

TRANSBOUNDARY POLLUTION PROBLEMS AND WATER VULNERABILITY ACROSS INTERNATIONAL BORDERS

By

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ABSTRACT:

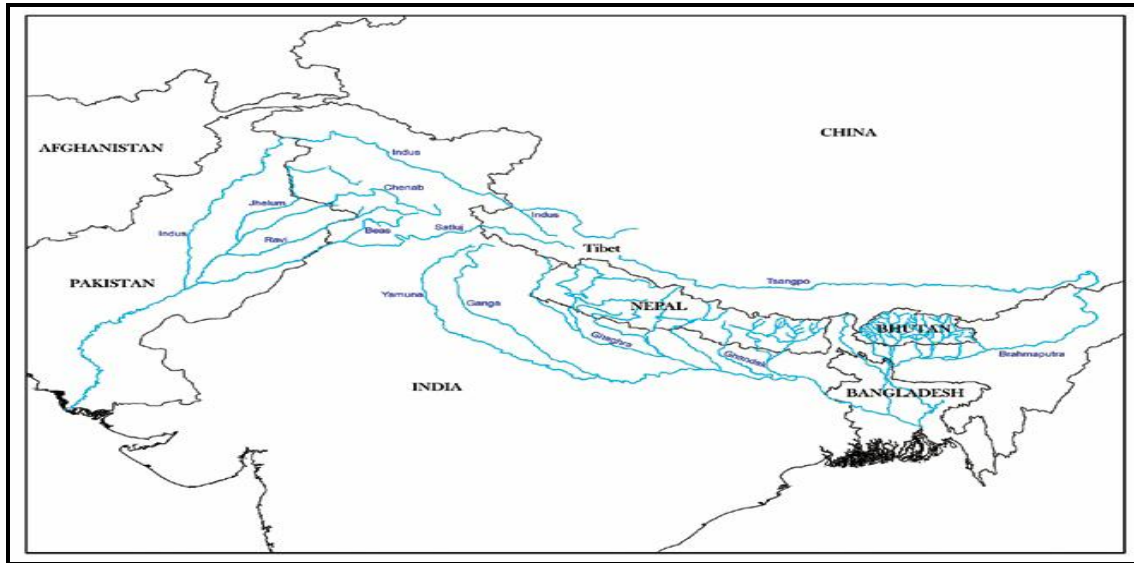
Transboundary water of 263 international rivers in the world constitutes 60 % of the water around the globe. Among these, 158 rivers exhibit problems of water pollution and other international disputes. More than 400 treaties are being signed between the countries for the development and utilization of these transboundary waters. The problem of transboundary water resources includes instability in water availability, decreasing outflow of waters, ecosystem vulnerability, eco-security and regional instability. The drivers involved in the transboundary water vulnerability are the physical conditions affecting availability of water, socio-economic conditions, lack of transboundary water emergency response and unsound administrative institutions. Transboundary water vulnerability of Asia and Africa is much more prominent than rest of the world and most importantly coordination and negotiations are needed to promote regional sustainable development, eco-security of water resources and help ensure global peace.

INTRODUCTION:

Transboundary water of 263 international rivers in the world constitutes 60% of the water around the globe (Wolf *et al.*, 2005). 40% of the river basins around the world are transboundary water-ways shared by two or more countries worldwide (Wolf, 1999). Most of these rivers have many problems that may result in international disputes. The rivers that may cause disputes spread over five continents of the world and most of them are in Asia and Africa where developing countries are located and where there are few international treaties on the development and utilization of transboundary waters signed between the states. Historical records showed that more than 400 water treaties and water related agreements were signed between 1820-2002. 60% of these treaties and agreements were concluded in Europe and North America whereas Asia and Africa, with nearly 75% of global population and more than 40% of international rivers, have only 30% of the treaties due to lag in legal system development and cross border cooperation. Therefore, the shared water vulnerability is much more prominent in Asia and Africa than in North America and Europe. (Yan *et al.*, 2008)

