'Out From the Nile': New Rivers, New Civilization in Egypt, Sudan

by Marcia Merry Baker

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The beautiful photographs coming from Mars, showing the terrain of the Red Planet, bring to mind the Earth's own Red region—the Red Sea Hills on the west bank of the Red Sea. And bring to mind our ability for "terra-forming"—the idea that "natural" landscapes can be man-made, both in space, and here on Earth, for the benefit of civilization. Therefore, "natural" resources are limitless.

From this vantage point, we report on infrastructure initiatives, and certain key interventions required for economic development in Africa, in particular, in the strategic, Nile/Red Sea nations of Egypt and Sudan (combined population of over 87 million), whose resources and economic development potentials are rich and vast.

On Jan. 9, 1997, Egyptian President Hosni Mubarak detonated a symbolic explosion in the desert near the lake of the Aswan High Dam, officially opening construction on a canal to create new oasis communities in the Western Desert. He called it Egypt's "Project of the Twenty-First Century," and said that it will create conditions to restore food self-sufficiency in the homeland, and that, "A new era is opening in Egypt—the era when we go out of the confines of the narrow Nile Valley."

At the same ceremony Prime Minister Dr. Kamal el-Ganzouri, said, "The event is not only establishing a canal or expanding agriculture, it is much more important." It is "historic;" it is "civilization in the making."[1]

Contrary to the lies of the zero population growth advocates, who say the resources of this region are "all used up"—in particular the waters of the Nile—the technologies exist, with the right applications, to literally make the desert sands bloom in this showcase region, and host millions more people.[2]

In terms of one of the most fundamental of all natural resources, annual potential photosynthesis, Egypt and Sudan occupy a position on the planet with a mean annual potential photosynthesis rate of 25 grams per square meter per day, the same as, or greater than, most of the world's current garden-spots.[3] The challenge is just to organize the *economic landscape*—water, power, transport, urban centers, and agriculture zones—to realize the potential.

The following review begins with rail transportation, then covers the physical resources base and infrastructure development plans.

Land-Bridge Crossroads: Build Rail Links

Strategically, the nations of Egypt and Sudan occupy the main geographic transit link between Africa and the Eurasian land-mass; thus they are a development crossroads. On the globe of the world's economic resource base, the whole continent of Africa is positioned between two great oceanic basins of development: the Atlantic and the Indian Ocean, as well as the Mediterranean Sea. But what stands out, looking at the intercontinental map of the Eurasian Land-Bridge—the New Silk Road infrastructure plan—Egypt and Sudan occupy a pivotal position as the overland route between Africa, via the Middle East, and all of Europe and Asia. If your starting point is Asia, you travel, across the Sinai, over the Suez Canal, technically the breach between the two continents, and then, through Egypt, to whatever your destination point in Africa; or go in the reverse direction.

Figures 1 and **2** show the existing rail grid of Africa as of the 1990s; and the map of proposed new rail lines and upgrades. The locations of Egypt and Sudan are highlighted.

Overall, there are no cross-continent lines; and outside of South Africa, no dense grids of regional lines. There are several incompatible gauges; and railway lines are run-down. The sparse distribution pattern shows how the lines dating

1. "Investing in Egypt, No. 4" January 1997, General Authority for Investment in Egypt, Cairo.

2. Statements that water scarcity and water wars, are inevitable, come regularly from the World Bank nexus opposed to infrastructure development. For example, the Washington D.C.-based International Food Policy Research (part of the World Bank-run CGIAR) states, "Strife over water is erupting throughout the Middle East, from the watersheds of the Nile to the Tigris and Euphrates. . . ." (Press release, June 14, 1995, "Potential for International and National Water Conflicts Is High in Coming Years.")

3. "Potential Photosynthesis and Crop Productivity," Jen-Hu Chang, *Annals of the Association of American Geographers,* March 1970.

from colonial times were meant to serve purposes of looting, not development.

The age of completion of the main links of the Sudan lines shows the colonial legacy:

- Wadi Halfa to Atbara: 1896-98
- Atbara to Khartoum: 1899
- Khartoum-Sennar-El Obeid: 1910-12
- Sennar to Port Sudan: 1926-29

After Sudan became independent in 1956, its plans to upgrade and expand its rail system were repeatedly thwarted by the International Monetary Fund (IMF) and its brother agencies.

Egypt, likewise, has next to no rail grid development, only point-to-point. There is the century-old Alexandria-to-Aswan system; and the link-up of main cities by rail. The Cairo Metro is notable (the first subway in Africa or the Middle East, it was opened in 1987, with an initial line length of 4.2 km), but the lack of density of rail is associated with the restriction of economic activity to the Nile Valley, discussed below.

What is required is to build the key transcontinental routes, and start to fill in the regional development lines, as the topology of each region's economic landscape requires. An example of a recent regional link, is the first railway to be built in the Western Desert of Egypt, which goes from the New Valley governate in the Western Desert to the Safaga Port on the Red Sea, via the Upper Egyptian town of Qena.

This and similar lines constitute the potential for *corridors* of development, where concentrations of power, water, and transport are available for population centers of agriculture, manufacturing, and cultural activities.

As part of the "Land-Bridge" world infrastructure drive, several projects are obvious for the international role of Egypt and Sudan. Continentally, a complete rail line running from Egypt southward, is essential to provide the communications line all through eastern Africa, and to constitute a development corridor at key hubs, and at nodes of development along the way. This north-south line intersects an essential east-west line, from Djibouti to Dakar, and others farther to the south.

One outstanding missing link in Egypt and Sudan, is the lack of rail connection at the border of the two nations. At present, the Egyptian railway stops at the northern end of Lake Nasser. The Sudan Railway begins at Wadi Halfa, at the southern end of Lake Nasser. The connection is made by ferry.

Along the east-west route in northern Africa, the trunk rail line interconnects, through Egypt, into Gaza and Israel, to all of Asia, and northward to Europe. This is a priority location for magnetic levitation rail lines.

At key intersection points, hubs of concentrated economic activity are defined, for manufacturing, trade, and education and services.

The Suez Hub

Such an international focal point for economic development is the Suez region, where the trans-oceanic shipping route through the Suez Canal, crosses the trans-continental land-bridge link. A major upgrading of the canal is in order, to accommodate increased traffic between the Indian Ocean Basin, and the Mediterranean Sea/Atlantic Ocean.

At present, plans are under way for a "Suez Bridge Project," for new rail and roadways to span the Suez Canal at the northern end. The site will be near the town of Qantara, 47 km south of Port Said city. The publicized plans call for a fixed-road bridge alongside a swing-bridge to carry a railway. Under the Suez Canal Authority recommendations, the road bridge span would start 5 km out from each bank of the canal, and rise to a height of 80 meters. The main, middle section of the bridge will be 3.9 km.

The proposals are part of government plans for the region, that include developing the east bank of the Suez Canal as a zone for electronics industries, and otherwise developing industry and mining in the Sinai, as well as tourism. There are plans to irrigate 160,000 hectares (400,000 acres).

The estimated cost of the Suez Bridge Project is $500 million. Construction is expected to start in 1998. Among the participants in the planning and funding, is the Japan International Cooperation Agency (JAICA), which was involved in preliminary studies on how to span the canal without disrupting shipping.

The Physical Geography

Snapshot views of the essentials of the physical geography of the region, are shown on the maps of Africa, with Egypt and Sudan highlighted, in **Figures 3, 4,** and **5.** Most outstanding is that rainfall is negligible throughout all of Egypt, and down into northern Sudan; Egypt is in the center of the world's largest desert expanse, from the Sahara to the Arabian Desert.

