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CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES  
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EXERCISE NEW HORIZONS

**Water, Water, Everywhere?<sup>1</sup>**

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## **Abstract**

One of the elements of national power is availability of strategic resources and traditionally, oil reserves, precious minerals or metals. Certain scholars now assert that, in a geopolitical sense, water is likely to become the "oil of the next century". On a per capita basis, Canada has the largest supply of fresh water in the world. Given global population pressures, increased industrialization and potential climate change, Canada's immense supply of fresh water will become increasingly valuable. Already demands for fresh water in the Southern USA are exceeding supply and the situation is expected to worsen. International demand for fresh water in Third World river basins such as the Nile, Indus and Tigris-Euphrates represent potential causes of interstate conflict.

Surprisingly, the DND Strategic Overview 2000, published by the Directorate of Strategic Analysis, NDHQ, provides not a single paragraph on the subject. This essay examines water scarcity, what can be done about it, and whether those efforts will be enough. By demonstrating that fresh water is a strategic resource for which demand has exceeded supply, this essay will argue that its scarcity will be a cause of future conflict.

"It is so obvious, everyone needs water to live."<sup>2</sup>

Our multi-polar world, divided along economic lines into the "haves" and the "have-nots", will continue to witness conflicts well into the future. The causes of these conflicts will be many, such as rising religious fundamentalism, political extremism, economic blackmail, and even population migration due to environmental change. In developing countries, conflicts over non-renewable resources are likely and, as populations grow, conflicts over renewable resources may occur as well. As recent events in Africa and the Indian sub-continent have shown, the developed world is not immune to the growing pressures and conflicts in the Third World.

The importance of timely identification of potential conflicts and their likely causes cannot be understated. Initially, they indicate potential military deployment locations, and in time could lead to future force structure requirements, military strategy and even government policy. Traditionally, one of the elements of national power is the availability of strategic resources such as oil reserves, precious minerals and metals. Given global population pressures, increased industrialization and for worse or better global warming, a nation's supply of fresh water will become increasingly valuable. A shortage of fresh water, caused by an inability to share common resources, may have grave consequences. There are scholars who assert that in a geopolitical sense, water is

## **Water as a Strategic Resource.**

Water is essential for the existence of all forms of life and for a broad range of economic and social activities. Fresh water is used primarily in three ways: domestically for drinking and sanitation; industrially; and agriculturally, primarily for irrigation and livestock. While the pattern of use varies significantly from one country to the next, on average some 10% is consumed domestically, 25 % industrially and 65 % in agriculture.<sup>3</sup> In parts of the developing world, irrigation can absorb a 90% share of fresh water use.

Water is critical to the world economy and there is no substitute available for industry or agriculture. It is the material used most often as a catalyst in chemical processes and it is fundamental to photosynthesis. While fresh water is relatively inexpensive, the World Bank now encourages a higher overall price to promote conservation<sup>4</sup>. In some areas of the world, the overall demand is expected to increase regardless of price, forcing security of fresh water resources to gain increased national importance.

In general, the security of the industrialised democratic societies depends upon both military strength and upon having strong economies that provide maximum employment, production and purchasing power. These broad-based economies have the potential to rapidly convert into defence-oriented production and consequently, an adequate supply of virtually every known material, including fresh water, can be viewed as a strategic necessity.<sup>5</sup> Access to and availability of fresh water can significantly

impact upon a country's security as the flow of water transcends political borders, which typically are not coincident with watershed boundaries.

There are considerable political and economic aspects of fresh water supply such as the protection of national resources, free trade of commodities, the demand for more efficient agricultural practices and the environmental impact associated with the removal of bulk water from watersheds. The political and economic shock of a sudden interruption in the fresh water supply, either natural or man-made, would be significant<sup>6</sup> as identifying and exploiting alternative sources of fresh water is a lengthy undertaking. While water is a renewable resource, the sources are finite and, in many cases, involve water basins shared between two or more countries. Hydro-politics, therefore, is the systematic study of co-operation and conflict between states over water resources that cross international boundaries.<sup>7</sup>

During the Cold War, criteria were developed to assist in identifying a nation's material vulnerability. Those criteria, when applied to fresh water, lead to an obvious conclusion: fresh water is a strategic resource. In total, thirteen of sixteen criteria for material vulnerability apply to fresh water, criteria that remain relevant today.<sup>8</sup> A nation's shortage or potential shortage of fresh water is thus a strategic issue. To fully understand this strategic issue, it is necessary to examine various water facts.

