibetan water resources is also limited as well as other region. Most important thing is stopping the misuse of water resources in all areas which is totally wasted the water generally.

China wants to build more dam:

China is a growing economic power, so decided to use the hydropower and build the dam on many rivers in Chinese region. “China’s domestic dam industry is unparalleled at the international level in a number of projects, financial investment, and impacts on the environment and society. Almost half of the world’s 45,000 large dams have been built or are under construction in China. Additionally, loss of land and environmental degradation caused by dam projects has imposed significant costs on the Chinese rural population. Jing stated that 10.2 million people living in rural environments had been displaced by hydropower projects by the 1990s. More alarmingly, in his 2007 work report to the National People’s Congress, Premier Wen Jiabao reported that 23 million people have been displaced by dam projects. China’s most recent five-year plan (2011–2015) has proposed an increase in the number of domestic dam projects by 50% to contribute 130–140 GW to the country’s energy supply” (Beck 2012: 6).

“The TGD (Three Gorges Dam) on the Yangtze (Chiang Jiang) River is the world’s largest hydropower plant. This was proposed for energy generation, flood control, and to increase trade routes to Western China, the Three Gorges Dam became fully operational in 2008, generating an electric potential of 18,200 MW” (Beck 2012: 8).

“The Three Gorges Dam is nearly 200 meters high, has a volume of 40 million cubic meters, and has created a reservoir 600-kilometer long with a total storage capacity approaching 40 billion cubic meters. Maximum storage of water behind the dam is expected to occur sometime in 2008. The 14

China diverts of Brahmaputra River:

China has a water scarcity problem; it has wanted to divert the Tibetan water resources from South to North region. The Yarlung Tsangpo/Brahmaputra river's divert plan is also being the part of south north interlinking water diversion project which diverts the water south to the northern Chinese region, this river water is diverting water by china for her long term plan to maintain flow Yellow river which is facing the problem of water scarcity present time (Rashid, ND: 3). China will be facing the huge water scarcity in the near future; it is also the pressure of rising power shortage and international pressure to reduce carbon emission. China is now focusing on generating hydro power that requires building dams (Husain 2012: 4). China grows economical power and wants to electrify for her economical development program at this time all countries looking at fresh electricity (lower use coal) us. China made the Zangmu dam on the Brahmaputra River. It has been working since 2010, which capacity 510 MW. China built the dam on Brahmaputra proposal based on Gao Kai and Li ling, who wrote a grand project of the Tsangpo diversion in their book called Xizang Zhi Shui Jiu Zhongguo (Save China through Water from Tibet).

The Chinese government has released an energy sector blueprint in 2011-2015 in which they have decided to construct at least 54 hydro power stations with a total capacity of 120 GW on the upper reaches of Driчу (Yangtse) and Zachu (Mekong) and Salween. There is clearly disregards the geological risks and global biodiversity and resettlement and impacts on downstream states. This plan also includes the reopening of previously shelved dam projects on the Salween River due to environmental concerns. China is looking to plan to install 1.2 TW (1200 GW) of water dependent power capacity by 2030 and 277 GW of coal fired power plant by 2015. As in the latter case, the majority of the coal reserves in China are in water scarce regions of Shanxi and Inner Mongolia and it is a well known fact that coal mining requires heavy water use. Managing and securing the water resource in Tibet could be the biggest and most important challenges face for the new Chinese leadership for her national development policy. Downstream states share of water originating in

Tibetan Plateau should establish a regional forum to create policies on trans boundary issues that effectively safeguard access and quality of water, at a time of accelerating glacier melt and damming activities (To Dam or Not to Damn, June 8, 2013, tibet-edd.blogspot.in).

China 12th five years plans to the built the hydro power project on the Brahmaputra river basin.

China has her five year national development policy which called its five year plan just like India has five year plan for national development programs. China has been revived every five years her national five year plan for her whole development program. Chinese 12th five year plan forms to increase the non fossil fuel energy which can decrease the carbon dioxide in the environment. "In the 12th Five-Year Plan adopted by the Chinese government in March 2011 devotes considerable attention to energy and climate change and establishes a new set of targets and policies for 2011-2015. While some of the targets are largely in line with the status quo, other aspects of the plan represent more dramatic moves to reduce fossil energy consumption, promote low-carbon energy sources, and restructure China's economic development. Another goal is to "gradually establish a carbon trading market." main targets include: 16 percent reduction in energy strength (energy consumption per unit of GDP) and increasing non-fossil energy to 11.4 percent of total energy use; and 17 percent reduction in carbon intensity (carbon emissions per unit of GDP)" (Lewis 2011: 1).

China wants to reduce the carbon based energy. Chinese 12th Five Year Plan that "includes a target to increase non-fossil energy sources (including hydro, nuclear and renewable energy) to 11.4 percent of total energy use (up from 8.3 percent in 2010). While not formally enshrined in the 12th FYP, one more recent notable announcement is a cap on total energy consumption of 4 billion tons of coal equivalent in 2015. To get together meet the cap on energy consumption, annual energy growth would need to slow to an average of 4.24 percent per year, from 5.9 percent between 2009 and 2010 years. The government is also trying to slow GDP growth rates, targeting 7 percent per year – far below recent growth rates. Lower GDP growth rates make it even

more challenging for China to meet energy and carbon strength targets, since energy and carbon need to grow more slowly than GDP for the country to achieve declining energy and carbon” (Lewis 2011: 1).

China built the three new dams on the Brahmaputra River:

China strategic interested diversion of on the Brahmaputra river basin is important river basins in Tibetan region which will be fill the gap Chinese electricity and irrigation problem in the southern Chinese region. China is building three more dams on the Brahmaputra river basin in Tibet. Chinese government allows building the three new dams on the Brahmaputra river basin such as Dagu, Jiacha and Jiexu. China makes the Pondo Water Control Project is located on the Lhasa River, a tributary of the trans-boundary Brahmaputra River. There is massive size has led to it being called “Tibet’s Three Gorges Dam.” Construction on the project began in 2008. It includes a reservoir that will irrigate 43,520 hectares of farmland and a hydropower plant that generates 599 million kilowatt hours of electricity a year. It has cost an estimated \$728 million USD. The three new dams have been approved by the State Council, or Cabinet, under a new energy development plan for 2015 (China built dams, The Hindu, January 30, 2013).

China began to construct three major hydropower dam on the mainstream of middle reaches of the Brahmaputra River. The plan said the government “will push forward vigorously the hydropower base construction” on the middle reaches of the Yarlung Tsangpo. In the Twelfth Five Year plan period (2011-15), and the government will begin construction of 120 million kilowatt of conventional hydropower (Dams across Brahmaputra, The Hindu, February 2, 2013).

The government has shelved a long-discussed plan to divert the Yarlung Tsangpo’s waters to the arid north, citing technical difficulties. The plan is part of the proposed Western route of the massive South-to-North Chinese diversion project, on which construction is yet to begin. Chinese officials exposed and analysts say a diversion plan is very unlikely, considering the difficult terrain and technical problems. Though, with the three new approvals

Territory. China is starting to build four new dam project on this river basin in Tibetan region; it is working on this project very fast to ignore all other things. Government of India also wants to build the dams on the Brahmaputra river basin in Indian Territory in Arunachal Pradesh for her strategic interest which will help of Indian energy supply and other kinds of water demands in the north eastern Indian region. While China has started more work on Brahmaputra river to divert the water to help south north water diversion project. As well Indian intention on Brahmaputra River is good for Indian states, if India will do (Himanshu Thakkar 2013).

People Republic of China's intension on Brahmaputra River will create the problem for the people in the downstream areas of India and Bangladesh. This will create a new dimension of conflict such as water conflicts between upstream and downstream countries. There is not working as an international treaty that would help downstream countries claim its prior user water rights. The UN Convention on the Law of the Non-Navigational Uses of International Watercourses could have been used, while India has yet to ratify the convention and china is not a member of this convention. The best course for India is to push China for a water sharing treaty with India and Bangladesh for respect of downstream water rights.

In current scenario every country should focus on climate change issue, it is a more sensitive issue for the whole world. Current time, climate change becomes a discussion topic on worldwide, there is some rule followed by some countries to protect the environment. Everyone has been making for their own development project; these kinds of project are impacting the environment to ignore climate change impact on worldwide. In Asian region many hydropower projects are working on, it is planned by many Asian governments which want to accelerate their economic growth. These kinds of things are help for their manufacturing project such as townships, roads, tunnelling, blasting, mining, manure dumping. Making dams and reservoirs are diverting the water from the main river basin; it will affect such terrestrial biodiversity, the glaciers, aquatic and communities, forests, water availability and water supply, these kinds of things will be become more dangerous during climate change time (Himanshu Thakkar 2013).

Environmental, social, and political issue:

Damming on Brahmaputra/Yarlung Tsangpo is becoming a discussion topic among many environment loving scholar, and India, China and Bangladesh; these dams are diverting the water on another way which affects the natural way ecology and social phenomena of downstream states. There is increase of social, economical and environmental problem lower riparian countries; it is worse impact on the agriculture sector which becomes the lifeline of South Asian countries like India and Bangladesh. South Asian country's economy mostly based on agriculture such as grain, rice and fisheries production, it is creating the problem of the water and food security, and people displacement problem in this region. This issue has also become a strong political issue between India, China and Bangladesh. "One of the strongest and most consistent arguments made by project proponents has been that the electricity produced by the dam would otherwise be produced by dirty Chinese coal burning power plants, with their serious environmental impacts. One of the strongest and most consistent arguments made by project opponents has been the huge scale of the environmental and social transformations of the watershed of the Yarlung Tsangpo/Brahmaputra river basin both upstream and downstream of the dam itself. These major questions are addressed here" (Gleick 2008-09: 141).

Environment issue:

Environmental concerns about the Dam on Brahmaputra/Yarlung Tsangpo River go beyond the affected wildlife and endangered species. "River sediment is a major threat that could undo all the positive effects the dam is supposed to get bring. Sediment builds up from the natural flow of the river will slowly cause the water level in the reservoir to rise - potentially flooding low-lying parts of the river basin area. Rising water levels could eventually transform the Dam into a massive waterfall. Millions of the people who live downstream states of the dam like India and Bangladesh would be endangered by overflow and destroy the region. The dam plays the role like war and disaster" (The Asian Development Bank and Dams fourth part: Dam impact and Effectiveness ND: 65).

“Dams building have to change part of the river ecosystems and loss biodiversity, in the upstream and downstream region states. The unscheduled releases or discharges of water from dam’s reservoir result in sudden changes in water climate disrupting seasonal migration patterns of fish and wildlife and destroying plant life in the region. The blocking of dams of the silt rich in nutrients is depriving fishes, and also not finding its way downstream for agriculture in the river basin. All these modifications and blocking during and after construction of dams, affect the resources available for land and riverine based productive activities, such as agriculture and fisheries and other purposes” (The Asian Development Bank and Dams fourth part: Dam impact and Effectiveness ND: 65).

China is building the three new dams on the Brahmaputra River, these three dams’ environmental impacts associated with large scale dams has significant negative impacts on the down stream’s environment. The creation of the dams and connected reservoirs has impacted both upstream from the dam and downstream. It has affected species in this area; some endangered, water quality, and may increase the likelihood of earthquakes and mudslides in the area. Brahmaputra River is the life line of some species like dolphin and other kind of species, damming on Brahmaputra will be negative impacts on those species in this area, which creates an ecological imbalance.

Social issues:

The dam building of Brahmaputra/Yarlung Tsangpo river basin for the hydropower and irrigation submerged communities like “indigenous people and distorted the riparian ecosystems of upstream and downstream thus affecting the resources available for land-and-riverine-based productive and economic activities where affected people depend their traditional livelihoods like agricultural production, fishing, livestock grazing, fuel wood gathering and collection of forest products” (The Asian Development Bank and Dams fourth part: Dam impact and Effectiveness ND: 59).

“There are about 40-80 million people who have been forcibly expelled or displaced from their homes to make way for dams. The impacts of dam-building have been particularly disturbing in Asian, African and Latin

American region. Large dams in India and China could have displaced between 26-58 million people between 1950 and 1990. The construction of the world's largest dam, the Three Gorges Dam in China, the level of displacement has increased substantially" (The Asian Development Bank and Dams fourth part: Dam impact and Effectiveness ND: 59).

"Most of the physical displacements due to dam-building is involuntary and engage coercion and force, and in a few cases even caused the lives of people. A million people have lost their lands, livelihoods and access to natural resources. The timing of these social impacts varies, depending on the close causes. In the case of loss of home and livelihood due to the build of a Dam, the social impacts are immediate in the region. The implications for downstream livelihoods, however, are palpable only after the completion of the dam. The scale and extent of impacts will vary depending on location, size and other dam characteristics such as submerged area and population density in the river basin region. In many cases in densely populated tropics large dams will lead to both physical and livelihood displacement. The damming of the upper reaches of the Yarlung / Brahmaputra River affecting the livelihood like fisheries and agriculture of the downstream people in India and Bangladesh" (The Asian Development Bank and Dams fourth part: Dam impact and Effectiveness ND: 60)

"The impacts of Yarlung/Brahmaputra dam-building not only spilt the riverine ecosystems, but also physically displaced and deprived indigenous people from the river systems where they depend on their traditional livelihoods. On a deeper insight, their physical displacement from the river system also alters their cultural way of life. Indigenous people are victims whose have no lands-no titles-no compensation resettlement practices" (The Asian Development Bank and Dams fourth part: Dam impact and Effectiveness ND: 60).