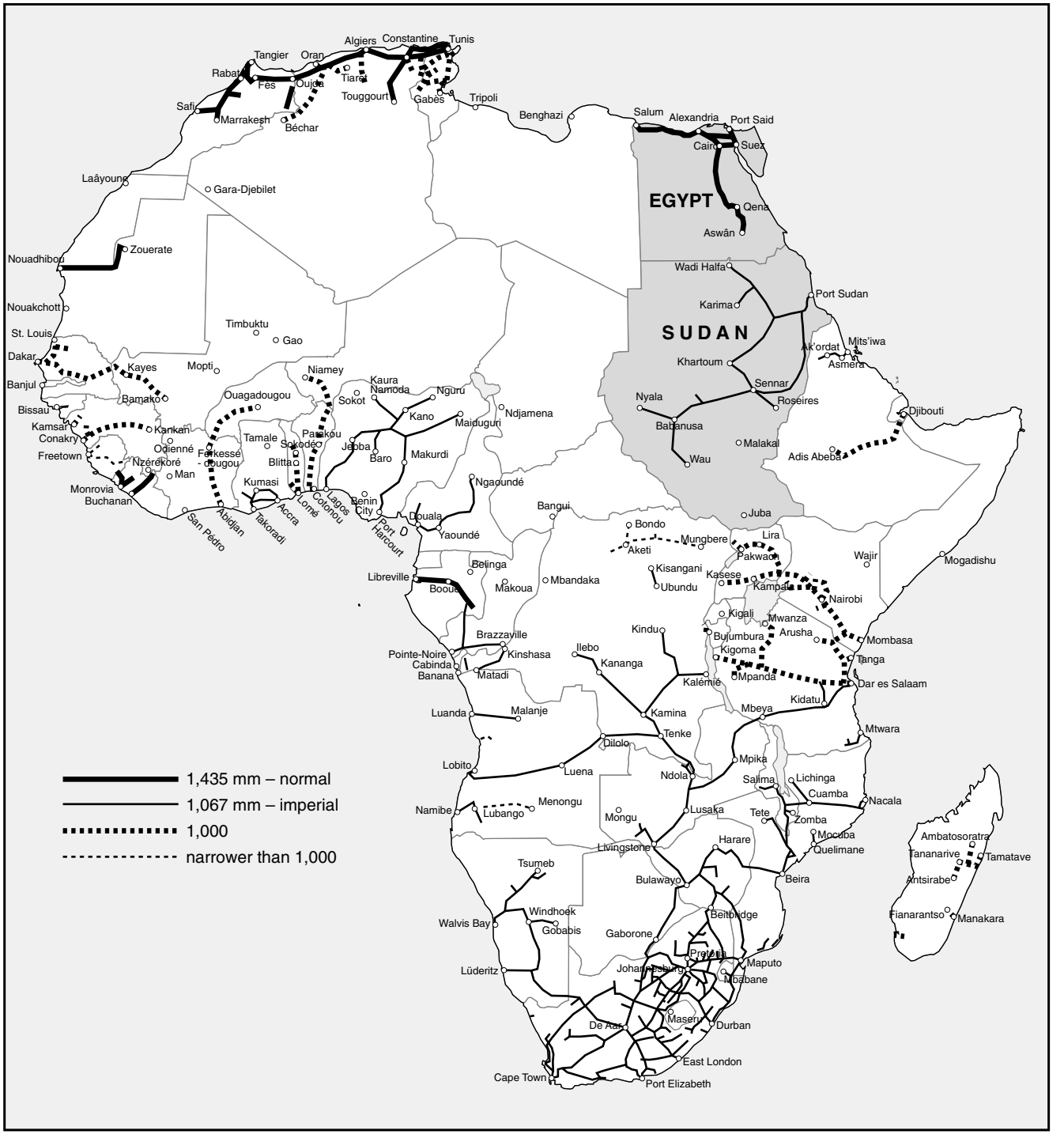
In Egypt, the population of 60 million inhabit only 6% of the land area, along the Nile Valley and Delta, making Egypt foremost in the density of persons per square kilometer of inhabited land. As of 1990, over 10.5 million people, 20% of the population, lived in the urban area of greater Cairo. The population density within Cairo's boundaries averages 26,000 people per square km. Almost all of the rest of the Egypt's desert land area, awaits reclamation and development.

The situation is just the opposite in Sudan, which is the biggest nation in all Africa (equivalent to one-third the area of the contiguous 48 states of the United States), and has a population of only 28 million people. Most of the land is arable grasslands, located south of the desert borders. Sudan is the homeland for "Sudan grass," the plant-type from the region, and is highly hospitable for agriculture, and dense settlement. It is among the most *underpopulated* places on our planet today. Information from the Agriculture Ministry of Sudan, to summarize the richness and diversity of Sudan's "agro-ecology," is shown in **Figures 6** and **7.**[4]

4. *EIR,* June 9, 1995, "Vast Resources Exist for Economic Development in Sudan."

FIGURE 1

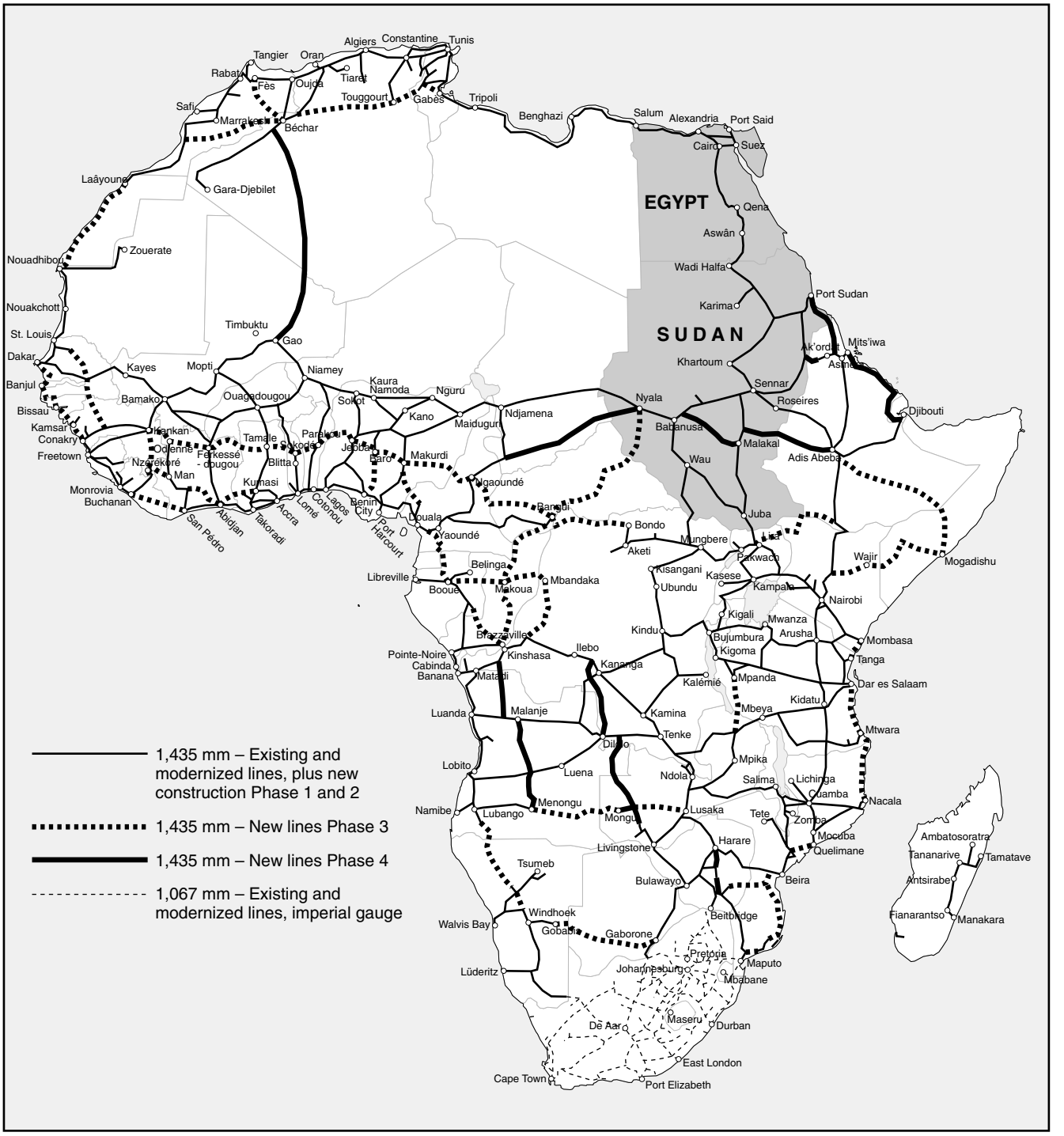
The State of African Railways in 1990



Sources: Fusion Energy Foundation, *The Industrialization of Africa,* Wiesbaden: Campaigner Publications, 1980; *The Times Atlas of the World,* New York: Times Books, 1990.

