

## **WATER SECURITY AND POPULATION DYNAMICS IN THE NILE RIVER BASIN**

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### **ABSTRACT**

In the 21<sup>st</sup> century, the potential for conflict over water is unacceptably high. Scarce resources must now serve competing needs in agriculture, industry; also in urban and rural populations across several nations, while retaining sufficient supplies in the environment to ensure long-term sustainability of ecosystems. The problems are especially acute throughout Africa, where many countries are balanced precariously on the edge of scarcity and survival. Recognizing the importance of preventing water-related conflict, the nations are asked to assist collaboration in their efforts to work together in addressing existing and potential water resources conflicts, both among nations and competing sectoral users. Africa has actually only a third per capita of the water that was available in 1960. This continent is, with Asia, the one where the water is becoming scarce and where its quality is getting worst. In many countries, water scarcity is one of the principal causes of poverty and malnutrition. At the beginning of a new millennium, the problem of water quality deterioration is also becoming important. Nowadays, 300 millions of Africans are likely to live a water shortage situation. Recurrent and localized drought, increasing food insecurity and diseases with hydrologic origin or transmission cause millions of deaths every year. Environmental pollution growth and African countries share one or more river valleys which extend beyond their national borders.

Winding more than 7000 kilometers through ten countries, the Nile River is one of the world's great natural assets, rich in culture and history, and often referred to as the "River of Life". But the waters of the Nile are also in high demand in a semi-arid region with substantial population growth where the priorities of riparian governments have not always coincided. The Nile River is shared by ten countries; Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. The basin contains outstanding environmental assets, such as Lake Victoria, the second largest fresh water body by area in the world, and the vast wetlands of the Sudd. It also serves as home to an estimated 160 million people within the boundaries of the basin, while about twice that number, roughly 300 million, live within the ten countries that share and depend on Nile waters. Almost all Nile nations lack hydrological data, capital, modern technology, and support from international organizations and donor countries. Egypt is the only nation with advanced technology, basin information, and substantial financial backing by developed countries and international organizations. International laws would help promote a basin-wide

perspective for river resource development, and would bolster support for the less developed basin nations. Future sustainable development of the basin's water resources depends on agreement and cooperation between economically poor nations sharing several common problems. The biggest problems are population growth, insufficient agricultural production, and evaporative losses. These problems impact available water supply and water quality for basin countries regardless of international boundaries.

Almost all countries in the Nile basin face environmental problems, such as deforestation, soil erosion, and sedimentation, besides social and political problems, such as lack of appropriate institutions, financial resources, and trained manpower for environmental protection and management. These problems, coupled with poverty and high population growth, pose serious threats to water resources and the basin's environment. The problem facing Egypt, Ethiopia, and the Sudan is a familiar one: there is not enough Nile water available to complete all of their irrigation needs. Nile water is currently mismanaged and heavily misused which makes regional water problems worse. The Nile nations have a fairly substantial freshwater resource available for their use, but the pattern of water allocation, along with policies that discourage (or at least do not encourage) efficient utilization lead to a perception of scarcity. There is a real necessity to develop a new basin-wide management strategy for the future and to renegotiate new agreements that include all Nile basin nations. There are numerous barriers to surmount, such as: perpetual political and economic instability; lack of skilled manpower; and a shortage of financial resources. Management needs to be addressed by all basin states to maximize available water resources since other options for developing new supplies are severely limited. Responsible water management would have to be on at least three levels: basin-wide, regional, and local.

## **INTRODUCTION**

Human welfare and progress have been closely associated with access of freshwater. However, in the last century rapid population growth and human activities development interfered with hydrological processes. Issues related to freshwater quantity and quality are becoming serious in many regions of the world. Arid and semi-arid regions face increasing stress from water scarcity, while most of the globe faces growing pollution problems as a result of environmental change and lack of adequate management. The population of water-short countries was estimated to be 550 million in 1998 and is expected to increase to 1 billion by the year 2010, while estimations on water quality pick out that 1 billion people do not have access to clean water, and 1.7 billion do not have sanitation. According to a report by the International Atomic Energy Agency (IAEA), only about 0.007 percent of all the earth's water is accessible for human use. Competition for fresh water is increasing. Since 1900, demand has increased six times, more than double the rate of population growth. Unplanned settlements in most of Africa's urban centres, currently representing about 60 percent of the urban population, is another major contributor to

the problem, as the ever-expanding settlements have had a marked impact on surface and groundwater resources.

