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The Nile River: Potential for Conflict and Cooperation in the Face of Water Degradation

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ABSTRACT

The Nile River has been the source of life and of conflict in the Nile Basin for centuries. Escalating degradation of the river waters has exasperated water scarcity issues in the basin, heightening tensions between riparian countries dependent on this shared freshwater source. The potential for conflict between Nile riparians is real, but recent efforts to construct an inclusive regional agreement to govern the river's use suggest that riparians will cooperate rather than quarrel over water in the future. This article describes the current state of the Nile River and the link between water degradation and conflict in the Nile Basin. It then considers the applicability of existing international instruments to facilitate cooperation in the Nile Basin. Finally, it discusses the recent Nile Basin Initiative and its potential for success in averting future conflict over the Nile waters.

INTRODUCTION

"Praise to Thee O Nile, that issueth from the earth and cometh to nourish Egypt."

Ancient Egyptian hymn to the Nile.¹

The Nile River is nearly synonymous with Egypt. Were it not for the river and its sediment, Egypt would have been a mere desert and its great ancient civilizations as well as the present population, cities, and economy would never have existed. Although Egypt is the furthest downstream Nile riparian, it effectively controls the majority of the water by having greater military and economic power than its upstream neighbors. Throughout its history, Egypt has jealously guarded its claim to the Nile waters, threatening military action against upstream Sudan and Ethiopia whenever they have announced water projects on the river. As internal strife and poverty have racked both upstream countries for decades, neither has taken serious action to dam the river for irrigation or hydroelectric power.

Ethiopia, impoverished and militarily weakened due to a prolonged civil war and rekindled conflict with Eritrea, is presently incapable of challenging Egypt over water allocation. However, in the face of its pressing needs to satisfy food and water minimums for its impoverished people, Ethiopia recently declared plans to capture a portion of the Nile waters for itself. Egypt responded with more threats, but nothing happened because Ethiopia resumed war with Eritrea, halting any major domestic water projects. Demand for water in the entire Nile Basin has escalated along with population and industrial and agricultural demands and is exacerbated by pollution from those same demanding sectors.

Fortunately, the Nile Basin countries, including Egypt, recently acknowledged shared responsibility to maintain the Nile River for the benefit of all its riparian countries. In 1994, the nine Nile riparians crafted a series of annual conferences to discuss river sustainability and possible joint water projects such as hydroelectric dams, efficient irrigation, and environmental analysis. The conferences culminated in the 1999 Nile Basin Initiative (NBI), the first regional agreement, signed by all of the Nile Basin riparian countries (except Eritrea), regarding the Nile River. This is good news for those fearing heightened tensions and potential war in the region as demand for Nile waters swells. It is unclear, however, how the Nile Basin countries will respond to the Initiative. Egypt continues to construct more canals to irrigate recaptured desert lands while asserting claims based primarily on its historical use of the water. Meanwhile, Ethiopia and the Sudan draft water project plans for their own eventual use, threatening to diminish the water flow into Egypt.

I. THE NILE RIVER

The Nile River traverses ten countries in north and east Africa, including Uganda, Rwanda, Burundi, Tanzania, Zaire, Kenya, Eritrea, Ethiopia, the Sudan, and Egypt. Of these, Egypt claims the greatest need and right to the Nile. As Egypt receives only negligible rainfall, nearly all of her freshwater comes from the Nile and about 95 percent of Egypt’s 63 million people live within twelve miles of the river. From the first dynasties, Egyptian Pharaohs engineered banks and canals to shape and move the Nile River to benefit all its riparian countries.

Nile water for human benefit, realizing their dependence on the water's flow.

Ancient Egyptians worshipped the Nile and its Mediterranean delta as a god, but as they came to understand the Nile's worldly sources, they pursued military ventures against upper riparians to secure the water's flow through their own country. Egypt tried several times to unify the Nile valley under Egyptian rule by conquering their upstream neighbor, the Sudan. The first Egyptian invasion dates as far back as 2900 B.C. The Sudan was invaded during Queen Sheba's reign, Nero's Roman Rule, and more recently, Anwar Sadat declared in 1979 that "[t]he only matter that could take Egypt to war again is water," suggesting that Egypt can still be provoked into conflict over the Nile.

The Nile River is comprised of three major tributaries: the White Nile, the Blue Nile, and the Atbara River. The furthest known source of the White Nile is the Lovinzola tributary that rises in Burundi and, joining the Kagera River, forms the border between Rwanda and Tanzania, and then the border between Uganda and Tanzania, before flowing into Lake Victoria. Lake Victoria, the second largest freshwater lake in the world, rests in the crux between Uganda, Tanzania, and Kenya. Its only outlet is over Ripon Falls in Uganda, where the White Nile waters begin. The White Nile River is remarkably wide and shallow and loses a substantial amount of water through evaporation and seepage, primarily in the Sudd region of southern Sudan. Less than half of the water flowing into the Sudd actually flows out again to continue north to Khartoum. The waters, however, are fairly clear and steady throughout the year, depending upon rainfall fluctuations in the Lake Victoria region.

Both the Blue Nile and the Atbara River rise from the Ethiopian Highlands, but each follows a separate path to join the main Nile in Sudan. Together, they account for over 80 percent of the Nile waters. The Blue Nile springs forth north of Addis Ababa and flows northwest through the Sudan to meet the White Nile near Khartoum, Sudan's capital city. Although its total contribution to the waters that reach Egypt almost doubles White Nile input, the Blue Nile discharge is extremely uneven, providing close to 90

5. William M. Wharton, Jr., The Sudan in Pre-History and History 34 (1960).
percent at its peak, and five percent during its low period.\textsuperscript{10} The Atbara River also rises from the same Ethiopian Plateau, but north of Lake Tana, from where it flows northwest to join the rest of the Nile River 200 miles north of Khartoum. Similar to the Blue Nile, the Atbara rises and falls with seasonal floods, but in its dry period, it shrinks to a halting series of pools and marshes.\textsuperscript{11}

Thus mingled, the Nile flows north through Egypt, where it empties into the Mediterranean Sea through two major distributaries, the western Rosetta and the Damietta in the east. Before human interference with the river flow, there were many more distributaries emptying Nile waters into the Mediterranean, but as people diverted and dammed water in the south, the delta waters slowed and silt accumulated at the coast, causing all but the two remaining distributaries to disappear.\textsuperscript{12}

A. Necessity of the Nile River

More than 97 percent of Egypt’s freshwater emanates from the Nile.\textsuperscript{13} Slight rainfall and underground reservoirs make up the remaining scant three percent. The Sudan also receives 77 percent of its freshwater from the Nile. All Nile Basin countries rely on the Nile for a certain amount of freshwater, but the Sudan and Egypt have few other options for agriculture, industry, and domestic use.

