

## ABSTRACT

*Land, water and air are the three basic components of the Biosphere and most environmental issues stem from the use or mis-use of these three. Water is particularly important because it is needed for life to exist. Many uses of water include agricultural, industrial, household, recreational and environmental. It is important to remember that only 2.5% of water on Earth is fresh water, and over two-thirds of this is frozen in glaciers and polar ice-caps.*

*Water-demand already exceeds the supply in many parts of the world, and many more areas are expected to experience this imbalance in the near future. Climate-change will have significant impact on water-resources around the world, because of the close connection between climate and the hydrologic cycle. Due to the expanding human-population, competition for water is growing and many of the world's major aquifers are becoming depleted.*

*Demand for clean water, caused by surging population-growth, environment abuse and poor water-management is today becoming a source of friction amongst nations in many parts of the world. Add to this the changing pattern of glacier melting, due to global warming, and we have a sure recipe for disaster. More and more conflicts and rising tensions in the world over control of the existing fresh-water reserves are brewing up among nations than have been witnessed in the past. More than 50 countries in five continents might soon be caught up in serious water-disputes, unless they move quickly to establish agreements on how to share reservoirs, rivers, and underground water aquifers. The management of water-resources is therefore a strategic issue in several parts of the world, in which borders and the sharing of resources have to be dealt with together. In this article we discuss some major flash-points that have the potential of erupting into full-scale wars among nations.*

## 1. INTRODUCTION

It is not easy to pin-point which of the triad of land, water and air that constitute the Biosphere is the most important. But one thing is certain that man has always been dependent on water, not only for his life, but also for his food. Habitation grew up around springs and rivers, and dwindled as these became insufficient.

There are four main points that come to mind when

one talks about global water-issues. These are:

*Water Sanitation:* In poor and developing countries, the main issue is the provision of clean drinking water to the masses. In far-flung and remote areas, villages and slums that have come to be associated with big cities, the inhabitants are deprived of the basic city-services like sewage-treatment and delivery of water through pipes. It is estimated that about 2.6 billion people lack these basic facilities, leading to about 5 million deaths per year.

*Access to Clean Drinking Water:* Even if there is enough drinking water in a certain area, the access to it may be difficult because of the nature of the terrain, lack of infrastructure and poverty.

*Management of Resources:* Managing the already available scarce water-resources and distributing it equitably among various groups, and vying for access to it may be a difficult task that has to be tackled politically at the national-level.

*Scarcity of Water:* The changing climate scenario is already leading to erratic weather patterns, resulting in drying up of traditional water sources. This has not only affected agriculture, it has put extra strain on the inhabitants for acquiring clean drinking water for their survival.

Climate-change, together with surging population-growth, compounded with poor water- management, is in fact becoming a source of friction amongst nations in many parts of the world. "Just as war over fire sparked conflict among early prehistoric tribes, wars over water may result from current tensions over resources in the next few years", says a report by the consultancy Pricewaterhouse Coopers (2009). A figure released by the United Nations (Development Report, 2003 and 2006) suggests that there are around 300 potential conflicts over water that are brewing up around the world and can even lead to major wars between Nations. As the demand for water increases, Nations are fighting over transboundary fresh-water reserves. More than 50 countries in five continents might soon be caught up in water disputes unless they move quickly to establish agreements on how to share reservoirs, rivers, and underground water aquifers.

- In Southern Asia, the biggest problem is the India-Pakistan dispute over the Indus waters, while in Central Asia "there are high risks of conflict"

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between Uzbekistan, Kazakhstan, Kyrgyzstan and Tajikistan over the Amu Daria and Syr Daria rivers and the already depleted Aral Sea (Ludqvist J. and Gleick P.H., 2000).

- In Africa, the Chobe, a tributary of the Zambesi, has become a cause of tension between Botswana, Mozambique, Zambia and Zimbabwe, while there have been border incidents between Mauritania and Senegal over control of the Senegal River.
- The Near and Middle East are the zones where there is the greatest threat. Two-thirds of the water consumed in Israel comes from the occupied territories, while nearly half of the Israeli water-installations are located in areas that were not part of its pre-1967 configuration. Friction between Lebanon and Israel rose sharply after the Jewish state accused its Northern neighbour of seeking to divert water from a river that feeds the Sea of Galilee, Israel's prime source of fresh water.
- Other big flare-points in the region are Turkey's plan to build dams to store the waters of the Tigris and Euphrates rivers, a scheme that is strongly opposed by Syria and Iraq; the Iraq-Iran row over the Shatt al-Arab waterway; and disputes over the use of water from the Nile, embroiling Egypt, Sudan and Ethiopia.