Water in border setting is a regional public good that is non-excludable but rival in consumption. Asymmetries over time and space between the countries are important to determine sustainable outcomes for water resources. (Fernandez, 2000)

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Map Showing the Water Sharing Among Asian Countries

The border region between United States and Mexico shares its surface water resources between Colorado River and Rio Grande river basin. The boundary between the two states is 3300 kilometers. In 1944, water treaty was signed between United States and Mexico for resolving the water sharing issues but it did not do so. The problem was the groundwater withdrawal on both sides of the borders and the deteriorating water quality. This requires binational cooperation that addresses water quantity and quality issues simultaneously. The variation in water bodies spans the variation elsewhere on earth in terms of some surface waterways flowing north to south, some flowing south to north, deep and shallow groundwater aquifers along the borders.



Water Sharing Between United States and Mexico

China is one of the most important upstream countries in terms of transboundary waters in the world, especially in Asia. China's terrestrial boundary measures approximately 220,000 km and borders 14 countries, making transboundary water issues as a key component in China's international relations. The shared water among the borders has the problems of variability in water demand due to social and economic development.



Water Sharing Between China and Other Borders

Pakistan shares most of its water resources with India. Major River, river Indus enters to Pakistan from India. Water pollution is the major problem in Pakistan by the water resources entering from India. Hudiara drain entering to Pakistan from Amritsar carries a lot of pollution and ultimately pollutes the rivers and streams of the country.



India and Pakistan Shared Water Resources

UNESCO organized the International Conference on Water and the Environment in Dublin, Ireland in January 1992. It enunciates four basic principles:

- Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment
- Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels
- Women play a central part in the provision, management and safeguarding of water
- Water has an economic value in all its competing uses and should be recognized as an economic good. (Jayakumar *et al.*, 2008)

INSTABILITY IN WATER AVAILABILITY:

Instability in availability of water is a major problem of transboundary waters. The variability and availability of water greatly affects the regional, social and economic development of the country. The availability of water is greatly affected by the conditions of the surrounding water resources such as the effects of global warming, human activities and water regulation by dam operations. (Yan *et al.*, 2008). Past results verifies that the natural environment is subject to the influences of a changing climate. Most of the international rivers were fed by melting glaciers, which were affected by global climate change. For example, the Himalayan glaciers were receding at an average speed of 10 to 15 m per year due to global warming. The rivers' flow would, therefore, notably increase in short term because of the increase in glacial melt, but over the long term, glacial shrinkage would likely result in greater problems, including floods, wetland drying, and unstable river systems. Instability of water is also brought forth from the social aspect, including population growth, immigration, and transboundary management of water resources. (Wolf *et al.*, 2005). Availability of water also varies with different seasons. Most of the East Asian region is subject to the monsoon climate, the warm and wet winds in spring and summer times bring most of the annual precipitation. However, in the winter seasons, the climate tends to be cold and dry. The water problems become worsened when climate change brings higher temperatures reducing amount of precipitation but increasing the rate of evaporation. (Jayakumar *et al.*, 2008). These conditions make the region vulnerable to floods, water logging, droughts, storms, hurricanes, wetland drying and unstable river systems. (Yan *et al.*, 2008)

DECREASING OUTFLOW OF RIVERS:

Decreasing outflow of rivers is the major problem of transboundary water across the globe. Riparian states are paying greater attention to water shortages in dry regions after the increase in demand, growth in population and economic development. In the northwest region of China, it was a great problem of international rivers that the use of water is over 40% of the total water resources in 1980-2006 (Liu and Chen, 2001). In the face of water shortages in all the riparian states of this region, there were great differences in transboundary water utilization among the riparian states. For example, the Kapchagay Reservoir, capable of multi-year water storage, is located in Kazakhstan

on the downstream of Ili River. The discharge regulation ratio of the reservoir is 56%. On the downstream of the Irtysh River, where a series of large-scale hydraulic projects were constructed, the runoff regulation ratio of Bykhtarmo Reservoir among these projects was 170%. All of these reservoirs control the entire outflow from the related rivers of China (Chen *et al.*, 2005).