Agriculture consumes the majority of the freshwater in the Nile Basin. Egypt spends 86 percent of its freshwater on agriculture.\textsuperscript{14} The Sudan is thought to apply 99 percent of its freshwater in the same way.\textsuperscript{15} Irrigation has been used for centuries to increase arable land for crops and today Egypt irrigates more than three million hectares of cropland.\textsuperscript{16} Nile Basin countries together irrigate over five million hectares, with estimated potential arable land ranging from eight to over ten million hectares.\textsuperscript{17} Old, inefficient irrigation techniques waste substantial amounts of crop-designated water through evaporation, but modern projects are implementing more suitable methods, maximizing the amount of water

\textsuperscript{10} U.N. \textsc{Food} & \textsc{Agric. Org.}, \textit{supra} note 8.
\textsuperscript{11} \textsc{Encyclopaedia Britannica} 695 (11th ed. 1911).
\textsuperscript{12} \textsc{Ameri}, \textit{supra} note 9.
\textsuperscript{13} U.N. \textsc{Food} & \textsc{Agric. Org.}, \textit{supra} note 8.
\textsuperscript{14} \textsc{World Bank, World Development Indicators} 130 (2000) [hereinafter \textsc{World Bank Indicators}]. \textit{See also}, Fatemah Farag, \textit{More Precious than Petrol: The Days When Water Could Be Taken for Granted Are Long Gone}, \textsc{Al-Ahram Wkly.}, Feb. 17-23, 2000, at \texttt{http://www.ahram.org.eg/weekly/2000/469/fo2.htm}.
\textsuperscript{16} U.N. \textsc{Food} & \textsc{Agric. Org.}, \textit{supra} note 8.
\textsuperscript{17} \textit{Id.}
actually reaching plant roots and minimizing losses. In addition to land agriculture, millions of Africans obtain the bulk of both their income and protein from freshwater fisheries. The annual fish catch in Africa is 1.4 million tons of freshwater fish, about 14 percent of which occurs in Egypt.

Countries that border Lake Victoria employ its waters and those that flow into it for use within factories, as well as for waste removal from textile and tannery mills; coffee and cotton processing plants; vegetable oil mills; and cosmetics, soap, and fish processing plants. Lake water pollution aggravates water quality and scarcity in the downstream Nile. Sugar cane and cotton are major industries along the Nile in Egypt and the Sudan respectively and appropriate water for processing and waste removal. Although Egypt uses only eight percent of its freshwater for industry, and industries can recycle about 80 percent of the water they use, the remaining heavily polluted runoff joins and contaminates remaining freshwater.

Domestic water use, such as for drinking, food preparation, cleaning, laundry, and hospitality services, accounts for only a small portion of water compared to agriculture and industry. For instance, Egypt presently uses only six percent annually for domestic use. Due to rising populations and economic development, however, domestic requirements are swelling. In the Nile Basin today, population has risen to over 246 million and studies project an estimate of 800 million in 2050. Between 1940 and 1990 global population more than doubled. Per capita water use also doubled during that time as standards of living rose. Global demand for freshwater consequently quadrupled in those 50 years.

Nile waters are an indispensable resource for the Nile Basin, particularly for Egypt, which finds itself in a precarious position by being the most needy and the most vulnerable to upstream siphoning and pollution. A recent study found that the Nile water volume is actually
declining in the twentieth century, exacerbating the urgency of Egypt's situation.\textsuperscript{26} Growing populations and increased pollutants decrease the amount of water available per person in the region. In Africa generally, per capita shares of water are estimated to have decreased as much as 50 percent since 1950.\textsuperscript{27}

B. Causes and Effects of Nile Water Degradation

The reasons for Nile water degradation include water diversions by dams and canals, as well as industrialization and population growth. While these factors have social and economic benefits, they also affect both the quantity and quality of available freshwater. The effects of Nile degradation are substantial, including serious human health problems, damage to crops and fisheries, and human displacement. Together, these effects often cause internal strife, which in turn can lead to conflict between nations, particularly when the source of the trouble is a shared resource.

1. The Aswan High Dam

Dam proponents argue that the benefits, such as stable water flow and diminished negative drought effects transcend the costs, both human and environmental, of damming inconstant waters. Critics, however, insist that the detrimental effects on society, the environment, and the economy unjustifiably outweigh those benefits. The Aswan High Dam, completed in 1970 in southern Egypt, is a focus of such debate.

The Aswan Low Dam was built in 1902 to save flood waters for dry season irrigation. The much larger Aswan High Dam took eleven years to build\textsuperscript{28} and required materials equal to seventeen Egyptian pyramids.\textsuperscript{29} It is a rockfill dam that controls the majority of the Nile's flow through Egypt. The resulting reservoir, Lake Nasser, is the second largest manmade lake in

\textsuperscript{26} Hamilton, supra note 6. See also, Jacobs, supra note 3, at 96 (stating that the 1989-90 flood yielded 74 billion cubic meters (BCM) of water, whereas previous floods discharged 84 BCM).