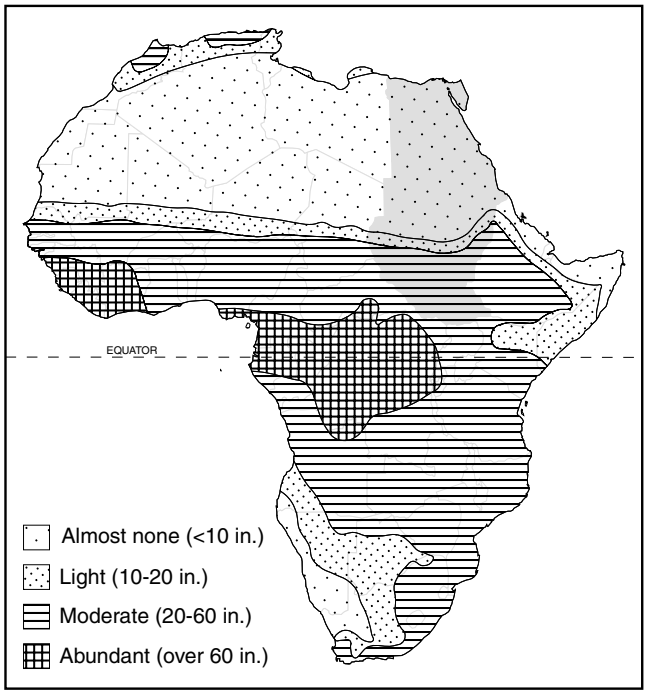
FIGURE 2

Projected African Railway Network (Main Lines)



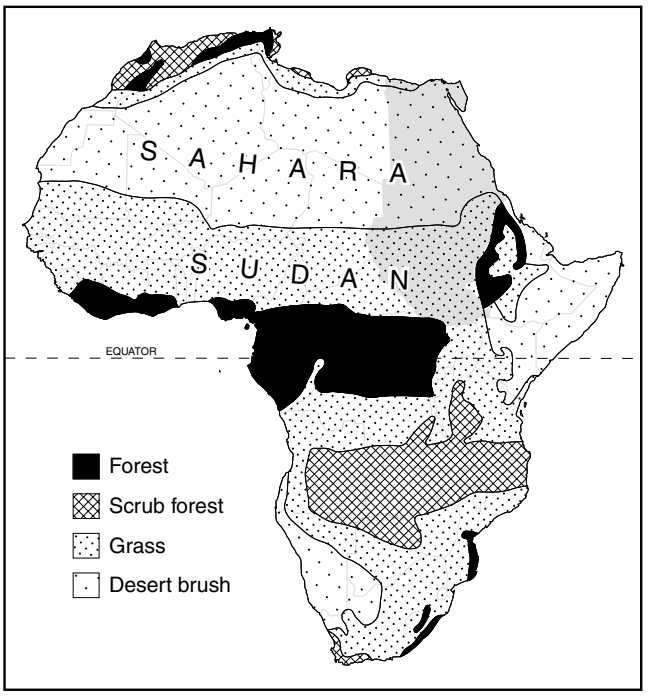
Sources: Fusion Energy Foundation, *The Industrialization of Africa,* Wiesbaden: Campaigner Publications, 1980; *The Times Atlas of the World,* New York: Times Books, 1990.

FIGURE 3
Relative Rainfall in Africa



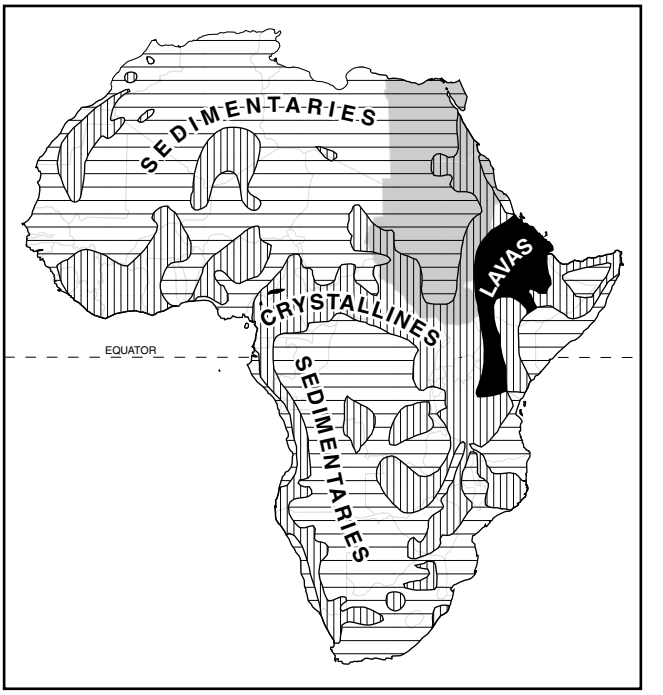
Source: George F. Deasy, et al., *The World's Nations,* New York: J.B. Lippincott, 1958.

FIGURE 4
Types of Dominant Natural Vegetation in Africa



Source: George F. Deasy, et al., *The World's Nations,* New York: J.B. Lippincott, 1958.

FIGURE 5
Rock Formations of Africa



Source: George F. Deasy, et al., *The World's Nations,* New York: J.B. Lippincott, 1958.

Finally, another way to look at the geographic essentials of these two nations, is in terms of their position in the Nile Basin. **Figures 8** and **9** show the extent of the Nile River system, and the schematic of existing and proposed waterworks projects on the Nile. The light area shows the extent of the Nile watershed, which drains an area of 3,030,300 square kilometers, constituting approximately 10% of all of Africa.

The Nile is the longest river in the world, running for 6,650 km, from its rise in the Central Lakes district, and final discharge into the Mediterranean Sea, through its delta, which has expanded outward over the centuries. At Khartoum, the White Nile and Blue Nile join. The Nile Basin encompasses land in nine nations: Burundi, Rwanda, Congo/Zaire, Tanzania, Kenya, Uganda, Ethiopia, Sudan, and Egypt.

The schematic in Figure 9 shows the major projects on the Nile River, some completed, some proposed. These waterworks mostly concern capturing and storing Nile flow, to gain maximum use.

The basic point is that, at present, the volume of the Nile flow is all "accounted for" in the economic activity supported in the basin. Though the Nile is the world's longest, it ranks far below other big rivers in volume of flow, way below the Amazon and Congo River, and below the Mississippi, for example.