## **Water Facts.**

Water can be found in many forms all over the planet. The hydrologic cycle is powered by gravity, which makes water fall, and the heat from the sun, which converts water to vapour and recharges the atmosphere with moisture. The cycle is balanced between precipitation, evaporation and runoff. Wherever it is and in whatever form it exists, water is part of one continuous and perpetual system of water transference from earth to atmosphere and back again. As water covers three-quarters of the earth's surface, the supply would seem ample. However, only 2.5 % of that is fresh water<sup>9</sup> and over 70% of all fresh water is frozen in glaciers, polar ice and perma-frost. Twenty nine percent lies beneath the ground, and what remains, less than one percent, is distributed unevenly in the lakes and rivers around the globe.<sup>10</sup>

The uneven distribution of surface water is also found with ground water. Ground water storage is created by the spaces between the rocks, stones and grains of sand in the earth, as well as in pores in the rocks themselves. Aquifers, those formations above impervious beds, yield their water readily. Although in these formations the movement of ground water is very slow, typically only a few inches or feet a day, the sheer volume makes ground water an important resource. Such high volume, slow speed flows of water have allowed significant industrial development and population growth in relatively dry areas, including the Southwestern USA.

Brazil, Russia and Canada have the highest average fresh water availability at 6,200, 4,000 and 3,300 cubic kilometres annually. Indonesia, China, the USA and India follow them. In contrast, Mexico has on average approximately 400 cubic kilometres per year of fresh water available. On a per capita basis, Canada has over 90,000 cubic metres per person: the highest in the world. This is evident in Canada by having over half of the world's area of fresh water and anywhere between 9 and 20 % of the world's total supply of fresh water, the latter figure including that locked in glaciers, ice and permafrost. The major river basins shared between Canada and the USA, the Mississippi, the Nelson-Saskatchewan and the St Lawrence Basin, which includes the Great Lakes, are ranked as the 3<sup>rd</sup>, 15<sup>th</sup> and 17<sup>th</sup> largest river basins in the world.<sup>11</sup>

There are 261 river basins shared by one or more sovereign states.<sup>12</sup> The five shared by the most states are the Danube (17), Congo (11), Niger (11), Nile (10) and the Rhine (9). In terms of continents, Africa is only fourth in terms of average water availability. It also contains the largest number of international river basins, sixty, and, more significantly, 30 % of the World's undernourished people.

The distribution of surface and ground water is immensely uneven around the world. A small handful of countries enjoy a significant excess supply of freshwater, however, pockets of water scarcity can occur in these countries. In general, the majority of Third World countries are not blessed with sufficient supplies of fresh water given their population size and thus scarcity of fresh water, in those countries, is a strategic issue.

## **Water Shortages.**

In 1999, Dr Ismail Serageldin, Chairman of the World Commission on Water for the 21<sup>st</sup> Century, warned that some 20 % more water will be needed than is currently available to feed the additional 3 billion or so people who will be alive in 2025. The looming shortage of fresh water is expected to be the most serious obstacle to food security, poverty reduction and protection of the environment. In a press announcement, Serageldin advised that even with improvements to irrigated agriculture, humanity would still need at least 17% more fresh water than is currently available to meet all its food needs. This "world water gap" predominately affects poor countries and results not only in water shortages but also higher food prices.<sup>13</sup> All agencies of the United Nations, the World Bank, and a number of countries, including Canada, supported the results of this Commission.

Some eighty countries, supporting 40 % of the world's population, currently suffer from serious fresh water shortages for personal and household needs<sup>14</sup> and those worst affected by water scarcity are often the poorest strata of society. The World Commission on Water projects that, by 2050, two thirds of the world population are expected to live in areas that receive less than one-quarter of the world's rainfall. World wide, it has been estimated that the total amount of water withdrawn from lakes, rivers and aquifers has increased nine-fold since the year 1900. Urban populations in the Third World are expected to triple in the next thirty years so that cities will be competing for water, to satisfy their own needs, against the demands of a growing agricultural sector expected to

feed the larger population. The Commission also warned that conflicts caused by the competing claims for water may erupt from what are becoming increasingly rancorous disputes over water.