\textsuperscript{27} Hamilton, supra note 6. The United Nations Development Program describes water stress as a rate of 1,700 cubic meters water available per person and water scarcity as 1,000 cubic meters or less per person, Comprehensive Assessment of the Freshwater Resources of the World: Report of the Secretary-General, U.N. Commission on Sustainable Development, 5th Sess., U.N. Doc. E/CN.17/1997/9 (Apr. 1997), \textit{available at} gopher://gopher.un.org/00/esc/cn17/1997/off/97-9.EN. These calculations are somewhat misleading, as they overlook countries such as the Sudan, listed as having 5,433 cubic meters per capita but still suffering water shortage and contamination because most of its water arrives in floods during monsoon seasons. In addition, low-income countries such as the Sudan have been unable to fully utilize or control the floodwaters that often damage buildings and agriculture.

\textsuperscript{28} Abu-Zeid, supra note 18.

\textsuperscript{29} Id.
the world, with a reservoir capacity of 169 billion cubic meters. Roughly one quarter of its capacity is reserved for flood protection against the highest floods projected for the next 100 years and for sediment deposits expected over 500 years. In order to build the dam, several temples were removed to higher ground to avoid being engulfed by the reservoir. The reservoir then submerged the old town of Wadi Halfa and displaced 50,000 indigenous people.

The Aswan Dam controls annual floods on the Nile, preventing floodplain damage and facilitating steady irrigation waters to cropland via a series of manmade canals. Today, Egypt irrigates over three million hectares of farmland, allowing for year-round crop growth, and additional arable land is created through desert reclamation projects. Although dam-prompted irrigation did increase crop yield per annum from the 1960s to the 1970s, in the 1980s, growth fell slightly under the 1960 level, in step with the rise in population. The Aswan Dam also provides about half of Egypt's power supply, increasing its economic capabilities and decreasing its dependence on other exhaustible energy sources. Consistent water flow has improved navigation, thereby increasing efficient transportation of goods and services. In addition, Lake Nasser has developed into a flourishing commercial fishery. Nile Perch and other sedentary fish species thrive in these waters, creating a more stable fish yield than that before the dam.

The dam, however, also created several problems that have had serious negative effects on both the land and its inhabitants. To begin with, reservoir inefficiencies have decreased the total amount of water previously entering downstream Egypt. For instance, three meters of water evaporates off the surface of Lake Nasser annually. Although the dam curtailed the floods, it also created a need to fertilize cropland. Annual floods previously deposited nutrient-rich silt from the Ethiopian Plateau onto the downstream floodplain, making this some of the most fertile soil in Africa. Now, the silt is caught in Lake Nasser, uselessly filling the bottom with stagnant sediment, farmers must

33. Hamilton, supra note 6.
purchase and use artificial fertilizer, produced in local plants that in turn use the water and flush wastes into the remaining Nile waters.\textsuperscript{40}

As beneficial as irrigation has been, each reclaimed portion of land is of lesser quality than that already cultivated.\textsuperscript{41} Poor drainage of irrigated lands has led to over-saturation and increased soil salinity. Inefficient irrigation techniques and inadequate drainage result in waterlogged crops and soil salinity, stressing the previously fertile Nile banks and delta region. Even with intense irrigation, Egypt imports 40 percent of its grain and constantly struggles to maintain food security for its growing population.\textsuperscript{42} Agro-economists suggest that grain imports are actually units of "virtual water;" that is, importing one ton of wheat is equal to the 1,000 tons of water required to grow the wheat. As such, importing grain appears to be a more efficient use of water, but by accepting imports for its main supply of food, Egypt gives up domestic food security and economic independence.

Upstream, the Sudan can expect increasing flooding at the southern end of Lake Nasser as sediment builds up behind the dam to the point where the reservoir flows over. Downstream, this same sediment was once responsible for preventing erosion of the riverbanks, bridge foundations, and the Mediterranean delta. Now, due to the dearth of sediment in the downstream flow, not only are riverbanks and bridge foundations washing away, but also the Mediterranean coastline is shrinking. The shrinking delta and lack of silt nutrients for fish fodder have led to a smaller shrimp catch at the coast and diminishing numbers of anchovies in the eastern Mediterranean sea.\textsuperscript{43} Before dam construction, migratory schools of fish made up most of the fish species in the Egyptian Nile waters, moving and spawning with the flood cycles. Since the dam, several species have drastically reduced in number, many disappearing altogether. While it is true that the Nasser fisheries produce stable quantities of commercially viable fish, the extinction of migratory schools remains a serious concern for environmentalists as well as the people living at the Nile's edge who are dependent on the downstream fish supply. Furthermore, worms and toxins pollute existing fish that are then consumed by humans. As the price of

\begin{footnotes}
\item[40] For artificial fertilizer usage per hectare, see \textit{World Bank Indicators}, \textit{supra} note 14, at 118.
\item[41] U.N. \textit{Food & Agric. Org.}, \textit{supra} note 8.
\item[43] \textit{Id.}
\end{footnotes}
contaminated fish drops, the city’s poor continue to eat it out of simple need and perhaps because they do not realize it is polluted. The Egyptians today cannot safely use Nile waters domestically without extensive treatment. The United States Agency for International Development (USAID) has invested over two billion dollars in urban water and wastewater infrastructure, but the situation remains dire, especially in urban areas. The head of the Internal Medicine Unit at a specialized hospital in Damietta stated that over half of the patients treated at the hospital’s Internal Medicine Unit suffer liver and kidney diseases and infections. Schistosomiasis, a parasitic disease carried by an aquatic snail, can lead to liver and urinary tract disease and cancer of the bladder. Although the disease has always been a chronic problem in Egypt, the World Health Organization notes that incidents of infection rise whenever a new dam or agriculture program is undertaken. After the Aswan Low Dam was completed, incidents of schistosomiasis in the general population reportedly increased from six percent to sixty percent in the 1930s. Cases increased again in the Sudan after the Sennar Dam was completed. Similarly, the Aswan High Dam led to an eruption of the disease, which increased from five percent of the population in 1968 to seventy-seven percent in 1993. Interestingly, reports from small dam projects show no significant evidence of a rise in schistosomiasis.

Other water-related infectious diseases, such as diarrhea, malaria, dengue, intestinal worm infections, and river blindness correspond with drinking and bathing in polluted water. Diarrhea alone causes four million deaths a year worldwide and is the leading cause of infant death in developing countries like those of the Nile Basin. Toxic chemicals dumped by various industrial operations are also responsible for harmful effects.

