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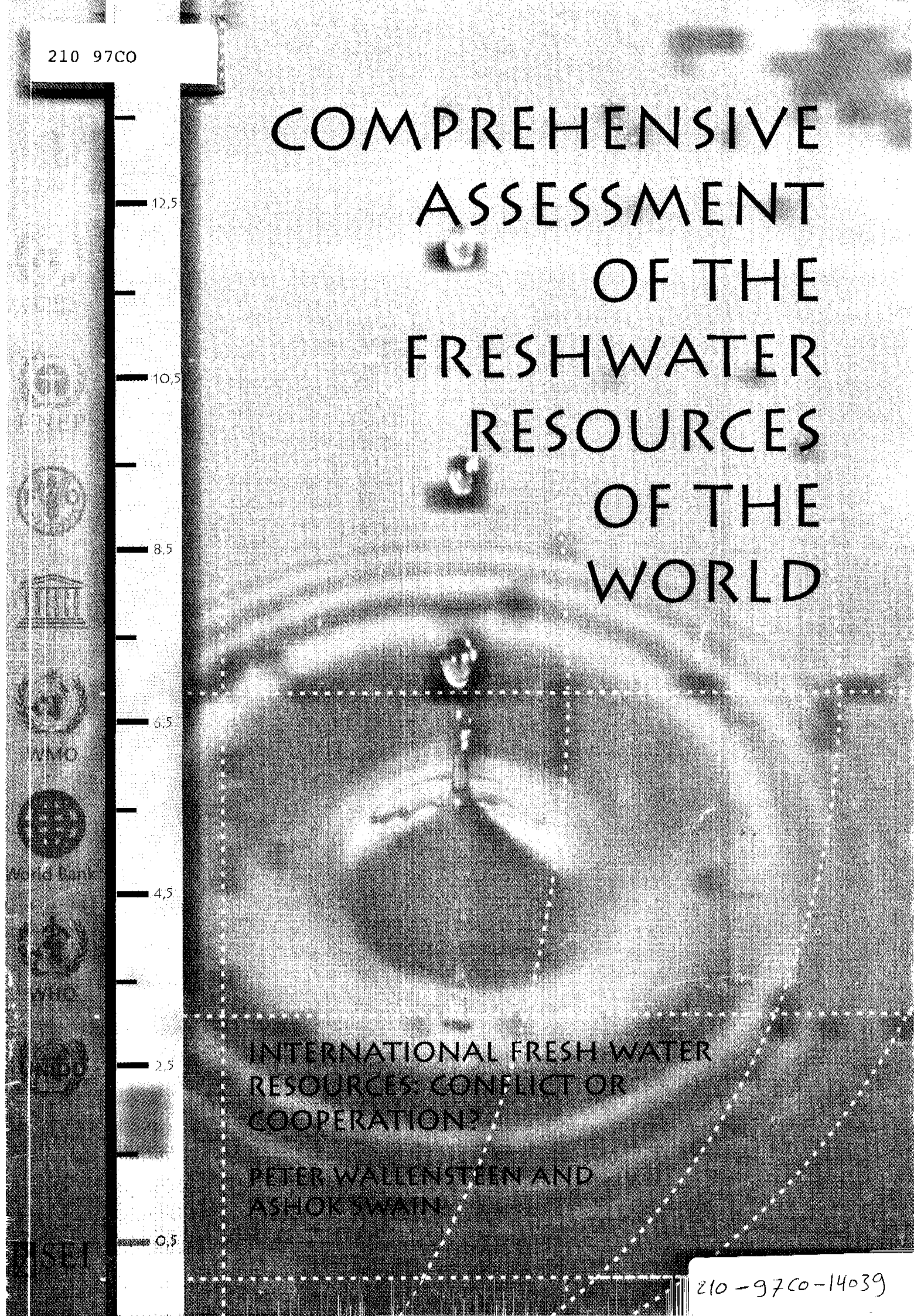
COMPREHENSIVE ASSESSMENT OF THE FRESHWATER RESOURCES OF THE WORLD



INTERNATIONAL FRESH WATER RESOURCES: CONFLICT OR COOPERATION?

PETER WALLENSTEEN AND ASHOK SWAIN

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FOREWORD

A rapidly growing demand on freshwater resources, resulting in increased water stress in several parts of the world, increasing pollution of freshwater resources and degraded ecosystems, made the UN Commission for Sustainable Development in 1994 call for a Comprehensive Assessment of the Freshwater Resources of the World. The final report (E/CN.17/1997/9), prepared by a Steering Committee consisting of representatives for UN/DPCSD, FAO, UNEP, WMO, UNESCO, WHO, UNDP, UNIDO, the World Bank, and Stockholm Environment Institute, is presented to the CSD 1997 and to the UN General Assembly Special Session June 1997.

Within the process of the Assessment a number of background documents and commissioned papers were prepared by experts with various professional background. The document *International Fresh Water Resources: Conflict or Cooperation*? is one of these. As a scientifically based document, any opinion expressed is that of the author(s) and does not necessarily reflect the opinion of the Steering Committee.

Stockholm, June1997

Gunilla Björklund
Executive secretary
Comprehensive Freshwater Assessment

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ABSTRACT

The scarity of freshwater is now an important issue in many parts of the world. When multiple countries are jointly dependent on the same water body, one's withdrawal or pollution provides the ground for conflict as well as co-operation among the riparian countries to ge the best use of the available resource. By making comparative analysis of the sharing of five international rivers, the study tries to determine under what conditions the conflict or co-operation takes place among nation-states over the freshwater issues. The river systems which are selected for close scrutiny are the Rhine in Europe, Colorado in North and Central America, Paraná in South America, Nile in Africa and Ganges in Asia.

The authors conclude: ther is a larger conflict potential in water quantity issues than in water quality issues. Issues of river water pollution and regulation appear to have a record of finding solutions. Finally, the successful cases of handling river water disputes appeared to be those cases where an "international regime"covered an entire river basin, not just major users of the river. The reason might be that this gives a chance of more relaxed discussion, more coalition building and, in essence, more third party activity.

International Fresh Water Resources: Conflict or Cooperation?

Peter Wallensteen & Ashok Swain[1]

1. WATER: ITS IMPORTANCE AND AVAILABILITY

The crucial importance of water to the survival of the human race can be observed in the old civilisations whose growth and sustenance were closely related to its water distribution systems. Many authors have located the importance of water in different religious observances. In Hindu and Buddhist traditions, the rivers of the earth, including the Indus, the Ganges, and the Brahmaputra, originate from the mythical Mount Meru, home of the gods. In Christian tradition, water originates from the Garden of Eden, and then divides the world with the great streams: the Nile, the Tigris, the Euphrates, the Indus, and the Ganges."[2] Islam also gives water its due importance. The holy book Koran describes that every living thing is made from water.[3]

The Planet Earth is unique in the solar systems in having water in liquid form which can support life. The other planets are either too hot or cold to maintain a water cycle.[4] However, water is also at the same time, one of the most erratic objects on earth. The total volume of existing water on the planet is 1.41 billion cubic kilometres. Nearly 98 percent of this water unusable since it is found in the saltwater of the oceans, inland seas, and deep underground basins.[5] The total volume of available fresh water stocks on a long term basis is only 35 million cubic kilometres. Most of this fresh water is stored in ice caps, glaciers and in permanent snow covers in Antarctic and Arctic regions. As Igor A. Shiklomanov estimates, "Fresh water lakes and rivers, which are the main sources for human water consumption, contain on average about 90,000 cubic kilometres of water, or just 0.26 per cent of total global fresh water reserves."[6]

The surface runoff is the most important source of the fresh water. The total global runoff average in annual basis is 44,500 cubic kilometres.[7] This runoff is

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[1] Thanks are due to Asit K. Biswas, Gunilla Björklund, Wulf Klohn and A. D. Mohile fo their comments and thoughts. Of course, any faults or errors are our own. Funding for this work was provided by the Swedish International Development Cooperation agency (SIDA) and Stockholm Environment Institute (SEI).

[2] Peter H. Gleick, "An Introduction to Global Fresh Water Issues" in his ed., *Water in Crisis: A Guide to the World's Fresh Water Resources*, (New York: Oxford University Press, 1993), p. 3.

[3] Malin Falkenmark, "Living at the Mercy of the Water Cycle" in *Water Resources in the Next Century* (Stockholm: Proceedings of the Stockholm Water Symposium, Publication No. 1, 12-15 August 1991), p. 13.

[4] National Research Council, *Opportunities in the Hydrological Sciences* (Washington DC.: National Academy Press, 1991).

[5] World Resource Institute, *World Resources 1990-91* (New York: Oxford University Press, 1991),p. 166.

[6] Igor A. Shiklomanov, "World Fresh Water Resources" in Peter H. Gleick, ed., *Water in Crisis: A Guide to the World's Fresh Water Resources*, (New York: Oxford University Press, 1993), p. 13.

[7] The global runoff figure excludes the ice flow of Antarctica. Igor A. Shiklomanov, No. 5, p. 15.

highly arbitrary in nature among different regions of the world. Most part of the total global runoff is concentrated in the temperate zone and equatorial regions, which cater to a relatively small population. In the case of Europe, the per capita run-off is half of the global per capita average. But, the larger part of the continent is endowed with temperate climate and many small rivers with steady flows, which makes it possible to tap a high proportion of the run-off.

This is not the case in many other regions. In the tropical and arid areas where most of the world population lives, the limited flowing water resources is very unevenly distributed. Almost all the developing countries are in the arid and semi-arid, tropical and subtropical regions and many of them are facing severe water shortages. The volume of the rivers, which is the major source of the fresh water, is also unequally distributed among the countries within these regions.[8] The runoff from the Amazon river alone amounts to 80 percent of South America's average runoff. Similarly, 30 percent of the total runoff in Africa originates from a single river basin, the Congo/Zaire. Another major share among the African rivers is made up by the Nile system. In Asia, the Ganges-Brahmaputra and Mekong basins are the carriers of a significantly high proportion of the continent's runoff. River runoff in the temperate belt is not as disproportionate as in the tropical and arid regions. The runoff in the countries of tropical regions also suffer from high seasonal fluctuations. Many regions get nearly all of their yearly precipitation during a brief, intense rainy season.

In this paper we scrutinise the water situation on a global level. We are interested in water as a potentially contested resource. Our analysis focuses on two aspects: the quantity and quality of water, in particular in rivers (chapters 2-4). Furthermore, a closer analysis is made of the river as a main carrier of fresh water. The control over water, in terms of quantity and quality, is an issue that may give rise to conflict as well as cooperation. The experiences in handling disputes is illuminated with respect to five internationally shared rivers (chapter 5). Finally, the search for an international solution is analysed, in particular in sharing river water resources (chapter 6). Some practical implications are outlined (chapter 7).

2. WATER: ITS GROWING SCARCITY

Between 1940 and 1990, world population jumped from 2.3 billion to 5.3 billion human beings. At the same time, the per capita use of water also doubled from 400 to 800 cubic meters per person per year. As result, the global human consumption of water increased more than four times in fifty years.[9] Present estimates indicate that the current world population is likely to be over 10 billion by the year 2050. As the practical availability of usable renewable fresh water in yearly basis is limited between 9,000 and 14,000 cubic kilometres, it is unlikely that another quadrupling of world water use can happen again. As the population increases and the sum of available water resources remains nearly constant, the maximum per capita demand that a country can support decreases correspondingly. The population growth has reduced the specific per capita water

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[8] See, The *World Water Balance and the Water Resources of the Earth* (Leningrad: Gidromoteoizdat, 1974).