Closer to home, the fresh water shortfall in the Southwestern US and northern Mexico has been growing for years. A combination of population increases, increased agricultural demand and low average rainfall have caused this water shortage. This has created a demand or pressure on countries including Canada, which have excess supplies of fresh water, to cooperate and seek solutions with those in need.

### **Water Shortage Solutions.**

Typically fresh water shortfalls can be overcome in one of three ways. First, by building structures such as dams, reservoirs, pipelines or canals, to block or redirect fresh water from areas that have an excess to those areas in need. The second approach involves more expensive and exotic techniques such as desalination of seawater, fog collection, transportation by water tanker, and even towing of icebergs.<sup>15</sup> The last approach, and arguably the most difficult, is conservation and cooperation within the water basin. All three approaches to reduce fresh water shortfalls have been tried in California over the past four decades. Most of California's water comes from the northern mountains in the winter and spring, but is needed and used in the arid south in the summer and fall to quench the thirst of the population and agriculture. Huge construction programs have turned the desert into a lush development, however, with an

increase in the availability of water and power, so to increases the population and farmland.

Grandiose water schemes, which focus on Canadian water resources, have been proposed as a solution for the North American water basins. One was to dam James Bay, turn it into a fresh water lake and then divert it south into the Great Lakes.<sup>16</sup> In the 1950's an engineering firm in Los Angeles concocted another plan to create a huge 500-mile reservoir down the Rocky Mountain Trench. Every single river between Anchorage and Vancouver would be dammed for power or water or both. The North American Water and Power Alliance (NAPAWA) scheme attracted much interest in the 1960s; however, interest waned in the 1970s because of pressure from the environmental movement.<sup>17</sup>

Elsewhere, conservation has been the best approach. The International Joint Commission (IJC) was formed in 1909 to find impartial solutions to issues associated with trans-boundary water between Canada and the USA. In a recently concluded, detailed study on the protection of the waters of the Great Lakes,<sup>18</sup> the IJC identified that a complex network of tributaries and ground water support the lakes, and if these are altered it would change the balance of the ecosystem in unpredictable ways. On average, less than one percent of the total water in the Great Lakes system is renewable because the majority of water was deposited there after the last Ice Age. The IJC reported that if all the political, economic and environmental interests in the region are considered, there will never be a surplus of water in the Great Lakes System.

## **Adequacy of Water Shortage Solutions.**

In the developed world, two countries such as Canada and the USA, can share significant trans-boundary water resources, albeit with some challenges. The pressures on the Provinces to sell bulk fresh water have already occurred<sup>19</sup> and the demand for water in South Western United States, when coupled with population growth data, has already well exceeded supply. In the next 25 to 50 years these pressures are expected to get worst.

In California, the demand for fresh water has increased the need to extract ground water and the aquifers have been pumped out at a rate faster than they are replenished. Over time, the structure of California's Central aquifer has collapsed so that the damaged aquifer can never hold as much water as before. It is estimated that California has permanently lost half of its natural underground water storage, nearly 20 million acre-feet, in spite of the massive water storage building programme in the boom years. The Government of California has realised that population growth will remain California's most intractable problem.<sup>20</sup>

Given our close political and economic ties, it is difficult to envisage a military conflict between Canada and the USA over water. However, tough future negotiations are not out of the question. Since 1980, awareness has reduced demand somewhat, however, despite this positive trend, experts worry that water-use efficiency will fail to keep pace with projected population growth.<sup>21</sup> Reisner quotes Canadian experts who

suggest that the Canadian public will eventually come to realise that, as far as the US is concerned, water has a value far beyond that which prevails today. For example, at some point in the future Canada may bargain a quantity of fresh water against a certain percentage reduction in US acid rain or to attain other ecological concessions.<sup>22</sup> Between peaceful developed countries, with growing populations and ample water resources, fresh water scarcity is manageable and perhaps even solvable.