46. Kamel, supra note 44.
48. Abu-Zeid, supra note 18, ("Parasite's eggs have been found in mumified viscera from Tutenkhamon's tomb.").
49. WHO Press Release, supra note 47.
50. U.N. FOOD & AGRIC. ORG., supra note 8, chapter 7.
51. Id.
53. Hamilton, supra note 6.
most clearly noted in decreasing wildlife fertility, birth defects, changes in body chemistry, and other illnesses. Suspended particulate and lead pollution rates in Cairo are the highest in the world’s largest cities and cause an additional 10,000 to 25,000 deaths a year.

2. Canals

Canals also artificially alter water flow, and like dams, they bestow both benefits and costs upon the environment and humanity. Several major canals have been constructed in Egypt, including the Ismailia, completed in 1862, which connects the Nile to the Suez Canal, and the Ibrahimia, completed to irrigate middle Egypt eleven years later. The Toshka Canal opened in 1997 and was meant to reclaim by irrigation 620 acres of desert in the Sinai Desert, providing resettlement land for 5.5 million Nile Valley residents. In the Sudan, construction began on the controversial Jonglei Canal in 1970, but the work was abandoned in 1983 due to civil unrest. The controversy that surrounds the Jonglei depicts the basic issues surrounding major canal construction.

Jonglei Canal planners intended to drain the Sudd region in southern Sudan to increase water flow in the main Nile River and thus increase water for irrigation and transportation. Unfortunately, canal planners failed to take into account the life supported by the Sudd marshes, let alone its underlying ecosystem. The waters support herds, perennial fisheries, and drinking water for local indigenous people who have adapted a unique lifestyle within the Sudd. Partly because of the internal strife caused by the potential displacement of these indigenous people, the canal was considered a major failure for both the Sudanese government and the World Bank, which sponsored the project. In 1983, civil war finally halted construction, although plans to resume building persist. In 1994, then Sudanese President General Omar Al Bashir reiterated his desire to complete the project. Commentators have optimistically suggested modifying canal plans to drain a portion of the water while doing minimum damage to the region. Environmental factors are not the only concern, however. When canals and irrigation divert original water flow, indigenous people, having created their lifestyle according to previously anticipated

55. Comprehensive Assessment of the Freshwater Resources of the World: Report of the Secretary-General, supra note 27.
56. USAID, supra note 45.
60. U.N. FOOD & AGRIC. ORG., supra note 8.
61. Id.
water supply, are forced to seek new habitation. This type of human displacement was evident after the Aswan High Dam was built and a similar potential exists in the Jonglei Canal scheme.

3. Industry

As previously mentioned, factories and mills near Lake Victoria dump wastewater that returns to the lake thick with toxic chemicals, heavy metals, and other harmful substances, making it unfit for other forms of consumption without extensive treatment. In addition, mining ventures create mercury waste in the lake basin, and overuse of agrochemicals and fertilizers adds to polluted run-off that eventually joins Nile waters both at Lake Victoria and along its flow.62

Considering the amount of pollution dumped into the Nile waters along its flow, the pollution levels at Lake Nasser appear to be minor in comparison to the pollution levels in upper Egypt. "We have been able to protect Lake Nasser from pollution," stated the head of the High Dam Authority. "We survey the mud and analyze the water, plants, sand—everything related to the lake. With these samples, we are able to be very confident of the quality of water."63 These studies indicate that Egypt itself creates the severe pollution problems downstream from the Aswan High Dam. A recent report estimates that 500 million cubic meters of industrial waste are dumped in the Nile by Egyptian plants.64

4. Population and Urban Development

Irrigation projects tend to increase population densities and urbanization in irrigated areas.65 Increased urbanization encourages inefficient water usage as well as greater quantities of municipal pollution as living standards rise.66 Leaky water supply systems account for significant losses in urban areas.67 Urban development also usurps arable farming land.68 When land is converted to urban use, natural runoff

62. See ROSEGRANT & RINGLER, supra note 20.
63. Farag, supra note 14.
64. Id. See also Christina Carroll, Past and Future Legal Framework of the Nile River Basin, 12 GEO. INT'L ENVT'L L. REV. 269, 290-91 n.150 (1999).
67. McCaffrey, supra note 66, at 809 (stating that 30-50% of water is lost to faulty urban water systems).
68. See Michael Renner, Environmental and Social Stress Factors, Governance, and Small Arms Availability: The Potential for Conflict in Urban Areas, WORLDWATCH INSTITUTE, at http://wwics.si.edu/THEMES/URBAN/occasional/rennerweb.htm (last visited Aug. 17,
patterns shift and soils erode. Urban runoff contains toxic sewage compounds, vehicle exhaust, and industrial pollution that escalate as population and urban areas expand. Unfortunately, raw sewage and untreated municipal wastes are dumped into the Nile even though Egypt does have applicable anti-pollution laws. Population growth thus creates a cyclical water predicament: as demand for usable water increases, so does sewage and other urban waste, that is then flushed into the population's primary source of freshwater.

Water scarcity can easily exacerbate social disparity and poverty within a country. Inequitable distribution provokes discontent. For instance, if the Jonglei Canal plan is completed, it will usurp present Sudd waters from southern Sudan while furnishing the north with greater flow, further dividing already high tensions between the northern and relatively poorer southern regions. In Egypt, urban riots and other domestic tensions in the 1980s were directly linked to inadequate food and drinking water. Those without access to modern water treatment systems, often peasant farmers along the Nile banks, suffer the most from contaminated water. Also, poverty is more prevalent in the northern delta areas where salination encroaches on previously arable lands.

II. WATER DEGRADATION: THE LINK TO CONFLICT IN THE NILE BASIN

Rival—Latin rivius—to share a river.

Two veins of thought guide contemporary discussions concerning the future of the Nile Basin. The first is that water scarcity does and will cause conflict between basin nations, as has been threatened in the not too distant past. The second is that water scarcity encourages cooperation rather than conflict between riparian nations as they better understand the river's limits and their shared responsibility to preserve it for the benefit of all.