ECO-SYSTEM VULNERABILITY:

Ecosystem security and river basin health has many factors, including limited water flow and its time-space distribution; water quality and its maintenance; land use and soil erosion. Transboundary waters on ecosystem vulnerability and security are mainly reflected by the floods, droughts, species invasion and loss of habitat. In most parts of the world, drought, decreasing outflow, and degraded ecology and natural environment resulting from competition for water between humans and ecosystem are the major issues (Yan *et al.*, 2008). China is facing a serious transboundary water pollution problem in the northeast region because more than 60% of river reaches were polluted, and it is getting worse day by day. In the southwest of China, especially in Tibet, glacial lakes resulting from rivers blocked by landslides have released floods into international rivers in recent years when their natural dams have broken. These disasters caused significant harm to the downstream countries (in this case, India, Nepal) and affected the relationships among China and its neighboring countries. Pakistan also experiences water pollution problems as it receives waste water from its neighboring country India (Swaran, 2005). Water species are very much affected by the quality of water and it is a threat to the aquatic ecosystem. But this also affects other activities as thick mats of the plant reduce oxygen content, degrading water quality for aquatic species and curtail recreational activity such as boating and fishing and clog water intakes for irrigation (Fernandez, 2000). During the past two decades, the rapid economic boom and growing agricultural, industrial and municipal development in the region leads to substantial accumulation of toxic organic compounds and a significant environmental impact has been imposed on the ambient conditions. Untreated sewage is discharged in an expeditious rate and large quantities of various pollutants have been released which is more threatening to the ecosystem. (Chau, 2005).

WATER SCARCITY AND WATER QUALITY DETERIORATION:

The vast amount of transboundary water in the world is facing the problem of increasing water scarcity and aggravation through competitive utilization for growing populations and has produced headlines warning of "water wars." In the arid Middle East, water is the prime driver for military strategies and territorial conquests, particularly in the ongoing conflicts between Arabs and Israelis. Headlines surrounding the transboundary water issues in China have, in recent years, been alarmist at times as the regional security is implicated by water development projects (Yan *et al.*, 2008). Pakistan and India are also facing water problems as India is constructing dams on the rivers which are coming towards Pakistan and this will cause water scarcity in the region in the coming years.

With untreated sewage and salinity traveling across the border, there are serious water quality problems in most of the surface waterways along the border. Urbanization in border cities next to rivers leads to urban runoff and sedimentation that is causing serious water quality problems. (Yan *et al.*, 2008) The Tijuana River Watershed that is

shared border with the upstream 2 / 3 of the watershed in Mexico and the remaining in the U.S. is threatened by degradation water quality. The wetlands of this watershed is an asylum for endangered and threatened bird, fish, and plant species and it was recently named as a Ramsar site of international importance. The three most significant aquifers include the Hueco, Bolson extending 3000 square miles in the Ciudad Juarez-El Paso region, the Mesilla Bolson extending 7450 square miles between Chihuahua and New Mexico, and the Mesa de San Luis aquifer extending 3000 square miles across Arizona and California in the U.S. and Sonora and Baja California in Mexico (Frisvold and Caswell, 2002).

PHYSICAL CHANGES AND SOCIO-ECONOMIC CONDITIONS AFFECTING WATER AVAILABILITY:

Climate change has the potential to make a significant impact on both the availability of and requirements for water in most part of the world. Rising temperatures and increasing variability of rainfall generally affects surface waters, increasing drought in some regions and causing floods in others, as well as influencing groundwater recharge. The probable effect is greater evapo-transpiration and more stress on arid and marginal zones.