In contrast, the surging populations of the Third World are intensifying the pressures on limited water supplies. Despite considerable progress with fresh water management to date, half of the world's population still suffers from water services inferior to those available to the ancient Greeks and Romans. Affordability is always an issue, particularly in the Third World, where the competing demands of urbanization, industrialization and agriculture place an increased strain on both the economy and the fresh water supply. The World Commission on Water has suggested that various solutions will have to be found to increase water supplies and reduce losses. These include making desalination more affordable, standardised water pricing to encourage conservation, using biotechnology to breed less thirsty and more drought resistant plants and developing technology to transport fresh water over long distances, including across oceans.<sup>23</sup>

Peter H Gliick, one of the world's leading experts on fresh water problems, predicts that water scarcity will cause serious problems with agriculture, industry and human health for at least 40% of the world's population. The world's population is

expected to expand from a current population of 6 billion to 7.5 billion people by the year 2025 and 9 billion by 2050. The majority of the world's population currently lives in Asia, and the UN expects this to grow to 60%, or approximately 5.2 billion people, by 2025. Like the developed world, ground water aquifers are being pumped down faster than they are naturally replenished in parts of India, China, Africa, and the Middle East. Long-term solutions to water scarcity, which work, more or less, in the developed world, may not be possible in many countries of the Third World. It is likely that the looming water crisis can only be delayed.

### **Outcomes of Water Shortage.**

A noted Canadian expert, Thomas Homer-Dixon, has suggested that in the future, violent conflict fuelled by scarce resources such as fresh water, may spread beyond the borders of impoverished countries. While some experts on fresh water believe that co-operation is much cheaper than confrontation and that human ingenuity can overcome the problems of water scarcity, in the Third World this is unlikely. Homer-Dixon differs with these water experts by suggesting that the environmental scarcity of resources is mainly an indirect cause of internal violence. He has concluded that there are second tier countries, affected with internal environmental scarcity, that are pivotal to the stability and well being of their region and the world.<sup>24</sup> These countries include South Africa, Mexico, Pakistan, India and China. If several of these pivotal countries fail to deal effectively with their scarcities, he believes that the world will be neither environmentally sustainable nor politically stable.

Professor Homer-Dixon also predicts a growing division between those countries who can adapt to fresh water scarcity and those who can not. "The world's wealthy regions should not assume that they will be able to wall themselves off from turmoil in societies that do not adapt well to scarcity".<sup>25</sup> Three examples of water basins, which may not adapt well to fresh water scarcity, are the Tigris-Euphrates, Nile and Indus river basins.

Tigris-Euphrates Basin– Turkey, Syria, Iraq. The headwaters of the Tigris and Euphrates Rivers are in Turkey and are the source area for more than 70 % of the total flow in both rivers. To date, Turkey has not used this water significantly. Downstream Syria depends on the Euphrates River for over half its water supply and even further along, Iraq is almost totally dependent on both rivers. Considerable political tension over water access has arisen in the past, as was witnessed in 1970 when Iraq massed troops at the Syrian border over the adverse impact of the Assad Dam. Turkey has now stated that she intends to develop both rivers by erecting 22 dams for electrical power and irrigation. It is estimated that upon completion, the project will increase Turkish use from under 10% to 50 %. The site manager of the Ataturk Dam identifies water as a weapon that can be used to regulate the Arab political behaviour.<sup>26</sup> The dam could stop the flow of water into both Iraq and Syria for up to 8 months without overflowing.

There are few bilateral agreements between the three states and this water conflict may have a decisive influence on the power structure of the region. In spite of talks no

settlement has yet been reached.<sup>27</sup> Projections of water scarcity in Iraq and Syria, coupled with the implementation of the large water-related projects on the headwaters in Turkey, could lead to a war over trans-boundary water resources. This potential water scarcity conflict would be inextricably intertwined with issues of national sovereignty; interstate rivalry and ideological competition as the hydro-politics play out in the basin. Turkey, a moderate Muslim state, is firmly in the Western alliance, however, both downstream countries, antagonised by water scarcity, may stir up trouble in the region in response such as religious fundamentalism. Both Syria and Iraq have misjudged western political will in the past and may challenge this NATO partner who perhaps selfishly claims all of the headwaters as an absolute sovereign resource.<sup>28</sup>