The Nile is one of the world's great rivers covers more than 35 degrees of latitude and draining an area of over 3 million square kilometers; one tenth of Africa's total land mass. It is a basin of varied landscapes, with high mountains, tropical forests, woodlands, lakes, savannas, wetlands, arid lands, and deserts, culminating in a vast delta on the Mediterranean Sea. It is generally agreed that the Nile has several sources. The principle streams are the White Nile, which begins in the Great Lakes region of Central Africa; and the Blue Nile (Abbay) and the Atbara (Tekeze), both flowing from the Abyssinian highlands. The most distant source is the Kagera River, which winds its way through Burundi, Rwanda, Tanzania and Uganda into Lake Victoria. The dream of an "Africa of the Nile" of last century explores' was not carried out: the Horn of Africa and the area which prolongs it to the South remain strongly divided and tormented. The conflicts in the continent cause population displacements on a large scale, used by governments as means of pressure on other States. Within the framework of universalisation the "Africa of the Nile" is now actuality. At the beginning of this new millennium, a few agencies are working on some projects on the Nile River Basin. By its size, physiographic, political divisions, and history, the Nile Basin is very complex. Therefore, although there are several projects operating actually in the region, it is still difficult to obtain reliable data, at detailed scales. Probably this situation can also be finding in other basins such as those facing major freshwater related problems.

Despite the extraordinary natural endowments and rich cultural history of the Nile Basin, its people face considerable challenges. Today, the basin is characterized by poverty, political instability, rapid population growth, and environmental degradation. Four of the Nile riparian countries are among the world's ten poorest, with per capita incomes in the range of USD 100-200 per year. Population is expected to double within the next 25 years, placing additional strain on scarce water and other natural resources. In a historic step, the riparian countries jointly established a Cooperative Framework to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources. Cooperative management of the Nile River Basin is one of the greatest opportunities of the global international waters agenda and provides a major prospect for riparian countries to realize significant transboundary economic and environmental benefits.

## **THE NILE RIVER WATER RESOURCES**

The Blue Nile has its source in the Ethiopian plateau where Lake Tana is its main source. The White Nile has its origin in Burundi. Through Rwanda and Uganda the watercourse flows into southern Sudan, where half of the water entering the Sudd region, an extensive swamp area of around 16200 km<sup>2</sup>, flows out of it into the White Nile. The main loss of water in that area is due to evaporation. South of the Khartoum, capital of Sudan, the White Nile confronts the Blue Nile. The joined river, further on

called the Nile, flows together where they meet Atbara, north of Khartoum. Lake Nasser, the second largest man-made lake in the world and the Aswan Dam are on the border with Egypt.

North of Cairo the Nile splits up into a delta, now mainly existing out of two streams. Different authors and different studies come with different conclusions when it concerns the contribution of the percentage of waters entering the Nile. Figures from 55% to 85% can be seen in different literature. It has to be noted that relevance must be given to the importance of the different seasons when working with these percentages. Another factor which has its importance when studying this subject is the consequence of evaporation. Losses occurring in Aswan Dam are estimated to be 10% of the stored water and variations in rainfall can cause quite considerable fluctuations in discharges. The White Nile catchment is especially sensitive to these fluctuations. Taking these influences into account, the average discharge figures could show big variations depending on the study period.

## **THE POTENTIAL OF THE NILE RIVER BASIN**

Nowadays, 300 millions of Africans are likely to live a water shortage situation. Recurrent and localized drought, increasing food insecurity and diseases with hydrologic origin or transmission cause millions of deaths every year. Environmental pollution growth and African countries share one or more river valleys which extend beyond their national borders. Due to intensive land use and deficiency of rural electrification in Ethiopia, growing population depend on natural trees and grasses, presently used for cooking and heating. Owing to loss of vegetation, land erosion occurs and the rainwater can not filtrate, causing non-refill for groundwater. Deforestation for centuries on Ethiopia highlands has had profound impact in this country as well as in the Blue Nile Basin.

Water evaporation also presents a severe problem. Ten percent of water evaporates from the surface of Lake Nasser every year. This is because of its location in the middle of the desert. However, if the dam were located elsewhere, Egypt would lose out on the hydroelectric power the dam provides although Ethiopia could benefit from selling hydropower to neighbor countries (ICE, 2000). Due to the very unsuitable conditions in Egypt for large scale agricultural production, the option of shifting crop production in Sudan from cotton to less water requiring food crops offers a potential solution in co-operation between the riparian countries. It is estimated that Ethiopia and Sudan could achieve satisfactory agriculture production if they could access to sufficient irrigation water for their farming land (ICE, 2000). However, irrigation water withdrawn from Blue Nile for Ethiopian agricultural sector could reduce the water flow to Egypt significantly.