The forces behind such disputes are clear, according to the World Health Organisation (WHO), which pin-points fast-growing population in poorer countries and water-resources that are often squandered or polluted. "Around one-sixth of the 6.1 billion people in the world lack access to improved sources of water, while 40 per cent are without access to improved sanitation services," it says. Each year, 3.4 million people, mostly children, die from water-related diseases.

## 2. INADEQUACY OF INTERNATIONAL LAW

There is no well-defined international law on the sharing of water-courses, rivers or cross-border aquifers. Water cannot be owned, but the methods by which an individual, a group, a legal entity or a nation can store, transfer and regulate the flow of water, makes this person "in control". Governments, organisations and individuals reach bilateral agreements, using a mixture of customary use, local and traditional laws, and the established right of use over a period of time not specified. Such a mixture is

often contradictory and in itself a cause of conflict. Ancient history contains many examples of civilizations that gave special attention to the storage and provision of clean water for its citizens, e.g. Rome and Baghdad.

Not many agreements have been reached between Nations on how the water should be shared. The agreements that have been reached are most often seen as unjust, as the upstream countries with the hands on the tap can dictate their terms and believe that they should control the flow of the rivers, taking what they like, if they can get away with it. This is true of countries like Turkey and India. Downstream countries, if they are more advanced and militarily stronger, have always challenged this assumption, like Egypt and Israel. It is a recipe for confrontation. The non-clarity of international law is a matter of great concern. In case neighbouring countries seek intervention of international bodies, like the UN international law commission or the International Court of Justice, there are very few precedents for these bodies to go by and not many countries have gone to these bodies as yet. The position may change in the future, as quarrels amongst nations come to a boiling point.

Only the World Bank (Barrett S., 1994) has set a precedent of loaning money, conditional upon the agreement of parties involved on coming to an understanding, on sharing the benefits of the dam between riparian nations. Independent studies are commissioned to alter designs and modify plans, in order to minimise the harm that the project might inflict on neighbouring people. This only works when nations approach the World Bank for a loan to finance a water scheme - like in North of Syria and South of Turkey in the 1950's and Pakistan and India in the 1960's. But, as history has shown, nations that did not go to the World Bank to finance their water-schemes had no ombudsman or a neutral observer to arbitrate between them and their neighbours. There was - and there still is - no provision in international law to stop them imposing their will on weaker or smaller neighbours, uprooting ethnic minorities by force or by ending their way of life and even having far-reaching and lasting devastating effect on the environment, all because they carried out their ambitious water-scheme, away from world-supervision without any proper studies, while mankind helplessly looked on.

We now take a brief look at some of the major potential flash-points regarding the use of water-resources.

### 3. THE SINO-INDIAN WATER DIVIDE

The rapid industrial development of two of the most rapidly growing economies of the world, China and India, has given rise to a middle class in both the countries. The demands of this middle class, together with the spread of irrigated farming and water-intensive industries, has led to a severe struggle for more water (Juha I.U. et al., 2002, Meredith G. et al., 2002, Gleick P.H., 1993). Even though India has more arable land than China – 160.5 million hectares, compared to 137.1 million hectares – Tibet is the source of most major Indian rivers. The Tibetan plateau's vast glaciers, huge underground springs and high altitude make Tibet the world's largest fresh-water repository after the polar ice-caps. Indeed, all of Asia's major rivers, except the Ganges, originate in the Tibetan plateau. Even the Ganges' two main tributaries flow in from Tibet.

China is pursuing major inter-basin and inter-river water-transfer projects on the Tibetan plateau, which threatens to diminish international-river flows into India and other co-riparian states (Li Ling, 2005). China has been damming most international rivers flowing out of Tibet, whose fragile ecosystem is already threatened by global warming. The only rivers on which no hydro-engineering works have been undertaken so far are the Indus, whose basin falls mostly in India and Pakistan, and the Salween, which flows into Burma and Thailand. Local authorities in Yunnan province, however, are considering damming the Salween in the quake-prone upstream region.