Political issue:

India and Bangladesh may have bigger and more challenging issues of water to face in future due to Tibetan water diversion by china. There have been speculations among some Indian think tank about a possible diversion of water from Yarlung Tsangpo. This proposal based on Gao Kai and Li ling, who wrote a grand project of the Tsangpo diversion in their book called Xizang Zhi

Shui Jiu Zhongguo (Save China through Water from Tibet). If we analyze the ongoing and planned location of dams, there are reasons to believe that the speculation of water diversion could be carried out in near future. Unfortunately, such a massive project will also have unprecedented social and environmental impact in Tibet as well as regions of downstream states.

“The Brahmaputra / Tsangpo River has always been considered as the source of fresh water for both India and Bangladesh and it divides into hundreds of channels in Bangladesh to form a vast delta which flows into the Bay of Bengal. Now India has awakened up of its rights when China wants to divert waters from the Tsangpo / Brahmaputra River. China is reportedly doing the same thing with India as India did with its trans-boundary rivers in relation to Bangladesh. Furthermore several Chinese projects in west-central Tibet have a bearing on river-water flows into India but China refuses to share information with India. The same tactics India adopted with Bangladesh are likely now biting India China does not find it necessary to consult, discuss and sit down with India in the proposed diversion of waters from the Tibetan Plateau. There cannot be one rule for India and China and another in India and Bangladesh” (Harun ur Rashid 2009: 1). Given the fact that most of the speculation regarding China’s plans to harness Tibetan rivers is actually being implemented, it is high time for the government of India and Bangladesh to jointly pressure on China for higher levels of cooperation in order to secure the water and livelihood of its citizens.

There is find that if India and Bangladesh fail to stop the damming of Brahmaputra/Yarlung Tsangpo river water from China that will be more effect in India and Bangladesh livelihood. So they go into negotiation with the Chinese government of right solution which will not be an effect of downstream livelihood, it is good for regional stability.

Chapter 3

Diversion of Brahmaputra impact on downstream states

China and India are neighbouring countries. They share the long physical boundary in Asian region. These two countries have the dispute due to the sharing of the water of the Brahmaputra river basin as china built dams on the upper reaches of the Brahmaputra river basin. The building of dams of Brahmaputra has the negative implications, leading to the serious problem of the downstream states. India and Bangladesh situated lower region of the Brahmaputra river basin is also known as downstream states. Both India and China are not only emerging power and contenders in the Asian region but they are also a worldwide contender in economic power and international power.

China utilizes of most of the water resources of the Tibetan Autonomous Region, from where most of the Asian river originates. Among these Brahmaputra River is an important one. Its basin covers areas India and Bangladesh. China has also a major concern to expand her power around the Indian Territory, for which it makes the Gyadar port in Pakistan. This is part of china's string of pearls strategic plan in south Asia. It has also made the Chittagong port in Bangladesh, the Humantota port in Sri Lanka. It's very crucial for Indian make the balance of power in South Asia, they are Indian neighbour states. Regarding the Chinese development in the south Asian region, it has the argument that those are not to counter India but are part of South Asian country development program. This China's policy seems like a blue water policy of Portugal earlier in British period in India to increase her power.

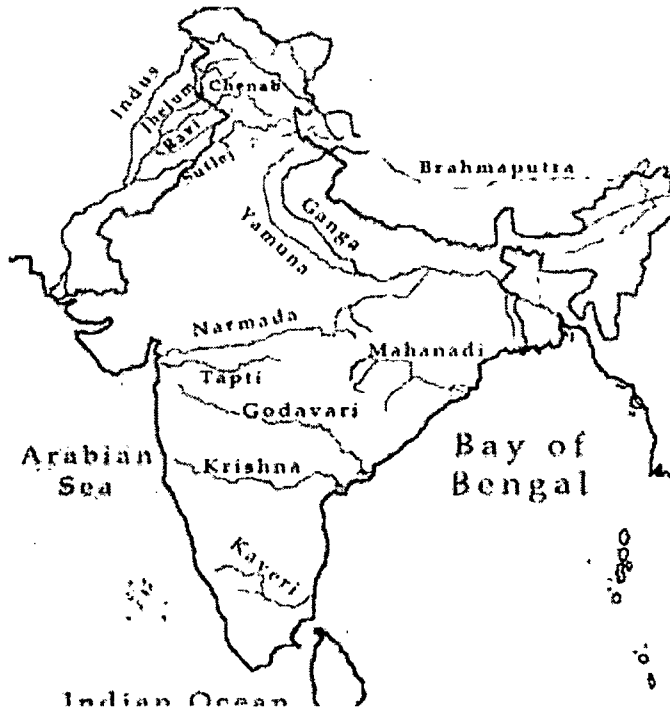
The Brahmaputra River Basin originates from Tibetan plateau flow through southern Tibetan known as Yarlung Tsangpo, after that it joins Siang River in Indian Territory and running through the Indian states of Arunachal Pradesh and Assam. Brahmaputra River enters in Bangladesh with join Meghna River

is running in the Bay of Bengal. The Brahmaputra river basin has a long running area; it has 1800 miles running Tibet, India, Bhutan, and Bangladesh. It is flowing 704 miles in the Tibetan region. "The Brahmaputra river carries approximately 2.7% of the total world freshwater discharge and is the single greatest source of sediment to the oceans" (Hren, et al 2007: 49). Brahmaputra river basin has given the life of Around 625 million people in the whole basin area, and all of them about 80% people are farmers and need the water supply for animals and their crops and other purposes. Mostly Bangladeshi gains the water demands from the Brahmaputra and Ganga river basin for her agriculture and other purposes as. Brahmaputra river basin is the life line of Bangladeshi people (Verghese 1990: 7).

The Chinese government is working on to build the three new dams on the Brahmaputra river basin is called as Great Bend, it is connecting of the Yellow river in the northeast end of the Tibetan plateau, it is part of Chinese south north water diversion project. This Chinese government project has given the water to the northern arid region of China. In the displacement of peoples, increased salinity, and decline of water quality due to dam building to affect water flow of Bangladesh. The Chinese government built dam without consideration of the countries downstream for instance India Bangladesh, this Chinese activity will create the problem of environmental and social and economic in downstream states.

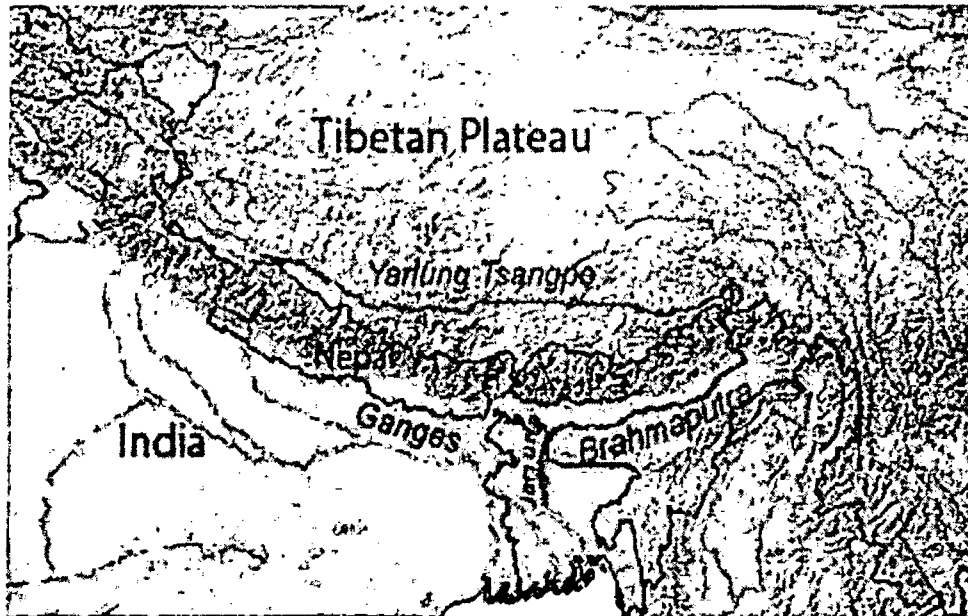
Populations and economic development are growing high in India. Human life cannot be possible without water, water is important to survival in human life; North-East India and Bangladesh depend on the Brahmaputra river basin of all purposes. Due to Brahmaputra river basin North-East India and Bangladesh face many challenges for instance drought and flood situations. Many North-Eastern people died and homeless due to Brahmaputra River's flood in every year. Brahmaputra River's good management will be filling the gap of North-Eastern India's natural disaster and the agricultural sector.

Map 11: Indian river basin:



Source: Meredith Brackett

Map 12: Brahmaputra/Yarlung Tsangpo



Source http://www.google.co.in/search?gs_rm=16&gs_ri=psy-ab&suggest=p&cp=12&gs_id=1a&xhr=t&q=brahmaputra+river&rlz=1C2CHMO

Current scenario, there is raised the question of securitization of water and environmental issue for India, it is emerging power country in world arena. It has growth rate very high, so India needs to more water, India has trans-boundary river system, along with many country share the water with India, for example India-china share the Yarlung Tsangpo river (Brahmaputra river). “The total water resources of river systems and ground water in India are estimated at 1900,000 million m³, of which 1645,000 million m³ are in all the river systems, and 255,000 million m³ are in ground water” (Kayastha 1981: 563). India established in downstream countries in the Brahmaputra river basin. India needs to management of Brahmaputra water resources for her social and economic purposes. Managing of transboundary water resources is very crucial among state such as China, India and South East Asian countries which share the Tibetan plateau water resources. There is absence any kinds of water treaty between India and China which resolve the water conflict issue.

Fresh water scarcities raise the internal and external security to economic growth, social progress, environmental sustainability, food security, public health and inter- riparian relations. India is growing to see the global power scenario, so it has so many challenges which are most important water security. Institutional gaps between India and China, it has major concern for them. Water is strongly linked with the overall development framework of the Brahmaputra basin.

“However, the absence of integrated management of Brahmaputra water resources and lack of coordination among the riparian states constitutes an ongoing threat to the future development plan within the basin. There is the absence of any treaty of Brahmaputra really tough for water sharing between India China and Bangladesh. They have large populations depend on Brahmaputra water resources and Bangladesh mostly affected flood due to the absence of the institutional framework of the Brahmaputra river basin. It is essential to develop an integrated water resources management approach involving all riparian to foster regional development and overcome the prospect of severe water conflict along the Brahmaputra river basin” (Rahaman, and Varis 2009: 2).

Brahmaputra's flood impact on India and Bangladesh:

Floods are a very dangerous disaster for human life, it is destroying all kinds of human activity like homeland area and other basic needy commodity. In case of Brahmaputra River floods, it has very dangerous for North East India and Bangladesh, every year this river destroy in this region. "One of the areas where information sharing is immediately required is in the area of sharing information related to floods in the shared rivers. The governments of many countries in the region seem to have a number of agreements to share information in this regard, including Pakistan-India, Nepal-India, Bhutan-India, Bangladesh-India and China-India, Unfortunately, the shared information on this aspect is not in the public domain" (Thakkar, 2013: 10).

Floods have remained blight in this region since 1950, when a shocking earthquake, not only raised the bed of the Brahmaputra, but also changed its course (Brahmaputra India, p 9). "There is 40% of its land susceptible to flood damage; the Brahmaputra Valley here represents one of the most dangerous regions in India. There is Weak geological formation, active seismicity, accelerated rate of erosion, rapid channel aggradations, massive deforestation, intense land use pressure and rapid population growth and especially in the floodplains, along with ad hoc flood control measures, are the main factors causing or intensifying floods in Assam" (Brahmaputra: 9).

"The valley of the Brahmaputra River covers almost 60 per cent of the state of Assam in northeastern India. The Brahmaputra river (known as the Yarlung Tsangpo in Tibet and Jamuna in Bangladesh), flows 2,900 km from its source in the southern Tibet to the Bay of Bengal, its course taking it through China, India (58 per cent of the basin is in India), and Bangladesh while its catchment area includes Nepal, Bhutan and Burma. The immense river is fed by the southwest summer monsoon, when over 80 per cent of India's total precipitation occurs. Extremely high, 24 hour rainfall events can occur in parts of the catchment, leading to the Brahmaputra River having one of the highest flood potentials in the subcontinent. Floods are common during the monsoon rainfall; varying from five to 19 floods per season, although floods can

develop into social and economic disasters causing loss of life, livelihoods and infrastructure in the region. Flooding is also part of the natural process which creates fertile lands. Indeed, the Brahmaputra valley is one of the most fertile stretches of land in India” (Mathur et al. 3).

“Assam has a primarily agricultural economy with 74 per cent of its population engaged in agricultural and allied activities. Monsoon-based rice production is the principal crop, covering 67 percent of the total cropped area. Nearly 500,000ha of the agricultural land are irrigated, over 50 percent of those from surface flow. Use of fertilizers and pesticides is increasing; fertilizer consumption rose from 14.2kg per ha in 1996-97 to 46.50kg during 2002-2003 and it has been found that pesticides are being used “randomly, without assessment of the pesticide formulation and quantity” mainly by farmers near urban areas who are converting to vegetable crops which are prone to pest attack. Assam contributes up to 55 per cent of India’s tea output, and 15.6 percent of world tea production” (Mathur et al. 3).

“The State of Assam covers almost an area of 78,438 Sq. Km. The Brahmaputra and Barak valleys, which are named after the mighty Brahmaputra and Barak rivers and two hill districts constitutes the total land mass of the State. The unique geographical location crisscrossed by a vast network of 48 major and 128 small rivers originating from the hills and mountains surrounding the State is largely responsible for the recurring floods and erosion of riverbanks. When the discharge in the rivers along with their tributaries synchronizes during monsoon, the State faces flood havoc and the damage caused is colossal. Further, deforestation in upstream and downstream areas of surrounding Hill States and Assam respectively has caused excessive siltation, resulting in an abnormal rise in the surfaces of major rivers. The siltation problem is acute in the case of rivers of Upper Assam, and Central Assam” (Economic survey Assam 2010-2011: 1).