2001) (describing rural to urban migration, environmental degradation, and the resulting stress on arable lands).

70. Id.
72. See ROSEGRANT & RINGLER, supra note 20.
73. Jacobs, supra note 3, at 119.
74. Kukk & Deese, supra note 58, at 42-43.
75. Renner, supra note 68.
Threats and actual conflict typify Nile history. In a usual riparian rivalry, upstream territories control the water flowing downstream. Egypt, however, has been militarily and economically more powerful than upstream riparians and has historically been able to control the majority of the water flow. Ancient Egyptian rulers, British colonists, and contemporary governments all recognized Egypt's vulnerable dependence on the Nile and jealously protected its proclaimed water rights. Modern conflicts over the Nile rise, as they did in ancient times, primarily between Egypt and the Sudan over the White Nile flow, and Egypt and Ethiopia over Blue Nile and Atbara waters. Friction seems to reappear whenever Ethiopia or the Sudan propose new water development projects. In response to upstream development plans, Egypt has voiced its willingness to militarily preserve its claims on Nile waters.77

In 1970, when Ethiopia proposed a dam on Lake Tana to preserve some of the Blue Nile headwaters for itself, Egyptian President Anwar Sadat threatened war.78 In a 1978 reference to Ethiopia, President Sadat again declared, "We depend upon the Nile 100 percent in our life, so if anyone, at any moment, thinks to deprive us of our life we shall never hesitate to go to war because it is a matter of life or death."79 In 1991, the Egyptian Defense Minister commented that Egypt would not hesitate to use military force to protect its access to Nile waters.80 Sudanese militants were blamed for a 1995 assassination attempt on Egyptian President Mubarak and shortly thereafter blunt threats passed between a number of Egyptian Ministers and the Sudan's Islamic leader Hassan al-Turabi over Nile water shares.81

The second, subtler vein of thought is that water disputes lead to cooperation rather than armed conflict.82 Particularly today, as more emphasis is given to joint responsibility for sustainable management of shared resources, it is quite likely that advance planning and more sophisticated technology may ease the tension in the Nile Basin and even avert conflict.83 Egypt is starting to apply modern technology domestically by implementing updated irrigation methods and considering shifting its

77. Ameri, supra note 9.
78. Hamilton, supra note 6.
79. Kukk & Deese, supra note 58, at 46.
80. Hamilton, supra note 6.
agriculture to less water-intensive crops. In addition, planning in the form of a basin-wide agreement has thwarted rising conflict in several instances.\textsuperscript{84} Such agreements require participation by all riparian countries, fair and reasonable water allocation, and effective dispute resolution procedures, as discussed in the following section. To date, the Nile region has no such agreement in place, although it has taken steps to create an inclusive framework. Water projects spurred by the need for economic development, particularly in Ethiopia,\textsuperscript{85} cause concern for Egypt and disturb the uneasy balance between conflict and cooperation.

Ethiopia, the origin of the majority of the Nile waters eventually reaching Egypt, has been militarily and economically unable to harness the flow of its own water. In the mid-1990s, it emerged from thirty years of civil war and famine, enjoyed a period of accelerated growth and economic development during which it planned and constructed several dams, but then returned to war with Eritrea in 1998.\textsuperscript{86} So far, the Ethiopian government has overseen the construction of over 200 small dams that will use nearly 500 million cubic meters of Nile waters annually.

Ethiopia is becoming increasingly vocal in Nile water discussions. It participated in forming the Convention on the Law of the Non-navigational Uses of International Watercourses (Watercourse Convention)\textsuperscript{87} as well as the NBI.\textsuperscript{88} Furthermore, last year, Ethiopia’s Ministry of Water Resources announced a “comprehensive and integrated water resources management policy,” as well as several new projects for both irrigation and hydroelectric power.\textsuperscript{89} When Egypt warned Ethiopia about tampering significantly with their apportionment, Ethiopia responded that their hydroelectric dam plans would not lessen the downstream flow.\textsuperscript{90}

The Sudan is also planning a large irrigation and hydroelectric dam at Welega that could divert as much as 39 percent of the Blue Nile waters.\textsuperscript{91} So far, the Sudanese civil war has kept this, as well as the Jonglei Canal project, from completion. The political unrest in both the Sudan and

\textsuperscript{84} Haner & Wolf, supra note 82, at 157.
\textsuperscript{85} See generally Population Action Int'l, supra note 83.
\textsuperscript{86} The Albara River forms part of the Ethiopia-Eritrea border, linking water allocation with the present conflict. See also, Conflict Spreads in Horn of Africa, STRATFOR, April 21, 1999, at http://www.stratfor.com/services/giu/042199.asp (last visited Aug. 17, 2001).
\textsuperscript{88} NILE BASIN INITIATIVE, supra note 2.
\textsuperscript{91} Kukk & Deese, supra note 58, at 44.
Ethiopia puts the region in a precarious situation, for as peace and prosperity come to the Nile Basin countries, the potential for water conflicts increases.  

Upstream, Kenya and Tanzania plan to use Lake Victoria for irrigation projects, potentially draining 1,860 cubic meters annually from the present White Nile supply. In addition, Burundi, Tanzania, and Uganda have joined together to develop the Kagera River that feeds into Lake Victoria, again decreasing water flow through the lake and lowering the White Nile flow to Egypt.  

Meanwhile, Egypt continues plans to divert large amounts of water for major irrigation projects. The Toshka Project, inaugurated in 1997, is still under construction. If successful, the project will relocate six million Egyptian citizens to portions of reclaimed desert in the southern valley region. The Sheikh Zayed Canal, Toshka's water source, will divert five billion cubic meters of water from the Aswan Dam reservoir annually. In northeast Egypt, the Al-Salam Canal began diverting water from the Nile in October 1997. Eventually, the canal will reclaim 420,000 acres of Sinai desert. Clearly, any significant upstream diversion of Nile water will severely limit the success of these projects and cause further strain on Egypt's already tight water security.