[9] Robert Engelman & Pamela LeRoy, *Sustaining Water: Population and the Future of Renewable Water Supplies* (Population and Environment Program, Population Action International, 1993), p. 10.

supply from 33,300 cubic meter per year in 1850 to 8,500 cubic meter per year in 1993.[10] Due to current population projection, the per capita water supply is projected to decline in much faster rate.

[10] Igor A. Shiklomanov, No. 5, p. 18.

Table. 1: Per Capita Annual Fresh Water Availability in 1990 and 2025 (UN Medium Population Growth Projection) in Selected Countries[11]

Country	Availability of Renewable Fresh Water Per Year (million cubic meters)	1990 Population (millions)	Per Capita Water Availability (cubic meters)	2025 Population (millions)	Per Capita Water Availability (cubic meters)
Argentina	993,998	32.3	30,753	45.5	21,844
Brazil	6,949,978	149	46,631	219.6	31,638
Bangladesh	2,357,010	113	20,733	223	10,588
India	2,085,015	846	2,464	1393.8	1,496
Egypt	58,874	52.4	1,123	93.5	630
Sudan	120,773	25.2	4,792	60.6	1,993
United States	2,478,002	249.9	9,913	322	7,695
Mexico	357,038	84.4	4,226	137.4	2,597
Germany	199,969	79.4	2,516	83.8	2,384
Netherlands	90,002	14.9	6,023	17.6	5,093

More than 90 million people add to the world's population every year. According to the World Bank Report, 95 per cent of future growth will take place in the developing countries of Africa, Asia and Latin America.[12] Human life relies on continuous access to fresh water and food resources. Food production, however, is critically contingent upon the availability of water. The total agricultural water requirement is likely to increase 6.5 times in the present century (1900-2000). Besides the demand in agricultural sector, with the rise in world population, water requirements for the purposes of energy generation, domestic uses, and industrial production have increased too.

Agriculture is accountable for the 64.9 per cent of the total water withdrawal on the Earth, while industry 23.6 per cent, urban water supply 7.3 per cent and reservoirs 4.1 per cent. Much of this water comes back to the rivers or other water systems for the use of other consumers. If we calculate purely consumptive use of water, then agriculture consumes 86.9 per cent, industry 3.8 per cent, urban water supply 2.2 per cent and reservoirs 7.2 per cent.[13] These figures show the high consumptive use of water in the agricultural sector.

The introduction of hybrid varieties of plantation is the major reason of highly increasing use of water in the agricultural sector. To meet the needs of growing population, irrigation has become the cornerstone of global food security. Across the world, nearly 17 per cent of the crop land is irrigated and provides one-third of global harvest. The amount of water used for irrigation networks has increased 10 times this century, and elaborate plans are being carried out for further expansion. 235 million hectares of land is currently irrigated–a five fold increases since 1900.[14] In spite of rapid expansions of irrigation schemes, per capita availability of irrigated land is decreasing due to massive population growth. In 1978, per capita irrigated land peaked at 48 hectares for every thousand people and since then it has started decreasing. As nearly all the easily available

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11 Robert Engelman & Pamela LeRoy, No. 8, pp. 50-54.

12 World Bank, *World Development Report 1992: Development and the Environment.* (New York: Oxford University Press, 1992), p. 26.

13 Igor A. Shiklomanov, No. 5, p. 20.

14 Sandra Postel, *Last Oasis: Facing Water Scarcity.* (New York: W.W. Norton & Co., 1992), p. 49.

irrigation schemes have now been developed, the implementation of new projects are becoming politically, economically and environmentally hazardous. The world's irrigated area grew by an average of 2 to 4 per cent a year through out the 1960s and 1970s, but slowed to one per cent in the 1980s.

3. WATER: ITS FALLING QUALITY

The use of fertilisers and pesticides in massive scale to increase agricultural production is contaminating the available water supply in many regions. It is true that the developed countries are much ahead in using the amount of fertiliser, but their developing counterparts are catching up. In 1980, fertiliser use per hectare in developing countries was 5.5 times less than in developed countries, but by 1986, this figure had dropped to only 2.2.[15] World fertiliser use is growing fast, averaging six per cent a year since 1961 and in the developing countries 11 per cent.[16] The pesticide use has increased much more than fertiliser use. Until recently, irrigation contributed little to the pollution of water basins, but the wide spread use of fertilisers and pesticides has started heavily to pollute irrigation return flows.[17] Drainage and run-off from fertilised crops bring high concentrations of nitrogen and phosphorous nutrients and the infusion of nitrates into drinking water lead to various human health hazards.

The change is also taking place in the pattern of water use. In the early years of this century, agriculture was responsible for nearly 90 per cent of total water requirements. In few years time, by the end of this century this amount is likely to reduce to 62 per cent. But, the use in the industrial sector, whose share was only six per cent in 1900, is likely to increase to more than 24 per cent.[18] Presently, the largest single industrial use of water is in the nuclear and fossil fuel power plants. In these cases, waters come back to their source after cooling the plants, so the concern is not about the increasing volume of water withdrawn, but the discharge of heated and polluted water back to the system.[19] The industrial use of water in Finland accounts 85 per cent of the total water used. In USA, Canada and Poland, 40 per cent of the total water use goes to power stations as cooling water.[20] The large-scale industrial use of water gives birth to severe problems of water quality. Water quality has already become one of the major environmental issues in many of the industrialised countries.

In Sweden, industrial water use quintupled between 1930 and 1965, but since then it has shown a marked decline. Strict environmental protection requirements for the pulp and paper industries, which account for about 80

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15 UNEP, *Freshwater Pollution* (Nairobi: UNEP/GEMS Environment Library No. 6, 1991), p. 12.

16 FAO, *Fertilizer Yearbook 1989* (Rome: FAO, 1990).

17 World Resource Institute, No. 4, p. 172.

18 Asit K. Biswas, "Water for Sustainable Development in Twenty-first Century: A Global Perspective" in Asit K. Biswas and others, eds., *Water for Sustainable Development in Twenty-first Century* (Delhi: Oxford University Press), p, 8.

19 Deonanan Oodit & Udo E. Simonis, *Water And Development: Water Scarcity and Water Pollution and the Resulting Economic, Social and Technological Interactions* (A Paper Prepared by the Research Professorship Environmental Policy Science Centre Berlin for the Committee for Development Planning, United Nations, FS II 89-406), p. 5.

20 Rabin Clarke, *Water: The International Crisis.* (London: Earthscan, 1991), p. 23.

percent of country's industrial water withdrawal, fostered widespread adoption of recycling technology. Despite more than doubling of production between early 1960s and late 1970s, the industry sector cut its total water use by half – a fourfold increase in water efficiency.[21] Similarly, in the former West Germany, total industrial water use in 1991 was at the same level as it was in 1975, while industrial output had risen 44 percent[22]

However, it has not been the same across the Baltic sea. In Poland, the share of river water of highest quality for drinking has dropped from 32 percent to less than 5 percent during the last two decades. In spite of recent improvements in the situation due to international assistance, nearly three fourth of the nation's river water is still too contaminated even for industrial use.[23] In the water-affluent Canada, which has nine percent of the world's available fresh water supply, there are water shortages at the local level and widespread contamination of both surface and ground water. The situation in USA, France, and Russia is even worse. Water quality in the rivers of the industrialised countries suffers from many contaminants and the chemical pollution is quite common.

Industrial and chemical pollution of the water resources is gradually spreading to the urban-industrial centres of the developing countries. It is estimated that 70 per cent of India's rivers are polluted with industrial waste.[24] 114 cities pour untreated sewage to India's most important river, the Ganges. Its Yamuna tributary picks up a daily 200 million litres of sewage and 20 million litres of industrial waste in Delhi alone. In the industrial city of Kanpur, only 3 factories out of 647 have treatment plants. When the Ganges reaches the holy city Varanasi, its water looks like Indian tea (a strong tea with milk).

In most of the developed countries in the North, where the per capita water availability is fairly plentiful, much of the water supply is polluted by various human activities in conspicuous consumption. The flush toilets and private swimming pool facilities in the households of these countries have been responsible to exceed the water consumption levels 500 litres per capita per day, while their counterparts in the developing countries use less than 50 litres. This conspicuous water consumption habit of the developed countries is now being described by the southern water researchers as the "Californian Syndrome".[25]

The world is passing through an urban revolution. According to the United Nations Population Fund's estimate, by the year 2000, 77 per cent of Latin America's population, 41 per cent of Africa's and 35 per cent of Asia's population will be city dwellers.[26] It is also projected that by the turn of the century, 23 cities will be mega-cities with more than 10 million of population each, and of which 18 will be in the developing countries. While the urban population is growing by only 0.8 percent per year in the developed countries, the growth rate in the

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21 Sandra Postel, *Conserving Water: The Untapped Alternative* (Washington D.C.: Worldwatch Institute Paper 67, 1985).

22 Roy Opie, "Germany's Double Bill" *World Water and Environmental Engineer* (April 1991) .

23 Sandra Postel, No. 13, p. 21.

24 Rabin Clarke, No. 19, p. 25.

25 Dipak Gyawali, "Energizing Development and Sustaining the Environment–A Nepali's View", *Development*, no. 1 (1991), p. 129.

26 United Nations Population Fund, *Population and the Environment: The Challenges Ahead.* (New York: UNFPA, 1991), pp. 9-10.

developing regions is 3.6 percent. The cities in developing countries are already surrounded by shanty suburbs, housing millions of inhabitants in mostly unauthorised slums without proper sanitation facilities.

The Thames river was full of salmon in the 18th century. Due to dumping of industrial waste and untreated water from the sewage into the river, it became so polluted that it started stinking in the 19th century. In 1858, the windows of the British Parliament had to be draped with the clothes soaked with chloride of lime to facilitate members' breathing. Keeping up with the great British tradition, that is being described in British history as The Great Stink of 1858.[27] In 1974 only, two purification plants with the latest treatment equipments were used to salvage the situation. In 1983, the first salmon was caught in the river in a century and a half.[28] Like Thames, a rapid recovery is presently taking place in the waters of Poland, Estonia and other Baltic countries. This has become possible due to massive international assistance.

In the developed countries, sewage and waste water treatment facilities have been put in place in recent years at considerable cost. However, the growing urban centres in the developing countries have not been able use these treatment facilities. Domestic pollution from the untreated water sewage of these areas contaminates nearly all the available source of water, which is affecting the quality of water especially for domestic use. The Global Environment Monitoring System (GEMS), the network which monitors the global water quality has assessed that the organic matter present in the domestic sewage is the most widespread water pollutant. According to their report, untreated water is the most commonly-encountered health threat in developing countries and causes an estimated 25,000 deaths a day.[29] Water quantity and quality issues are linked to each other as minimal river flow levels are required to dilute polluted waters. The GEMS Study estimates that all over the world, nearly 450 cubic kilometres of waste water enters to the river system and for the transportation and dilution of these waste, there is need of 6000 cubic kilometres of water. To clean the world's waste will require the amount of water equivalent to two-thirds of total reliable run-off.

4. HUMAN NEEDS AND WATER AVAILABILITY

In spite of many human endeavours to make optimum use of water and supplement the available water supply, already as many as 2 billion people live in areas which experience almost continuous shortage of water.[30] In 88 developing countries, with nearly 40 percent of world's population, water shortages are already a serious constraint on their development.[31] One out of every three people in the world do not have access to a safe and reliable water supply for their daily

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27 R. J. Mitchell & M. D. R. Leys, *A History of London Life.* (London: Penguin, 1963), p. 273.

28 United Nations Environmental Programme, *Technical Annexes to the State of the Marine Environment.* (Nairobi: UNEP Regional Seas Reports and Studies no. 114, 1990), pp. 389-390.

29 UNEP, No, 14, p. 4.

30 United Nations Population Fund, *Population, Resources and the Environment: The Critical Challenges,* (New York: UNFPA, 1991), p. 35.