“The Brahmaputra (Jamuna) river above Bahadurabad has a length of approximately 2,900 km and a catchment area about 5,83,000 sq-km. Started from the glaciers in the northernmost range of the Himalayas and flows east far above half its length across the Tibetan plateau. In the complex mountain

People depend on the Brahmaputra river basin:

China is embarking on an ambitious dam building program on the Brahmaputra river basin in the Tibetan Autonomous Region which is causing controversy due to its impact on people and the environment in the downstream states. There is recognizing point that china needs for unprecedented power is due to its model as well as the mode getting its project need. China did not consult with affected population; displacement (Tibetan autonomous region's people) and environment the downstream states. Brahmaputra river basin is linkages of Ganga, Meghna river basin. The Ganga-Brahmaputra-Barak basin (Barak becomes the Meghna in Bangladesh). "There are 625 million people living in the basin, 80% of which are farmers and need the water for their crops and animals, Bangladesh gets 94% of its water from rivers flowing into the country equating 2.9 billion metric tons from the basin" (Verghese, 1990: 7).

Most popular tribal groups have been living together Brahmaputra river basin in northeast India. "An Indo-Mongoloid and East Asian group of people, live in the eastern region of the Brahmaputra valley in Assam, India, with habitations scattered now in eight districts of the state, such as Tinsukia, Dibrugarh, Dhemaji, Lakhimpur, Sibsager, Jorhat, Golaghat and Sonitpur. Miri is an exonym (name used by nonMishing to refer to them), while Mising is an autonym (name they use themselves). They migrated from the eastern Himalayan regions of Tibet in the hoary past and finally settled in the fertile Brahmaputra valley in Assam after having lived for long centuries in the Siang region of present-day Arunachal. While migrating to Assam, the Mishing followed mainly the course of the Brahmaputra, gradually spreading to other stretches of land lying on the banks of its tributaries like the Dihing, Disang, Dikhow, the Subansiri, the Ranganadi, the Dikrong, etc. They are, therefore, basically a riverine tribe, but erosions of the river Brahmaputra have forced a section of Mishing to move to other places away from rivers" (Gam and Nath, 2012: 62).

The agriculture sector is using high water resources for sustaining its life. There is thought that agriculture based on water resources, without water resources could not be possible high produced from agriculture sector. India and Bangladesh are depending on agriculture base employment, it would be at least half populations of countries. In case of Bangladesh is more than India. They are depending on Brahmaputra river basin for their agriculture and other uses of water on this river basin. There is thought that run of the river or storage dams will be affected not only people living in near about basin region but also people of downstream countries. These kinds of constructions will be effective such as river transportation fisheries, and agriculture, in the lower riparian region of the Brahmaputra river basin. The main problem is this construction sedimentary problem, there is see that the natural way of the river is driven sediment one way, when the change of the river route than river will not sediment to drive one way, it is changing her route, it is transported sediment another route. This is harmful of the lower riparian region. Floods time, this problem will become a big problem of the lower riparian region.

The richest region of ecological:

Environment is important for all kinds of species' life. In case of riparian states of the Brahmaputra is very rich as biodiversity region. "The region is rich in biodiversity and is home to important populations of wildlife species for instance the rhino, elephant, tiger, wild water buffalo, pygmy hog and Gangetic river dolphin in the Tibetan Plateau, northeast India, and Bangladesh. Three out of 34 biodiversity hotspots identified globally – Himalaya, Indo-Burma, and Western Ghats cover parts of India. The Northeast is traversed by the first two and in 8% of the country's geographical area it also houses 21% of Important Bird Areas within India, identified as per international criteria. It is an area which is still poorly documented and in recent years biologists have discovered new species and extended known ranges of existing ones in the region. This is not just restricted to smaller life forms, but also large mammals such as primates, the discovery of which is rare these days, an indication of how unexplored the region is. The Northeast also has a high level of endemism (plant and animal species found nowhere else)" (Vagholikar et al 2011: 362).

“The Brahmaputra is one of the world’s largest river basins, with a drainage basin of 580,000 sq km, 33% of which are in India. Originating in the great glacier mass of Chema-Yung-Dung in the Kailas range of southern Tibet at an elevation of 5,300 m, it traverses 1,625 km through Chinese territory and 918 km in India, before a final stretch of 337 km through Bangladesh, emptying into the Bay of Bengal through a joint channel with the Ganga. A unique river, it drains such diverse environments as the cold dry plateau of Tibet, the rain-drenched Himalayan slopes, and the landlocked alluvial plains of Assam and the vast deltaic lowlands of Bangladesh. An extremely dominant monsoon interacting with a unique physiographic setting, fragile geological base and active seismo-tectonic instability, together with anthropogenic factors, have moulded the Brahmaputra into one of the world’s most intriguing and gigantic river systems” (Vagholikar 2011: 361).

“The dramatic reduction in the slope of the Brahmaputra as it cascades through one of the world’s deepest gorges in the Himalayas before flowing into the Assam plains explains the sudden dissipation of the enormous energy locked in it and the resultant unloading of large amounts of sediments in the valley downstream. The river carries the second largest sediment yield in the world, while it ranks fourth in terms of water discharge. In the course of its 2,880 km journey to the Bay of Bengal, the Brahmaputra receives as many as 22 major tributaries in Tibet, 33 in India and three in Bangladesh. Many of the north bank tributaries are of Himalayan origin, fed by glaciers in their upper reaches, e.g. the Subansiri, the Jia Bharali (Kameng), and the Manas. The Dibang and the Lohit are two large tributaries emerging from the extreme eastern flank of the Himalayas, while the Jiadhal, the Ranganadi, the Puthimari, and the Pagladiya are some of the major tributaries with sources in the sub-Himalayas, the latter two in Bhutan” (Vagholikar 201: 361).

“The river system is intricately linked with the floodplain ecology of wetlands and grasslands in the Brahmaputra valley. For example, these linkages are evident in the world-renowned ecosystems such as the Kaziranga National Park in Assam. Due to the colliding Eurasian (Chinese) and Indian tectonic plates, the Brahmaputra valley and its adjoining hill ranges are seismically

very unstable and the region has seen some major earthquakes” (Vaghlikar, 2011: 361).

Dam's impact on ecology of downstream states:

Mostly Dam effected downstream state's ecological and human life, downstream states depend on upper stream states for flow of water. “Rivers have played a major role in shaping the earth's physical and ecological landscapes through their unique hydrologic characteristics, as well as shaping cultural landscapes by providing food, water, and other ecosystem services. Negative environmental impacts of dams can occur upstream, downstream, and in reservoirs, in addition to habitat degradation or destruction, dams induce significant barrier effects by blocking the downstream flow of sediment and nutrients and preventing the migration of fish and other aquatic organisms” (Beck et al 2012: 2).

Brahmaputra dam's impacts on Indo-Burma biodiversity hotspots, one of the 34 biodiversity hotspots in the world. There is a serious impact on the livelihood of thousand people living in the catchment areas of Brahmaputra river basin, on the river that are being dammed, It is feared that the Kaziranga National Park and the Manas National Park, both is established on the lower reaches of the Brahmaputra river basin which is china build the dam on the mainstream of the Brahmaputra as well as on some its major tributaries.

Kaziranga national park:

“The Kaziranga Tiger Reserve has an area of 1033 sq.km. Which includes the Kaziranga National Park (859 sq.km.), Bura Chapori Wildlife Sanctuary (44 sq.km.) and Laokhowa Wildlife Sanctuary (70 sq.km.). The reserve is located in Nagaon, Golaghat and Sonitpur District of Assam and is bounded by the Brahmaputra, and to the South of the Karbi Anglong Wildlife Sanctuary, the National Highway 37 separates the reserve from the said Sanctuary” (Environment and forest Government of India, ND).

“Kaziranga National Park in Assam has to be one of the best places to experience wildlife in India. Located in the floodplains of the mighty Brahmaputra River (Yarlung Tsangpo), the park's ecology is unique in that it is representative of three distinct bio-geographic regions the Eastern Himalayas, Indo-Malayan and Indo-Gangetic regions. Its location is at the junction of two global biodiversity hotspots - Eastern Himalayas and Indo-Burma. This unique situation has led to very high species diversity, which in turn implies that wildlife watching is quite rewarding here. The National Park's importance in wildlife conservation is among the highest in the world because it is one of the last remaining refuges for a large number of faunal species. It is the largest tract of wet tropical grassland habitat left in the Brahmaputra basin. UNESCO declared it a World Heritage Site in 1985” (Baruah 2006: 1). See below park's importance:

- “About 75% of the world population of Great One Horned Rhinoceros (~1800).
- About 70% of the world population of Asiatic Water Buffalo (~1500).
- Almost the entire world population of the Eastern Swamp Deer (~500).
- Highest density of tigers of any protected area in the world (~17 per 100 sq km).
- Highest number of endangered, threatened and near-threatened bird species of any protected area in the Indian subcontinent (46).
- Globally significant population of Asian Elephant (~1200) importance” (Baruah 2006: 1).

The Kaziranga National Park has the largest grassland area in the Assam region. It situated about 50 km along the south bank of the Brahmaputra river basin. The annual river floods refill the wetlands and allow the grassland areas to thrive. In this area has affected severe erosion due to Brahmaputra river basin in every year. Satellite data have been cleared to a loss of more than 51 km between 1967-68 and 1998-99 although silt deposition also leads to new land forming in other areas. The mostly Significant animal has deaths due to floods, during major floods in 1998 many animals were drowned; for instance carcasses were found of 39 rhinos, 23 wild water buffalo, 19 wild pigs (*Sus scrofa*) and 15 sambar (*Cervus unicolor*). In case of Hog deer (*Axis porcinus*)

Majuli is world famous river island. “Majuli Island, one of the largest riverine islands in the world situated between latitude 26° 45'N – 27° 12'N and longitude 93° 39' E – 94° 35' at an altitude of 60 – 95m msl. Majuli, the world’s biggest inhabited River Island is located in Northern part of Jorhat district of Assam. The island is bounded by the Brahmaputra river basin on the South and the river Subansiri on the North-West and Kherkatia Suti in Northeast” (Kumar & Bordoloi Sabitry 2012: 1), the physical status of the island is alluvial region. Its four boundaries are natural barriers represented by the mighty river Brahmaputra and the Kherkatia –Lohit Channels. Majuli the world’s biggest River Island was created in between 1691 and 1696. “All of the above the river, its tributaries, the wet lands and the chaporis along with the island of Majuli make it the largest mid river delta system in the world” (Nath, 2012: 16). It is a pollution free fresh water island. Majuli is rich in biodiversity potentialities in the Brahmaputra Valley.

Majuli is the home of many people, they are different communities live together. Majuli is inhabited by different groups of people for instance Missing, Deori, Konch, Kolita, Ahom, Kachari (Sonowal Kachari) Koibatra, Nath (Yogi), Brahmin, Gosain etc. The different tribes of indigenous people have been living in Majuli with peace, unity and amity, hope since time immemorial. The Island is the nerves centre of Neo-Vaishnavite cultural heritage of Assam state in India. Majuli has been regarded as the treasury of different types of indigenous and traditional culture and typical biological resources. The Good environment, life-style, special traditional food habits & house-types have been a unique feature of human ecology and geographical environment of Majuli (Nath 2012). Environment point of view Majuli is most important island in north east region. There is so many species live. Its area is rich for biodiversity region. Every year destroy the Majuli Island due to Brahmaputra river basin floods which is life line of Majuli Island and some time bad for island when floods came out in the region and destroy the home of people and species live there. (See below Majuli island map)

“Presently Sundarbans has cover of 10,200 sq km forest areas which shared between India and Bangladesh. India’s share of this forest area is around 4,200 sq. km and Indian Sundarban also includes around 5,400 sq. km. area outside the forest cover that includes inhabited lands along the north and north-western boundary of the forest. The Sundarban areas are rich in biodiversity and the biotic factors here play a significant role in physical coastal evolution and for wildlife conservation. It has significant ecological implication for marine life and livelihood of coastal communities for a large part of south-east Asia. The Sundarbans includes 26 true mangrove species, 29 mangrove associates, and 29 back mangrove species of 40 families and 60 genera. The mangrove vegetation itself assists in the formation of new landmass and the intertidal vegetation plays an important role in swamp morphology” (Human Development Report 2009: 294).

Faunal Diversity in Sundarban:

“In terms of faunal endowment Sundarban is famous for Royal Bengal Tigers. It is the only mangrove forest in the world that lives tigers here. It is also the single forest areas tract where the largest number of tigers is found. As per December 2001 census, the number of tigers in Indian Sundarban is 271. It is also home to a good number of globally endangered animals like estuarine crocodile, and fishing cat, and Gangetic dolphin, olive ridley and green sea turtles etc. Several bird species are found including a large number of migrants from the higher latitudes that visit the area in winter. Species composition and community structure vary from east to west, and along the hydrological and salinity gradients. Numerous species of phytoplankton, fungi, bacteria, zooplankton, invertebrates, molluscs, reptiles, amphibians and mammals are also found here. All these make Sundarban a biodiversity hotspot and its conservation is a global concern” (Human Development Report 2009 294).

Some species mention here:

- Vertebrate Species = 481
- Hemichordate Species = 1
- Invertebrate Species = 1104
- Protozoan Species = 106

- Mammals = 58
- Birds = 248
- Reptiles = 55

Species that gone extinct in the last hundred years with human invasion:

- Javan Rhino
- Wild Buffalo
- Barking Deer
- Swamp Deer

Sundarban delta is ecologically important for India and Bangladesh. It has biodiversity rich area which is maintained regional ecology. Brahmaputra river is vital important this area for maintenance of biodiversity. If China diverts the full water for her own utilization of the Brahmaputra river basin than its area faces many problems due to a shortage of water resources whose life depend on many species in this region.