FIGURE 6
Sudan's Average Annual Rainfall

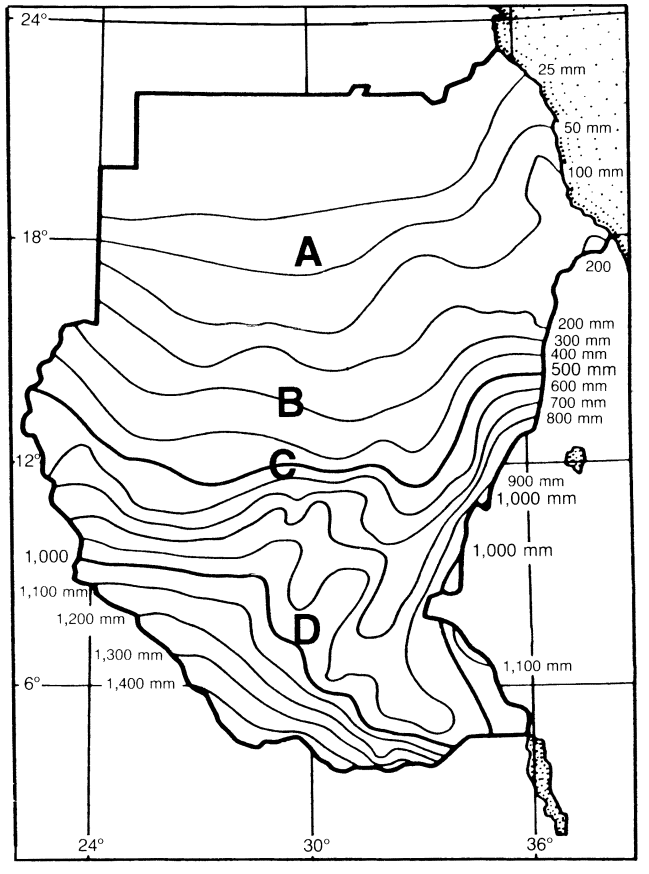
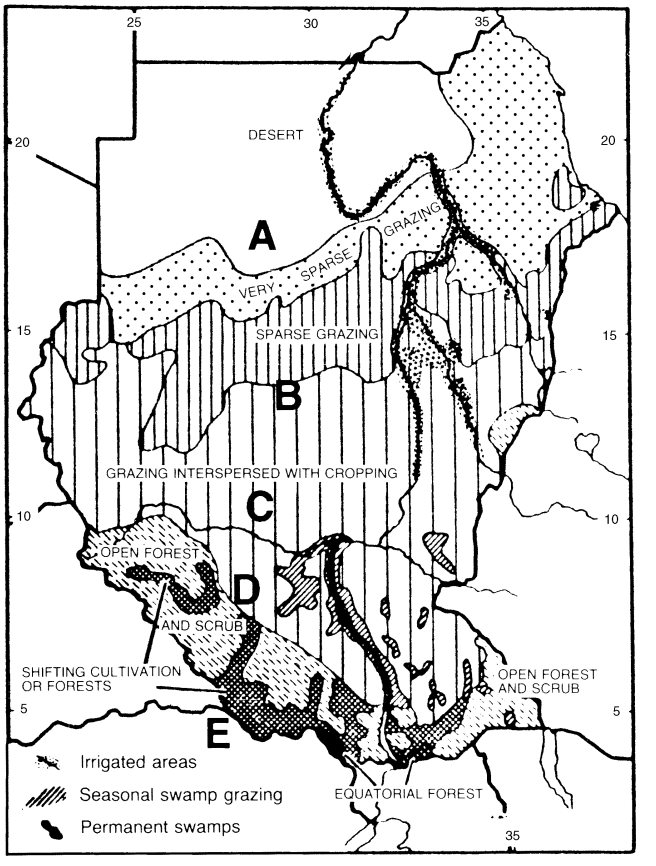


FIGURE 7
Sudan's Diverse Agro-Ecology: Land Use Zones



As measured at Aswan, the annual volume of water of the Nile is given as 84 billion cubic meters. The relative shares of use of this water between Sudan and Egypt were given in the 1959 treaty between the two nations, called, "Full Utilization of the Nile Waters," which apportioned 55 billion cubic meters for Egypt, and 18.5 billion for Sudan.

Though the Nile waters can be augmented through completing the unfinished upriver projects, nevertheless, new water sources must be brought on line for the dry lands of the lower Nile region for the 21st Century.

Nuplexes for Geo-Engineering

Even if all the possible improvements are completed on the Nile system (Figure 9), if additional water is captured and utilized, and more hydroelectric power produced, still, the ratios of water and power, on a per-capita and per-square-kilometer basis, would not be enough to support growing economies. The needed ratios of water and power per capita, and per unit area are too low from this mode of resource base.

For this region, and throughout all of North Africa and the arid Middle East, the essential source of new water, as well as power, are "nuplexes"—complexes made up of modular nuclear power stations, coupled with advanced seawater desalination systems, and industrial and agricultural projects.

Such a nuplex project was proposed for the west of Alexandria on the Mediterranean Sea, in 1988, and was discussed by leading sectors of the Egyptian government, including by Minister for Electricity Maher Abaza. The project was not pursued.

Figure 10 shows one of the latest, advanced designs for the nuclear power module for a nuplex, and gives the profile of its many advantages.[5]

Nuplexes, located at strategic sites on the Red Sea for Sudan and the Mediterranean Sea, Suez Canal, and Red Sea for Egypt, can provide the volumes of power and water flows to transform the region, by allowing for the creation of the equivalent of man-made rivers and lakes, as the basis for new

5. *21st Century Science & Technology,* Summer 1996, p. 21.