31 United Nations Population Fund, No. 25, p. 19.

needs. As a result, waterborne diseases account for an estimated 80 percent of all illness in developing countries.

More and more countries are gradually being pushed into a situation of water stress and chronic water scarcity. The hydrologists are now widely using the "water barrier" concept of Malin Falkenmark to measure the water sufficiency of different countries. This concept provides a simple index of water availability for each country, measured in the ratio of its annual renewable fresh water to the population. The countries where the per capita annual supplies of water per person is greater than 1,700 cubic metres, are treated as water sufficient countries, with only occasional or local water problems. When the per capita water availability in annual basis remains in between 1,000 and 1,700 cubic meters, the country confronts "water stress" which indicates that water management is needed to encounter widespread shortages. When the annual supply per person goes below 1000 cubic metres, the country reaches "water scarcity" which threatens health and development of the country. If the index drops down to 500 cubic meters, the country goes beyond the water barrier and confronts "absolute water scarcity". Beyond this red line, it is almost certain there will be inherent water deficit problems, often outright shortages and acute scarcity.

The water barrier concept is being criticised for its failure in excluding imported water and for its emphasis on population while the per capita demand depends on economic activities, type of agriculture, livestock practices and lifestyle.[32] It also masks the seasonal nature of scarcity. Moreover, the concept does not capture the existing differences over the form and nature of water use among the different regions of the world. However, this approach provides a simple and comprehensive global view of the water situation. According to the water barrier index, in 1990, eleven countries were in the "water stress" category, while seven had reached "water scarcity" situation, and thirteen countries had already water resources below 500 cubic meters per capita.

Water shortage has been a major problem in many countries in the Middle East, North Africa, and Sub-Saharan Africa. These regions are also experiencing fast population growth. Egypt at present uses 97 percent of its available water resources. Its population is expected to increase from 54 million in 1990 to 94 million in 2025.[33] Water shortages in highly populated countries have already become serious. China , with having only 8 percent of word's renewable water resource, faces water scarcity to meet the demands of its population over one billion.[34] Nearly 40 million people in northern part of China are already affected due to rural water shortages. Hundreds of thousand villages across India are suffering from water deficits and their numbers are increasing. Many Indian urban household do not get water in the summer seasons for several days in a row. India is already using half its total available run-off, and drawing half as much again

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32 For the criticism of the water barrier concept, see Paul Raskin, Evan Hansen & Robert Morgolis, *Water and Sustainability: A Global Outlook* (Stockholm: Stockholm Environmental Institute, Polestar Series Report no. 4, 1995).

33 United Nations Population Fund, The *State of the World Population*. (New York: UNFPA, 1990), p. 8.

34 Sandra Postel, "Emerging Water Scarcities" in Lester R. Brown, ed., *The Worldwatch Reader: On Global Environmental Issues* (New York: W.W. Norton & Co., 1991), p. 134.

from groundwater resources. As it is estimated, by the year 2025, India's demand will reach 92 per cent of its total annual fresh water resources.[35]

Thus, it is logical that many observers expect water to become a key issue in disputes, conflicts or even wars in the future. Such developments might mean that technical solutions are impeded by political problems, and the water situation deteriorates even further. This is one possible scenario for the future. Others might be more optimistic by pointing to the ability of finding solutions which are both social and technical. To this issue, we now turn.

5. WATER RESOURCES AND INTERNATIONAL CONFLICTS

The connection between fresh water resources and international conflicts can be investigated at least in two different dimensions. First, in an inter-state conflict, the deliberate targeting of water storage facilities may be directly responsible for inducing water scarcity or reducing the water quality of the other side. Thus, water scarcity becomes part of a military strategy and military behaviour. Dams were destroyed during World War II and in the Korean War. Irrigation systems in North Vietnam were bombed by USA in the Vietnam War. Iran claimed to have hit an hydroelectric station in Iraq in July 1981, as part of the Iran-Iraq War. Dams, water storage and conveyance systems were targeted by the warring sides during the 1991 Gulf War. Armies in Yemen (in the 1994 war) and former Yugoslavia (1991-1995) used the water storage facilities as targets to create problems for their adversaries. The mass migration to Zaire following the internal war in Rwanda in 1994 led to shortage of fresh drinking water supply to the receiving areas. These are cases, where in fact a human population is held hostage to political and military leaders. Manipulation with such basic human supplies in times of war should be an urgent issue for international humanitarian law, and it certainly would be unacceptable under conditions of peace. However, our aim here is to concentrate on a second dimension of the relationship: the likelihood of changes in fresh water resource supply to cause or contribute to the emergence and/or escalation of conflicts among states or human groups.

As we have just shown there has been a general decline in the quantity and quality of global fresh water resource. This leads us to consider scarcity of resources as a cause of conflict, in conflict theory language: an incompatibility between already existing parties. A common starting point in the analysis of many inter-state conflicts has been sought in the desire of the leaders of states to acquire territory and natural resources. Geopolitical and realist thinking has assumed that there are such interests which direct the course of political action. Recently, Vasquez has returned to the importance of territory in the understanding of how states act towards each other.[36] In the post-Second World War period, it has become unfashionable and immoral to conquer territories of others. Nevertheless this has happened repeatedly, for instance, in the Middle East (e.g. the Arab-Israel and Iran-Iraq conflicts), in South and Southeast Asia (e.g. partition of India, Indonesia's actions vis-à-vis neighbours) and lately in Europe (e.g. in former Yugoslavia). This is, however, not easily attributed to resource competition.

Only under special circumstances is it likely that scarcity of resources give rise to serious armed conflict, for instance when a stronger party is dependent on a

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35 Rabin Clarke, No. 19, p. 13.

36 John A. Vasquez, "Why do Neighbours Fight? Proximity, Interaction, or Territoriality", *Journal of Peace Research*, vol. 32, no. 3, August 1995, pp. 277-293.

particular resource, has no alternative resources available and has the military capacity to act in the region in question.[37] In the case of water resources, this means that competition is more likely to occur regionally. Water is not transported across large distances as is the case with oil or minerals, for instance. With increasing scarcity, however, this might be a possible scenario for the future. In the post-World War II period, political actions are taking place more in order to satisfy the demands of the majorities of a country. This means that stronger nations might be more in need of natural resources on the territory of other states, to meet the growing needs and desires of the home population. In this way, "development" might be seen to require the acquisition or exploitation of a larger share of jointly owned fresh water resource. Thus, the interests of other user states become affected. This then, might result in a spiral of events: Subsequent actions by the affected states to protect their interests might escalate conflicts.

5.1 International Rivers

The water on the surface of the Earth is naturally organised within river basins, thus these river basins are the fundamental units of the fresh water world.[38] Moreover, the river runoff is the most important source of available fresh water for human consumption. Forty percent of the world's population is directly dependant upon the fresh water from rivers and about two thirds of these people live in developing countries.

The international rivers flow from one country to another. The use or misuse of water in the up-stream countries affects its quantity and quality in the down-stream countries. Down-stream nations can affect the flow of water by building large scale dams, with effects spilling over the borders. In a situation of increasing water demand, international rivers may become a ground for breeding disputes among the riparian states. The dependence on external water might be a crucial factor. Table 2 shows the situation by the early 1990s, but many of the situations portrayed has a longer history.

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37 Mats Hammarström, *Securing Resources by Force: The Need for Raw Materials and Military Intervention by Major Powers in Less Developed Countries* (Uppsala: Department of Peace and Conflict Research, Report No. 27, 1986).

38 Gordon J. Young & others, *Global Water Resource Issues* (Cambridge: Cambridge University Press, 1994), pp. 17-21.

Table 2. Countries Heavily Dependent on Imported Surface Water

Country	Percent of Total Flow Originating Outside of Border	Country	Percent of Total Flow Originating Outside of Border
Egypt	97	Iraq	66
Hungary	95	Albania	53
Mauritania	95	Uruguay	52
Botswana	94	Germany	51
Bulgaria	91	Portugal	48
Netherlands	89	Bangladesh	42
Gambia	86	Thailand	39
Kampuchea	82	Austria	38
Romania	82	Pakistan	36
Luxembourg	80	Jordan	36
Syria	79	Venezuela	35
Congo	77	Senegal	34
Sudan	77	Belgium	33
Paraguay	70	Israel°	21
Niger	68		

°A significant proportion of the Israel's water supply comes from the disputed land.
Sources: Quoted from, Peter H. Gleick, "Water and Conflict: Fresh Water Resources and International Security", International Security, vol. 18, no. 1, Summer 1993, pp. 79-112. The original source of these data is , World Resource Institute, *World Resources, 1991-92* (New York: Oxford University Press, 1991).

Table 2 lists the countries most externally dependent, in terms of water resources. It is interesting to note that none of the major nuclear powers are in this category. The only water-dependent country being a major power in the industrial era is Germany. However, few historians have observed a possible water-control pattern in German expansion against neighbours during the first part of this century. Certainly Wilhelminian or Hitlerite Germany showed a great interest in controlling neighbouring countries, most of them also being important sources of German water supply. The reasons given were other, however: local German population, immediate military considerations, resources for industrial production. Furthermore, for a much longer part of its industrial era, Germany has been acting fairly peacefully against its neighbours. Few of the countries in the list have displayed any particular pattern of conflict behaviour against neighbouring water suppliers. Only when we add the variable of military strength does such a pattern emerge. Egypt has repeatedly interfered in the affairs of Sudan, and showed interest in Ethiopia. The water dependence might be a part of that, but also Egyptian desire to play a role in Arab and African politics. Some other countries are also relatively powerful, and thus, water becomes part of the analysis: Syria vs. Turkey (support to the PKK), Iraq vs. Turkey and the Kurdish population in Iraq, Thailand's influence in Laos, Israel vs. Arab neighbours. However, the reverse seems more common: the water dependent country has also been dependent on the upstream country in other respects, particularly when this has been a stronger country. That actual dominance or fear of dominance has been a significant political factor can be seen in many cases listed in Table 2: Hungary for a long time was dominated by Austria, Botswana by South Africa, Gambia by Senegal, Paraguay by Brazil, Albania feared dominance by Yugoslavia, Portugal by Spain, Bangladesh by India, etc. Still these countries have remained independent entities, suggesting that the struggle for survival and distinctness has been part and parcel of a policy to control the water resources on the territory of the state. From these examples we can observe that the water-conflict nexus is a

complex one, but where distinctness and political resources play an important role.

The Centre for Natural resources, Energy and Transport (CNRET), now a defunct UN unit, brought out a *Register of International Rivers* in 1978. In that, it listed 214 internationally shared rivers and lakes: 148 flowing through two countries, 31 through three countries and the remaining flowing through four or more countries. According to this study, 47 percent of the land area of the world (excluding Antarctica) is within these international river and lake basins. On the continents of Asia, Africa and South America, the shared basins make up at least 60 percent of the land area.[39]

The CNRET study has become dated because of significant changes in international geopolitical borders and names of countries and rivers in the last 18 years. Moreover, some do not accept the CNRET report as a definitive study on the grounds of its methodological and factual short-comings.[40] It was entirely a desk study, which drew its figures from then available maps in the UN Map Library. It is nearly impossible to locate all the international surface water systems from the small maps alone. The definition adopted by the CNRET only considers first order river basins and does not include the tributary or other outlet basins. This means that, for the time being, there is no authoritative study that has data on rivers basins throughout the world. Such a study would be important to initiate, not the least as an international project.

5.2 International River Disputes

The root of the English word 'rival' is from the Latin term *rivalis*, which originally meant using the same stream (*rivus*)."[41] When two or more countries share the same river systems, the upstream withdrawal, pollution or management may lead to the "upstream-downstream" conflicts. The growing strain on the quantity and quality of the fresh water and its unequal distribution among the users, pave the way for greater number of disagreements in the near future.