India's government has been pressing China for transparency, greater hydrological data-sharing, and a commitment not to redirect the natural flow of any river or diminish cross-border water flows. But even a joint expert-level mechanism – set up in 2007 – merely for "interaction and cooperation" on hydrological data – has proven of little value (Chellaney B., 2009; Stobdan P., 2009).

The most ambitious-idea China is now contemplating is the northward re-routing of the Brahmaputra river, known as Yarlung Tsangpo to Tibetans, but which China has renamed Yaluzangbu. It is the world's highest river, and also one of the fastest-flowing. Diversion of the Brahmaputra's water to the parched Yellow river is an idea that China does not discuss in public, because the project implies environmental devastation of India's north-eastern plains and eastern Bangladesh, and would thus be akin to a declaration of a "water war" on India and Bangladesh.

Nevertheless, an officially blessed book published in 2005 (Li Ling) openly championed the northward re-routing of the Brahmaputra. The issue now is not whether China will re-route the Brahmaputra, but when. Once authorities complete their feasibility studies and the diversion scheme begins, the project will be presented as a *fait accompli*. China already has identified the bend where the Brahmaputra forms the world's longest and deepest canyon – just before entering India – as the diversion point.

China's hydro-engineering projects and plans are a reminder that Tibet is at the heart of the India-China divide. Tibet ceased to be a political buffer when China annexed it nearly six decades ago. But Tibet can still become a political bridge between China and India. *For that to happen, water has to become a source of cooperation, not conflict.*

### 4. TURKEY AND ITS NEIGHBOURS

Turkey, Syria and Iraq are in confrontation regarding the waters of Tigris and Euphrates. This historic and geostrategic conflict sheds new light on the interest which the Occident has today in this cradle of the ancient Ottoman Empire. Turkey controls the supply of water to its two neighbours.

In 1990, Turkey stopped the flow of the Euphrates, ostensibly to fill up the large lake in front of the newly constructed Ataturk dam (Gleick P.H., 1993). In fact, this decision had hidden political connotations. The aim was to show Syria what could happen if the then President Hafez-al-Asad continued his support for Kurdish rebels in South-East Anatolia. The only problem was that this also brought severe water-shortage in Iraq. Two sworn enemies forgot their old antagonism to form a common front against Turkey. Faced with this unforeseen development, Turkey allowed the river to flow again after three weeks of stoppage.

Trouble between Turkey and Syria over water can not be ruled out. So far, Turkey has completed only about half of the projected 22 dams and reservoirs on the Euphrates to reclaim 1.7 Mhectare of land. When the project is completed, the quantity and quality of water-flow to Syria will be reduced by an estimated 40 per cent of its 1980 flow (which was 7,000 bn gallons of water). Turkey says the water will eventually return back to the river after watering its fields, but the water will be much saltier by then, the Syrians say. After the projects on the Euphrates are complete, the Turks intend to harness the Tigris. That will have a direct

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effect on Iraq. This could again force Syria and Iraq into an alliance against Turkey - though they almost went to war in 1975, when Syria built the Thawrah dam. President Suleyman Demirel summed up the intransigent attitude of the Turks: 'Neither Syria nor Iraq can lay claim to Turkey's rivers, any more than Ankara could claim their oil . . . We have a right to do anything we like. The water resources are Turkey's, the oil resources are theirs. We don't say we share the oil resources, and they cannot say they share our water resources.'

### 5. THE NILE BASIN

Egypt is as ready as any other country to use force to protect its vital water resources. It is worried about dams that might be built in the Ethiopian highlands, which will affect the flow of the Nile, and about grandiose plans for a canal that could tap the sources of that great river in central Africa (Gleick P.H., 1990 and 1991).

The Blue Nile with its source in Ethiopia contributes about 85 per cent of the annual flow that reaches Egypt. In November 1989, the Ethiopian ambassador was summoned to the Foreign Office in Cairo to provide an explanation on the presence of Israeli hydrologists and surveyors studying the areas on the Blue Nile, with the possibility of building a number of dams to store 51 billion cubic meter. He was left in no doubt about Egypt's stern response. On the same day Egyptian members of Parliament lined up one speaker after the other saying they would back the government in taking military action in Ethiopia.