**Table 1: Water Resources and water availability per person in the Nile Basin Countries (FAO, 1995)**

Country	Internal Renewable Water Resources (IRWR) (km <sup>3</sup> /year)	Actual Renewable Water Resources (ARWR) (km <sup>3</sup> /year)	Dependency Ratio %	IRWR per inhabit. in 1994 (m <sup>3</sup> /inhab)	ARWR per inhabit. in 1994 (m <sup>3</sup> /inhab)
Burundi	3.6	3.6	0.0	579	563
DR Congo	935.0	1019.0	8.2	21,973	23,211
Egypt	1.7	58.3	96.9	29	926
Eritrea	2.8	8.8	68.2	815	2,492
Ethiopia	110.0	110.0	0.0	2,059	1,998
Kenya	20.2	30.2	33.1	739	1,069
Rwanda	6.3	6.3	0.0	833	792
Sudan	35.0	88.5	77.3	1,279	3,150
Tanzania	80.0	89.0	10.1	2,773	2,998
Uganda	39.2	66.0	40.9	1,891	3,099

**Table 2: Nile Basin Repartition (FAO, 1999)**

Country	Country Area (km <sup>2</sup> )	Area within the Nile Basin (km <sup>2</sup> )	% of the total Nile Basin area	% of the country in the Nile Basin
Burundi	27,835	13,260	0.4	47.6
Dr Congo	2,345,410	22,143	0.7	0.9
Egypt	1,001,450	326,751	10.5	32.6
Eritrea	121,320	24,921	0.8	20.5
Ethiopia	1,127,127	365,117	11.7	32.4
Kenya	582,650	46,229	1.5	7.9
Rwanda	26,340	19,876	0.7	75.5
Sudan	2,505,810	1,978,506	63.6	79.0
Tanzania	945,090	84,200	2.7	8.9
Uganda	236,040	231,366	7.4	98.0
<b>Total</b>	<b>8,919,072</b>	<b>3,112,369</b>	<b>100.0</b>	<b>34.9</b>

## THE NILE WATER SCARCITY

Freshwater resources are finite, unevenly distributed worldwide, and often shared by more than one country. Thus, fresh water can be a trigger for conflict--but it can also become a reason for cooperation, as parties in water-scarce regions join together to manage this crucial shared resource. Nonetheless, the disparities between countries are wide and some are already faced with constraints in meeting domestic water demand owing to physical, socio-economic and political factors. As a result, water and water-supply systems may become instruments of political confrontation and objectives of

military operations as the global population expands. Water quality has also become a crucial factor in the discussion over water availability, conflict and cooperation. In many countries, both developing and developed, current water use is not sustainable because water is poorly allocated and/or managed. The situation is especially grim in the Middle East and North Africa (MENA).

In general, the MENA region accounts for about 5% of the world's population, but only 1% of the freshwater. Eighty-seven percent of all freshwater resources in the region are used in mainly low value agriculture; water losses in municipal distribution systems often exceed 50% of the water supplied for urban use (World Bank, 1995). The highly tapped Jordan River basin provides critical water supplies to Israel, Jordan, Syria, the Palestinian territories and Lebanon and has been a source of frequent conflict in the region. In the Jordan basin, the situation is exacerbated by politics: while some of the riparians are at peace with one another, others are still at war or in the process of slow reconciliation. In North Africa, nine sovereign states share the Nile basin's water, key to development and revival in the region. Egypt, Sudan, and Ethiopia are most vocal about problems in the basin, and the Nile's water is becoming increasingly subject to demands by riparians which previously did not necessarily insist on their share. Throughout the MENA region, water quantity is the most serious issue, followed by water quality.