Nile Basin – Egypt, Sudan, Ethiopia. Distinct among the international water basins, the Nile basin is shared by some of the youngest sovereign states in the world. Egypt, the strongest of the states, is almost totally dependent on the Nile waters, which are generated almost exclusively beyond its borders. The headwaters of the Nile originate in two areas: the Blue Nile in Ethiopia and the White Nile in eight different countries of East Africa. The main fresh water disputes thus far involve Egypt, Sudan and Ethiopia. While there are historical agreements giving Egypt a higher proportion of the available flow, the civil wars in Ethiopia and Sudan affect further water development projects. Egypt has a population of 67 million, is growing annually by more than 1 million, and predicts an increased demand for fresh water. Egypt fears the construction of a number of dams in the Ethiopian Highlands, the source of 85% of the Blue Nile flow, will reduce the available flow. Population pressures in Ethiopia and Sudan are

increasing demand for fresh water and this is expected to reduce the amount of water available downstream. International Law entitles Sudan and Ethiopia to a larger portion of Nile water however, Egypt remains the most powerful nation in the basin.<sup>29</sup>

While Burundi, Congo and Rwanda, three of the eight East African countries whose waters feed the White Nile, face the danger of state collapse due to civil war, Eritrea is struggling towards independence after years of civil war. This instability in the Nile basin may lead to volatile hydro-politics in the future. In 1979, a former Egyptian leader, Anwar Sadat, is reported to have said that the only reason that Egypt would go to war with its neighbours in the future is a dispute over water.<sup>30</sup> Egypt has overwhelming military superiority and diplomatic clout in the region, which may minimise the effect of an underdeveloped water system and political instability upstream.

Indus Basin – India, Pakistan. When partition occurred in 1947, the Indian Subcontinent was divided and the country of Pakistan was created. The new international boundary cut across the Indus River and its tributaries and canals. As a result, all of the Indus headwaters were in India leaving Pakistan, the downstream user, vulnerable. Four months after partition, India cut the flow from two canals in a hostile act to reduce Pakistan's capacity for irrigation during the sowing season and to deprive Lahore of municipal water.

The Indus Treaty, negotiated with the help of the World Bank, allocates 81% of the water to Pakistan and 19 % to India. This Treaty, signed in 1960, extended the 1947

partition process so that even the rivers were divided between the adversaries.

Geographically, Pakistan remains vulnerable to the adversary upstream. Both India and Pakistan have growing populations, increasing demands for water and have demonstrated a nuclear weapon capability. A leading water expert has suggested that "no army, with bombs and shellfire, could devastate a land as thoroughly as Pakistan could be devastated by the simple expedient of India's permanently shutting off the sources of water that keep the fields and people of Pakistan alive".<sup>31</sup>

It is thus reasonable to conclude that future water scarcity will become a cause for a conflict in the Third World. DND publishes an annual analysis of the international environment and its implications for Canada's long-term security interests. The foreword suggests that the document highlights developments that are likely to have important implications for global security and could have a significant impact on Canada's interests and values. Unfortunately, it does little to recognise any environmental concerns on the impact of fresh water scarcity or hydro-politics. Given an increasing awareness of fresh water issues in the press and recent Government announcements, one might expect to find in the analysis more than simply a passing mention of general development pressures and the noting of water rights in Israeli-Syrian negotiations.<sup>32</sup>

## **Conclusion.**

The distribution of fresh water, both surface and ground water, is uneven around the globe and political borders have been created with little regard for the boundaries of water basins. There are countries, which have tremendous fresh water resources, and others, which have significant water scarcity. This is compounded when countries must share a limited source of fresh water in cooperation with their neighbors. This cooperation assumes a willingness to seek and the determination to pursue workable solutions. In the developed world this is possible but not so in many areas of the Third World.

The typical solutions to solve water scarcity work best in wealthy, energy rich countries. While future Canadian hydro-politics and US fresh water demands may collide, conflict between Canada and US over fresh water is unlikely. This pales in comparison to the intense fresh water demands and instabilities found in the Third World. The demand for fresh water, when coupled with population growth, has created a "water gap" in many areas of the Third World. Fresh water is now a strategic resource and there is a strong likelihood that fresh water scarcity will cause conflicts around the world.