Egypt is equally worried about Sudan. Cairo blames extremists across the border for the wave of terrorist attacks that have halved its tourist trade. Egypt may seek an excuse to intervene in Sudan: 'any 'unauthorised' interference with the flow of the Nile would be an ideal pretext'.

A more immediate danger to the Nile basin and the environmental welfare of the valley is posed, in the eyes of the Egyptians, by Colonel Muammar Gaddafi's 'Great Man-Made River' in neighbouring Libya. A huge pipeline carries water from 120 wells, tapping the Kufrah aquifer in the sparsely populated south of the country, to the arid, densely inhabited coast in the North.

In addition to the huge cost of the project (the final cost could exceed \$32 billion, the cost of a dozen desalination plants - while the water, which could be

mined just once, is unlikely to last more than 15 years). According to some hydrologists, the rapid depletion of this aquifer could lead to seepage from the Nile. Meanwhile, some geologists fear a change in the sub layers or rocks under the desert as a result of speedy pumping of the water. There are reasons to suspect that in the event of geologists presenting the proof that mining water by the Libyans is having a direct effect on the Nile bed, the Egyptian army may, directly or indirectly, intervene to put an end to the project.

### 6. THE MIDDLE EAST

In the Middle East, water plays a strategic role that is often overlooked. Occupation of Trans-Jordan by Israel can only be understood by recognizing the fact that this provides Israel an aquifer that allows the survival of its colonies and supplies a quarter of the water of the country. The same is true of the Golan plateau, a rich source of water for the region. The survival of the state of Israel depends on the control of these waters (Bullock J. et al., 1993; Hussain A. A. 2002; Munther J. H., 2002; Darwish A., 1994).

The short, muddy Jordan flows through the most hotly disputed territory of all, and is bordered by countries that have history of using force to gain their ends. The annual flow in the whole area controlled by Israel, since 1967, is just under 500 cubic metre per person. The 1991 figures indicate that Israelis use 375 cubic meter apiece and Palestinians 180 cubic meter apiece (assuming 5 million Israeli citizens and settlers and 2 million Palestinians and Golan heights residents). Looking at birth rates, the population could double some time between 2010 & 2020. The flow of the river Jordan cannot be improved either. Even less than 15 months after some unusual heavy rain in 1991 that caused flood, water shortages were endemic in Amman despite ongoing water-rationing.

A study, in 1990, by Dan Zaslavsky, Israel's national water commissioner, found that 10 consecutive years of above-average rainfall are needed to replenish the heavily overtaxed underground resources. In the five years since, it only happened in 1991, and partly early 1993.

In the Jordan basin, it is a zero-sum game. If Israel obtains more, Jordan will receive less, and vice versa. One of the bitter sources of conflict, which Arabs never fail to mention, is that while the Jordanian average-use is 80 litres per day, Israelis use 300 litres of the same river and the same aquifers! If you go to the West Bank, an area of 5,890 square kilometres occupied by

Israel, the differences are great and both sides' belief, in their right to water, makes their ideological differences over land, and religious interpretation, etc., seem moderate.

The presence of some 100 Israeli settlements (populated by over 100,000 Jews) on land occupied in the West Bank in 1967, is a thorny issue. Water is very much at the heart of the conflict. The 100,000 settlers are given (100 million cubic meter) almost as much water as the one million Palestinians who live in the region (given 137 million cubic meter). This is a source of bitterness and a real obstacle for peace. All Israeli settlements have water, lawns and swimming pools, while dozens of Palestinian villages are with inadequate water-supplies and suffer from water-shortage.

Figures published by Palestine Hydrology Group (PHG) indicate that Israelis take 80 per cent of the annual flow of 615 million cubic metre of mountain aquifers that should be Palestinian water. This means that one quarter of water used by Israelis annually is seen by Arabs as 'stolen water', which they want back. The PHG also accuses the Israeli occupation authority of forbidding Palestinian civilians from drilling new wells or deepening existing wells since 1967, while Israeli wells are six times deeper causing Palestinian wells to be totally dry for more than 5 months a year. As a result, the PHG argue that irrigated Palestinian farmland declined from 27 per cent of all agricultural land in 1967 to a meagre 4 per cent in 1990.