FIGURE 8
The Nile River System

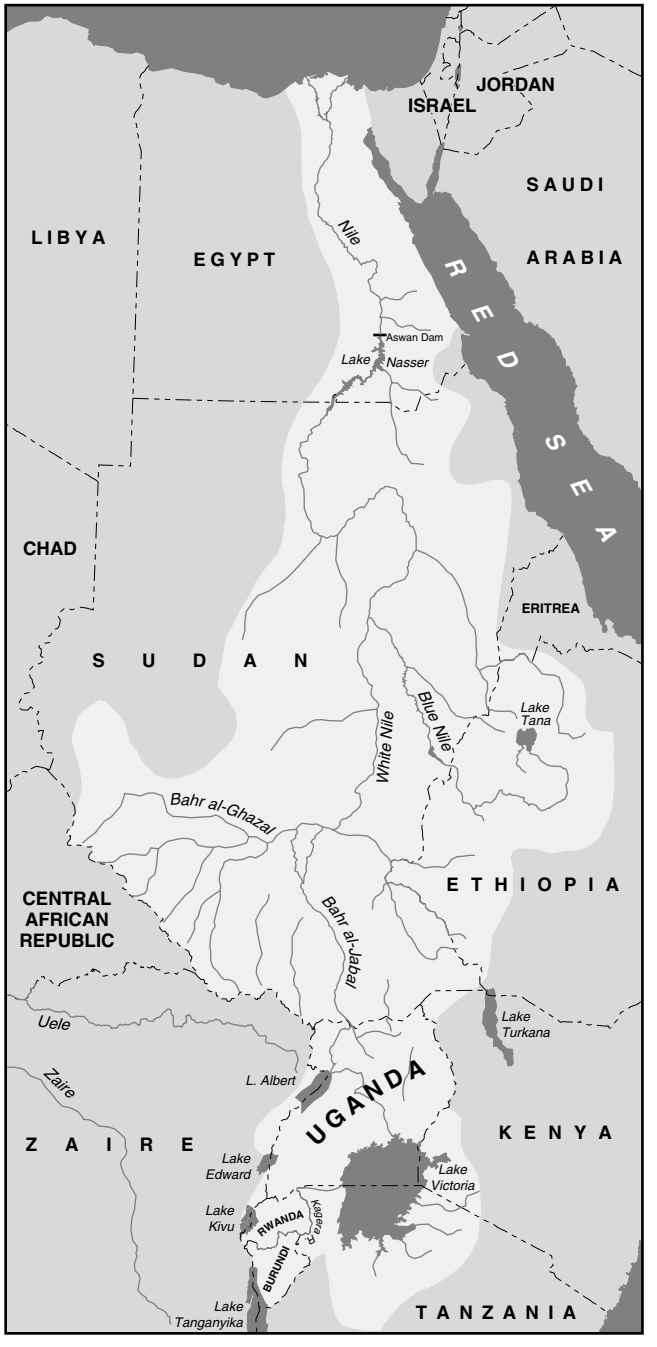
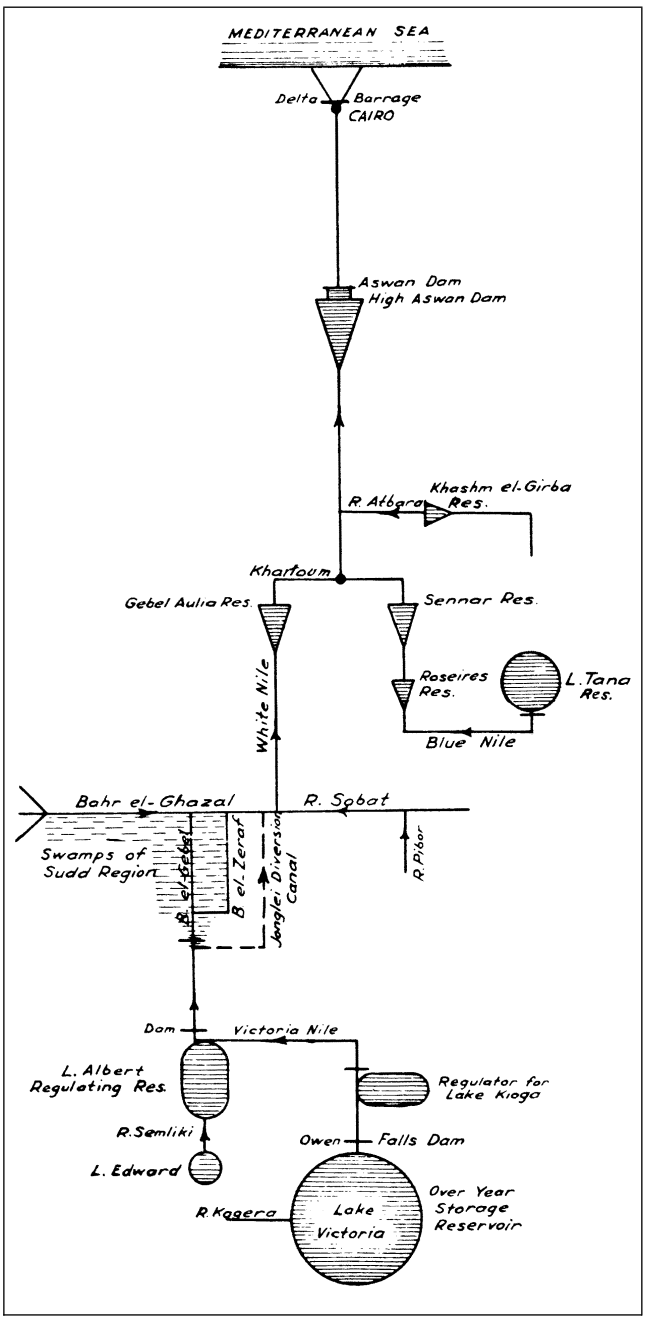


FIGURE 9
Major Nile River Projects



cities and agro-industrial regions—an overall approach, to which Lyndon LaRouche gave the name, "Oasis Plan," referring in particular to the prospects for peace in the Middle East, based on mutual economic development.

In August 1990, speaking in opposition to the gathering storm of the Bush/Thatcher Gulf War, LaRouche said of the "Oasis Plan" approach: "The primary considerations . . . for the Middle East [are] water, power, transportation, and the location of urban centers." He said, "One could define the proper approach to development of the Middle East, if no persons lived there, as if, for example, we were planning the settling of Mars, an uninhabited planet, by aid of artificial environment. We could define the future cities, the future topography of Mars, from the standpoint of its geography,

PMBR

South Africa has an active nuclear development program, which could solve the dearth of electrical power in Africa. With the Pebble Bed Modular Reactor (PBMR), a module of which is shown here with a greatly magnified cutaway of a fuel pebble, South Africa has taken the leading edge in fourth-generation nuclear technology capable of producing high-temperature heat for the production of hydrogen-based fuels and other industrial proceses, as well as cheap electricity. The PBMR's fuel, helium coolant, and reactor construction form a reactor in which the rector core cannot experience a meltdown. It uses a direct-cycle helium helium turbine to generate electricity, which is much more efficient than a steam turbine. The fuel elements are tiny kernels (0.5 mm) of uranium-dioxide-coated layers of high-temperature-resistant ceramics, which turns them into 60 mm spheres that "contain" the fission reaction. The first pilot PBMR will be completed in 2011, to be followed by commercial mass production.

and a few principles of topography."[6]

For the interim—pending construction of the nuplex system—there are significant groundwater supplies, that figure in the emerging patterns of new settlements and farmlands. In 1984, satellite overflights of the Middle East, using a "Big Camera" with remote sensing, took wide pictures of the desert regions, in order to detect the location of underground water. Later, on-the-ground teams of geologists went into the Western Desert of Egypt, and verified the presence of groundwater. Some of this water is related to the water deposits under the Sahara, which Libya is pumping into its "Great Man-Made River" tunnel, which conveys the water north to the coast. Egyptian geologist, Dr. Farouk al Baz, director of Boston University's Remote Sensing Department, has carried out in-depth research on the extent of the several aquifers apparent from satellite imaging. Archaeological evidence indicates that ancient irrigation systems fed as much as 1 million acres of land from deep wells in these aquifers.

'Terra-Forming' the Sahara and Nile

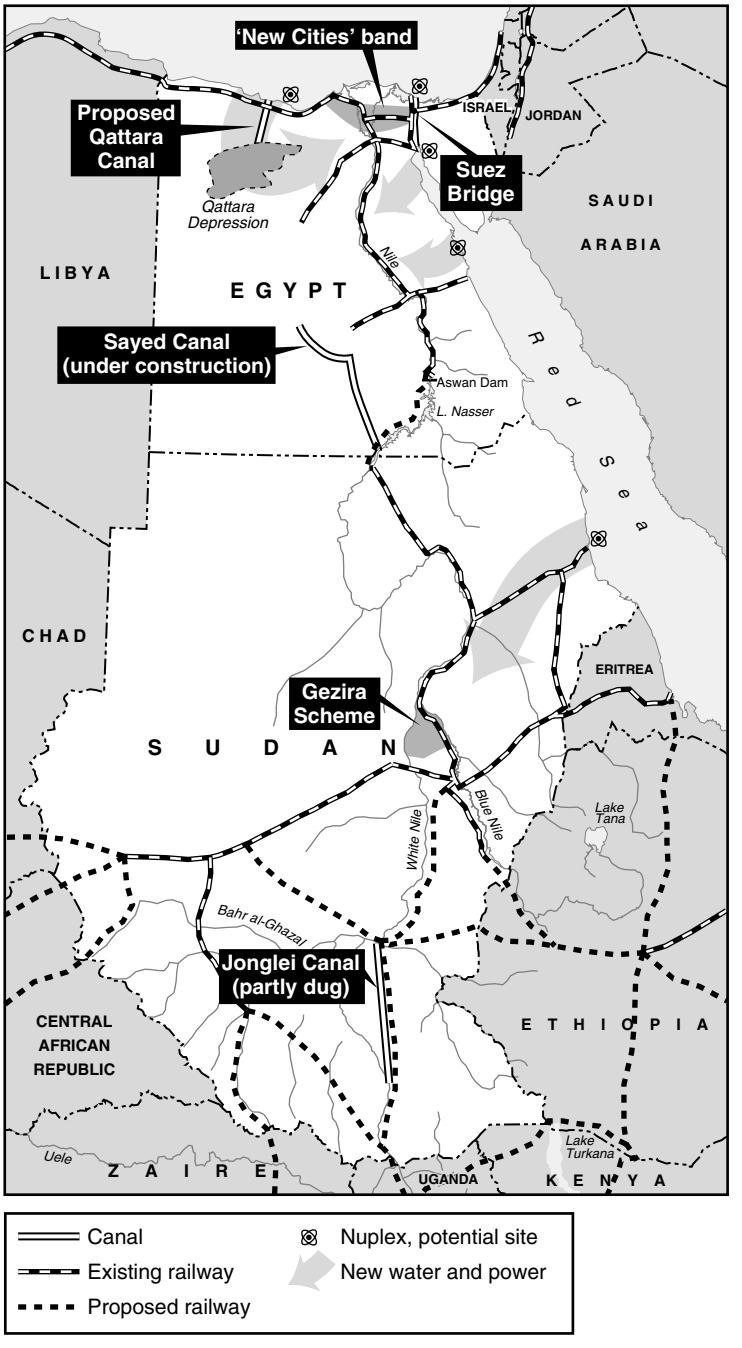
Figure 11 is a reference map showing a selection of infrastructure projects, including nuplexes, canals, and other improvements, for transforming the economic geography of Egypt and Sudan, through an "Oasis Plan" approach. The map includes both priority proposals for the future, and projects under construction right now.