Recent conference reports suggest that alone, freshwater access and quality problems do not automatically lead to international or even local conflict; rather, political strife is the main instigator of international conflict. Nile Basin countries do have several political differences unrelated to the Nile waters. Environmental issues are, however,

95.  Sheikh Zayed Canal 60% Completed, ARABICNEWS.COM, Dec. 11, 2000, at http://www.arabicnews.com/ansub/Daily/Day/001211/2000121137.html. As of December 2000, the Sheikh Zayed Canal was 60% constructed. Id.
increasingly linked to traditional national security issues as resource degradation creates internal desperation and political instability. In the general context of interstate relations, initially unrelated political disputes can become tangled in transboundary freshwater management. Considering the history of strife over Nile waters and the present state of freshwater scarcity, the Nile Basin appears primed for conflict. Egypt's willingness to participate in the Nile Basin Initiative provides some optimism that a proper basin-wide agreement will be constructed before disputes lead again to armed conflict. The need for such an agreement is imperative for the stability of an already stressed region.

III. INSTRUMENTS AND AGREEMENTS

Early agreements between riparian countries were woefully inadequate for water management or preservation, as they were based on British colonial aspirations focused on exploiting rather than preserving the Nile River. Understanding that the Nile waters held great economic and political importance for a successful occupation, the British, on behalf of Egypt, concluded an agreement with Ethiopia in 1902 to guard Egypt's claim on the Nile. After extensive conflict between the Sudan and Egypt, the British and Egyptian governments concluded the 1929 Nile Waters Agreement on behalf of both countries. This Agreement stipulated that construction on the river, its tributaries, or its source that would possibly obstruct the Nile's flow and affect Egypt's own exploitation of the water would be impermissible. The Agreement then allocated 48 billion cubic meters (BCM) of water annually to Egypt and four BCM for Sudan, completely disregarding the eight remaining riparian countries.

After gaining independence in 1953, the Sudan demanded modification to the existing Agreement. The years between 1954 and 1958 were particularly volatile between economically suffering Sudan and economically advantaged Egypt, but in 1959 the two countries finally

102. See Bertrand Charrier et al., Water, Conflict Resolution and Environmental Sustainability in the Middle East, ARID LANDS NEWSLETTER, Fall/Winter 1998, at http://ag.arizona.edu/OALS/ALN/ALN44/charrier.html.


104. See Carroll, supra note 64, at 276-77.

105. Exchange of Notes Regarding the Uses of the Waters of the Nile for Irrigation, May 7, 1929, Egypt-U.K., 93 U.N.T.S. 43.

106. Tadros, supra note 7, at 1095.
settled on a division of water.\textsuperscript{107} The 1959 Nile Waters Agreement re-allocated 55.5 BCM to Egypt and 18.5 BCM to the Sudan, but still excluded all other riparian countries. Moreover, the parties agreed to "adopt a united view" on upstream riparian claims threatening their water flow.\textsuperscript{108} As the other seven riparians were not parties to the Agreement, nor were they consulted in its drafting, they are under no obligation nor feel any responsibility to honor it. The 1959 Agreement is virtually useless today considering the interconnected nature of contemporary water scarcity issues. Water degradation does not stop at political borders; therefore the entire Basin's cooperation in sustaining the Nile's viability is imperative.

Until recently, Egypt controlled Nile waters by retaining economic and military strength while asserting its "superior" historical use, supported by colonial treaties.\textsuperscript{109} In the past few years, however, Egypt has acknowledged its dependence on upstream riparian countries. While serving as Egypt's Minister of State for Foreign Affairs in 1989, former United Nations Secretary General Boutros Boutros-Ghali stated that "the national security of Egypt is in the hands of the eight other African countries in the Nile basin."\textsuperscript{110} Egypt has since participated in Nile Basin conferences and in efforts to fashion an inclusive Nile River agreement. Varying theories and needs specific to the region will make this agreement a challenge, but the entire Basin region agrees that a cooperative and effective plan for handling water scarcity problems is essential to prevent further disputes over the Nile waters.

Historical doctrines regarding watercourses conflict in both domestic and international law. Egypt asserts the "prior" or "historical use" doctrine, as well as the "no harm" doctrine, declaring that upstream riparians may not use shared waters in a way harmful to a downstream riparian country.\textsuperscript{111} On the other hand, upstream countries, including Ethiopia, espouse the Harmon Doctrine, holding that as a matter of sovereignty states may use water within their borders unconditionally, at the expense of other riparians.\textsuperscript{112} A third competing voice comes from environmentalists and indigenous people such as the Sudan's Sudd residents and advocates for ecosystem conservation over national boundary concerns.

\textsuperscript{107} Agreement for the Full Utilization of the Nile Waters, Nov. 8, 1959, The Sudan-Egypt, 453 U.N.T.S. 51, 51 [hereafter 1959 Nile Waters Agreement].
\textsuperscript{108} Id. at art. 1, § 5.
\textsuperscript{109} Tadros, supra note 7, at 1096.
\textsuperscript{110} Id. at 1093.
\textsuperscript{111} Kukk & Deese, supra note 58, at 33-34.
\textsuperscript{112} Id. at 33-34.
A. International Instruments

There are several potentially useful international instruments applicable to water resources, environmental degradation, and international relations generally.\textsuperscript{113} Two of the most relevant instruments are the non-binding Helsinki Rules and the recently adopted 1997 Watercourse Convention.\textsuperscript{114} Current principles attempt to balance competing riparian positions while recognizing that water scarcity issues are best resolved by preserving and managing the river basin as a whole, rather than in splintered jurisdictions.\textsuperscript{115}

1. The Helsinki Rules and Equitable Utilization Theory

The International Law Association published the Helsinki Rules in 1966 as a comprehensive codification of international river basin principles. Although non-binding, the Rules concern and attempt to clarify existing rules of international watercourse law.\textsuperscript{116} In this way, they are akin to and may hold as much weight as customary international law. The Rules embrace the theory of equitable utilization. Under this theory, each riparian state is entitled to a "reasonable and equitable share" of the international watercourse.\textsuperscript{117} States may utilize the watercourse in an "equitable and reasonable manner," but are urged to consider the rights and interests of all other users. "Equitable and reasonable" use is determined in light of relevant factors including geography, past and present utilization, economic and social needs, and availability of other sources of freshwater.\textsuperscript{118} As such, the Helsinki Rules establish a balancing test to resolve what use is "reasonable" according to each particular situation.