Many conflicts are going on among the users of the international river basins in the different parts of the world, where the control of the river water is a part of the dispute. Some of these conflict inducing international rivers are: the Jordan, Nile, Euphrates-Tigris, Danube and Ganges. With the exception of the Jordan basin, most such water conflicts have confined themselves to being non-armed in nature, though the threats of use of arms in these cases are not so uncommon. As early as the mid-1980s, US intelligence services estimated that there were at least ten places in the world where war could break out over the shortage of supply of fresh water – the majority in the Middle East.[42] The study did not specify a time-frame, and as of yet serious conflicts have not yet arisen. It raises the question of whether war or accommodation is the more likely outcome. Indeed, actions by the international community might have an impact on this. There are conflicts on a lower level regularly reported from different parts of the

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[39] Asit K. Biswas, "Management of International Water Resources: Some Recent Developments" in his, ed., *International Waters of the Middle East: From Euphrates-Tigris to Nile* (Bombay: Oxford University Press, 1994), p. 189.

[40] Asit K. Biswas, "Management of International Waters: Problems and Perspective", *Water Resource Development*, vol. 9, no. 2, 1993, pp. 167-188; & Asit K. Biswas, No. 38, pp. 185-214.

[41] Asit K. Biswas, No. 39, pp. 180-181.

[42] Joyce R. Starr, "Water Wars", *Foreign Policy* , no. 82, 1991, p. 17.

world over the international rivers In some cases, there are agreements regulating the water distribution among the riparian states. However, many of these cooperative arrangements have began to crumble.[43]

Scarcity, pollution and management of water resource, has not only generated conflicts among the riparian countries, but also in some cases, it has been instrumental in developing cooperation among them. Water in general and rivers in particular have also been seen as the source for state building in the past. Dynamic cultures have grown across river resources; Indus, Nile, Euphrates. Thus water also brings people together. Better use of water as well as the need to control water, is an important input in joint human construction. Presently, there has been a number of individual cases where there are cooperative arrangements for the better use of the available water resource. Thus, the shared water resource itself might not be the full explanation of inducing conflicts among the states, its various properties might have different contributions. So, it is necessary to analyse under what circumstances water-related issue conflict might take place among the riparians of an international river basin. With the help of five case studies, the paper aims at answering this question.

5.3 Case Analyses

The criteria adopted here for choosing cases for analysis are (a) rivers that are of economic significance for riparian states, and (b) the selected rivers reflect major global differences in economic and social life and in the per capita availability of fresh water resources. These are the reasons for choosing cases from different continents. Then it is important (c) that the rivers are shared between at least two countries. Also, the cases should (d) reflect variations on a conflict dimensions, some being known to be fairly peaceful and others involving conflict among the parties. This makes possible a discussion whether river properties do influence conflict and cooperation among the riparians. These criteria result in the selection of five major river systems in five continents, which are chosen for the close scrutiny. These river systems are: The Rhine in Europe, Colorado in North and Central America, Paraná in South America, Nile in Africa, and Ganges in Asia. All these river systems are either bilaterally or multilaterally shared. All of them are economically significant for their basins concerned. We approach the issue by studying how the countries have handled disputes that have arisen around the use of the river water.

5.3.1 The Colorado River

The Colorado river water is shared between the two riparian states, the United States and Mexico. Both the riparians had signed a treaty in 1944, in which Mexico was guaranteed to receive 1.5 million acre-feet[44] of water annually from upstream USA. Increasing salinity emerged in the Colorado water in the early 1960s due to the drainage into the river from the Arizona's Wellton-Mohawk Irrigation Project. The quality of water delivered to Mexico fell dramatically.[45]

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[43] Ashok Swain, "Water Scarcity: A Threat to Global Security", *Environment & Security*, vol. 1, no. 1, 1996, pp. 156-172.

[44] An acre-foot is the amount of water it would take to cover an acre to a depth of one foot.

[45] Allen V. Kneese, "Environmental Stress and Political Conflicts: Salinity in the Colorado River", Paper Presented at the International Conference on *Environmental Stress and Security*, Royal Swedish Academy of Sciences, Stockholm, Sweden, 13-15 December 1988.

This led to excessive crop losses in Mexicali Valley, the region which grows seven percent of the total irrigated crops in Mexico.[46]

In the 1960s, Mexico protested to USA about the quality of the water. The Treaty of 1944 had no specifications on the quality aspect of the allotted water, but Mexico's argument was the deterioration of water quality on the Mexican side was in violation of the spirit of the Treaty. The US position was that their own legal standing was strong but, rather than fight it out legally, the US began as early as 1961 to look for the solution to the issue. This "soft attitude" of the US Administration brought it into disagreement with local politicians of South-Western USA. There was a fear that any water concession to Mexico might decrease their own states' allocation. Following intense negotiation within the country and also with Mexico, President Nixon appointed Herbert Brownell, Jr. as his special representative in August 1972 to find a "permanent solution" to the salinity problem of the Colorado river water delivery. This led to the signing of Minute 242 of the International Water and Boundary Commission, in which USA pledged itself to deliver water to Mexico that would be no more salinated than 300 ppm measured at the site of Imperial Dam. To achieve this objective, USA started building at its own cost a desalinisation plant at Yuma, Arizona and a canal to divert some saline water from the Wellton-Mohawk irrigation district to the Gulf of California.[47] Due to all these measures, the salinity level of the Colorado River in Mexico has now fallen ten times below of its 1960s level.[48]

As Kneese argues, the cheapest way for USA to deal with the Colorado River salinity problem with Mexico would have been to reduce the irrigated areas in the Wellton-Mohawk project. The demands from the farmers in the south-west basin states not to give a single drop of water more than was already allotted in the 1944 Treaty closed this option for the US negotiator.[49] After the agreement in 1972, Herbert Brownell Jr. told, "This is a project that is based on dollars and not on water. .... There are no limitations in the agreement which would adversely affect any of the planned programmes for the development of natural resources of the basin states (inside the US)."[50]

Why did USA agree to pay the entire cost of mitigating the salinity problem in Colorado, though technically it could have totally ignored the Mexican protest? The reasons given by writers are interesting from the perspective of conflict management and conflict resolution. First, USA chose to maintain good relations with Mexico for the resolution of other bilateral problems – including illegal immigration, drug trafficking, and trade. Second, USA did not use an unlimited territorial sovereignty concept as it feared that the same concept might be applied

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46 I. L. Murphy & J. E. Sabadell, "Impact of Water Resources Public Policies on International River Basin Conflicts", in V. de Kosinsky & M. De Somer, eds., *Water Resources for Rural Areas and Their Communities* (Ghent: Crystal Drop Publications, 1985), pp. 883-892.

47 Katrina S. Rogers, "Rivers of Discontent–Rivers of Peace: Environmental Cooperation and Integration Theory", *International Studies Notes*, vol. 20, no. 2, Spring 1995, p. 15.

48 Rabin Clarke, No. 19, p. 100.

49 Allen V. Kneese, No. 44.

50 *Department of State Bulletin*, vol. 69, 24 September 1973, p. 391.

by Canada against USA in other similar cases.[51] Third, US "softness" might have had something to do with the growing awareness that Mexico was the repository of a great deal of oil.[52] Whatever may be the reason, in this case, the United States' policy was based on using the international river water resource in an equitable way. By accepting the "polluter-pays" scheme, it avoided a major conflict with the downstream neighbour Mexico and instead, the gesture led to strengthening the bilateral cooperation.

5.3.2 The Rhine River

The Rhine basin contains nine countries, but the main stream of the river passes through four: Switzerland, France, Germany and the Netherlands. The river is the major supplier of fresh water to one of the most industrially developed regions on earth and its water is also used for drinking purposes in the basin-dependent areas.[53] The navigation of this river is governed by one of the oldest agreement in Europe, and from 1918, the river is open for the navigation to all countries, not just the riparians. However, the pollution of the river water became a matter of contention among the riparians in the 1970s.

Besides other forms of pollution, the Rhine River is affected badly due to the emission of waste salt from potassium mines in the Alsace region of France. One mine, in French known as Les Mines de Potasse d'Alsace, was contributing 40 percent of all salt entering to Rhine. This salt pollution was making the river water unusable for the agricultural purposes and it posed serious threat to fish population of the river. In the early 1970s, salt content exceeded 300 mg in a litre of Rhine water while it was flowing in Dutch-German border areas.

In 1950, the Switzerland, France, Germany, Netherlands and Luxembourg formed the International Commission for the Protection of Rhine Against Pollution.[54] This commission coordinates the collection of water quality data and gives recommendation. For the implementation of commission's advice unanimous agreement is needed among the member-countries. Due to this limitation, the Commission has not able to handle the discontent of the Netherlands and Germany over the salt emission issue. Instead, this problem was taken up by the political authorities of the basin-states

As French mines were the major polluters, the negotiation aimed at reducing the salt emission from them.[55] A Conference of the Ministers on the Pollution of the Rhine agreed to limit the concentration of chloride ions to 200 mg per litre at the moment when the Rhine reaches the Netherlands. To achieve this objective, it was decided to reduce the emission by 60 kg/sec from French mines from 1975. The estimated cost of the underground storage, about 100 million French Francs,

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51 These two arguments are given in, Scott Barrett, *Conflict and Cooperation in Managing International Water Resources* (Centre for Social and Economic Research on the Global Environment—CSERGE— working Paper WM 94-04), pp.17-18.

52 Marc Reisner, *Cadillac Desert* (New York: Viking, 1986), p. 483.

53 Jan M. Van Dunne, "The Case of the River Rhine: The Rotterdam Contribution", in Patricia Thomas, ed., *Water Pollution: Law and Liability* (London: Graham & Trotman and the IBA, 1993), pp. 75-87.

54 The 1963 Berne Convention made the tenure of the Commission permanent and, in 1979, the European Economic Community became signatory to the agreement.

55 David G. Le Marquand, "Rhine River Pollution" in *International Rivers: The Politics of Cooperation* (Vancouver, BC: Westwater Research Centre, 1977), p. 104.

was divided among the four states: France (30%), Germany (30%), the Netherlands (34%), and Switzerland (6%). Before the agreement came into force, France objected to the cost-sharing and this led to a temporary deadlock. Finally the agreement, known as Convention on the Protection of the Rhine Against Pollution by Chlorides, was concluded in 1976. It stipulated the set objective to be achieved gradually but the cost sharing remained as previously agreed.[56] The agreement did not become operative until 1985 due to delays from the French side.[57] There was considerable opposition in France against the plan for the underground storage of the emissions. It was feared that it would affect the aquifers from which local water supply is drawn.[58]

The implementation of the agreement resulted in significant improvements in the entire riparian ecosystem, and contributed to the high level of cooperation among the major basin states. Domestic political stability, sound economic conditions, and cooperation in many other matters have played a role in creating such fruitful river cooperation[59] The cost-sharing arrangement is interesting. Unlike the Colorado River case, the major victim of the salt pollution in the Rhine, the Netherlands, pays the largest share towards the pollution control measures. The country agreed to this as it is the major beneficiary of the agreement, though it does not contribute to the pollution. The major polluter, France also pays a substantial amount of the expenditure. Germany agreed to pay the same amount as France. It is not as affected by the pollution to much as is the Netherlands, so its benefits are less. It is not a major contributor to the pollution either. Most interestingly, the country farthest upstream Switzerland which has no role in the salt pollution of the river or nothing to gain from the agreement has been a party to the cost sharing arrangement. This gesture of solidarity of Switzerland might be explained by a wish to project an international image[60] or it may expect to gain on other subsequent issues[61]

5.3.3 The Paraná River

The Rio de la Plata basin covers 3.2 million square kilometres and drains all of Paraguay, most of Uruguay, northern part of Argentina, south side of Brazil and eastern Bolivia in South America. The Paraná river is one of the major streams of this basin. It flows from Brazil to Argentina, crossing the heart of Paraguay and after its confluence with River Uruguay, reaches Rio de la Plata. From 1853, there has been various agreements which have led to the free navigation in the Plata and also in the River Paraná.[62] In the 1970s, a major disagreement surfaced among

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56 Scott Barrett, No. 50, pp. 17-18.