In the 1970s, Egypt began its "New Cities" program, to

6. Aug. 21, 1990. Memorandum, Lyndon LaRouche, "Oasis Plan and Geo-Engineering." Among the development proposals by LaRouche and correspondents over the 1970s-90s period of dialogue: "IDB: How the International Development Bank Will Work," by Lyndon H. LaRouche, Jr., Campaigner Publications, 1975; *The Industrialization of Africa,* by the Fusion Energy Foundation, Campaigner Publications, 1980; *Stop the Club of Rome Genocide in Africa: A Critique of the Lagos Plan,* by Lyndon H. LaRouche, Jr., 1980 MS, *EIR.* A book-length critique of the "Lagos Plan of Action" (April 28-29, 1980) of the Organization of African Unity; "For a True Fourth UN Development Decade: A Concrete Solution to the World Economic Breakdown Crisis; A Discussion Paper for the 46th Regular Session of the UN General Assembly," issued by the Schiller Institute in September 1991, it features LaRouche's "Oasis Plan." Published in *EIR,* Sept. 27, 1991; "Secure World Peace with Economic Development: Implement LaRouche Oasis and Productive Triangle Programs," The Committee to Reverse the Accelerating Global Economic And Strategic Crisis—A LaRouche Exploratory Committee, September 1993.

FIGURE 11

Egypt and Sudan: Selected Infrastructure Projects, Present and Proposed, 1997



ring the old Nile Delta with a band of new towns, going all the way to the Suez on the east, and to west of Alexandria. Mostly, pumped groundwater is in use for these towns.

In the northern part of the Nile Delta and the Sinai, the El-Salam Canal is shown.

Also in the north, the roadways are shown (dotted lines) that are considered priority upgrades as a "Peace Roads" system for the Sinai Peninsula, to interconnect with Gaza and Israel, under the 1994 proposal, "Development Options for Regional Government," put forward under the initiatives of Israeli statesman Shimon Peres.[7]

The "Toshka Project" was begun in 1997, a plan to divert flow from the Nile, at Lake Nasser, into the Western Desert, to create a string of new cities, or man-made oases.

These projects are implementing the Egyptian goal of going "out from the Nile," by terra-forming the basis for new communities. Between the initiatives already undertaken, and the vast potentials that obtain from nuplex development, a new, 21st century landscape is already coming into view.

In Sudan, where vast tracts of land lie ready for the tools of development, such as mechanized farming, the proposed rail grid symbolizes the overall process required of creating "corridors" of development. The Jonglei Canal, which would form a straight cut through the famous Sudd swamplands in southern Sudan, is on hold at present, because of the strife inflicted on Sudan by the British geopolitical wargames. Completing this canal would increase the waters of the Nile by 5-7% for use downstream by Egypt and Sudan.

What the infrastructure map also indicates, is the thrust for development provided by seacoast-based nuclear-powered desalination plants. In addition, inland seawater canals could provide the sites for desalination and power generation in the hinterlands, creating the means to span the desert with ribbons of green habitation and production.

Initiatives in Egypt

The Toshka Project was officially inaugurated on Jan. 9, 1997 by President Mubarak. Thirty-seven years earlier to the day, President Gamal Abdel Nasser attended the ceremony for the Aswan High Dam. The official name of the Toshka Project is the National Project for Developing Upper Egypt (NPDUE). Toshka is the name of the depression near the Nile, at the point near the beginning of the new canal, designed to take water from the Nile along a length of 310 km to new communities in the desert.

The aim is to "go out from the Nile Valley," and

7. *Development Options for Regional Cooperation,* Government of Israel, planning document submitted to The Middle East and North Africa Economic Summit, October 1994. See also, "Palestinian Emergency Development Program, The West Bank and Gaza Strip: A Brief Economic Overview," and "Invest in Palestine," by the Palestinian Economic Council for Development and Reconstruction.

Egypt's Prime Minister Dr. Kamal el-Ganzouri and President Hosni Mubarak look over a scale model of the Toshka Project, to create a new Nile delta in Upper Egypt, which was inaugurated on Jan. 9, 1997.

to set up new agro-industrial population centers in the central Western Desert. The town of "New Tiba" (built on an area of 700 feddans) is to have a population ranging from 35,000 to 150,000; the proposed town of New Aswan (to be built on an area of 250 feddans), is intended for 50-75,000 people.

The goal is to reclaim some 1 million feddans (420,000 hectares) of land for farming, irrigated equally by groundwater, and by canal-borne water from the Nile. Water from the Nile will be diverted northwestward, pumped out at a station on Lake Nasser, just north of the Toshka outfall. The Nile water will run along a route that some geologists believe was the former western branch of the Nile. The project is sometimes also called the "New Delta" project.

Similar plans for a "New Valley" were put forward in the recent past. President Nasser had backed development of Western Desert oases, based on drawing water from the Nubian aquifers. These are the same types of water deposits lying beneath the Sahara, that are being tapped for the source of Libya's "Great Man-Made River Project."

In the 1970s, President Anwar Sadat's Administration backed the idea of permanently filling the Toshka depression, which is designed to take overflow from Lake Nasser, and build a canal to irrigate projects in the New Valley. The first time the Toshka overflow canal, completed in 1978, came into use, was on Oct. 6, 1996, when the level of Lake Nasser, behind the Aswan Dam, reached the record high of 178.10 meters (584 feet) above sea level.

Under the new Toshka Project, the government plans on taking some 5,000 million cubic meters of water out of Lake Nasser yearly. Under the terms of the 1959 Nile-watersharing agreement with Sudan, in which Egypt's annual entitlement is 55,500 million cubic meters, Egypt would then offset the Lake Nasser withdrawals by limiting use elsewhere, which the government has said can be done using a number of means, including recycling treated wastewater, and improving agricultural methods in the Delta.

A centerpiece of the construction to date is what's known as the "world's biggest bulldozer," which is a 750 horsepower earth-moving machine. The canal channel is 30 meters wide, being dug out of sand and rock. The channel is called Sheikh Zayed Canal, after Zayed of Abu Dhabi, which is financially backing the project.