The Israeli counter-argument is based on their military superiority and a status quo that won't help peace, as well as the lack of provision on water use in international law. Before the six day war, Israel controlled less than 10 kilometres or 6.25 miles only of the Yarmuk River, now it has a de-facto control that stops Syria and Jordan from diverting the headwaters if they chose to. A report prepared by the Israeli Military warned the then Prime Minister, Yitzhak Rabin, against pulling out of the Golan Heights. Two reasons were given; first water security and second the army intelligence-gathering operation.

Even if some generous compensations are to be paid to the settlers to hand back settlements to the Palestinians, no electable Israeli government is likely to let go of control of water-supplies, unless alternative source is found by some miracle. In 1989 - just less than two years before the Arabs and Israelis met in Madrid - an official publication issued by Israel's Ministry of Agriculture, which was then headed by the

hardliner Rafael Eitan, concluded that full control of the mountain aquifers are our vital necessity : "It is hard to conceive of any political solution consistent with Israel's survival that does not involve complete and continued Israeli control of the water-system." General Eitan later argued that, overriding any religious and even security grounds for keeping the West Bank is Israel's need to stay because it must have the water.

## **7. THE INDUS BASIN**

The waters of the Indus basin begin in the Himalayan mountains of Indian-held Kashmir. They flow from the hills through the arid states of Punjab and Sindh, converging in Pakistan and emptying into the Arabian Sea located South of Karachi. Where once there was only a narrow strip of irrigated land along these rivers, developments over the last century have created a large network of canals and storage facilities that provide water for more than 26 million acres - the largest irrigated area of any one river-system in the world.

The partition of the Indian sub-continent created a conflict over the plentiful waters of the Indus basin (Gulhati N., 1973; Michel A., 1967; Undala Z.A., 2002). The newly formed states were at odds over how to share and manage what was essentially a cohesive and unitary network of irrigation. Furthermore, the geography of partition was such that the source rivers of the Indus basin were in India. Pakistan felt its livelihood threatened by the prospect of Indian control over the tributaries that fed water into the Pakistani portion of the basin. While India certainly had its own ambitions for the profitable development of the basin, Pakistan felt acutely threatened by a conflict over the main source of water for its cultivable land.

On April 1, 1948, India had stemmed the flow of tributaries to Pakistan and discontinued water to the Dipalpur Canal and main branches of Upper Bari Doab Canal. Pakistan wanted an equitable allocation of the flow of Indus River and its tributaries between India and Pakistan. Negotiations had started from 1951, and the treaty was signed in 1960 that gave Pakistan the right to receive unrestricted flow of the western rivers, and it was obligatory on the part of India to allow the flow of water unimpeded, with minor exceptions. It was provided in the treaty that in case of a dispute, the World Bank would appoint a 'neutral expert', whose decision would be final.

The matters did not end there. Unilaterally, India embarked upon projects on the rivers that had been

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allocated to Pakistan. These included the Kishanganga, Baglihar and Wullar Projects.

The proposed Kishanganga Hydroelectric Project is located in Indian-occupied Kashmir on River Neelum. Under the project, the water is to be diverted through a 21-kilometre tunnel to produce 330 MW of power. The water, after production of power, will join the Wullar Lake. Pakistan raised objections to the diversion of flow and the design of the project.

The Baglihar Hydro-electric Plant was constructed by India on River Chenab. India provided information about the plant in May 1992, under the relevant provision of the Indus Waters Treaty. Pakistan raised objections to the design of the plant. Since the Indus Commission could not resolve the differences, Pakistan referred the dispute to the World Bank, which appointed a neutral expert in May 2005. The expert called the two parties to Paris in June 2005 and formulated modalities in the form of a protocol. The expert gave his final determination on February 12, 2007. The decision of the neutral expert upheld Pakistan's contention that the design by India is not in conformity with the Treaty.

In February 1985, Pakistan learnt that India was planning the Tulbul Navigation Project at Wullar Lake on River Jhelum. In March 1985, Pakistan conveyed its concerns to India and sought details. The Indian position is that it is a navigational structure, rather than a storage facility. It also believes that Pakistan's downstream uses are not prejudiced by the project. Pakistan's point of view is that the structure is essentially a barrage, which will convert the natural Wullar Lake into a man-made storage.