57 P. W. Birnie & A. E. Boyle, *International Law and the Environment* (Oxford: Clarendon Press, 1992), p. 244.

58 Malin Falkenmark, "Fresh Waters as a Factor in Strategic Policy and Action", in Arthur H. Westing, ed., *Global resources and International Conflict: Environmental Factors in Strategic Policy and Action* (Oxford: Oxford University Press with SIPRI & UNEP, 1986), p. 95.

59 Katrina S. Rogers, No. 46, p. 14.

60 Allen V. Kneese, No. 44.

61 David G. Le Marquand, No. 54, p. 119.

62 Gordon Ireland, *Boundaries, Possessions, and Conflicts in South America* (Cambridge, Mass.: Harvard University Press, 1938), pp. 34- 39.

Brazil, Paraguay and Argentina over the construction of a dam on the Paraná River.

Brazil and Paraguay decided in the early 1970s to construct one of the largest dams of the world across the Paraná River at Itaipu, where the river forms the border between the two countries. This dam project was funded by Brazil who put up almost 90 percent of the capital required, while Paraguay was to receive 50 percent of the produced hydropower.[63] It was the largest planned hydroelectric facility in the world with an estimated 12.6 million kilowatt capacity and the project was scheduled to begin its operation from 1983.[64] This project was conceived by the Brazilian authorities for their need to supplement the electric power availability of the industrial centre-south. However, the project led Argentinean authorities to become concerned, because of possible environmental repercussions in the downstream areas. Moreover, Argentina was planning its own dam further down-stream of the river. The Brazilian-Paraguay project would give regulatory control in the hands of Brazil also for the Argentinean project, something which was not easy for Argentina to accept. Due to these reasons, Argentina demanded prior consultation in the project planning and construction, by referring to international norms. This demand Brazil refused to accept.

Argentina brought this issue before the 1972 Stockholm Conference on the Human Environment and the issue was referred to the UN General Assembly. Before it was taken up in the UN, the foreign ministers of Brazil and Argentina agreed on December 1972 to find a solution to the problem bilaterally with the exchange of information. The text of the agreement was later adopted as UN General Assembly Resolution 2995 (XXVII) of 15 December 1972. Argentina still was not satisfied and it brought the issue to the G77 meetings of 1973 and 1974 . It also took it up when it hosted the UN Global Water Conference at Mar del Plata in 1977.[65] After intensive negotiations, an agreement between Argentina, Brazil, and Paraguay was reached on 19 October 1979 on Paraná River projects. This agreement permitted made it possible for Argentina to construct the Yacyreta dam on the downstream of the Paraná River[66]

The agreement of 1979 stipulated the maximum normal level of the water of Argentina's dam and also minimum flow variations of the Brazilian project. According to this agreement, it was decided that the prior notification and the technical information regarding the filling of the reservoirs would be available to the parties. It further asked the authorities of the two projects to "establish adequate procedures of operational coordination for the attainment of reciprocal benefits, including the exchange of information."[67]

The dispute between Argentina and Brazil erupted in the early 1970s over the issue of prior notification and consultation. The incorporation of these

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[63]Hans J. Hoyer, "Paraguay" in Harold E. Davis, Larman C. Wilson & others, *Latin American Foreign Policies: An Analysis* (Baltimore: The John Hopkins University Press, 1975), p. 300.

[64] Wayne A. Selcher, *Brazil's Multilateral Relations: Between First and Third Worlds* (Boulder, Col.: Westview Press, 1978), p. 82.

[65] Wayne A. Selcher, No. 63, p. 82-83.

[66] Peter H. Gleick, "Water and Conflict: Fresh Water Resources and International Security", *International Security*, vol. 18, no. 1, Summer 1993, p. 92.

[67] Stephen C. McCaffrey, "Water, Politics, and International Law", in Peter H. Gleick, ed., Water *in Crisis: A Guide to the World's Fresh Water Resources*, (New York: Oxford University Press, 1993), p. 97.

principle in 1979 Agreement brought a peaceful resolution of the disagreement and led to cooperation in the Paraná river basin. By agreeing to the Brazil and Argentina's exploitation of the Paraná River, Paraguay has able to develop its tremendous hydro-power potential, and it is said to have become the largest exporter of electricity in the world.[68] It is of vital interest to Paraguay to maintain cordial relations with Argentina and Brazil, since these countries control Paraguay's outlets to the Atlantic Ocean. The willingness of the Brazil to accept some of Argentina's demands may be due to its limited interest involved in the Itaipu project as it was looking for the possible need of the hydro-power in the future. Moreover, the concession to Argentina regarding the issue of prior consultation and notification did not pose any serious threat to its own development plan. The fear of Argentina was, that in the absence of coordination, the dam at Itaipu would prevent the execution of its own proposed dam project. Its major concern was not about the quality or quantity of the water but to participate in its control management, and once it was achieved, the door was opened for cooperation.

5.3.4 The Nile River

The basin of the world's longest river, the Nile, includes ten states– Rwanda, Burundi, Zaire, Tanzania, Kenya, Uganda, Eritrea, Ethiopia, Sudan and Egypt– and the largest consumer of its water are the two last riparians. The Nile is formed by two main tributaries: the White Nile and the Blue Nile and both converge at the Sudanese capital, Khartoum and then flows through Egypt and drains into the Mediterranean. Though most of the water of this river is used by Egypt and Sudan, 86 percent of the discharge originates in Ethiopia.[69]

In 1929, Sudan represented by Britain signed an agreement with Egypt in which 48 billion cubic meters of water was allocated to Egypt, while Sudan's share was 4 billion. From the early 1930s, irrigational agriculture gradually came to Sudan and the demand for water increased. On the eve of its independence and following the Egyptian revolution in 1952, the administration in Sudan started demanding to renegotiate the water agreement with Egypt. The period of 1954-58 witnessed a conflict between Sudan and Egypt over the High Aswan Dam plan and sharing of water. The relations soured when Sudan declared unilaterally its non-adherence to the 1929 Agreement. In this period of tension, Egyptian army units were moved to the border as a show of force.[70] After the military take-over in Sudan in 1958, Sudan began to soften its stance and a new agreement was signed in 1959 between these two countries. From the newly calculated discharge of 84 billion cubic meters per year, Egypt got the right to use 55.5 billion cubic meters, and 18.5 bln was allotted to Sudan. This agreement also included some provisions in regulating the filling of the storage created by the Aswan Dam[71]

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[68] Fred Pearce, "Tide of Opinion Turns Against Superdams", *Panscope*, No. 33, November 1992, p. 3.

[69] Natasha Beschorner, "Water and Instability in the Middle East", *Adelphi Papers*, no. 273, Winter 1992/93, p. 45.

[70] Gabriel R. Warburg, "The Nile in Egyptian-Sudanese Relations", *Orient*, vol. 32, no. 4, December 1991, p. 570.

[71] Sofus Christiansen, "Shared Benefits, Shared Problems", in Sverre Lodgaard & Anders H. af Ornäs, eds., *The Environment and International Security* (Oslo: PRIO Report No. 3, 1992), p. 57.

After the 1959 Agreement, the work on the Aswan Dam started in 1960 and it was completed in 1971. From the year of agreement until the fall of Sudanese President Numayri in 1985, Egypt had a friendly regime in Sudan. In return for helping Numayri to stay in power, Egypt received the concession from Sudan to carry out the Jonglei Canal project in 1978. It would decrease the loss of water of the White Nile while it passes through the sudd swamps.[72] This canal could have supplemented an annual flow of 4.7 billion cubic metres of water, of which the Lake Nasser's share was 3.8 billion. The need for enhancing the supply arose due to noticeable decrease in the quantity of water flowing into the Lake Nasser since 1980 as result of population growth and continuing drought in the upstream areas.[73] However, the opposition from the Southern Sudanese armed opposition, SPLA, brought the digging of the Canal to a halt in 1984.

A number of dams are being built in Sudan to store the water of Nile and also the construction of new dams are being considered. Due to rapid population growth, Sudan is in the need of more water to meet the demand of its food production. The country plans to introduce a new irrigation system, which may raise demand by as much as 10 billion cubic meters yearly.[74] Egypt's relation with Sudan have deteriorated considerable since Numayri's ouster in 1985. There have been demands from the Sudanese side to revise the 1959 Agreement in order to increase its share, but Egypt is strongly opposed. Sudanese officials have recently started using the threats of withholding Nile waters from Egypt. President Mubarak of Egypt has responded to this in an interview to a local newspaper *Al-Akber*, "Those who play with fire in Khartoum...will push us to confrontation and to defend our rights and lives."[75] Egypt, in the past, has never hesitated to use the threat of war to stop the ambitions of the upstream countries in encroaching the Nile's water.

The other major threat to Egypt's water supply comes from Ethiopia, who controls the Blue Nile tributary that supplies more than 80 percent of the Nile's water entering Egypt. With its own rapid population growth and increasing food demands, Ethiopia now requires more water for her own use. Not bound by any water-sharing agreement with Egypt or Sudan, it unilaterally plans to divert 4 billion cubic metres of Blue Nile's water for its own irrigation project.[76] In spite of objections from Egypt and Sudan, Ethiopia maintains its sovereign right to develop the water resources within its border. Economic and technological difficulties and political crises have stalled the Ethiopian plans for some years now. In the year 1990, Egypt was instrumental in blocking an African Development Bank loan to Ethiopia for a water development project, which could have reduced the flow to the downstream.[77]

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72 R. O. Collins, *The Waters of the Nile: Hydropolitics of the Jonglei Canal, 1900-1988* (Oxford: Clarendon Press, 1990).

73 Gabriel R. Warburg, No. 69, p. 566.

74 Peter Beaumont, *Environmental Management and Development in Drylands* (London: Routledge, 1989).

75 "Water as a Weapon", *Sudan Update*, vol. 6, no. 11, 15 July 1995.

76 Rabin Clarke, No. 19, p. 104.

77 Alan Cowell, "Now, a Little Steam. Later , Maybe a Water War", *New York Times*, 7 February 1990.

The situation has remained tense from the 1980s among the three major riparians – Egypt, Sudan and Ethiopia – over the distribution of the Nile's water. In an interview with the weekly *al-Musawwar* in May 1988, the Egyptian Defence Minister Marshal Muhammad Abdul-Halim Abu Ghazala, asked himself these rhetorical question: "How will Egypt react if one of its southern neighbours attempts to divert the Nile waters? Will we die of thirst or fight for the supreme interests of the homeland?"[78] The answers to these were already given by the then foreign minister of Egypt and presently the Secretary General of the UN, Boutros Boutros-Ghali in his comments in 1985 "the next war in our region will be over the waters of the Nile, not over the politics ...."[79]

The sharing of water among a number of riparians from the same source has made the situation complicated in the Nile basin. The water scarcity in this region has been exacerbated due to explosive population growth and the expansion of agriculture, the basin's primary sector. Over 80 percent of the population in almost all the basin countries are engaged in agricultural production.[80] Due to its almost total dependence on the Nile's water, for Egypt this is of high foreign policy concern. However, its political dominance in the basin region has been reduced due to signing of an agreement between Sudan and Ethiopia in December 1991 to cooperate over the use of Nile water.[81] In the absence of a basin-wide arrangement, while the demand for the water is growing in the region, it is not difficult to foresee a real conflict over the sharing of the Nile River in the near future,[82] and the prospects of cooperation remain limited.[83] The political changes makes the situation unpredictable, however. For instance, the assassination attempt against Egyptian President Mubarak in Addis Ababa in 1995 was attributed to the Islamic regime in Sudan by both Egypt and Ethiopia, thus isolating Sudan.