Runoff is highly dependent upon changes in rainfall, and groundwater recharge even more so. Parts of Africa could experience reductions in runoff and/or stream flow of up to 10%, which could be evident in the western parts of the country in as soon as 2015. The decrease in runoff would move progressively from west to east, and could be expected to reach the east coast by 2060. Even if the average rainfall were to remain the same, increased variability of stream flow would result in reduced natural yields and reliability, and an increase in the unit cost of water from dams.

From 1980 to 2006, the total water resources in the northeast region of China changed greatly compared with the normal years, causing the most serious recorded flooding in a century (1998), which was then followed by severe drought for four consecutive years. Water resources are becoming even scarcer, as population and development pressures grow, and it is increasing tensions regarding water utilization and degradation of aquatic environments. In China, water resources are over-exploited. The construction of large number of hydraulic projects interrupted the flows of some rivers; it decreased outflow and results in the destruction of the riverine ecological systems. (Sergei Blagov, 2005).

POOR EMERGENCY RESPONSE:

Sound administrative institutions and emergency response is necessary for the shared waters. Due to lack of understanding of the international rules, duties and obligations of states set forth in international laws, have led to serious shortcomings in emergency response mechanisms. This creates tension in relations of the countries with the other countries who shared international rivers with it. There should be proper institutions for the control and management of shared water resources.

REGIONAL COOPERATION ON SHARED WATERS:

Transboundary waters include any surface or groundwater that mark, cross or located on the boundaries between two or more states. By the year 2006, 263 transboundary waters were identified in the world and the number has increased by emergence of the

newly independent states after the breakup of the former Soviet Union. Europe alone has 100 transboundary groundwater aquifers and more are expected to be identified in the future (United Nations Development Programme, 2006). Due to the increasing pressure of economic development and competition for scarce resources, many international water basins have to suffer serious environmental, social and political problems. The United Nations Conference on efforts among European, South-American and Middle-East countries for cooperation on transboundary water between neighboring countries, East Asia has relatively low number of transboundary waters and thus less cooperative work regarding sharing waters. China shares 12 main rivers with six neighboring countries, including Mongolia, Pakistan, India, Kazakhstan, the Kyrgyz Republic, Myanmar, Lao People's Democratic Republic and Vietnam. Pakistan shares its water resources with India and Kashmir, United States with Mexico and Bangladesh shares its water resources with Bhutan. And to promote regional cooperation between these cross-border water resources, Environment and Development (UNCED) in Rio de Janeiro in 1992 adopted Agenda 21, recognizing the multi-sectoral nature of water resources development as well as the diverse interests in their utilization (United Nations University, 1990).

CROSS-BORDER WATER POLLUTION MANAGEMENT:

Over the past half a century, Western academic communities accumulated substantive literatures on transboundary water pollution management, such as industrialized countries successfully engaged in controlling water pollution of rivers. Transboundary cooperation was the core component of these studies since transboundary water pollution had to be addressed through transboundary cooperation, and specific institutional arrangements might result in wider and sustainable water cooperation. Focusing on the cooperation between countries or regions, Western scholars carried out multidisciplinary studies from such aspects as economics, law, politics, management, and empirical methodology, which involved a wide range of contents, including extensive discussions on institutional and system arrangements for transboundary cooperation. They developed a number of models for the design of water pollution management systems, probed into various influencing factors on institutional choices and changes, and summarized international experience in the institutional arrangements for the water quality management of Transboundary Rivers.

CONCLUSION:

At the dawn of the new millennium water is becoming a strategic, limited resource that needs our concern and protection. Water related problems and concerns are not new, but now they are becoming more and more obvious and materialization of the international concern should be applied in this field. There should be integrated river basin management which will represent a unified approach towards water management and includes all stakeholders within the basin. Special attention needs the transboundary river basins in which some specific problems have to be overcome: legal and political discrepancies, communication problems, social, cultural, historical differences and economic issues. Public participation is very important for the river basin management. There is a dire need to properly monitor the instability in water availability

and flow of the rivers and sound institutions are required for properly managing the shared water resources and cross border pollution problems around the globe.

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