Climate change impact on Brahmaputra river basin:

Climate change is an important issue present time in worldwide. There is place of discussion here that Himalayan Glacier where is the source of originate of Brahamaputra/Yarlung Tsangpo river basin. How impact on this area of climate change. The climate is commonly defined as the weather averaged over a long period and affected by its latitude, terrain, and altitude, as well as nearby water bodies and their currents. It is a freely available natural resource, human interference to the atmospheres has rendered it highly vulnerable and unstable which in the future has potentials to impact all spheres of life on the planet. The globe is warming due to anthropogenic factors such as emission of greenhouse gases which increases in global temperature (Bajracharya et al.).

The Brahmaputra is a major transboundary river which originates in the glaciated areas of the Kailash range in Tibet Autonomous Region at an elevation of 5300m above the sea level. "The river has a length of 2900 km, drains an area of around 530 000 km² and traverses four different countries

Climate change will create the problems such as floods, landslides, and droughts will impose significant stresses on the livelihoods of downstream populations such as India and Bangladesh. Eventually, due to melting of glaciers there is “seriously threaten on water availability in the region, particularly during the lean flow seasons when melt water contribution is crucial to sustain the river flow which supports human activities and ecosystem services in the areas and downstream” (Shilpakar et al ND: 2). The region where more than 80% of the population's livelihood depending upon agriculture, change in climate will have a significant social and economic impact.

Present time climate change is becoming the main discussion issue in the whole world. Every country wants to maintain a minimum level of increase the greenhouse gases. Many treaty is working to decrease greenhouse gases and maintain global temperature. For the Tibetan water resources faces many problems if temperatures increase which is result of Himalayan glacier melting and which increase the water flow in the Tibetan rivers in faces flood situations South and South East Asian countries. Due to brahmaputra river dams would be more challenging for downstream countries to maintain their water flow.

Chapter 4

Conclusion

River basin is very crucial for the development of human civilization because there is truth that civilization grew in and around the river basin. That's why it is also called as the cradle of human civilization. The present study analyzed the China's water diversion of the Brahmaputra River and Brahmaputra's Dam's impact on downstream states. The study shows that there is a gap in institutional mechanism on water sharing of the Brahmaputra River, which again resulted into the Chinese overuse of water of Brahmaputra River. This has the overall implications on the livelihoods and ecologies of both downstream countries of India and Bangladesh. Brahmaputra is a big river basin area in the Asian region. It covers the countries of China, India, Bhutan and Bangladesh.

In ancient time river basin played the important role in developing our ancient society. Countries sharing the water of Brahmaputra River are countries of high population. They are living very near the river basin area because they simply find out the fresh water very near their home to different kinds of uses. Water is crucial to sustain human life. Without water in our planet, cannot be imagine the beautiful earth. Simply, simply say, No water, no life. Through different mission to different planets scientist are at first trying to confirm if the planet has the water. The moon mission can be a good example for this.

As the populations are growing high in the present scenario, the fresh water per capita demands and supply too is growing high. Fresh water is very useful for human life which is good for sustaining their long life. Fresh water has many sources for instance glacier, ground water, river water, rainfall etc. but among these most important is river water. We can reach for River water is very easily not like glacier and underground water because we tend to live near the river. Even the runoff water of the river is not that much costly in comparison with the other sources of water.

In case of India, many big cities established near river basins, for instance Kolkata is established on Hugli River, Allahabad is established near Ganga River etc. Interestingly, in case of the Brahmaputra River, it does not have big cities near its

bank but it concentrates large population which depends on its water resources for use their own daily lives of China, India and Bangladesh.

Managing of Transboundary water resources is strategically important for equal utilization of water resources which shares the same river basin of water resources for social, economical and environmental. All over the world are about 261 major transboundary river basins. In case of Tibet's ten most important river basins are flown as a transboundary river basin in South and South East Asia. Almost 145 countries are sharing the transboundary water resources. Brahmaputra river basin is one all of them. Tibetan plateau has been given 90% fresh water as China, India, Bangladesh, Nepal, Bhutan, Pakistan, Thailand, Myanmar, Laos, Cambodia, and Vietnam. 47% world populations have been taking the water of the Tibetan plateau.

Managing of Brahmaputra river water resources is becoming very tough between upstream and downstream countries. China did not sign in The UN Convention of Non-Navigation of Watercourses Law; it is a very important law for transboundary water resources management. This law provided rights for equitable utilization of water resources in which are sharing the same transboundary water resources. China occupied the Tibetan water resources which have a much transboundary river flow to Asian countries. Brahmaputra is mother of water of North East India and Bangladesh. This river is more important in this region.

Brahmaputra river basin is the most important river flowing control by China. China is utilizing the water of Brahmaputra River for her electricity generation and agriculture purposes, in southern and northern part of China. Brahmaputra river water is become as a hot issue between China and India; in current scenario because of China build the more dam on Brahmaputra river basin without concerning lower riparian countries (India and Bangladesh). China made the already Zangmu dam on the upper reaches of Brahmaputra river and working on electricity generation and divert the water of this river. China also made the South-North water diversion project for the Chinese Northern arid region because of the Chinese northern region is a very populated area not in China but also in the world. Chinese south-north water diversion project is three routes, one is the western route, second is middle route, and the third is an eastern route project which is planned to huge water diversion project linking of the Yangtze, Yellow, Huai, and Hai rivers. This water reduces the water scarcity

problem in the northern region of China. China diverts the water on upper middle and lower of southern china to northern and northwestern Chinese region.

The Government of China is working on conserving energy generation during 2011-2015 time periods, total capacity of its 120 GW which will provide by 54 hydro power stations. Brahmaputra River's dam is part of it. China's coal reserve is facing the problem to sustain in a long term energy generation, and pressure of international to reduce the carbon emission. So China is very much looking at Tibetan water resources for energy generation. China is also an economic powerhouse in the world; it is the second largest economic power behind United States of America. It defeated the Japan of economy area in before couple of years. China would not be sustaining her high growth rate without energy generation. China is established Tibetan plateau as future energy generation conserve the area. All of us know that coal energy is not a long term energy area, it is not renewing resources. So China is focused on non fossil fuel for long term energy generation. Hydro power is non fossil fuel energy generation. China's 12th five year plan (2011-2015) is more focus to produce of energy generate. Recently China has been focusing on the Brahmaputra hydro power project; it is part of China long term energy generates planning.

Chinese hydropower project on Brahmaputra is the effect of downstream water resources demands and supply. India and Bangladesh have been taking the water from Tibetan plateau transounadary water resources. China is exploiting water of Brahmaputra River; it is unparalleled to build the many dams on Brahmaputra river basin which will bad impact on downstream livelihoods. China focuses on the Brahmaputra River for fillip the gap of electricity generation and farming from Brahmaputra River's dam, Zangmu dam, Dagu, it is established less 18 km upstream of Zangmu. It is capacity 640 MW. Another 320 MW dam is built at Jiacha, it is established middle reaches of the Brahmaputra downstream of Zangmu. A third dam name is Jiexu which 11 km upstream of Zangmu. It is capacity yet not confirm. These dams have recently announced by the Chinese government. The Chinese government is working on this area to driven the water in the Great Bend area of this river, where is largest water resources store. China connected water from the Brahmaputra River to Yellow River; it is called a Great Bend area.

China is growing on industrialization and urbanization is growing, this sector is really increased of fresh water demands in China. China's northern area is a huge industry and largest population another place in China. They are really consuming huge capacity of water resources. Northern household water consumption is rising quickly. In Chinese northern region is a limited water resource. The Chinese government is driving the water resources from the southern region in the northern region for water demands. The agriculture sector is also rising in China; it is also wants to huge water demands and supply. This is the most important threat to the Chinese water supply sector. China is diverting the Brahmaputra river water for this sector through Yellow River. There is seeing here that China is diverting the Brahmaputra water for her own utilization.

The Brahmaputra water resources is not a China diversion issue, it is an issue of all riparian states which share the Brahmaputra water resources. Brahmaputra river basin is recognized as Transboundary River. China should not build the dams and divert of Brahmaputra water for own utilization without downstream concern. China will do again and again; downstream countries will strongly raise the question of diversion of Brahmaputra water resources in front of the Chinese Government. This is a total violation of downstream water rights. There is issue of displacement of peoples, increased salinity, and decline of water quality makes to dam building to affect water flow of Bangladesh and India. They should make the institutional framework of the Brahmaputra river basin which will help to maintain the flow of river basins in all riparian states.

Brahmaputra river water resources are playing the important role between downstream and upstream state's water resources. When china diverted water of this river than downstream countries is fear about to maintain the flow of this river basin in the lower riparian region. Present time China is fully focused on Brahmaputra river basin water resources. China is making the dams on Brahmaputra upper, middle and lower riparian. It is diverting the natural way of Brahmaputra River. Around 625 million people are depending on Brahmaputra river basin area. This is most populated areas in the world.

Around 80 percent people depend on this river for their agriculture, fisheries, economic activity, etc.

Indian northeastern people are most affected due to floods of Brahmaputra River in every year. They are dying and homeless due to Brahmaputra River's flood. Managing of Brahmaputra River water resources will be reduced this problem in North East India and Bangladesh whose are more affected of this cause. There is the absence of any treaty of Brahmaputra really tough for water sharing between India China and Bangladesh. They have large populations depend on Brahmaputra water resources and Bangladesh mostly affected flood due to the absence of the institutional framework of the Brahmaputra river basin. It is essential to develop an integrated water resources management approach involving all riparian to foster regional development and overcome the prospect of severe water conflict along the Brahmaputra river basin.

Diversion of Brahmaputra River will be affected economic growth, social progress, environmental sustainability, food security, public health in downstream states. Brahmaputra's dams impact on downstream ecologically. Brahmaputra dams change the life of the Indo-Burma biodiversity hotspots which is one of the 34 biodiversity hotspots in the world. There is a serious impact on Kaziranga National Park and the Manas National Park and Sundarban delta. It is fear about the most important species whose depends on Brahmaputra river water resources for their livelihood. Diversion issue will be creating the problem two economic powers in the Asian region, India and China. Now China is economic hub and India is also growing as an economic power in the world. Those countries are facing the water scarcity problem; water diversion of Brahmaputra will play the important role interstate relationship. Balance of power is important for regional security, if China and India will not make a better relationship with each other than Asian region will not be maintained regional security. India, China have nuclear power states, they are a big power in the Asian region. They are going to the war situation, it will not good for whole regional security. An institutional gap of the Brahmaputra is a major issue between India and China.

Climate change will be a significant social and economic impact in this region. Current time climate change becomes the important issue in the whole world.

In case of Tibet is very important, Tibet flows the fresh water in Asia which will be affected by climate change in future time. This will not happen good for Asian countries. Climate change will be create the problem drought and floods in anywhere anytime. We want to save the Tibetan water resources and Himayan glacier for our future generation will consume. So there is important to managing of Brahmaputra water resources for future generation whose will consume water without facing any problem.

China is not working only diversion of water but also working on another tactic importance in South Asian region for other purposes. China has taken many areas for her strategically. China builds the Gyadar port in Pakistan; it is part of china's string of pearls strategic plan in south Asia. China also made the Chittagong port in Bangladesh, the Humantota port in Sri Lanka. It's very important for Indian security purposes. India wants to make the balance of power in the Asian region for regional stability. China presence in South Asia will create the problem for her neighbour countries. Thus China's policy remembers like blue water policy of Portugal earlier British period in India. They were increased her power. Just like China is doing in South Asia.

This research will provide to management of Brahmaputra river water resources effectively. One thing to share here about Brahmaputra River, it should have legal institutional framework between upstream and downstream countries to solve the problem of water resources. China, India and Bangladesh will make an institutional framework for Brahmaputra River. This will reduce the problem of sharing of Brahmaputra water among those countries. Nile and Mekong riparian have an institutional framework for using water resources. Why cannot be possible on Brahmaputra river. There is a good thing for using of Brahmaputra water resources.

Through the present study it can be said that, where rivers, lakes, or aquifers are shared between countries, transboundary water allocation and management issues remain a major challenge to the sustainability of inland water ecosystems. In order to overcome this challenge, it requires international cooperation among sharing states of the water system, without having a negative impact on the ecosystem.

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Appendices

Appendix 1

Convention on the Law of the Non-navigational Uses of International Watercourses 1997

Article 1

Scope of the present Convention

1. The present Convention applies to uses of international watercourses and of their waters for Purposes other than navigation and to measures of protection, preservation and management related to the uses of those watercourses and their waters.
2. The uses of international watercourses for navigation is not within the scope of the present Convention except insofar as other uses affect navigation or are affected by navigation.

Article 2

Use of terms

For the purposes of the present Convention:

- (a) "Watercourse" means a system of surface waters and groundwater constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus;
- (b) "International watercourse" means a watercourse, parts of which are situated in different States;
- (c) "Watercourse State" means a State Party to the present Convention in whose territory part of an international watercourse is situated, or a Party that

is a regional economic integration organization, in the territory of one or more of whose Member States part of an international watercourse is situated;

(d) “Regional economic integration organization” means an organization constituted by sovereign

States of a given region, to which its member States have transferred competence in respect of matters governed by this Convention and which has been duly authorized in accordance with its internal procedures, to sign, ratify, accept, approve or accede to it.

Article 3

Watercourse agreements

1. In the absence of an agreement to the contrary, nothing in the present Convention shall affect the rights or obligations of a watercourse State arising from agreements in force for it on the date on which it became a party to the present Convention.

2. Notwithstanding the provisions of paragraph 1, parties to agreements referred to in paragraph 1 may, where necessary, consider harmonizing such agreements with the basic principles of the present Convention.