5.3.5 The Ganges River

The Ganges River, about 2510 kilometres long, rises on the southern slope of the Himalayan range in India. It moves through south-east direction in Indian territory to enter into Bangladesh. The major distributary Bhagirathi-Hooghly takes off from the southern bank of the mainstream before it reaches the border of Bangladesh. The Ganges becomes the border between India and Bangladesh for about 112 kilometres, and then moves towards the south-east to join Brahmaputra at the heart of Bangladesh. The combined flow runs south to empty into the Bay of Bengal. The major tributaries of the Ganges, Gandak, Karnali and Kosi originate from Nepal.

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78 Quoted in: Gabriel R. Warburg, No. 69, p. 572.

79 Norman Myers, "Environment and Security" Foreign *Policy*. no. 74 , 1989, p. 32.

80 Yahia A. Mageed, "The Nile Basin: Lessons from the Past", in Asit. K. Biswas, ed., *International Waters of the Middle East: From Euphrates-Tigris to Nile* (Bombay: Oxford University Press, 1994), p. 172.

81 Natasha Beschorner, No. 68, p. 60.

82 Few years back, a Policy Paper of the Department of National Defence of Canada also predicts in this line. Stephen Lonegran, *Climate Warning, Water Resources and geopolitical Conflict: A Study of National Dependent on the Nile, Litani and Jordan River Systems* (Ottawa: Dept. of National Defence, Canada, Operational Research & Analysis Establishment, ORAE Extra-Mural Paper No. 55, March 1990), p. 57.

83 Natasha Beschorner, No. 68, p. 60.

The dispute over sharing the Ganges water came up in early 1950s, when Bangladesh was the eastern province of the Federation of Pakistan. It started when India planned to construct a barrage at Farakka, 18 kilometres upstream from the East Pakistan (Bangladesh) border, for the diversion of mainstream water to supplement the dry season flow of its own Bhagirathi-Hooghly River.[84] In spite of Pakistani objections, India carried on with the project and unilaterally decided to begin the barrage construction in 1962. The demand of the growing Calcutta city and its port as well as agricultural needs of the state of West Bengal induced the Indian government to go ahead with the design. With the independence of Bangladesh in 1971, it was expected that this dispute would be resolved to the mutual advantage of both the neighbours in view of the help rendered by India to Bangladesh in its liberation struggle. However, the political realities in both the countries blocked the path of a negotiated settlement of the dispute. The Farakka Barrage was commissioned in 1975 on a trial basis, following an agreement signed by India and Bangladesh, for 40 days only.

The assassination of pro-Indian President of Bangladesh, Mujibur Rehman in August 1975 deteriorated the bilateral relations between India and Bangladesh. From January 1976, India unilaterally started to divert the Ganges dry-season flow at Farakka and the new leadership of Bangladesh raised this issue in various international forums. In 1977, when a change of government took place in India, both the countries came to an agreement to share the Ganges dry-season water for five years. They also pledged to work for finding long-term arrangements to augment the dry-season flows of the Ganges.

For the augmentation of the dry-season flow, both the countries by 1978 came forward with their respective proposals.[85] The Bangladeshi plan proposed the building of up-river storage dams in Nepal, and India proposed a scheme to divert water from the Brahmaputra river to the Ganges through a link canal across Bangladesh's territory. It was important for Bangladesh to involve Nepal in the project since it was seen to be more difficult for India to break a trilateral commitment than a bilateral one. On the other hand, India only wanted to work for augmenting the Ganges at the bilateral level with Nepal because of her desire to divert the increased flow for the use of its southern part, which is chronically deficient in water. All these considerations did not permit the contesting parties to accept each other's proposal for augmentation.[86]

After the expire of the 1977 agreement in 1982, there were two more agreements between the contesting parties to share the dry-season flow of the river Ganges on a short term basis. However, from November 1988, there was no agreement in force and India was withdrawing water at its own will. Due to successive failures of the bilateral negotiations, Bangladesh started to internationalise the Ganges water issue. In October 1993 it put the question before the UN General Assembly and Commonwealth Heads of Governments Meeting (CHOGM). After the change of regimes in both countries, India and Bangladesh have signed an agreement in December 1996 to share the Ganges water at Farakka for 30 years. This water sharing agreement is a breakthrough but to achieve the

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84 The rivers which have originated from the Himalayas face the 'dry season' period from the beginning of January to the end of May due to transformation of rain water into snow in the catchment area.

85 M. Rafiqul Islam, "The Ganges Water Dispute", *Asian Survey*, vol. 27, no. 8, 1987, pp. 918-34.

86 Ashok Swain, "Conflicts over Water: The Ganges Water Dispute", *Security Dialogue*, vol. 24, no. 4, December 1993, pp. 429-439.

lasting solution to the water problem, there is a need of agreement on augmentation of the river's dry-season flow. Unfortunately, both countries still hold different views on this.

The dispute over the Ganges has been how to share its water for the five dry-season months. During the rest of the year, there was sufficient water for both India and Bangladesh. In dry-seasons, the average minimum discharge to Farakka was falling below 55,000 cusecs, but India asked to divert 40,000 cusecs while Bangladesh needed all to save its territory from environmental problems. The increasing upstream withdrawal in Northern India further lowered the dry-season flow at Farakka, which made the situation more complicated. In March 1995, Bangladesh complained of obtaining only 9,000 cusecs in the acutest period which led to the assumption that the water availability at Farakka has come down to, at the most, 49,000 cusecs in the dry-season and this new figure hindered the negotiators on both sides to agree at least on a short-term basis till December 1996.[87]

India's withdrawal of water in the upstream has been based on its argument that it holds the sovereignty over the water resource flowing in its territory. The downstream country Bangladesh does not possess powers similar to Egypt in the Nile Basin, to safeguard its own requirements. India, for its own benefits, does not want to participate in a basin-wide framework which is favoured by Bangladesh. The massive population growth and intensified use of water in the agricultural sector has been multiplying the scarcity tendency of the water in the Ganges basin. A Joint River Commission has been established by the two riparians since 1974, but it enjoys advisory power only. This conflict has fallen short of use of physical force because the sheer size and strength of one party has acted as an effective deterrent factor. However, the non-armed character should not lead to an underestimation of the seriousness of this conflict when we look at the deterioration which has taken place in the Indo-Bangladeshi relationship in the last two decades.[88]

5.3.6 Comparing the Five Cases

In all the selected five river basins, at some time or another, there have been disagreements over the sharing of the waters among the riparians. Thus, sharing a river between several countries is likely to involve a certain amount of friction, no matter who the countries are. We also observe that in all the cases, there are efforts to cooperate among the contending riparians to exploit their respective international rivers. In three cases – the Colorado, Rhine and Paraná – agreements have been reached over the contentious issues involved and successful schemes of cooperation among the water-user nations have been worked out. It also appears that such agreements have a positive effect on overall cooperation among the states. Also, the reverse may be true: it is easier to make agreements when there is considerable interest of another nature in having international cooperation. In two cases - Nile and Ganges - there have been some agreements, but the conflictual tendencies are more apparent among the contending nations with respect to water management, but also to over-all relationships. The disputes have been confined

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87 Ashok Swain, "Displacing the Conflict: Environmental Destruction in Bangladesh and Ethnic Conflict in India", *Journal of Peace Research*, vol. 33, no. 2, May 1996, pp. 189-204

88 Elisabeth Corell & Ashok Swain, "India: The Domestic and International Politics of Waster Scarcity", in Leif Ohlsson, ed., *Hydropolitics: Conflicts over Water as a Development Constraint* (London: Zed Books, 1995), pp. 123-148.

to diplomatic and political behaviour. No wars have erupted. However, explicit military threat has been part of the picture in at least one of the disputes, Egypt-Sudan, and the military asymmetry may act as a deterring factor in one case (India-Bangladesh), i.e. the two cases may be those which have the largest potential of escalation.

How can these differences be explained? First, we may note that there are many common features, which means that many simple explanations will not suffice. All river basins show increases in population or in general economic activity. Also, we can note that the issues are international in character, involving governments on opposite sides. Thus, the typical inter-state rivalry could in principle be expected in all cases, but the outcomes still vary.

It is, furthermore interesting to observe that the negotiations have been carried out among the parties themselves, without assistance or guarantee of any third party. The number of countries involved is not a difference either: Agreements were reached in bilateral relations as well as in multinational relations, agreements failed in bilateral and multilateral situations. Successful cooperation is not limited to developed democracies of Europe and USA only. It has involved countries in Latin America: Mexico is party to the River Colorado agreement, fairly undemocratic regimes in Argentina, Paraguay and Brazil negotiated the Paraná arrangement. Working collaborative arrangements are, thus, not simply a matter of countries being rich or democratic.

Also, we have seen that the issues are not strictly inter-governmental. On both sides the river question involves many intra-national actors as well. The accommodation thus has to involve a settlement on two levels: between the governments, and between each government and local actors in its own society. This made an agreement costly (in the Colorado case, for USA) or slow in implementation (in the Rhine case, by France), but did not prevent agreement.

A close look of these five cases brings out one major and one additional difference between the cases of successful cooperation and the conflicting ones. The major differences concern an aspect of the issues involved in the disputes. Let us review the three cases with working agreements first, and then discuss the other two.

In the Colorado river basin, the increasing salinity due to agricultural pollution was the issue of the contention between Mexico and USA. As mentioned, Mexico was unhappy over the quality of the water, not its quantity. The US Chief Negotiator had even described the 1972 Agreement as an agreement of dollars rather than water. The US satisfied the demand of the Mexico mainly by putting a desalinisation plant. It would have been comparatively difficult for USA to negotiate over the quantity of the water given to Mexico. As was also mentioned before, the farmers of the South-western part of USA were not prepared to give away more water than what is allocated in 1944 Agreement.

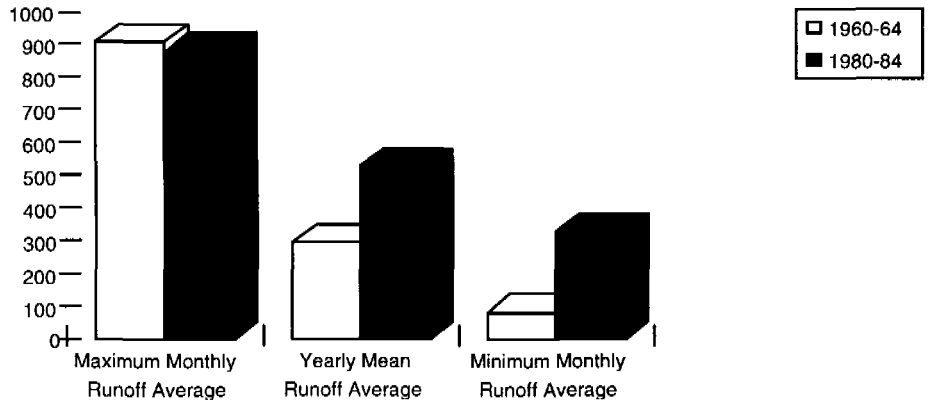

Figure 1. Comparing the Runoff of the Colorado River[89]

The successful ongoing cooperation between USA and Mexico over Colorado River after 1972 can also be attributed to the increasing runoff in the river. The data of the River Colorado's runoff at Lees Ferry, Arizona projects the increased flow from the 1960-64 to 1980-84. As Figure 1 suggests, the yearly mean runoff average in the early sixties was only 291.2 cumecs which has jumped to 528.8 in the early 80s. There has been also an increase in the monthly minimum runoff at that time (from 83.4 cumecs to 329 cumecs), and this, of course, reduces the scarcity tendency of the water supply and helps to dilute the pollution in the water. This increased runoff has been possible mostly due to better water management in the irrigation sector.