Central to these problems is the assertion that resource scarcity and certain forms of environmental degradation are major factors in political instability or violent conflict at local, regional and interstate levels. In short, there is a growing perception that local, regional, and global environmental deficiencies or resource scarcities may increasingly lead to conflict (Gleick, 1998a). In both the Middle East and North Africa, increasing poverty in certain countries, population pressures, unsustainable water withdrawals, continuing territorial dispute and growing nationalism, environmental degradation and water scarcity are factors that may increase regional tension. Furthermore, Middle Eastern leaders, both past and present, have stated that water is the factor most likely to lead to war. The link between environmental degradation, water scarcity and violent conflict is a serious threat. Water is becoming a commodity that even peaceful neighbors are willing to battle over. For the sake of the region it is crucial that water scarcity and environmental degradation be dealt with in a manner that will ensure essential water demands are met sustainably.

## **THE NILE WATER CRISIS**

Some 261 of the world's rivers are shared by two or more countries. These international watersheds account for about 60 percent of the world's freshwater supply and are home to approximately 40 percent of the world's people. Despite the absence to date of full-scale water wars, unresolved tensions over water have persistently irritated relations, fueled other hostilities, and occasionally led to military action that risked provoking a larger conflict. Yet, the overarching lesson to draw from the basins of the Jordan, the Nile, and the Tigris and Euphrates rivers and other regions of water

dispute is not that worsening scarcity will lead inevitably to water wars. It is rather that unilateral actions to construct a dam or river diversion in the absence of a treaty or institutional mechanism that safeguards the interests of other countries in the basin is highly destabilizing to a region, often spurring decades of hostility before cooperation is pursued. In the Jordan River basin, for example, violence broke out in the mid-1960s over an "all-Arab" plan to divert the river's headwaters (itself a pre-emptive move to thwart Israel's intention to siphon water from the Sea of Galilee). Israel and Syria sporadically exchanged fire between March 1965 and July 1966. Water-related tensions in the basin persisted for decades and only recently have begun to dissipate.

A similar sequence of events transpired in the Nile basin, which is shared by 10 countries—of which Egypt is last in line. In the late 1950s, hostilities broke out between Egypt and Sudan over Egypt's planned construction of the Aswan High Dam. The signing of a treaty between the two countries in 1959 defused tensions before the dam was built. But no water-sharing agreement exists between Egypt and Ethiopia, where some 85 percent of the Nile's flow originates, and a war of words has raged between these two nations for decades. Along with civil war and poverty, such verbal threats have likely inhibited Ethiopia's water development, leaving the Horn of Africa more vulnerable to drought and famine. Meanwhile Egypt, the regional power, has continued to pursue large-scale river basin schemes unilaterally. As in the case of the Jordan, only in recent years have the Nile nations begun to work cooperatively toward a solution.

## **POPULATION DYNAMICS AND FOOD SECURITY**

The population of Egypt, which grows by more than one million per year, could reach 85 million by the year 2015. Since the annual increase in population (2.8%) exceeds the annual increase in food production (2.6%), Egypt's imports of food, currently valued at more than \$3 billion, absorbs most of its foreign currency earnings. In the absence of agreements, therefore, if irrigation dams were to be built in either Ethiopia or East Africa, or if climatical change were to result in increased warming, or in droughts and increased evaporation, reduced water flow into the Nile would further exacerbate Egypt's problems, and the country could face an explosive situation. There is a need for water availability to keep pace with the expansion of irrigated agriculture but in the future agriculture will have to compete with water needs for other purposes. Requirements for the domestic sector will continue to increase because of the increase in population. Industrial demands will also increase significantly. The amount of water available for agriculture will then decline requiring more efficient agriculture that makes better use of land and human resources.

Water is one of the most important of all natural resources. It is vital for all living organisms and major ecosystems, as well as for human health, food production, and economic development. Since the first civilizations arose in the Nile, Tigris, and Euphrates river basins, population growth and distribution have been intimately linked to the availability of freshwater. Today, nearly 40 percent of the world's food supply is

grown under irrigation, and a wide variety of industrial processes depend on water. In the last half of the 20<sup>th</sup> century, population growth and urbanization, together with changes in production and consumption, have placed unprecedented demands on water resources. Already, humans use more than one-half of all accessible surface water runoff. This proportion is expected to increase to 70 percent by 2025, thereby reducing the quantity and quality of water available for aquatic ecosystems. These ecosystems are critical for a range of life-supporting functions - including the cleaning and recycling of water itself. More than 1 billion people today lack access to an adequate supply of safe water for household use. In 30 years, as many as 5.5 billion people may live in areas suffering from moderate to severe pressure on water resources, rendering the provision of safe water even more difficult. In light of these trends, new approaches are urgently needed to manage water resources rationally and equitably. This entails efforts that will simultaneously address population dynamics, consumption patterns, and environmental conservation.