The water will be lifted out of Lake Nasser at a pumping station, intended to have a capacity of 300 cubic meters (66,000 gallons) per second. It will then be transported along a course that follows underground aquifers. There is the possibility that water to irrigate reclaimed land, will additionally have the benefit of contributing to recharging the aquifers.

The pumping station will be the largest in the world. The water must be raised between 21.5 and 53 meters (70 and 175 feet). It will be powered by electricity.

The project is being supervised by the Public Works & Water Resources Ministry. As of May 1997, six pump supplying companies were shortlisted to bid by mid-July for the contract of building the pumping station. The chosen companies will then be required to form a consortium with other companies involved in other aspects of building the station, which overall, is expected to cost about $300-400 millions.

The New Cities project: In the 1970s, in connection with land reclamation, the "new cities" drive was implemented to create new population centers outside the confines of the "Old Valley" along the Nile, for new agro-industrial activity. More than eight cities were initiated along a road arc swinging from Alexandria to Cairo to the Suez (see **Figure 12**).

As President Anwar Sadat said in 1977, Suez City, built up in connection with the Suez Canal (opened 1869) was the last new city in Egypt for 100 years, and therefore, the construction of the new cities project was long overdue. The first "new" cities included El Amria, Sadat City, Nasser City, El Obour, Tenth of Ramadan, and Sixth of October.

Ramadan City, for example, was started in 1977, and built to receive 500,000 inhabitants by the year 2000. It is an example of the new cities process, which was based on the idea of

FIGURE 12
Egypt's New-Cities Program

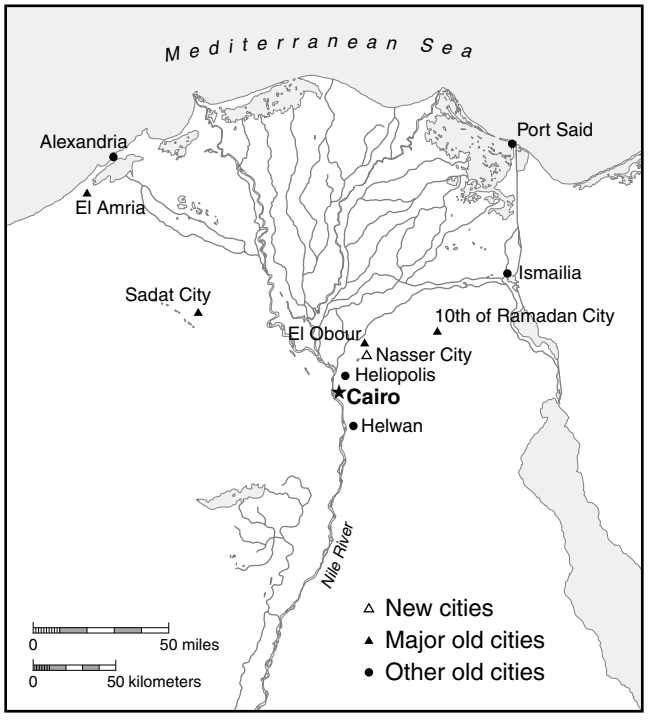
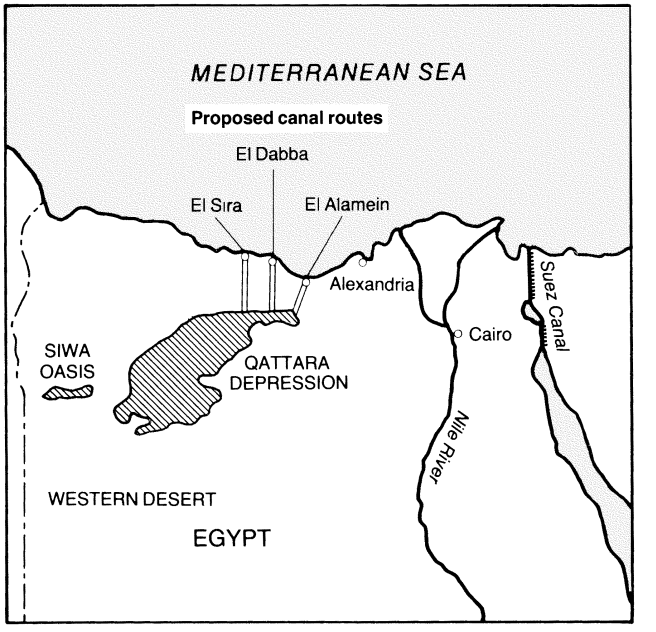


FIGURE 13
Qattara Depression Project



a division of labor among them. Ramadan was designed to be an independent hub of medium and heavy industries, ultimately providing some 150,000 jobs, including such factories as glass, pipe, and cement.

The shape of each city is custom-designed. Ramadan City was built as a hexagon, divided at the beginning into four communities of 40,000 people each. The communities were further subdivided into neighborhoods of 5,000 inhabitants each. The neighborhoods were designed with apartments, and detached dwellings, schools, medical centers, stores, and religious sites. By the early 1980s, Ramadan City was a large oasis in the middle of desert.

The original vision of the New Cities project was to see millions of people reside in the new cities by the 21st Century. However, the expansion process has been held back by the world economic depression, and its effects on the Egyptian economy, along with IMF conditionalities. At present, tens of thousands of people commute back and forth, working in the new cities by day, and returning at night to Cairo and Alexandria.

Land reclamation: During the 35 years from 1952 to 1987, nearly 1.92 million feddans of land were added to agricultural cultivation through reclamation. The goal is to continue the reclamation process to reach a total of 2.8 million feddans reclaimed by the year 2000.

In 1974, Egypt became a net food importer, after centuries of food exportation. This import-dependency, however, is not dictated by any lack of resource base, but came about because of the anti-infrastructure moves forced on Egypt over the past 25-30 years.

Qattara Depression: In northern Egypt, only 35 miles from the Mediterranean coast, is the Qattara Depression, an unusual land-form that has been studied for unique opportunities to produce power and water for "terra-forming" the locality (**Figure 13**). It is a huge, dank sinkwell, 185 miles long (about the size of Connecticut and Rhode Island), deep, and with brackish water. One proposal is to cut a seawater channel to within a few miles of the depression, then run the flow in a tunnel through the escarpment, and down into a waterfall whose plunge can be harnessed for hydropower. A German engineering plan estimated that 2.7 billion kilowatt-hours of electricity a year could be realized. Also, there are new systems of desalination membrane technology, in which the water can effectively de-salt itself by falling at sufficient pressures of pounds-per-square-inch, through the new desalination films. The feasibility of any of these projects must take into account the hydrostatic pressure that may affect the Delta and cultivated areas.

The Challenge in Sudan

Unlike Egypt, where the challenge is *to create* resources of land and water for settlement, in Sudan, there are vast *unused* resources of land, and even water.

Only 8.5% of the potential farmland base is presently under cultivation, some 6.8 million hectares (17 million acres). Figures 6 and 7 fill out the picture of the huge unused agro-resource base awaiting development. Sudan has at least 81 million hectares (200 million acres), which could easily be cultivated, which is more than half the currently cultivated acreage-base of the United States. These acres could potentially produce crops sufficient to feed all Africa. Sudan has another 88 million hectares (218 million acres) suitable for forestry, and 23 million hectares (57 million acres) for pasture.

Of the 6.8 million hectares which are under cultivation, 5.1 million hectares are under rain-fed modes, and merely 1.82 million are irrigated. Because annual rainfall is highly variable—up to 40% variation from year to year, the annual output of the rain-fed farming in central Sudan also goes up and down. These swings would be mitigated, if other inputs were made available, such as mechanization, farm chemicals, transport, and storage capacity.