The dispute over the waters of the Rhine came up due to salt pollution from the French mines in the 1970s. As in the case of Colorado, the downstream countries, particularly the Netherlands objected to the quality of the receiving water, not its volume. Due to comparable economic development of all the basin states, it was not difficult for them to accept the formula of cost-sharing arrangement for investments halting the pollution. While the agreement on Colorado was over dollar not water, the same deal can be seen in the case of Rhine, where the negotiation and agreement centred around the costs (francs not water). The successful cooperation among the basin states of the Rhine has now been going on for more than a decade, without being hampered by the shortage of water in the river.

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89 The source of the river runoff data is: The Global Runoff Centre, D–56068 Koblenz, Germany. To obtain the maximum runoff average of these years, we have taken the monthly flows for the those months which were the highest to get an average. The yearly mean runoff average is calculated by dividing the total flow of the river in these years in to an average monthly basis. The minimum runoff average is derived from the lowest monthly flows of these years.

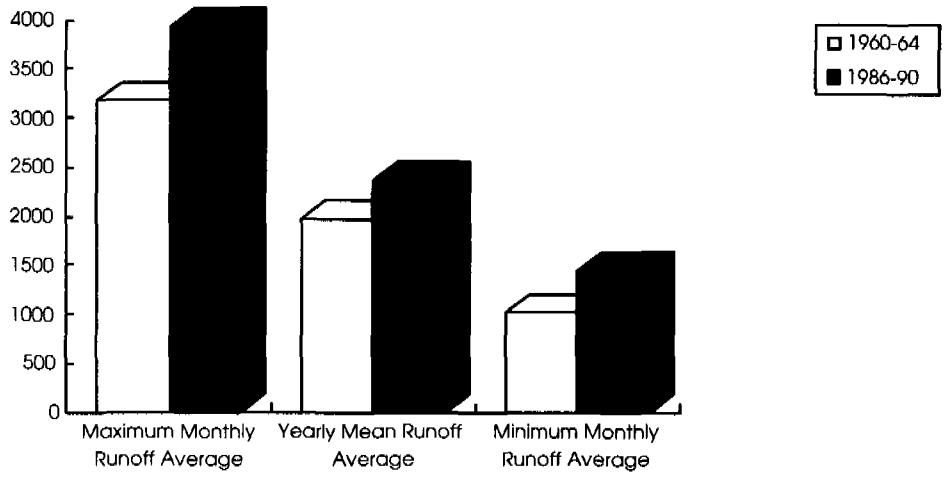

Figure 2. Comparing the Runoff of the Rhine River in the Netherlands [90]

As we see in Figure 2, the maximum and minimum monthly runoff average as well as the average of the yearly mean runoff of the Rhine river at Lobith station of the Netherlands have increased from 1960-64 to 1986-90. The maximum monthly run-off average in the first half of the 1960s was 3173.1 cumecs, which has increased to 3927.4 cumecs in the late 1980s. Similarly, the minimum runoff has increased from 1021.1 cumecs to 1442.9 in the corresponding time period. Also, the mean flow in a year has jumped from 1969 cumecs to 2365.2. The availability of larger volume of water in the downstream clearly projects that the quantity of the water has not been an issue of the discontent. Rather, it can be argued that the increased runoff, by helping the quality improvement, is paving the way for the successful mutual cooperation among the riparians of the Rhine River.

The conflict over the Paraná River came up between Brazil and Argentina as a part of their competition to have their say in the regulation and control of the water resources in Paraguay. The bilateral agreement in the early 1970s between Brazil and Paraguay over the construction of Itaipu dam became the source of irritation for Argentina as the country was being left out. The main purpose of the Itaipu dam being hydro-power production, the quantum of water supply to Argentina was not an issue. Rather the dispute concerned the control of the supply. Once Argentina found its place in Itaipu's regulating mechanism, the three basin states had no problem in cooperating among themselves over the water resource exploitation.

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[90] *ibid.*

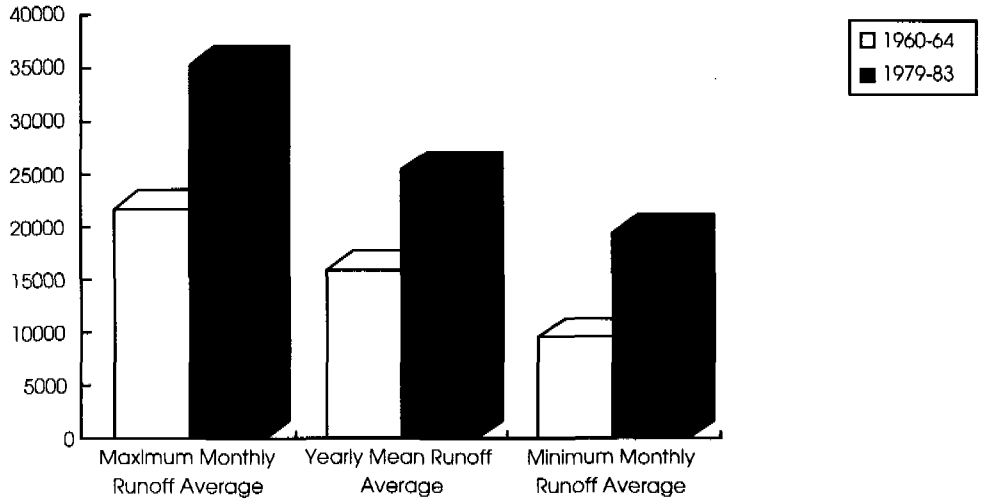

Figure 3. Comparing the Runoff of the Paraná River in Argentina[91]

The issue of disagreement among the riparians of the Paraná River has never been over the scarce supply of the water. As Figure 3 suggests, the runoff of the Paraná river has increased from the 1960-64 period to the 1979-83 period. Even after the Itaipu dam in the upstream had started its operation in the early 1980s, the downstream discharge in Argentina increased. The maximum and minimum monthly runoff at the Corrientes station of Argentina has increased from 21,667.2 and 9584.8 cumecs in 1960-64 to 35220 and 19480 cumecs in 1979-83 respectively. The yearly mean runoff also has increased from 15983.3 cumecs to 25327.5 in the corresponding time periods. The total volume of water available in this river is much larger in quantity and the demand for the direct consumption of water is not that high in the dependent basin. This means that the conflict over Paraná has not over been the amount of available water, rather its increased runoff has positively contributed in solving the contention over the water management of the resource among the riparians.

For the other two cases, the picture is different. In the case of Nile, the disagreement among two major users Egypt and Sudan has always been over deciding their share of the water. The 1929 Agreement was changed due to increasing demand for water in Sudan. The Agreement of 1959 was possible to certain extent as the river's runoff that time had increased from 1929 according to updated calculations and also large volume of the water had been left unallocated in the 1929 Agreement. However, due to rapidly increasing internal water demand, Sudan became dissatisfied with 1959 Agreement. In failing to carry out the Jonglei Project, there is now less hope to augment the supply of river and to go for a newly calculated arrangement with Egypt. The growing population and acute water scarcity in Egypt do not allow her to compromise the share of water she has been given in the 1959 Agreement. Ethiopia for its own needs, like Sudan, also wants to use more of the water which is flowing in its own territory. The declining quantity of the water has been the most important factor in the conflictual position adopted by the three major riparians of the Nile system (Figure 4).

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91 ibid.

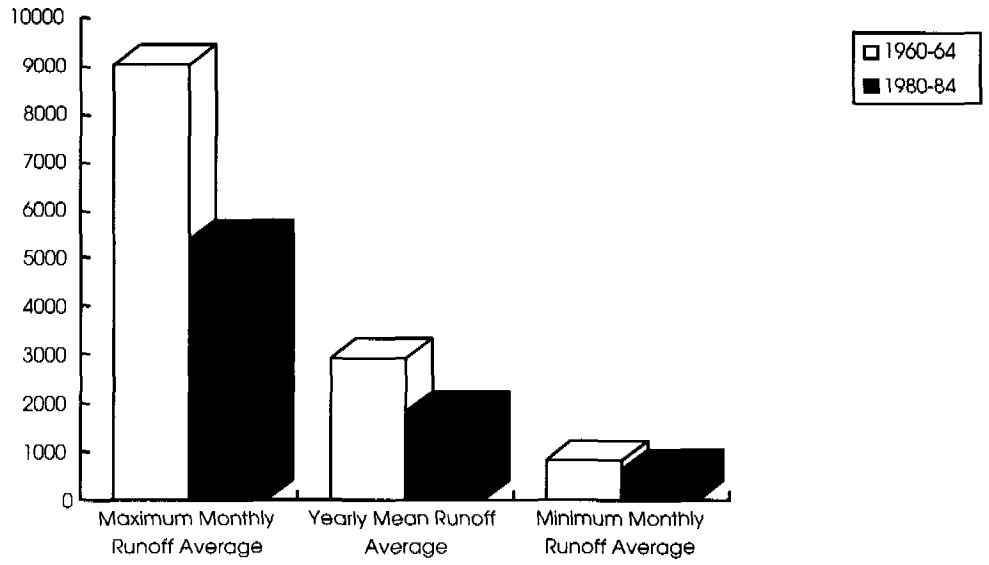

Figure 4. Comparing the Runoff of the Nile River in Sudan[92]

As can be seen in Figure 4, the runoff of the Nile River inside Sudan has decreased considerably from the time of its signing the agreement with Egypt to the time when it started to demand revision of the agreement. The maximum and minimum monthly runoff of the Nile River at, Dongola, Sudan have declined from 9018.8 and 847.6 cumecs respectively in 1960-64 period to 5389 and 657 cumecs in 1980-84 period. The yearly mean runoff of the river also fell from 2941.8 cumecs to 1814.5 cumecs in the corresponding periods. This reduced supply has been mainly due to increased water use in the further upstream countries, like Ethiopia. In this scarcity condition, it is increasingly difficult for Sudan to meet its own requirements as well as the quota, stipulated by 1959 Agreement, of delivering to the Egypt. The sheer reduction in availability of the water has destroyed the cooperative arrangement of this basin and has led to conflicts.

The dispute between India and Bangladesh over the Ganges River has come up due to India's diversion of water at Farakka barrage to meet its own growing needs. The increasing demand of these two countries had been the major hindrance to reach an agreement over the sharing of the Ganges water. The quantity of the water has always been the main focus of their negotiation and the fear of future water scarcity has blocked any lasting arrangement on the river. The decreased flow to the Farakka due to upstream withdrawals, had led to India's decision of not renewing the short-term arrangements after 1988 till 1996. The increased demand in Bangladesh did not allow its negotiators to agree to a lower level of available water than what has been decided earlier.

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92 ibid.