3. Watercourse States may enter into one or more agreements, hereinafter referred to as “watercourse agreements”, which apply and adjust the provisions of the present Convention to the characteristics and uses of a particular international watercourse or part thereof. 4. Where a watercourse agreement is concluded between two or more watercourse States, it shall define the waters to which it applies. Such an agreement may be entered into with respect to an entire international watercourse or any part thereof or a particular project, programme or use except insofar as the agreement adversely affects, to a significant extent, the use by one or more other watercourse States of the waters of the watercourse, without their express consent.

5. Where a watercourse State considers that adjustment and application of the provisions of the present Convention is required because of the characteristics and uses of a particular international watercourse, watercourse States shall consult with a view to negotiating in good faith for the purpose of concluding a watercourse agreement or agreements.

6. Where some but not all watercourse States to a particular international watercourse are parties to an agreement, nothing in such agreement shall affect the rights or obligations under the present Convention of watercourse States that are not parties to such an agreement.

Article 4

Parties to watercourse agreements

1. Every watercourse State is entitled to participate in the negotiation of and to become a party to any watercourse agreement that applies to the entire international watercourse, as well as to participate in any relevant consultations.

2. A watercourse State whose use of an international watercourse may be affected to a significant extent by the implementation of a proposed watercourse agreement that applies only to a part of the watercourse or to a particular project, programme or use is entitled to participate in consultations on such an agreement and, where appropriate, in the negotiation thereof in good faith with a view to becoming a party thereto, to the extent that its use is thereby affected.

Article 5

Equitable and reasonable utilization and participation

1. Watercourse States shall in their respective territories utilize an international watercourse in an equitable and reasonable manner. In particular, an international watercourse shall be used and developed by watercourse States with a view to attaining optimal and sustainable utilization thereof and benefits therefrom, taking into account the interests of the watercourse States concerned, consistent with adequate protection of the watercourse.

2. Watercourse States shall participate in the use, development and protection of an international watercourse in an equitable and reasonable manner. Such participation includes both the right to utilize the watercourse and the duty to

cooperate in the protection and development thereof, as provided in the present Convention.

Article 6

Factors relevant to equitable and reasonable utilization

1. Utilization of an international watercourse in an equitable and reasonable manner within the meaning of article 5 requires taking into account all relevant factors and circumstances, including:

- (a) Geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character;
- (b) The social and economic needs of the watercourse States concerned;
- (c) The population dependent on the watercourse in each Watercourse State;
- (d) The effects of the use or uses of the watercourses in one watercourse State on other watercourse States;
- (e) Existing and potential uses of the watercourse;
- (f) Conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect;
- (g) The availability of alternatives, of comparable value, to a particular planned or existing use.

2. In the application of article 5 or paragraph 1 of this article, watercourse States concerned shall, when the need arises, enter into consultations in a spirit of cooperation.

3. The weight to be given to each factor is to be determined by its importance in comparison with that of other relevant factors. In determining what is a reasonable and equitable use, all relevant factors are to be considered together and a conclusion reached on the basis of the whole.

Article 7

Obligation not to cause significant harm

1. Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.

2. Where significant harm nevertheless is caused to another watercourse State, the States whose use causes such harm shall, in the absence of agreement to such use, take all appropriate measures, having due regard for the provisions

of articles 5 and 6, in consultation with the affected State, to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation.

Article 8

General obligation to cooperate

1. Watercourse States shall cooperate on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection of an international watercourse.
2. In determining the manner of such cooperation, watercourse States may consider the establishment of joint mechanisms or commissions, as deemed necessary by them, to facilitate cooperation on relevant measures and procedures in the light of experience gained through cooperation in existing joint mechanisms and commissions in various regions.

Article 9

Regular exchange of data and information

1. Pursuant to article 8, watercourse States shall on a regular basis exchange readily available data and information on the condition of the watercourse, in particular that of a hydrological, meteorological, hydro geological and ecological nature and related to the water quality as well as related forecasts.
2. If a watercourse State is requested by another watercourse State to provide data or information that is not readily available, it shall employ its best efforts to comply with the request but may condition its compliance upon payment by the requesting State of the reasonable costs of collecting and, where appropriate, processing such data or information.
3. Watercourse States shall employ their best efforts to collect and, where appropriate, to process data and information in a manner which facilitates its utilization by the other watercourse States to which it is communicated.

Article 10

Relationship between different kinds of uses

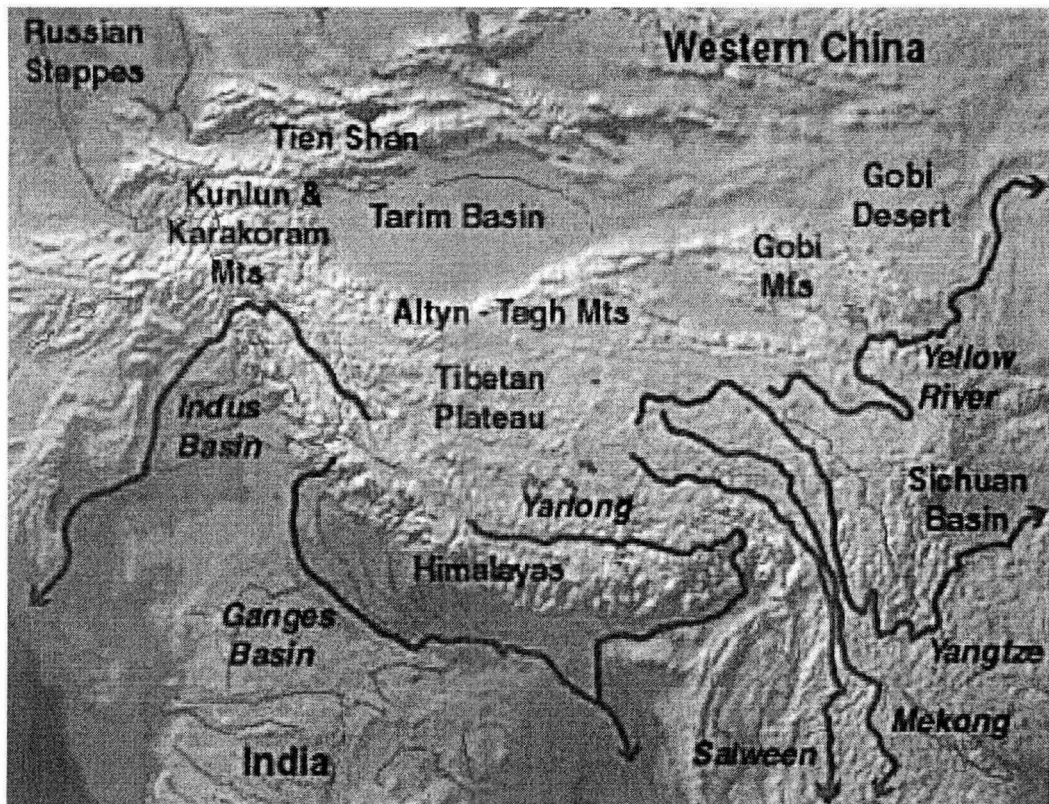
1. In the absence of agreement or custom to the contrary, no use of an international watercourse enjoys inherent priority over other uses.

2. In the event of a conflict between uses of an international watercourse, it shall be resolved with reference to articles 5 to 7, with special regard being given to the requirements of vital human needs.

Source: United Nations Report: Supplement No. 49 (A/51/49), 2005

China (50.5 %), India (33.6 %), Bangladesh (8.1 %) and Bhutan (7.8 %). Average discharge of the Brahmaputra is approximately 20000m³ (Immerzeel, 2008). “The greater Himalayan region sometimes called the ‘Roof of the World’, is noticeably impacted by climate change. The most widely reported impact is the rapid reduction in glaciers, with profound future implications for downstream water resources. The impacts of climate change are superimposed on a variety of other environmental and social stresses, many already recognized as severe. The ‘Roof of the World’ is the source of ten of the largest rivers in Asia. The basins of these rivers are inhabited by 1.3 billion people and contain seven megacities. Natural resources in these basins provide the basis for a substantial part of the region’s total GDP, and important environmental services, which are also of importance beyond the region” (Mats Eriksson et al.). (See below the map of Tibetan plateau):

Map 17: Tibetan plateau



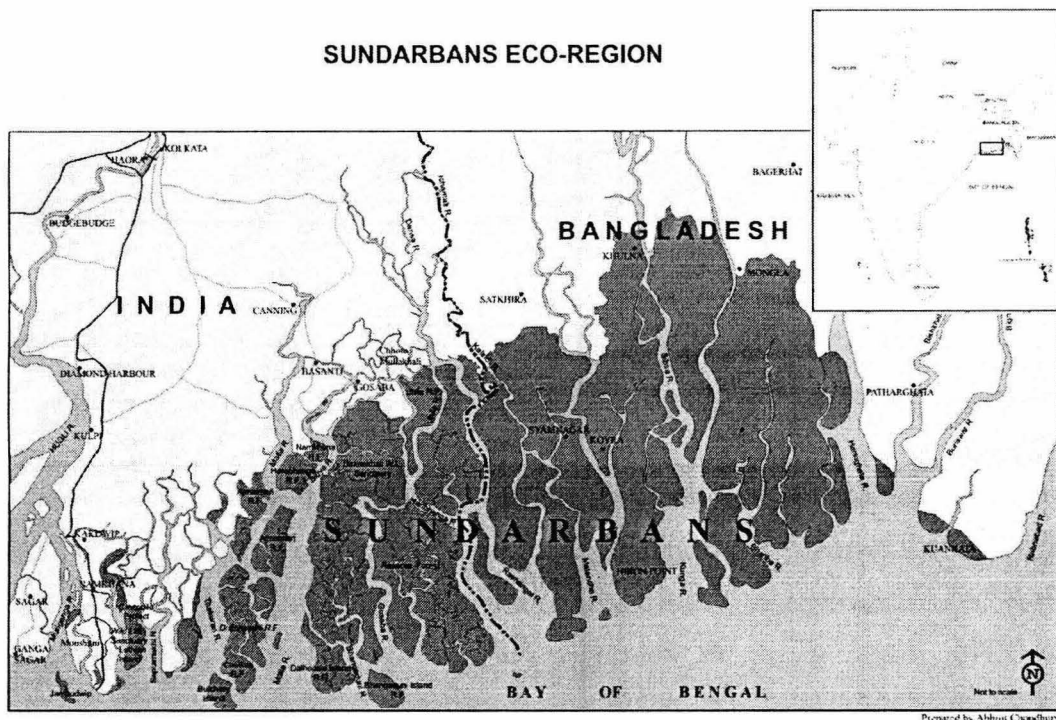
Source: Human Development Report 2007/2008

Climate change will create the problems such as floods, landslides, and droughts will impose significant stresses on the livelihoods of downstream

Brahmaputra River brought sediments from her upper region. This is important for made of Sundarban delta.

One good thing about Sundarbans delta ecosystem step has taken by the government of India. Sundarban has Mangrove forest which is most important for biodiversity conservation. "India has a large grant project in the Sundarbans Mangroves with the West Bengal Forest Department for 300,000 USD. The project is under formalization and the focus of the project is the reduction in anthropogenic pressures on the mangrove forest resources through the provision of alternative livelihoods and income generating options and it seeks to pilot disaster preparedness initiative and reduce the risk of damage to lives and livelihoods from flooding and other related natural disasters that the area is prone to, institutional building/strengthening is also a key component of the project" (Report to the people on Environment and forest Government of India 2011: 6). (See below the map of Sundarban)

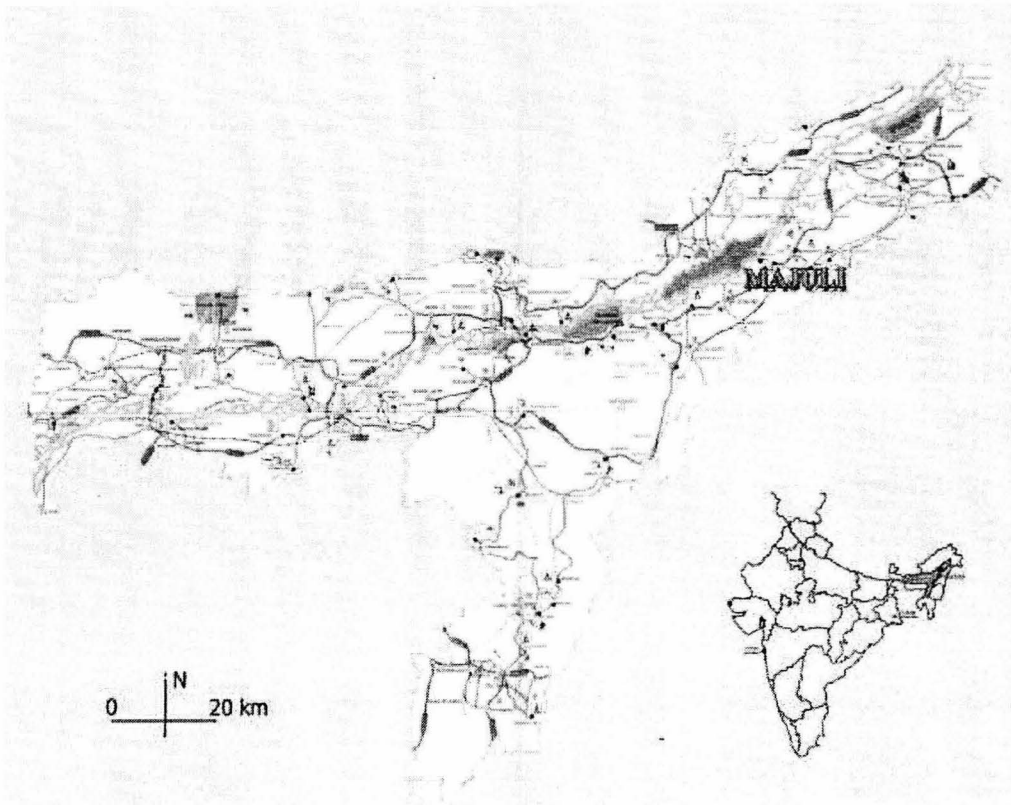
Map 16 Sundarban Delta



Sources: http://www.google.co.in/search?q=india+and+bangladesh+sundarban+delta+map&safe=active&rlz=1C2CHMO_enIN501IN502&source