Recently, the officials of General Headquarters (GHQ), National Engineering Services of Pakistan (NESPAK), Water and Power Development Authority (WAPDA), Irrigation Department of Punjab and Pakistan Commission of Indus Water met to discuss the adverse impacts on Pakistan's water and defence interests of the ongoing construction of the three dams in Ladakh region on River Indus (Jamil M., 2009). India is constructing large dams on River Indus, which include Nimoo Bazgo, with a height of 57-metre; Dumkhar of 42 metres height; and Chutak Dam of 59 metres height, to basically generate hydropower. The huge quantum of water to be stored in the three dams could play havoc in the Northern Areas of Pakistan, if the reservoirs either collapse, for any reason, or New Delhi, intentionally or unintentionally, releases the huge quantity of water. It was decided that the matter

should be taken up at government-level with India, and if the dispute remains unresolved by both the governments, then a neutral expert should be moved. Pakistan had suffered a loss exceeding five billion rupees in paddy crop production only due to water shortage after India stopped Chenab water to fill its Baglihar Dam during the month of September 2008.

India is violating Indus Water Treaty, and the objective seems to be India's attempt to dry up Pakistan. India's think-tanks have been working on river-diversion plans, with a view to creating acute water-shortage in Pakistan, which could lead to acute shortage of wheat and other crops and also result in inter-provincial conflicts over distribution of water. But those who think that India could make Pakistan a desert, through river-diversion plans, do not understand that although there is no war on Kashmir, there could be a "water-war" between two nuclear states, which could be disastrous for both the countries.

## 8. OTHER TROUBLE SPOTS

Other instances of conflicts based on sharing of water resources are quoted below:

- There exists strong tensions around Amon-Daria and Syr-Daria between Uzbekistan, Tajikistan, Kyrgystan and Kazakhstan.
- Border incidents between Mauritania and Senegal have multiplied for the control of the river Senegal.
- To a lesser extent, there is a problem between Mexico and United States, regarding the waters of the Colorado, a ghost of a river because of over exploitation and pollution (Gleick P.H., 1988 and 1990).

## 9. CONCLUSIONS

Water has always played an important role in the growth and development of civilization and thus the use of water has a geopolitical dimension. Water moves from upstream to downstream users, and withdrawals and type of use in one place may affect the quantity or quality of supplies downstream. There are also historical, cultural, economic and social aspects of water-use. To some, water is a gift from God, and should not be priced, while others, such as the World Bank, have pushed for full marginal cost pricing of water.

- Water scarcity is a function of supply and demand. The demand is increasing at an alarming rate in some regions, through population-growth and increasing per-capita use. In many water-scarce countries, there is no obvious and inexpensive way to increase the water supply, and tensions among different water-users are likely to result. In other countries, improvements in water- efficiency, moving away from water-intensive crops, or importing water from nearby countries may offer reasonable solutions.
- The lack of a suitable legal framework for resolving international water-resource disputes presents another problem. *Sovereignty over international rivers generally invokes one of four doctrines: (i) absolute territorial sovereignty, which implies that riparian states may use water resources in any way they please, even to the detriment of other nations; (ii) absolute territorial integrity, which suggests that riparian use of a river should not negatively affect downstream riparians; (iii) limited territorial sovereignty, which invokes a combination of the two within a framework of equitable use by all parties; and (iv) community of co-riparian states, which promotes integrated management of river basins.*
- There is little question that water scarcity will be a problem in some regions of the world in the future. Global warming is likely to alter rainfall patterns in many regions, and long-term planning for water-supply must take this into consideration. There is also little question that water will cost more, as it becomes increasingly scarce. This will necessitate improvements in water-use efficiency and possibly the restructuring of economies away from water-intensive sectors.
- Is there likely to be violent conflict over water in the future? Past experience suggests that this is unlikely. However, many claim that the probability of conflict is increasing. The basis for most projections for future conflicts is that, with the growth of demand, the decline in freshwater availability (through groundwater mining and pollution), and the adverse health-effects from poor water-quality and scarcity will result in violence and water wars. Yet fighting over water makes very little sense, economically or politically. Most certainly, water-scarcity will be at the forefront of the international agenda for decades to come. In some cases, water may even be a contributing factor in international conflict. A

member of the Israeli negotiating team to the Middle East Peace Process, Hydrology Professor, Uri Shamir, once noted: 'If there is a political will for peace, water will not be a hindrance. If you want reasons to fight, water will give you ample opportunities'.

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