\textsuperscript{115} McCaffrey, supra note 66, at 815.


\textsuperscript{117} Helsinki Rules, supra note 114, at art. 4.

\textsuperscript{118} Id. at art. 5.
Critics argue that the Helsinki Rules are ineffective because no factor carries greater weight or preference against another. An upstream country may consider its industrial needs to outweigh a downstream country’s need for clean fishery waters. Egypt clearly considers its present usage and need, bolstered by historical rights, to outweigh Ethiopia’s need to develop its Nile water resources. Other criticisms include the Rules’ focus on past and present usage instead of future potentials and precautionary measures, the emphasis on “utilization” with little attention to conservation, and the lack of dispute resolution mechanisms. Finally, the Rules’ provisions are ultimately unenforceable. As a historical marker, however, they do solidify the equitable utilization theory, displacing outdated and impractical insistence on national sovereignty for resolving disputes over shared watercourses.

2. Current Doctrine: The Watercourse Convention

Adopted in 1997, the Watercourse Convention is a framework treaty meant to harmonize existing treaties with Convention principles. As of December 2000, only sixteen countries have signed and four countries have ratified the treaty. None of the Nile Basin countries are parties to the Convention, but nearly all participated in the draft discussions, suggesting willingness to consider Convention principles in a regional agreement.

As a framework, its rules are flexible to fit various basin scenarios. Like the Helsinki Rules, the Watercourse Convention endorses “equitable and reasonable utilization” and lists similar factors relevant to identify “reasonable” use. Article 7 states an “obligation not to cause significant harm to other watercourse States,” and provides for possible mitigation or elimination of such harm and, “where appropriate, to discuss...compensation.” States are to notify other riparians of planned water projects, but only when the project “may have a significant adverse effect” upon them. The term “significant” remains

119. Tadros, supra note 7, at 1106.
120. Id. at 1112.
121. See e.g., A. Dan Tarlock, Safeguarding International River Ecosystems in Times of Scarcity, 3 U. DENY. WATER L. REV. 231 (2000), for a discussion on how international law is evolving to take ecosystem conservation into account.
122. Watercourse Convention, supra note 87. E.g., Colleen P. Graffy, Water, Water, Everywhere, Nor Any Drop to Drink: The Urgency of Transnational Solutions to International Riparian Disputes, 10 GEO. INT’L ENVTL. L REV. 399, 413 (1998).
124. Watercourse Convention, supra note 87, at art. 5-6.
125. Id. at art. 10.
126. Id. at art. 7.
127. Id. at art. 12.
undefined, allowing for local interpretation but also leaving room for abuse, misunderstanding, and argument. While several provisions for information sharing with other riparian countries are included, items such as environmental impact assessments are merely encouraged rather than required before countries undertake water projects.

Critics argue that the Convention falls too heavily in favor of developing watercourses for economic use rather than preserving them as ecosystems.128 It does, however, address intergenerational rights in its preamble and sustainable utilization in articles 5 and 24, and articles 21 through 28 address pollution prevention in some detail. Granted, the Convention neither endorses harm mitigation nor embraces precautionary measures, but in cases such as the Nile Basin where simply agreeing to convene in a basin-wide discussion on river sustainability is a fresh and tenuous venture, perhaps including less elastic provisions at this stage would hinder states from accepting the Convention at all.129

As it is, only Kenya and Uganda voted in favor of the Convention but still have not signed or otherwise formally accepted it. Burundi voted against the Convention (for national sovereignty reasons), and Egypt, Ethiopia, and the Sudan, the primary players in potential Nile Basin conflict, abstained.130 Ethiopia and the Sudan expressed concern that Egypt would construe the "adversely affect to a significant effect" clause too narrowly, such that any upstream project would affect Egypt "adversely," thus violating the clause.131 Egypt meanwhile reiterated its position requiring more emphasis on prior use and lack of alternatives.132

Although the Nile Basin countries did not ardently endorse the Watercourse Convention, they may still include select provisions in future regional instruments. The Nile Basin Initiative, the recent joint effort to resolve Nile Basin issues, adopts the Convention's main principle of sustainable development and management and then outlines a program tailored for regional implementation. Regional mechanisms have the ability to more efficiently and speedily aid troubled areas than general international instruments, because they can be written precisely for that situation. A framework such as the Watercourse Convention could be very useful in guiding drafters of a Nile Basin treaty.

128. See Tarlock, supra note 121.
129. See Lien, supra note 116, for an assessment of the Convention's applicability to Middle East river disputes and states' potential arguments had they adopted the Convention.
131. Id.
132. Id.
B. A Regional Solution: The Nile Basin Initiative

Nile Basin countries united for the first time in 1992 to pursue a joint dialogue on sustainable development and management of the Nile waters. Out of shared need, water affairs ministers from the Nile Basin countries gathered a group of scientific professionals from all riparian countries for discussions that culminated in the 1997 Nile Basin Initiative (NBI). The NBI is intended to be a temporary, transitional arrangement to implement programs until members establish a permanent legal framework. The NBI’s final conference is scheduled for June 2002, when members will discuss options for such a permanent instrument.

Member countries emphasize economic utilization of the river. They state that their vision for the NBI is “to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.” The Policy Guideline, however, refers to the Nile as “a resource which needs to be held in trust for future generations” and the necessity for immediate action to avoid environmental degradation. Thus, the wording acknowledges an urgency to protect the Nile, not only for present usage, but for the future as well.