Water is essential to all life: even a nine-year-old can grasp this simple truth. However, their generation has yet to learn that a world, seemingly so plentiful in one resource, is likely to face a water crisis in their life times. Fortune and economics play a role in determining whether one is born into a region blessed with water or conversely a region of the world where the simple truth is the central focus of ones existence.

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- <sup>1</sup> Taken from The Ancient Mariner, Anon.
- <sup>2</sup> Michael Peter Bodner, age 9, at the dinner table, 29 Jan 01.
- <sup>3</sup> PH Gleik, The Worlds Water, 2000-2001, Island Press, 2000, Table 3.11, page 53.
- <sup>4</sup> World Bank, Press Release on Water Pricing, 1999.
- <sup>5</sup> LH Bullis and JE Mielke, Strategic and Critical Materials, Westview Press, Boulder and London, 1985, page 109.
- <sup>6</sup> The recent water crisis in Walkerton Ontario shows the impact of a sudden loss of fresh water supply.
- <sup>7</sup> AP Elhance, Hydro-Politics in the Third World, 1999, page 3.
- <sup>8</sup> Hydro-Politics in the Third World, page 114.
- <sup>9</sup> The World's Water, 2000-2001, Table 2.1, page 21.
- <sup>10</sup> JS Cram, WATER, Canadian Needs and Resources, Harvest House, 1973, pages 21-25.
- <sup>11</sup> Ibid page 131.
- <sup>12</sup> United Nations, Register of International Rivers, Oxford, Pergamon Press, 1978.
- <sup>13</sup> World Commission on Water, Press Release, The World Water Gap, 20 Mar 99
- <sup>14</sup> Hydro-Politics in the Third World, 1999, page 8
- <sup>15</sup> The Worlds Water, 2000-2001, Chapter 5, pages 175-181. Fog collection currently occurs in Chile, Peru and Oman.
- <sup>16</sup> C Mungall and DJ McLaren eds, Planet Under Stress, The Royal Society of Canada, Oxford University Press, Toronto, 1990, pages 158 to 160
- <sup>17</sup> Marc Reisner, Cadillac Desert, The American West and its Disappearing Water, 1993, page 487.
- <sup>18</sup> International Joint Commission, FINAL Report on Protection of the Waters of the Great Lakes, Nov 2000.
- <sup>19</sup> To date 3 known attempts to sell Canadian bulk water abroad have occurred. In Newfoundland, the McCurdy Group of companies, Gander Newfoundland, applied to export 52 billion litres of water a year from Gisborne Lake in Southern Newfoundland. In Ontario in 1998, NOVA Group did seek a permit to ship 600 million liters of water annually to Asia. Last, in British Columbia, the government has previously licensed bulk water movement but has ceased due to a US company that wants to take tankers of water to a town on the coast of Southern California.
- <sup>20</sup> National Geographic, Special Edition on Water, November 1993, pages 44 –52
- <sup>21</sup> Scientific American – February 2001. Making Every Drop Count, Peter H Glietck
- <sup>22</sup> Ibid, page 493.
- <sup>23</sup> The World Water Gap Press Release, 20 Mar 99
- <sup>24</sup> TF Homer-Dixon, Scarcity and Conflict – Spring 2000 – Vol 15, pages 28-35 of the Forum for Applied Research and Public Policy, Knoxville.
- <sup>25</sup> Ibid.
- <sup>26</sup> ICRC Geneva, Forum - Water and War, Nov 1998, page 109.
- <sup>27</sup> Water and International Conflict, Feb 2000, Third World Quarterly.
- <sup>28</sup> The Tigris-Euphrates Basin. Hydro-Politics in the Third World, pages 151-153.
- <sup>29</sup> Christine Drake, Water Resource Conflicts in the Middle East. The World and I, Washington, Sep 2000,
- <sup>30</sup> Hydro-Politics in the Third World, pages 81-82.
- <sup>31</sup> MR Lowi, Water and Conflict in the Middle East and South Asia. Journal of Environment and Development, La Jolla, Dec 1999,.
- <sup>32</sup> D Strat A, Strategic Overview 2000, 20 Sep 200, NDHQ, pages 19 and 68 respectively.

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