The water and population dynamics workshop at IUCN's World Conservation Congress in October 1996 examined these issues through presentations of regional and local case studies. The workshop brought together nine country teams representing diverse settings in Africa (Mali, Zambia, and Southern Africa), North Africa and the Middle East (Morocco and Jordan), South Asia (Bangladesh, India, and Pakistan), and Central America (Guatemala). In one-and-a-half days of animated discussions, the teams and invited experts shared findings, explored "local-to-global" links, and examined the implications for improved policy and practice at the local, national, regional, and global levels. The food security imperatives of Egypt and the need to prepare for the winter of the future is compelling. Egypt, like Ethiopia, is currently trying to meet this challenge of the future through a massive Nile water diversion.

Today, nearly 90 percent of Egypt's 70 million people live on and work the land in the Nile River Delta, which totals only four percent of Egypt's entire area. Farmers have managed to maximize arable land by irrigating desert along the Nile's edge and around Lake Nasser, the mammoth reservoir created by the Aswan High Dam. But with a projected population of 85 million by 2015, the government contends that new areas for cultivation must be developed. Indeed, the importance of the project is also underlined by the magnitude of the investment and its technical complexity: The project's cost is to be more than US\$2 billion. The massive pumping station, which will lift water 55 meters from Lake Nasser, will cost \$810 million. The rest of the money will provide for construction of a three-mile tunnel and a canal, which may become the world's longest, at 150 miles (240 kilometers). This channel will provide irrigation for over 500,000 acres and link the oases of El Kharga and Farafra. Nearly 10 percent of all the water collected each year in Lake Nasser would be pumped along this ditch into the Western Desert.

## **THE NILE WATER SECURITY AND SELF SUFFICIENCY**

Remember the last time two nations went to war over water? Probably not, since it was 4,500 years ago. But today, as demands for water hit the limits of a finite supply, conflicts are spreading within nations. And more than 50 countries on five continents might soon be spiralling toward water disputes unless they move quickly to strike agreements on how to share the rivers that flow across international boundaries. Talk of water wars reverberates around the globe these days. United Nations Secretary-General Kofi Annan said last March that "fierce competition for fresh water may well become a source of conflict and wars in the future," and a recent report of the U.S. National Intelligence Council concludes that the likelihood of interstate conflict will increase during the next 15 years "as countries press against the limits of available water."

A renewable but not infinite resource, fresh water is becoming increasingly scarce: The amount available to the world today is almost the same as it was when the Mesopotamians traded blows, even as global demand has steadily increased. Just since 1950, the renewable supply per person has fallen 58 percent as world population has swelled from 2.5 billion to 6 billion. Moreover, unlike oil and most other strategic resources, fresh water has no substitute in most of its uses. It is essential for growing food, manufacturing goods, and safeguarding human health. And while history suggests that cooperation over water has been the norm, it has not been the rule. One fourth of water-related interactions during the last half century were hostile. Although the vast majority of these hostilities involved no more than verbal antagonism, rival countries went beyond name-calling on 37 recorded occasions and fired shots, blew up a dam, or undertook some other form of military action.

According to the consultation was held to develop the Vision for Water in the Nile River Basin Countries. The consultation was attended by 450 participants from the Nile River Basin and representatives of several international organizations. It took place as a part of the 7<sup>th</sup> Nile 2002 held in Cairo, Egypt from 15-19 December, 1999. The consultations included several workshops dedicated to develop the vision along four tracks: Water for Food and rural development, water for nature, water for people and hydro-energy, and water and institutional aspects. The definition of water security and self sufficiency are summarized as:

1. Providing the minimum water requirement to 1000 m<sup>3</sup>/capita/year,
2. Provision of sufficient calories (1500 cal/day) importation and exportation,
3. Maintenance of the integration between countries,
4. We should consider not only quantity but food quality also.

Several actions were identified that should be taken:

1. More coordination among the basin countries,
2. Capacity building for data and training,
3. Form long term planning for the Nile Basin,
4. Enhance confidence among Nile Basin countries,

5. High priority for national and regional projects in the Basin,
6. Each country form its own water master plan which subscribed to the whole master plan, and
7. Utilization of the internet for cooperation in the future.