Ecology of sundarban:

Map 15: Majuli Island:



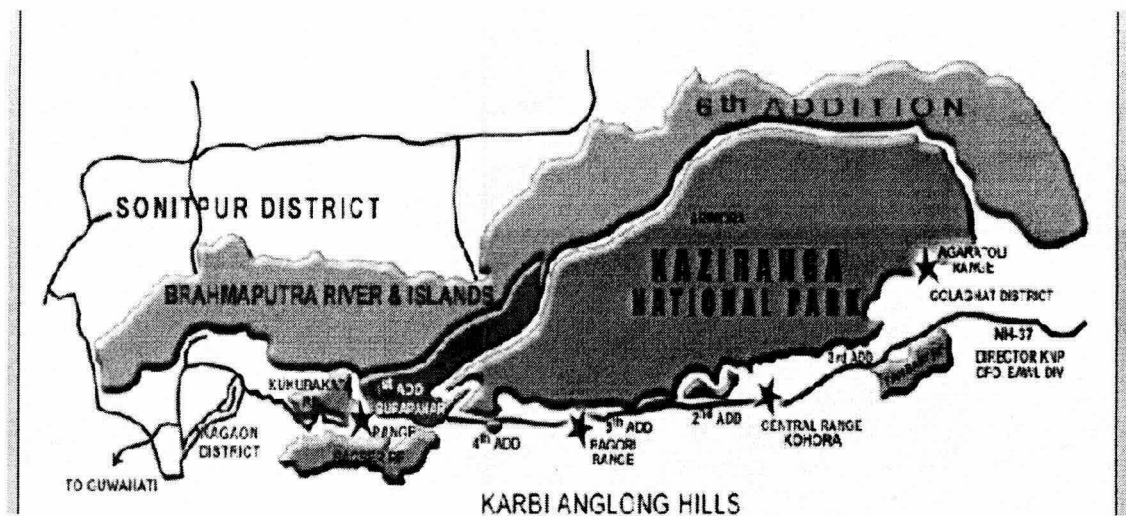
Source:http://www.google.co.in/search?rlz=1C2CHMO_enIN501IN502&q=majuli%20island%20images&psj=1&bav

Sundarban Delta:

Sundarban delta is richest for biodiversity. “Sundarbans is the world’s largest prograding delta region that spreads over India and Bangladesh covering around 25,500 sq. km. The Indian part is approximately 9,630 sq. km, rest of the area covering of Bangladesh. The region consists of 102 islands out of which 54 are inhabited; this area is home to over 3.9 million people” (Human Development Report 2009: 291), the Sundarbans along the Bay of Bengal has evolved through quaternary (began about 2 million years ago and extends to the present) sediments deposited mainly by the mighty river Ganges, Brahmaputra and, Meghna and their numerous distributaries. Sundarban delta builds by mainly these three river basins (Ganga, Brahmaputra and Meghna).

were most seriously affected, with 473 recorded deaths. This species were also badly affected by the 1988 floods. Although precise statistics of flood related mortality are not available, there were only 2,900 deer counted in the census of 1991, compared to 10,000 in 1984. The wild pig has seen a similar decline with the census of 1991 counted only 555 individuals compared to a count of 1,645 in 1984. Despite all odds in the last 100 years Kaziranga National Park has been able to secure the habitat of several endangered species including rhino, elephant, tiger, wild buffalo and swamp deer. The park managers, Frontline staff, local communities and the civil society representatives have under the guidance of the administration as well as political leadership in the State of Assam and played a vital role in achieving this conservation success (Mathur et al: 4). Kaziranga National Park has been affected by The Brahmaputra river flood Plains; the reserve is prone to annual floods. The Brahmaputra normal flood inundation is an inherent and important aspect of the Kaziranga ecosystem to maintain the floral/faunal biodiversity in this area. (See below a map of Kaziranga National Park)

Map 14: Kaziranga National Park



Source: <http://www.assamforest.in/knp-osc/presentation-knp-n7w>

Mazuli Island:

terrain bordering northeast India and China it bends through a series of gorges and is joined by a number of major tributaries and the Dihang and the Lohit before entering its broad valley section in Assam. This stretch is about 720 km long to the border of Bangladesh and throughout most of this, the course is braided. This braided channel continues to the confluence with the Ganges, Within Bangladesh, the Brahmaputra receives four major Right Bank tributaries – the Dudkumar, the Dharla, the Teesta and the Hurasagar” (BWDB Annual Report, 2011: 12).

“The first three are flashy rivers, rising in steep catchments on the southern side of the Himalayas between Darjeeling and Bhutan. The Hurasagar River is the outlet to the Karatoya-Atrai river system, which comprises much of the internal drainage of northwest of Bangladesh. The Old Brahmaputra is the main left-bank distributaries of the Brahmaputra River presently known as the Jamuna. The shift of river course appears to have been taken place after a major earthquake and a catastrophic flood in 1787. It is now a high flow spill river contributing largely to flood, as in the Dhaleswari, and their behavior is highly dependent on the variations of siltation at their entries” (BWDB, Annual Report 2011: 12). (See below map of Brahmaputra with Ganga, and Meghna).

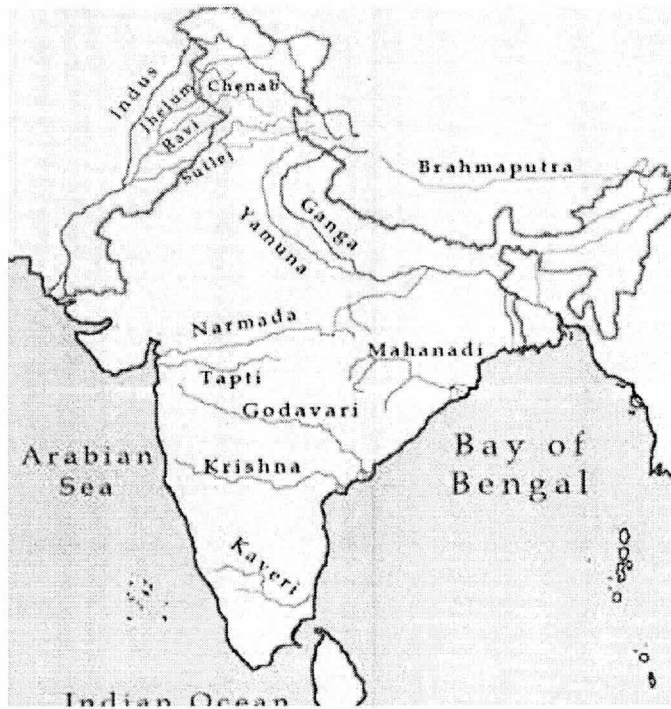
Map 13: flood region



The Ganges, The Brahmaputra, The Meghna River Basin

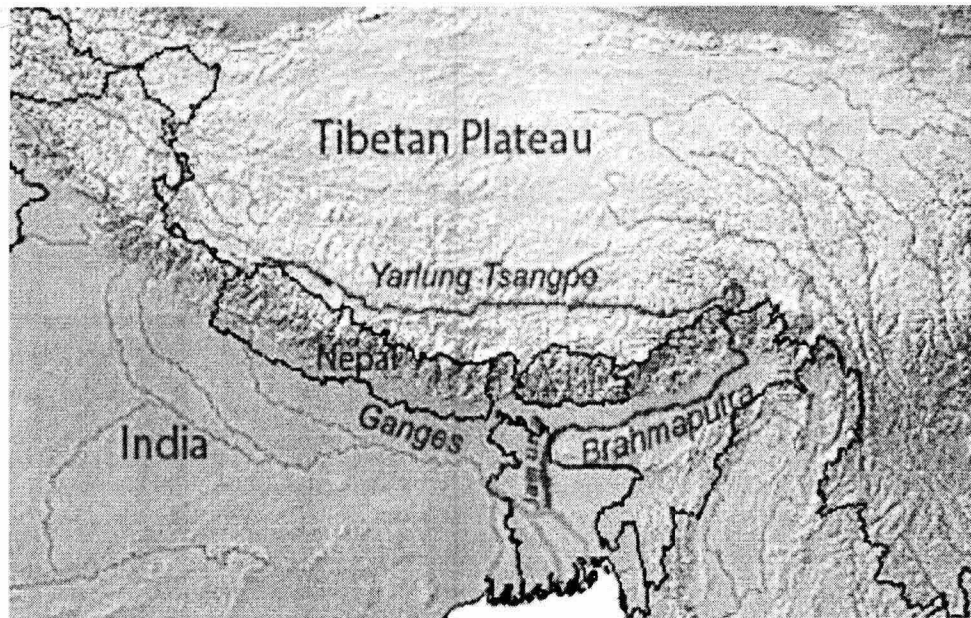
Source: The World Bank, 2006

Map 11: Indian river basin:



Source: Meredith Brackett

Map 12: Brahmaputra/Yarlung Tsangpo

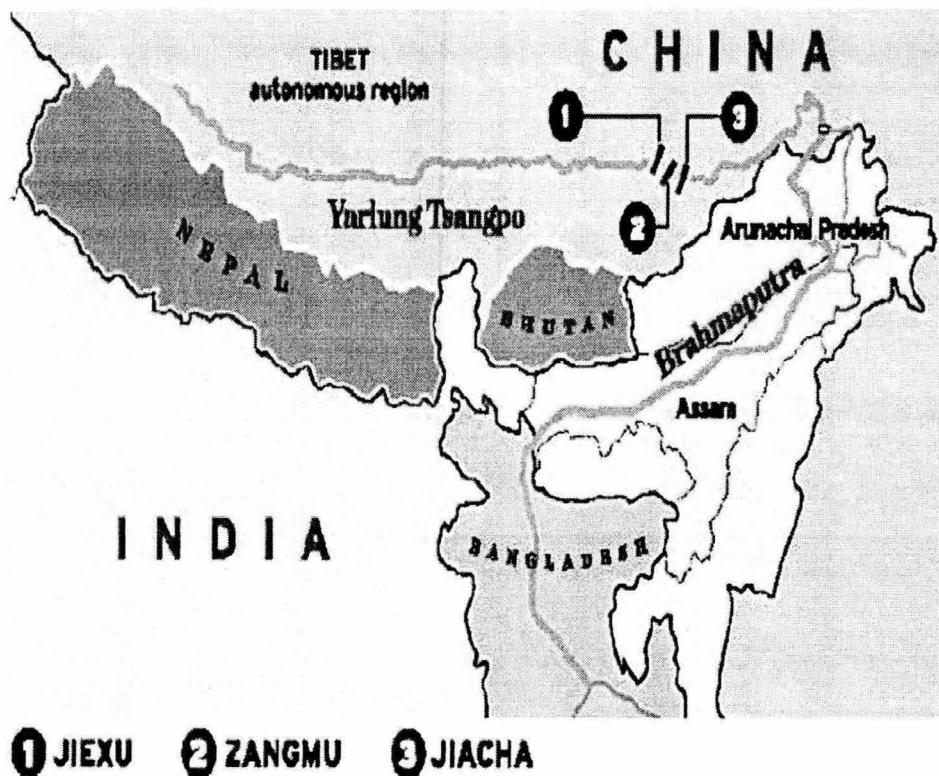


Source http://www.google.co.in/search?gs_rn=16&gs_ri=psy-ab&suggest=p&cp=12&gs_id=1a&xhr=t&q=brahmaputra+river&rlz=1C2CHMO

under the energy plan, four hydropower projects will now be built — all located within a few dozen kilometers of each other — on the mainstream of the middle reaches of the Brahmaputra (Dams across Brahmaputra, The Hindu, February 2, 2013).

There is called Dagu, which is less 18 km upstream of Zangmu. It has capacity 640 MW. Another 320 MW dam will be built at Jiacha, which is middle reaches of the Brahmaputra downstream of Zangmu. A third dam name is Jiexu which 11 km upstream of Zangmu. It has capacity yet not confirm. These three dams are part of Chinese 12th five year plan (2011-2015) strategy. China, the world's most 'dammed' nation today (Chellaney 2011: 61). China has the most dams in the world. (See below the map of three new dams on the Brahmaputra River Basin)

Map 10: Three New Dams



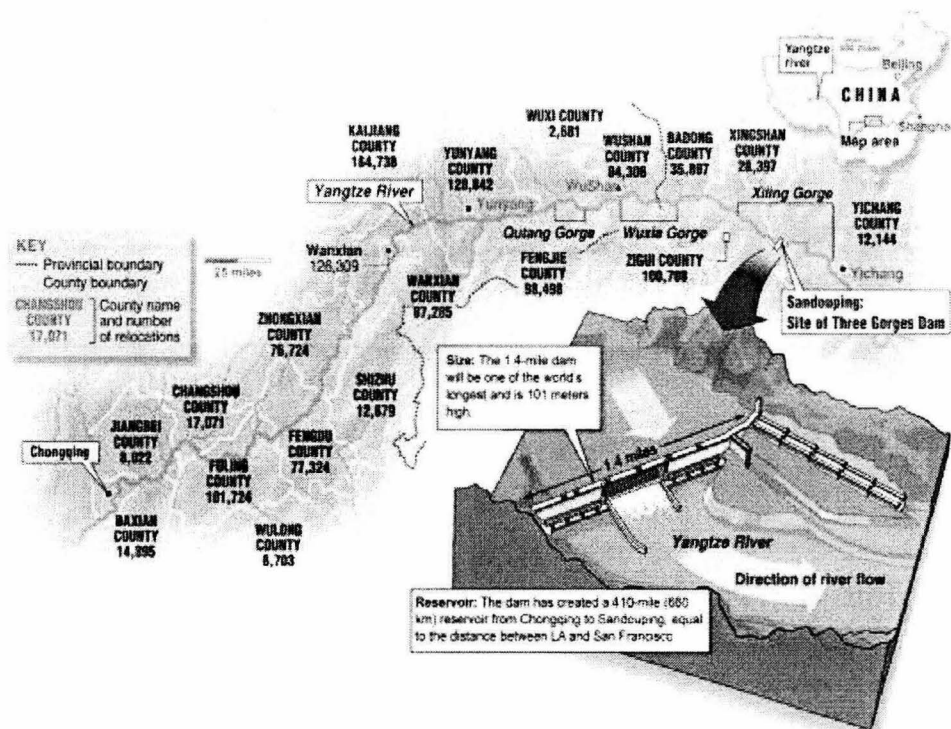
Source: the Hindu April 5, 2013, New Delhi

The government of China has exposed about her strategic interest of diverting the Brahmaputra River to North China, where it is entered into Indian

generators in the north side of the dam have already been installed and they reached full capacity (9,800 MW) on October 18, 2006 after the water level in the reservoir had been raised to 156 meters. Installation of seven generators in the south side of the dam was completed by the end of 2007 and bringing the total power capacity to 14,800 MW and surpassing the generating capacity of the Itaipu Dam (14,000 MW) in Brazil” (Gleick 2008-09 140).