The NBI’s Strategic Action Program implements water use and preservation programs. It functions at two levels and contains both proactive and reactive provisions. The Shared Vision Program creates a coordination mechanism and “enabling environment” to implement programs on a basin-wide scale. Next, Subsidiary Action Programs will plan and implement action “on the ground at the lowest appropriate level, taking into account benefits and effects of planned activities on other countries.” Potential projects include efficient irrigation use, hydropower development and trading opportunities, environmental analysis, and public information exchange.

133. Members of the Initiative are Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. Eritrea refused to attend the conference in Addis Ababa due to the present conflict with Ethiopia.
137. Id. at §1.
139. NBI Policy Guidelines, supra note 136, at §3.
140. Id. at §4.
141. NILE BASIN INITIATIVE, supra note 2.
Drawbacks of the NBI include its lack of concrete dispute resolution provisions and the omission of neutral scientific experts in decision-making processes. In addition, while the NBI considers impacts on the environment and future generations, it is silent regarding subgroups such as the Sudd region dwellers, who could potentially halt action programs, just as they appear to have halted the Jonglei Canal plan. Particularly considering the political history in the Nile Basin, a workable dispute resolution mechanism is necessary to make the NBI and its progeny successful.

The NBI is still very new and it is unclear how Nile riparians will proceed with a permanent agreement, considering past tensions and present standpoints. As hopeful as it appears, several factors may hinder cooperation in the Nile region. For example, unpredictable monsoon rains, low or negative economic growth in several basin states, high population growth rates, and intra-state conflicts, all compounded by burgeoning water-related needs, may break down negotiations. Furthermore, the expense of water projects in the Nile region may be prohibitive, even with foreign aid. Still, commentators call it the most promising collaborative effort in the Basin thus far.

The 1960 Indus Waters Treaty between India and Pakistan illustrates how countries with a history of mutual conflict can resolve water disputes with the proper framework in place. Like the tense history between Egypt and its southern neighbors, India and Pakistan have a history of conflict fueled by disagreements over use of the Indus River after India was partitioned in 1949. After partition, the Indus River headwaters remained in India while the major portion of irrigated land lay in Pakistan. Disputes raged for years, India asserting territorial sovereignty and Pakistan seeking equitable use. With the World Bank acting as mediator, India and Pakistan finally constructed the successful Indus Waters Treaty.

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142. To date, the success of NBI projects and level of cooperation between countries is undocumented. For updates, see id.
143. Dinar, supra note 103.
144. See Nile Basin Council of Ministers Meet in Khartoum, ADDIS TRIB., Aug. 4, 2000, at http://allafrica.com/stories/200008040108.html. The International Consortium for Cooperation on the Nile (ICCON) was created to raise funds for transboundary projects on the Nile. At present, the United Nations Development Programme (UNDP), the Food and Agriculture Organization of the United Nations (FAO), several European governments, and the Canadian International Development Agency (CIDA) have joined as donors.
allowing unrestricted use for both countries while each publicly asserted victory for its original position.\textsuperscript{149}

The Indus River consists of six tributaries and courses through only two countries, creating the possibility of unrestricted use of the water. The Nile waters, on the other hand, affect nine countries and narrow into a single river in the Sudan before entering Egypt. The option for unrestricted use for any, some, or all of the Nile riparians would be impracticable considering these characteristics as well as Egypt's increasingly desperate water situation. While this amicable allocation arrangement may have been the primary feature of the Indus Waters Treaty to satisfy both parties, the treaty's success has been largely attributed to its extensive dispute resolution provisions and the inclusion of non-political actors, such as neutral scientific experts, as advisors.\textsuperscript{150} By including these provisions, volatile situations have been diffused in the scientific rather than the political arena.\textsuperscript{151}

Successful basin-wide agreements have most often resulted from strong third party or NGO involvement.\textsuperscript{152} The NBI grew out of years of non-governmental technical and scientific cooperation rather than government or administrative bureaucracy.\textsuperscript{153} Hopefully then, the emphasis on the science of the Nile rather than territorial sovereignty will continue to guide the NBI discussions, easing political tensions and neutralizing past differences.

**CONCLUSION**

The Nile Basin is in desperate need of an inclusive, effective agreement concerning the Nile River. Each riparian country depends on the others to use the waters fairly and responsibly. Although Egypt possesses the greatest economic and military strength in the region and has thus been able to preserve its historical claim to the waters, it is also the most vulnerable to upstream pollutants and diversions. As Egypt has virtually no other freshwater source available, further degradation of the Nile River could easily lead to massive human and environmental suffering. At the same time, the Sudan and Ethiopia bear poverty that could be alleviated with efficient usage of their own upstream waters. The entire Basin region suffers water-related problems from health issues to soil degradation to simple scarcity. The situation grows grimmer as domestic, industrial, and

\textsuperscript{149} Id. at 427.

\textsuperscript{150} Id.

\textsuperscript{151} Id.

\textsuperscript{152} Dinar, \textit{supra} note 103.

\textsuperscript{153} Posthumus, \textit{supra} note 145.
agricultural water needs escalate with population growth. Conflicts that characterize much of the Nile's history recur at every announcement of a new water project on the river. As water stress becomes water scarcity, more water projects will be planned and constructed, increasing discord between riparian countries.

The history of Nile conflict, however, need not continue. Nile riparian countries, including Egypt, now acknowledge the shared responsibility to preserve and manage the Nile River. The Nile Basin Initiative is a bold and revolutionary step for the region, bringing together all regional riparians for the first time to implement a practical strategy for sustainable use and development of this shared resource. The legal framework expected to evolve out of the NBI will most likely adopt the general principle of equitable utilization from existing watercourse instruments such as the Helsinki Rules and the Watercourse Convention. To be effective, the NBI must go further and construct an efficient and explicit basin-wide treaty providing a neutral dispute resolution mechanism as well as specific pollution prevention procedures. Although the NBI focuses on use and development of the river, it has the potential to be environmentally progressive as it already emphasizes preventing harm and preserving the waters for future generations.

The Nile Basin countries have an enormous challenge ahead. The goals of preservation and management compete with the immediate needs of all riparians suffering water shortage. Averting future conflict in the region depends on efficient water usage in the face of such need and true cooperation between riparian countries.

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