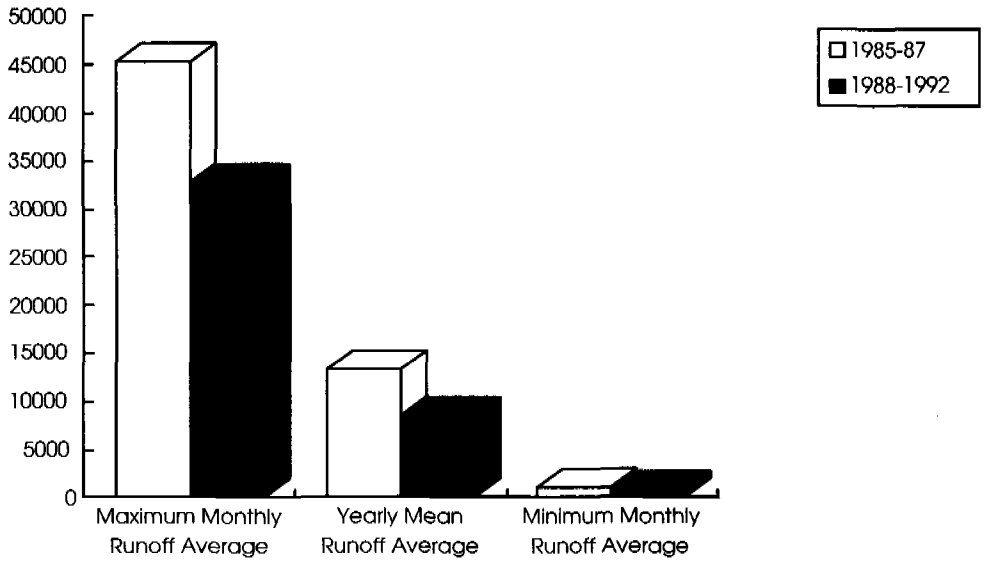

Figure 5. Comparing the Runoff of the Ganges River in Bangladesh[93]

In Figure 5, we see the fall in the quantum of Ganges water available to the Bangladesh from Indian side, from the years of the short-term sharing arrangement to the years of without any agreement. The maximum monthly runoff of the Ganges at Hardinge Bridge station of Bangladesh has fallen from 45296.7 cumecs in 1985-87 to 32802.1. Most importantly, in the corresponding time periods, the minimum monthly runoff has also declined from 1015.3 cumecs to 618 cumecs, while the yearly mean runoff has declined from 13335.1 cumecs to 8530.6 cumecs. Due to this falling supply when its own demand is rapidly increasing, Bangladesh had no other option but to demand for more water from Indian side. However, India's own scarcity situation did not allow her to meet these demands and this led to conflict between the two riparians.

The issues of disagreement in the cases of Colorado and Rhine have been quality, in the Paraná, it has been the control and regulation and for the Nile and Ganges, it has been the quantity. In the first three cases, there has been no disagreement over the amount of available water to the riparians and all these basins have opted for successful cooperation. The increased runoff of these rivers has further helped the basin countries in their cooperative endeavours. However, in the Nile and Ganges basin, the disputes have always centred around the availability of the water resource. Water is irreplaceable – so, the problem of its reduced quantity cannot be easily solved. The quantity factor in these cases have contributed to destroying existing cooperative arrangements and led the parties to take conflicting positions. The quantity issue can, most easily be formulated in a zero-sum game: what country X gets is denied to country Y, whereas issues of quality is something all may gain from, and control is something that can more easily be shared. This means that the three cases, Colorado, Rhine and Paraná, may have been "fortunate" as there is more water in these rivers than before, presumably rising at a rate keeping pace with population growth. The conflicts have basically be remedied by increasing the resources. Such a pattern is not

93 ibid.

easily repeated in the other two cases, although a case might be made for improved water management in irrigation, etc.

In addition to the quantity issue, the three cases of successful cooperation are different from the two conflict cases on the basis of their sharing arrangements. Over the Colorado, Rhine and Paraná rivers, the riparians have come together in a basin-wide framework and the agreements do not exclude relevant parties. However, for the Nile and Ganges, the attempted arrangements have been mostly bilateral, and thus not aimed at including the entire basin. This means that they have been more concerned about political management of the issue than in finding appropriate and equitable ways of sharing legitimately based interests among all relevant parties. This can be seen by the absence of important upstream countries, for instance Ethiopia in the case of Nile and Nepal in the case of Ganges, in the agreements. There is a similarity in the Egypt-Sudan and India-Bangladesh relationship, where the first country has dominant attitude to the second one. The water issue might then be seen as a political tool, more than a human question, on either side of the relationship. A more comprehensive, less politicised approach might be preferable, although more complicated, in working out a lasting arrangement.

6. FINDING WAYS TO SHARE INTERNATIONAL RIVERS:

What have seen so far in this study is that the way the water issue is defined and handled is more important: if it consists of a quantity issue difficulties accumulate. If, in addition, it activates a previous political divide, management might not be pursued in the equitable way required for a lasting solution. Under such circumstances, the increasing pressure to exploit the international rivers to meet the water scarcity situation may lead to growing disagreements among the riparians and existing cooperative arrangements might be undermined. To meet this situation, a global consensus is needed on such issues as the right to quality water and the right to have a hearing on the issues.

Besides the efforts of the International Law Association and later on the International Law Commission in preparing the draft law of the non-navigational uses of international watercourse, there have been several discussions and declarations in various international fora related to sharing of the international water resources. The United Nations Conference on the Human Environment held in Stockholm in 1972 discussed over the natural resources shared by more than one country. In 1977, the first global water conference involving delegations from governments, NGOs and UN bodies took place Mar del Plata. This United Nations Water Conference urged the member-states: "... to the use, management and development of shared water resources, national policies should take into consideration the right of each state sharing the resources to equitably utilise such resources as the means to promote the bonds of solidarity and co-operation."[94] No other similar conference was held until the International Conference on Water and the Environment (ICWE), in Dublin, Ireland, from 26-31 January 1992. The Dublin Statement, while advocating the river basin approach for the planning and management of water resources, recommended for the preparation and implementation of integrated management plans, endorsed by all affected

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[94] *Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977*, New York: United Nations Document No. E/CONF. 70/29, 1977.

governments and backed by international agreements."[95] These recommendation of ICWE were incorporated into the Agenda 21 (Chapter 18), which was the main outcome of the Rio Conference (The United Nations Conference on Environment and Development, June 1992).

There have been numerous separate attempts made by, for instance, the World Bank, United Nations Environment Programme (UNEP), United Nations Water Conference and FAO in finding ways of successfully sharing of international watercourses among the states. The World Bank follows the Operational Directive 7.50 to finance the projects on international rivers. The Directive is based on two main principles, "no appreciable harm to other riparians" and "equitable sharing by all the riparians."[96] Through the initiative of the UNEP, a pilot project has been formed to share the waters of the Zambezi river among its 8 riparians. This experience is also being implemented by the UNEP for the Lake Chad Basin and the Damman aquifer in the Arabian Peninsula. The recent setting up the World Water Council (WWC) and Global Water Partnership (GWP) may further help the peaceful sharing of international rivers.[97]

In the absence of a universally acceptable legal framework, it is not easy to address the problems associated with the sharing of international rivers. However, as the evidences suggest in many cases, parties concerned are reaching voluntary agreement among themselves. Two surveys by FAO of the United Nations (one in 1978 and the other in 1984), compiled 3,707 agreements among the riparian countries, most of which are bilateral ones.[98] These treaties extend back centuries and they deal with various aspects of river water use. The presence of these treaties has been instrumental in reducing the conflicts among the riparians, but due to increasing demand for water resources, many of them are beginning to flounder.

These treaties on the individual river basins are in most cases not completely cooperative in nature as they do not include all the affected riparians. It has been the case while agreeing to share the River Ganges, Nile. The other problem with these individual agreements among the riparians is that it cannot be enforced by a third party. Due to its self-enforcement nature, the successful implementation of the agreements depends upon the behaviour of the signatories.[99] Some of these agreements have led to the establishment of the river basin commissions, but most of these commissions concentrate on exchange of

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95 "The Dublin Statement on Water and Sustainable Development", Annex 1 in Gordon J. Young & others, *Global Water Resource Issues* (Cambridge: Cambridge University Press, 1994), pp. 161-166.

96 World Bank, *Operational Directive 7.50: Projects on International Waterways*, World Bank, Washington, 1990.

97 Ashok Swain, "Sharing International Rivers: The Need for a Regional Approach", in Nils Petter Gleditsch, ed., *Conflict and the Environment* (Dordrecht: Kluwer Academic Publishers, 1997).

98 Food and Agricultural Organisation, *Systematic Index of International Water Resource Treaties, Declaration, Acts and Cases by Basin* (Rome: FAO, Legislative Study No. 15, 1978); Vol. II (Rome: FAO, Legislative Study No. 34, 1984).

99 Scott Barrett, No. 50, p. 6.

information rather than allocation of the flow[100] In some cases, the countries are not prepared to share the data with the other member of the commission.

7. CONCLUSIONS

From the analysis of global scarcity and international conflict we conclude the following.

First, there is a quantitative problem of water scarcity, in particular in developing countries. The ratio of population to water resources is increasing, as captured by the water barrier concept. It is interesting to note, however, that in richer countries, the water availability in the river systems has increased, not decreased. Probably this can be attributed to improved ways of water management. Thus, there might be a potential of *remedying some of the water scarcity problem through improved skills* in water management.

Second, there is a larger conflict potential in water quantity issues than in water quality issues. In the latter cases, it appears that countries have been capable of finding formulas for handling the questions. Thus, issues of pollution and regulation appear to have a record of finding solutions. However, in cases where the quantity of water is the one of central concern, the conflicts sharpens. It easily becomes a zero-sum game: "it is my water or your water." This appears to be the situation in some major rivers in developing countries, where populations are also rising rapidly. There are various doctrines for dividing water between countries. The strength of countries, in military terms or in hydrological terms (up-stream location versus down-stream location) appears decisive. If, however, the basic principle of *an internationally agreed and guaranteed equal human right to water of human quality* were to be the point of judgement, the legal situation might change significantly. Then, water would be the right of the individual rather than the state, and an equal portioning on this basis would be the only legitimate one.

Third, among the existing norms or doctrines for sharing water, we find that they have significant inconsistency. Such inconsistencies are difficult to avoid, but may, in this case, make countries subscribe to a particular rule, because it can be interpreted in a particular way. This suggests the importance of *instituting an International Water Court*, for make a judgement on international water disputes. This instrument, furthermore, would be most relevant if a case could be brought before the Court, if at least one complaint is raised, presumably by a national or local government. This idea is worth closer scrutiny.

Fourth, the successful cases of handling river water disputes appeared to be those cases where an *"international regime" covered an entire river basin*, not just two major uses of the river. The reason might be that this gives a chance of more relaxed discussions, more coalition building, and, in essence, more third party activity, if the conflict seemed to posit two countries particularly hard against each other.

Fifth, the situations are normally not plain: *a country may at the same time have an up-stream location on one river and a down-stream position on another.* As countries want to be consistent in order not to incite more conflict than necessary, this might have a softening impact on governments. Thus, it would be interesting to find out which countries do have such a double position and more closely analyse such cases. A hunch is that the pointing to such a double position

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[100] Malin Falkenmark, "Global Water Issues Confronting Humanity", *Journal of Peace Research*, vol. 27, no. 2, 1990, p.184.

might have an impact of countries seemingly acting aggressively on the water issue in one relation. This, furthermore, might contribute in developing international rules. Such rules would simplify the handling of water disputes for all parties concerned, not the least countries in such a double position. By building on this interest, in addition to other considerations, international support for general and more precise rules could be further developed.

Sixth, we observe that the international river water sharing issue has not been pursued as seriously as the situation demands by the international organisations. This can be attributed to the inherent sensitivity of these issues. Probably a more successful strategy would be to *deal with different water issues differently.* For instance, the issue of quantity should be dealt separately from the issue of quality or regulation control.

Finally, *the end of the Cold War* might make it easier to bring up the water issue internationally and it might also now be possible to make principles of equitable sharing more acceptable. We have noted that also during the Cold War, the different interests between countries located up-stream and down-stream was marked, and this distinction does not easily fade. Also in the future, the political aspects should not be neglected. Thus, we conclude that the end of the Cold War has freed the issue from one of its shackles, it remains for decision-makers to grasp this opportunity. Before the water issue has been boxed in by emerging concerns of a particularistic type.

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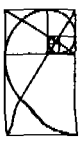

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