“At its completion, sometime after 2010, the project is expected to have a total installed hydroelectric capacity exceeding 22,000 MW. This power capacity is higher than originally proposed because of an expansion initiated in 2002. In 2007, the turbines generated around 62 billion kWh of electricity – about two-thirds of the maximum level expected from the completed project. Other benefits of the project claimed by project designers include 140 The World’s Water 2008–2009 flood protection on the historically dangerous Yangtze River and improvements to river navigation for thousands of kilometers” (Gleick 2008-09 140). (See below the Yangtze River basin)

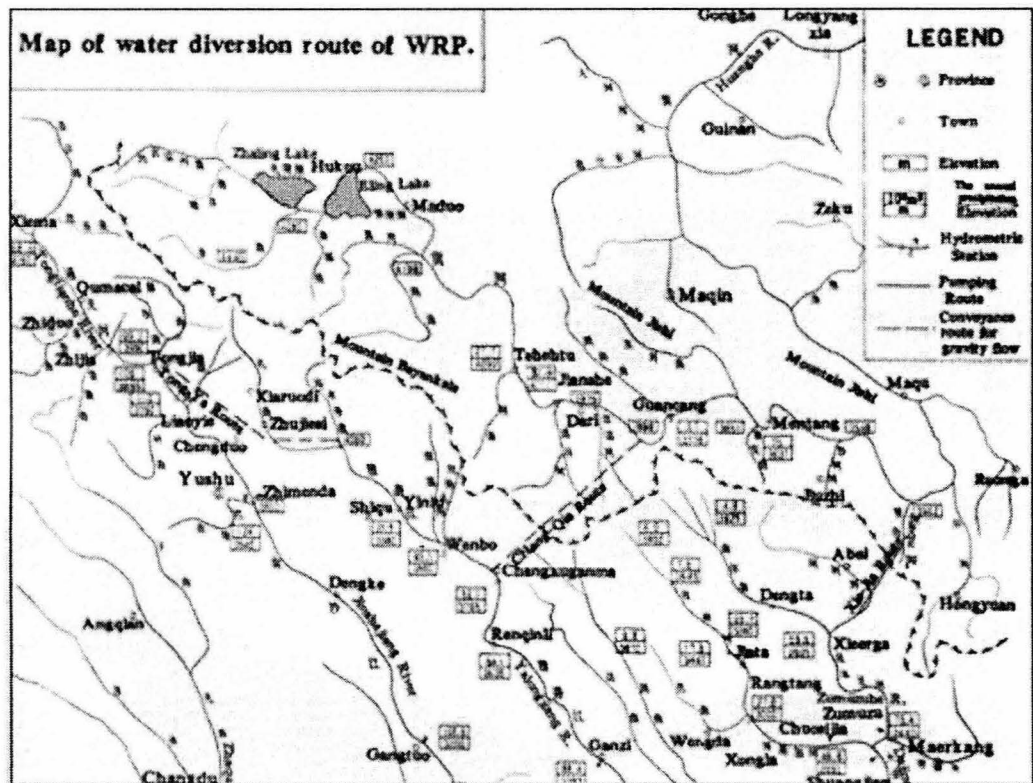
Map 9: Yangtze River



Source: <http://www.internationalrivers.org>

development in the region (Carla Freeman). The project area aim covers six provinces Qinghai, Ganshu, Ninxia, Inner Mangolia, Shaanxi and Shanxi (Jeremerhoff, 2003). (See below a map of the Western route project)

Map 8: Western route



Source: <http://www.cawra.com/PDFtext/SouthToNorthWaterTransfer>.

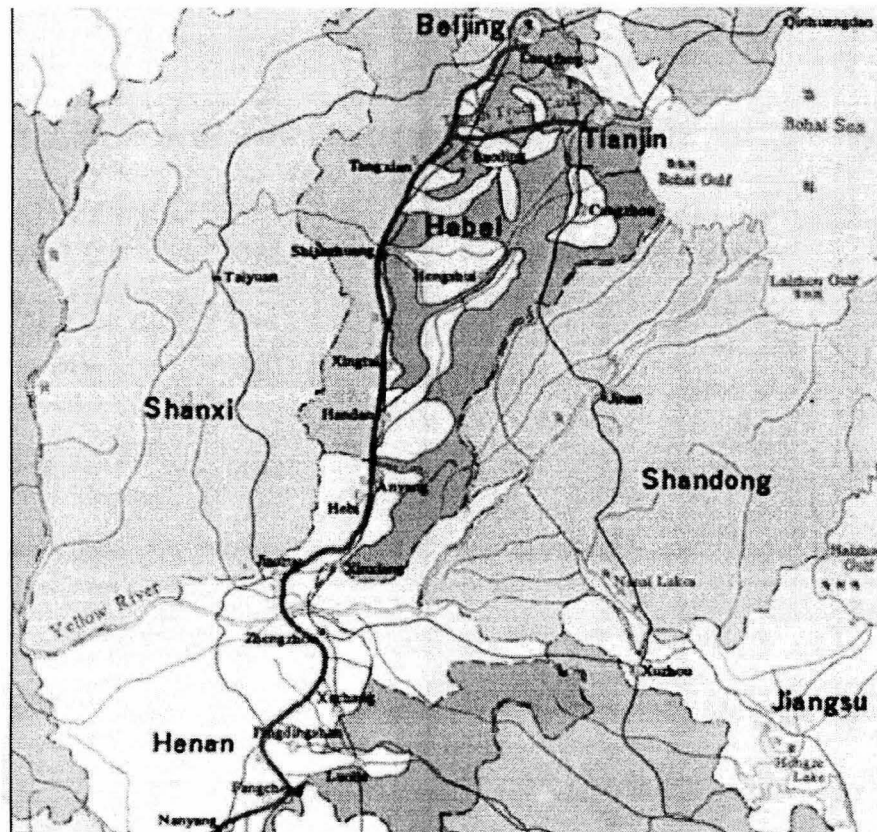
China gets to benefit from a western route project:

- “Increase the irrigated area and supply domestic and industrial water in the western region
- Promoting the economic development of the North-West Loess Plateau” (Wang et al 2004: 7).

China’s south-north diversion project will be reducing the Chinese arid region such as northeastern and northwestern region which are facing many problems due to a shortage of water.

Yellow, Huaihe, and Haihe of river basin are flowing most important Chinese region which is driving the national economic development program smoothly.

Map 7: Middle route



Source: <http://www.cawra.com/PDFtext/SouthToNorthWaterTransfer>.

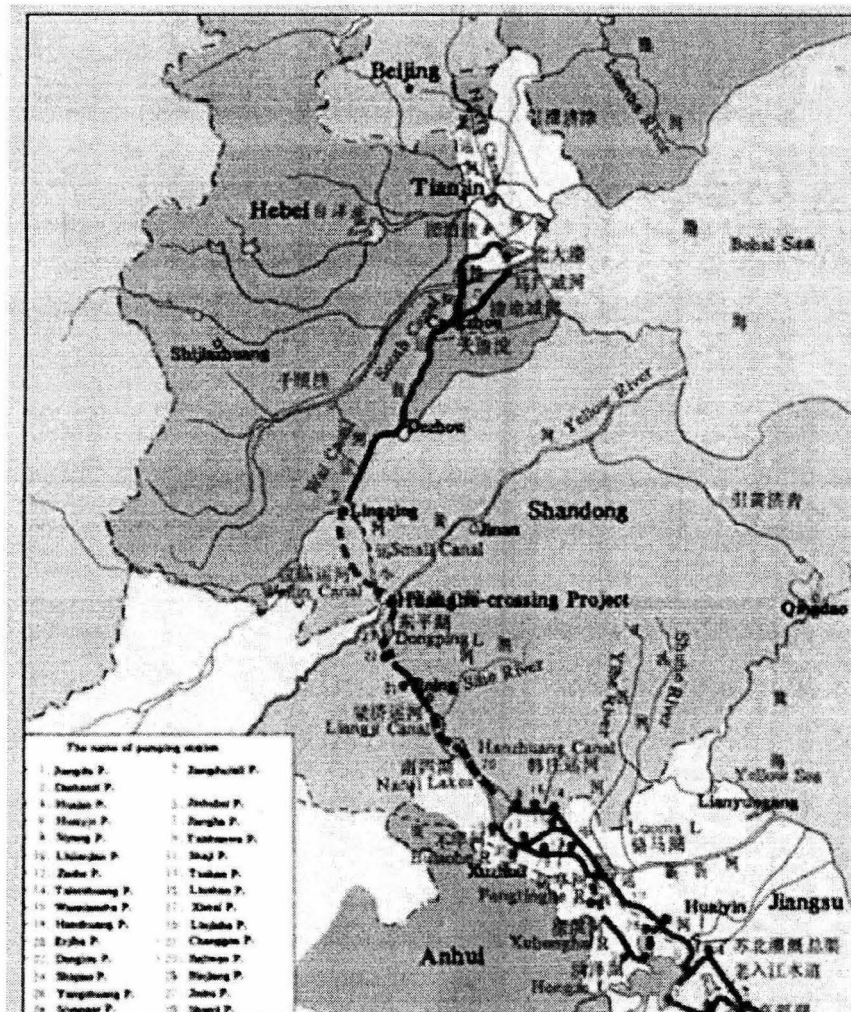
China gets to benefit from middle route project:

- “Mitigate the water crisis in Beijing, Tianjin-Hebei and Henan.
- Increase the ability of food control in the middle lower Hangjiang” (Ruan, B, Wang et al, 2004).

Western route project:

The Western route is stunningly ambitious. It is designed to tap three tributaries of the Yangzi—the Tongtian, Yalong and Dadu rivers—on the Qinghai-Tibet plateau, where nearly one-third of China’s water resources are concentrated, and move water nearly 500km through the Bayankala Mountain range involving elevations of 10,000 to more than 16,000 feet above sea level to northwest China where it will help replenish the Yellow River principally to provide water to irrigate millions of hectares in western China but also to meet the demands of urban, industrial, and energy

m³/s by 2010, 1000 m³/s by 2020 and ultimately to 1400 m³/s. Conveyance (1150 km) is via a network of rivers, lakes, reservoirs and canals, including the Grand Canal, most of which exist in some form to the Shandong border. The water will be lifted 65 m by twelve pump stations to the Yellow River, crossed by tunnel. From there, water can flow north by significance to Tianjin. The next stage will cost US\$3000M, including US\$600–800M for an emergency Tianjin project (US Embassy, 2001; WWF, 2001). Accessory costs (mainly for pollution control) could cost US\$4000M although much of this is desirable in its own right. At full development some 3% of annual Yangtse flows (975 km³) will be diverted suggesting that the impact on the lower Yangtse will be insignificant (Jeremy Berkoff, 2003, p 5). (See below a map of the Eastern route project) Map 6: Eastern Route



Source: <http://www.cawra.com/PDFtext/SouthToNorthWaterTransfer>.

There are three water diversion projects.

- Eastern Route project (ERP).
- Middle Route project (MRP) central route (see below figure).
- Western Route project (WRP).