## **THE NILE WATER DROUGHT AND FAMINE**

A recent review of the status of breeding for tolerance of abiotic stresses by John Bennet (International Rice Research Institute) concluded that the advances in genomics, and the development of advanced analytical tools at the molecular level, provide a basis for understanding the mechanisms of stress tolerance. Investments in the new tools for gene discovery will produce breakthroughs in understanding abiotic stress tolerance. Drought is the most important but also the most intractable of abiotic stresses but irrigated and rainfed crop plants can be developed that are high-yielding even when grown under recurrent mild water deficit. The necessity for seeking durable long-term remedies to the problems of drought and famine is underlined by the wealth of historical evidence on the frequent recurrence of the problem. Drought in Ethiopia has, for instance, led to large-scale starvations, death and dislocation of people from 1836 to the present.

In 1836 the northern provinces and the Lasta regions of Wello were hit by drought. From 1886-89, 1899-90, 1921-22 and 1932-34, Ethiopia as a whole was hit. The focus of the drought then shifted to Wello, which suffered a succession of drought-induced famines in 1953, 1958 as well as from 1964-65, 1965-66, 1973-76, 1984-85 and 1987-90. The drought-caused famine of 1973-74 was one of the immediate causes for the collapse of the Haile Selassie regime and the demise of the 3,000 year-old Ethiopian Empire. The 1984/85 drought-induced famine should have served all concerned as an omen of the disasters to come if nothing was done to utilize the abundant water resources of the nation for achieving food security. In a span of fifteen years the ugly spectre of drought is yet again haunting Ethiopia.

In the climate of growing scepticism and reluctance to interfere in the fact of the mounting drought-induced famine, by the International aid community as evidenced in the drought 1998-2000, Ethiopia is left with only one choice; utilize the Nile waters for irrigation to produce food and cash crops to cater for its needs. In this regard the importance of an agreement for the equitable sharing of the Nile waters cannot be over emphasized. While Ethiopia is ready to discharge its responsibility in this respect, reciprocal moves on the part of the international community is eagerly sought. Also bilateral partnerships and private sector investment is being solicited to exploit the Nile waters for Ethiopia's dire needs of food security and hydropower generation. A brief look at the famines of 1973/74, 1984/85 and 1998, 1999 and 2000 further highlights the point. One should bear in mind that dependence on food aid, apart from the stigma, has many associated drawbacks. These, inter alia, include: 1) The use of food as a political weapon. 2) A negative image which repels investors and tourists from the country. 3) The negative effect of scaring away of tourist from the country.

4) The loss of self-confidence and morale which has a negative impact on the drive for self-sufficiency and will for development. 5) The entrenchment of a culture of dependency resulting from dependence on aid and the platitudes of donors. Yet, against the above backdrop, one need not overemphasize that most of the above problems can be overcome via cooperative endeavors in the Nile basin based on specialization in production which ensures a more efficient utilization of the water and important savings for the future. In this context one need not overemphasize the importance of Ethiopia's development for Egypt.

## **CONCLUSIONS AND RECOMMENDATIONS**

Overcoming the world water crisis - achieving water, food and environmental security simultaneously - is one of the most formidable challenges to achieve sustainable development. More and more people, organizations and governments are aware of this challenge. The World Summit on Sustainable Development should reconfirm the priority of this issue and adopt targets and actions that jointly will address this challenge. Both Egypt and Sudan would gain more water from Nile flow from the Jonglei Canal and other upper Nile system improvements, perhaps up to 7% more water downstream, and there are watersharing agreements in place for this incremental increase. But the essential source of additional water to these dry lower Nile lands is to desalinate Mediterranean Sea, Red Sea, and Suez saltwater with cheap nuclear power, at strategic development locations on the coastlines. The first conclusion to be drawn from the study is that population control and stopping growth of water-demanding agriculture and industry are crucial to avoid the imminent water crisis in the Nile River Basin. Moreover, because the crisis is so imminent, international cooperation between the riparian countries is vital to achieve rapid action and mutual support in order to avoid war for the water. Co-operation is even more important when we see that, Egypt, the most downstream country has the most hydrological and technical knowledge about the river, while Ethiopia who hosts the Blue Nile source has least knowledge. It must be also noted that Egypt is naturally not suited for agricultural production as presently being the highest consumer of water for irrigation in the region. All in all, the need for integrated assessment and management of the Nile River is quite clear; the establishment of sustainable water use agreements can only base on considering the basin as a whole, not as a set of fragments.

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**Figure (1): Modern Map of the Nile River Basin  
(Microsoft Picture Library 11)**