This water diversion from upper, Middle, and lower reaches of Southern part to Northern part and North-Western part of china. (See below a map of the Chinese water diversion project)

Map 5: Western, Central and Eastern route project



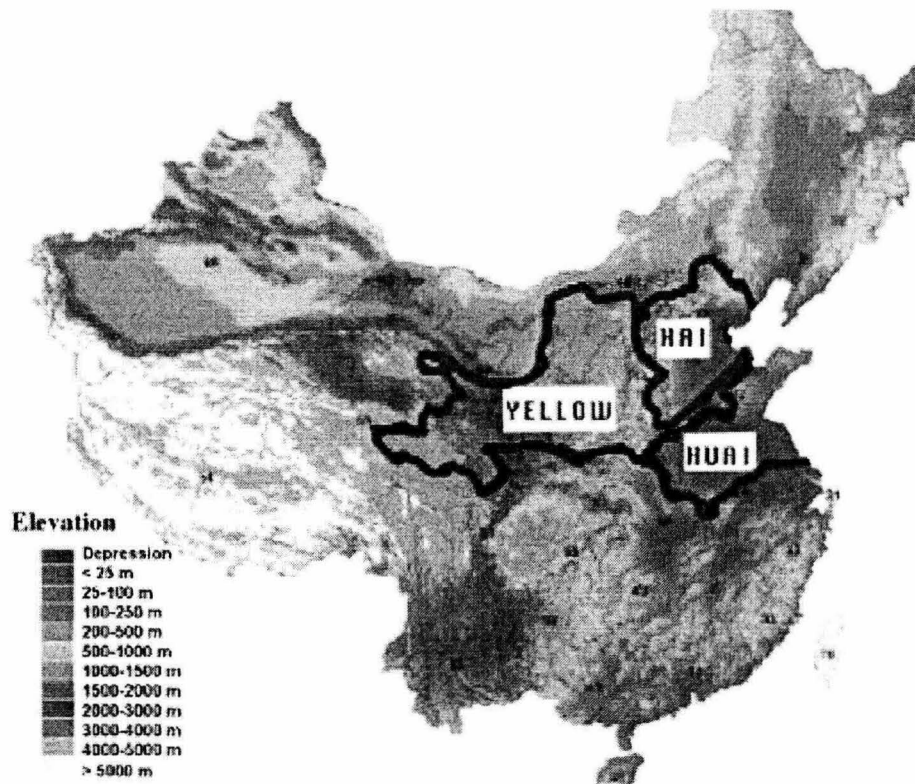
Source: <http://cis.uchicago.edu/outreach/summerinstitute/2010/documents/sti2010-okeefe-water-diversion-china>.

Eastern route project:

The eastern route project takes water from the Yangtse about 100 km below Nanjing and 250 km from the sea. A first time was inaugurated in 1961, based on the Jingdu Pump Station (400 m³/s, one of the largest in the world) mostly for irrigation in Jiangsu. Capacity at this and other stations will increase to 600

transfer; the western, middle and eastern routes are planned in this huge water diversion project linking of the Yangtze, Yellow, Hai and Hai Rivers through these three transfer routes. This is expected that the water resource shortage in the middle and northern part of China will be reduced and the alleviation of the serious flood threats in the southern part of China can be reduced. It has three water diversion routes. The western route project is first and the Middle route project is second and third is an Eastern route project. China diverts water from upper, middle and lower reaches of the southern part to the northern part and north-western part of China. China aims to acquire the target years of 2050 the total water volume to reroute it will be 45 billion m³. Eastern route is 15 billion m³, middle route 13 billion m³ and western routes 17 billion m³. China wants to improve her own water shortage problem (Wang and Chen, 2004: 3) (See below Yellow, Hai, and Huai river map)

Map 4: Three rivers

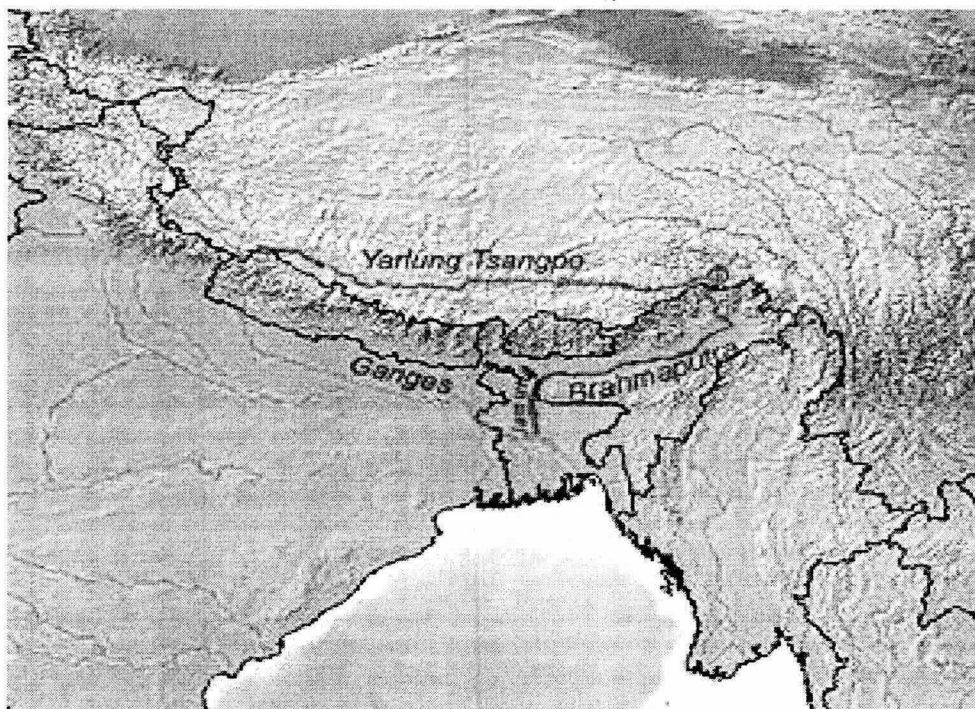


Source: WB 2001

Source: Jeremy Berkoff

Almost 47% of the people of the world depends on the flow of the fresh water originating from the Tibetan area. The Brahmaputra river system lies between latitudes 20 degrees north and 32 degrees north and longitudes 80 degree east and 96.30 degrees east. Brahmaputra is flowing in the Tibetan region where does it know as Tsangpo River. Tibet, China, India and Bangladesh region cover by Brahmaputra river basin, and the areas of Brahmaputra has a long route through the arid and plane region of southern Tibet. (See below Map of the Yalung Tsangpo/Brahmaputra river basin)

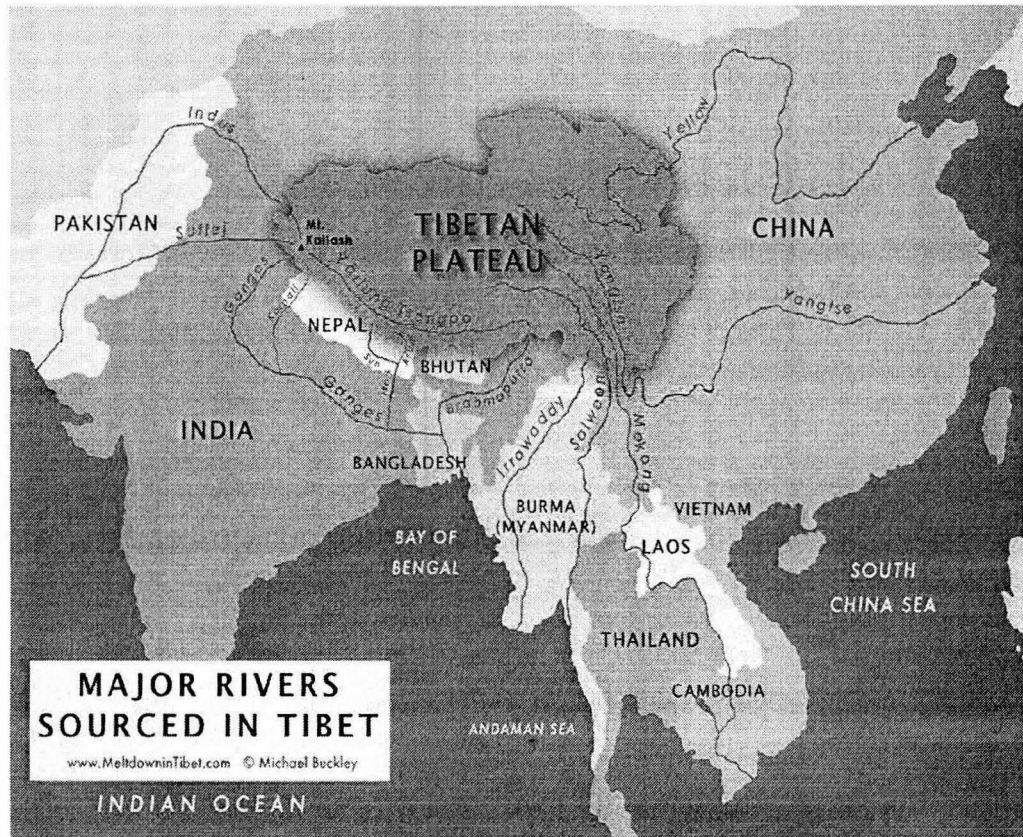
Map 3: Brahmaputra/Yarlung Tsangpo river basin



Source: <http://www.google.co.in/search?q=yarlung+tsangpo+river+map&safe>

The people have known about the Brahmaputra River, it has gained the position of one of the largest rivers of the Asian region. The Brahmaputra length is almost 2900 km; the river originates from the Mansarover Lake of the Himalayan Mountain, it shares the water such as China (Tibet), Burma, India and Bangladesh. This river is identified as Yarlung Tsangpo River in Tibetan region. “In Sanskrit word called of the Brahmaputra is Laohitya. The word Brahmaputra means son of Brahma and according to the Hindu mythology” (History of Brahmaputra, May 21, 2013, www.indianetzone.com). It is a holy

Map 2: Tibetan river system



Source: <http://www.google.co.in/search?q=tibetan+rivers+map&safe>

Brahmaputra/Yarlung Tsangpo River basin:

A River basin is to be defined as the geographical area determined by the watershed limits of the system of waters, including surface water and underground waters, following into a common terminus (Helsinki Rules, international law association, 1996, article second).

The Brahmaputra River basin is one of the largest river basins in the world. Yarlung Tsangpo is known as the ‘Brahmaputra Himalaya Range River’ in India with an average discharge of 20,000 m³ /s originates from the glaciers of Mt. Kailash range in Tibet. “This mighty river drains an area of 651,335 km² connecting China (50.5 %), India (33.6 %), Bangladesh (8.1 %) and Bhutan (7.8 %)” (Immerzeel, 2008, 23). “The Indian part of the basin is shared by Arunachal Pradesh (41.9 %), Assam (36.3 %), Meghalaya (6.1 %), Nagaland (5.6 %), Sikkim (3.8 %) and West Bengal (6.3 %)” (Goswami ND 2). There is

of China's rice production, 50% of its grain production, more than 70% of fishery production, and 40% of the China's GDP" (the impacts of climate change, May 15, 2013, <http://tew.org/archived/2010/climatechangereport.pdf>)

Tibetan plateau provided the fresh water in desert regions. "The Plateau provides Asia's fresh water resource from the deserts of Pakistan and India to the rice paddies of southern Vietnam, from the great Tonlesap lake of Cambodia to the North China plain. With the major Asian rivers originating from its plateau, the total river basin area is estimated above 5,477700 km². That is 3% of the land surface of our planet. Beyond the populations residing in the watersheds of these rivers are the additional hundreds of millions or billions who depend on monsoon rains drawn inland by the Tibetan Plateau. According to World Wildlife Fund for Nature (WWF), the Tibetan Plateau Steppe—one of the largest land-based wilderness areas left in the world—has the most pristine mountain grassland in Eurasia" (The impacts of climate change, May 15, 2013 <http://tew.org/archived/2010/climatechangereport.pdf>)

Map 1: Tibetan Plateau

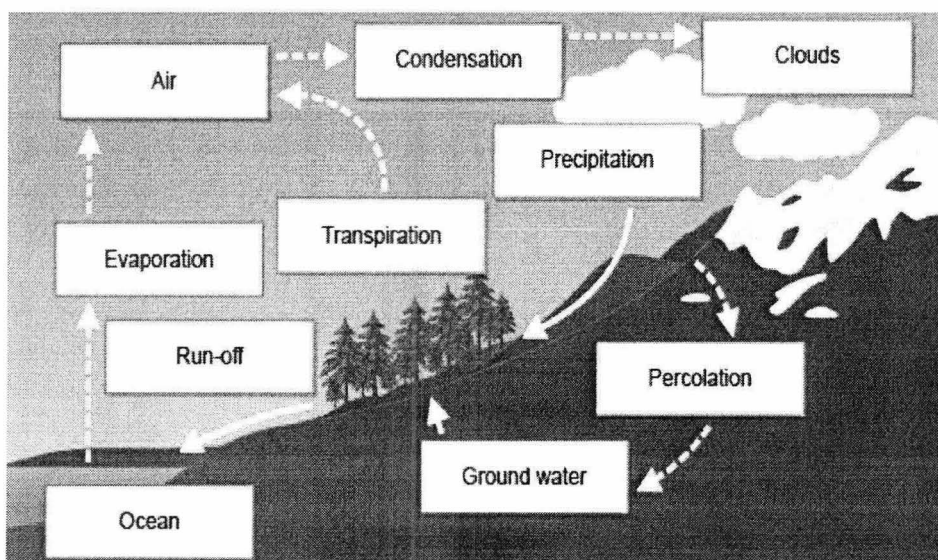


Source:http://www.google.co.in/search?gs_m=17&gs_ri=psab&pq=tibet+plateau&cp

provide for the future world population will depend on the availability of a consistent water supply, it must be insured only by irrigation. The consistent availability of sufficient quantity and quality of water for growing agricultural production would be continued to an important factor in the entire humanity fine into the twenty first century (Varis et al 2008: 19-20).

Rivers and lakes cover less than one percent of the Earth's surface. The volume these fresh waters amount to just 0.01 percent of the world's total water. River water has sources of fresh water which is a part of the water cycle. "Water cycle is also known as the hydrological cycle. Seas and oceans contain 97 percent of the world's water, and ice holds two per cent. That leaves just one per cent of the world's water as fresh water on land or in the air. This water is recycled again and again through the process of evaporation. The process in which a liquid turns into a gas, called it as a condensation. Condensation is a change of state in which gas becomes liquid by cooling. Water transfers such as surface runoff. The river basin transfers the water one place to another place" (Background to rivers,May 2, 2013, BBC - GCSE Bite size). The figure 1 shows the situation of the water cycle.

Figure 1: Water Cycle



Sources: BBC - GCSE Bite size - Background to rivers