These essential inputs are the kind of potential aid that could come from Iran, an idea which was discussed in Tehran, July 14-15, 1997, at the third seminar on, "Iran-Africa: Practical Ways for Development and Cooperation," by an agency associated with Iran's Foreign Ministry. At the concluding session, Mr. J. Roshanzamir, Head of Africa Studies at the Institute for Political and International Studies, which hosted the seminar, presented recommendations which noted that Iran can use its own vast experience in construction of dams, and silo storage, in Africa; and furthermore, the Silk Road of infrastructure corridors should be extended to Africa, for which Iran has a special responsibility.

Why has Sudan experienced such underutilization of its resources to date? Sudan has been politically targetted for destruction by Britain's imperial oligarchy, for the very reason, among others, that its food output capacity is so great; The nation could feed itself, the rest of Africa, and beyond. The very decision by the current Sudanese government of President Gen. Hassan Omar al Bashir, to make food self-sufficiency its first priority, was seen by the IMF-World Bank crowd as a *casus belli.* Sudan is being subjected to sanctions, in an effort to kill its productive potential.

In 1990, Sudan adopted its "Economic Salvation Program," part of which included directing resources to the agriculture sector. In 1993, Sudan became self-sufficient in food supplies. As of the 1992-93 harvest season, Sudan began food relief to points of need, including to Bosnia, Somalia, Zambia, Zimbabwe, and Afghanistan; and to Gaza and Egypt after the earthquake in 1992.

Sudanese agriculture specialist Dr. Abdalla Ahmed Abdalla, then, Ambassador to the United States, told *EIR* in 1993 that the food increases resulted from both "horizontal expansion [of cropped area] and vertical expansion—that is, productivity per unit area, resulting from the new policies introduced."

The Gezira Scheme: A leading factor in achieving food security in Sudan is the performance of the famed Gezira Scheme, which at present accounts for 60% of the nation's agricultural production, and shows the immense productivities possible from concentrated agriculture methods at future locations elsewhere in Sudan and Egypt. It is located in the state of Gezira, south of Sudan's capital, Khartoum, in between the Blue and White Nile Rivers. The immense area stretches 300 km south to north, and 100 km east to west, an area estimated to be twice the size of the Tennessee Valley Authority.

The project's farm fields cover 2.2 million feddans of relatively flat land, utilizing gravity irrigation. Out of the total land under irrigation, 1.5 million feddans per year are cultivated on a crop rotation basis. In recent years, the rotation is typically, 350,000 feddans for cotton; 400,000 for wheat, and the same for sorghum; 240,000 for ground nuts; 50,000 for vegetables; 10,000 for fodder, and the same for sunflowers; and 400,000 feddans lie fallow. There are also significant livestock herds.

Sudan as a whole has 1.7 million sheep, 1.6 million goats, 700,000 cattle, and 200,000 camels (for which Sudan is particularly famous). One-third of the animal stock on the Gezira Scheme, about 300,000 in total, was purchased from local nomadic and semi-nomadic herds of the Kenana, and is a subtype of the short-horned Zebu, known for their quality milk and meat. The purchased cattle and sheep were distributed to farmers who had no livestock. This was done in order to make full use of the annual crop residues of about 3,130,361 tons. The residues are mixed with fodder produced through crop rotation.

The Gezira Scheme is self-sufficient, in that it does not depend on Federal government funds for its functioning. The Scheme includes food processing, cigarette manufacture, and edible oil production, in addition to basic agricultural products. These include cotton, wheat, sorghum, sunflower, peanuts, and sesame.

Among the services provided centrally are fertilizers, about 100,000 tons of which are imported per season; insecticides, herbicides, jute sacks, spare parts for vehicles, telecommunications, and an internal light-railway network. The Gezira Light Railways has 1,300 km of rail lines all over the Scheme, transporting inputs to the field, and outputs to the gins and warehousing facilities. Spraying of pesticides is done with 35-40 aircraft and 200-250 tractors, from the private sector.

The huge complex is under one centralized management, run by boards of representatives, and the net proceeds go to the tenant-farm households, which number over 112,000 families, located in 1,055 villages. The tenants pay for use of land and water, and are provided with agricultural services, inputs at cost, technical and administrative supervision. The

tenants pay 4% of the gross returns of cotton, which are allocated as follows: 2% for social development, 1% for local government councils, and 1% for the tenants' reserve fund.

The state of Gezira covers an area of 36,000 square kilometers and has a population of 3.76 million, second only to Khartoum state, whose population is about 5 million. Roughly 90% of Gezira state's economy is accounted for by the Scheme, where 80-90% of the state's people are employed.

The state is proud of its social services, financing for which takes up two-thirds of the budget. There are 36 hospitals, two or three of them teaching hospitals, and 400 health centers, clinics, and local health units.

Plans are under way to increase the production of Gezira Scheme by 6-10% per year, to expand the area to one and a half times its current size, over time. There are to be more dams, more water for irrigation, and more energy.

In parallel, there are efforts under way elsewhere in Sudan to settle the large nomad population of herdsmen, particularly in the west and south, by digging wells to provide for stable water supplies, and setting up housing settlements, with social services, including education.

The Gezira Scheme was first established in 1911 as a private farm of 2,000 feddans. Originally, under British colonial rule, the area produced raw cotton for export to the textile factories in the United Kingdom. It soon grew in size and, after the completion of the Sennar Dam in 1925, started functioning on the basis of gravity irrigation. After Sudan's independence, production began to be diversified, and the area was increased to 2.1 million feddans between 1957 and 1962; and then up to its present size.

The Jonglei Canal: In the Sudd, the great swamp in which gather the waters of the upper White Nile, in the state of Jonglei, there stands a half-finished, 180-km-long, man-made channel, the northern portion of the Jonglei Canal. The completed canal is intended to divert a portion of the water from entering the Sudd, and send it directly, for a total distance of 360 km, from south to north, from Bor to Malakal (see Figure 11) to provide great ecological and economic benefits to both the immediate region and downriver lands.

In 1994, President al Bashir announced a commitment to completing the project.

The channel digging began in 1978, after a 1976 agreement (and 1980 emendations) between the government of Sudan and the French engineering firm Compagnie des Constructions Internationales (CCI). A famous excavating machine, the "Roue-pelle," or "Bucketwheel," was brought in from Pakistan, where it had dug the 101 km Chasma-Jhelum link canal between the Indus and Jhelum Rivers (completed 1970). The Bucketwheel was built for the Pakistan project by the Lübeck, Germany firm of Orenstein und Koppel Tagebau und Schiffstechnik, based on an adaptation of a digger in use in the open-pit lignite mines near Cologne.

Thanks to the initiative of Sudanese hydrologist Yahia Abdel Magid, the Bucketwheel, which went into use in Pakistan in 1968, was refurbished and brought to Sudan for use. It is the largest excavator in the world, weighing over 2,100 tons. It consists of 12 giant buckets of 3 cubic meters each, hung on a circular wheel (12.5 meters in diameter), which dig earth, then dump it onto a conveyor belt that, in turn, deposits it on an embankment. It is self-propelled. Operating at full tilt in 1981, the Bucketwheel was excavating 2 km a week, and digging at a rate of 2,500-3,500 cubic meters per hour. There were three eight-hour shifts of 25 operators, including Pakistani, Sudanese, and French nationals. The great machine requires 40,000 liters of gasoline per 24 hours.

Now the Bucketwheel lies disabled in Jonglei. In 1984, all work on the canal was suspended, after synthetic insurgencies were mobilized against it and other infrastructure initiatives, by the geopolitical opponents of Africa's economic development.

The canal is designed to divert about 25 million cubic meters a day from the southward flow of the upper Nile waters just north of Bor (see Figure 3), and channel it through a cut of 360 km, which would deliver about 4.7 billion cubic meters of volume annually at the northern terminus of Malakal. This would mean adding to the downriver Nile volume about 3.8 billion cubic meters yearly, as measured at Aswan (subtracting for losses in transmission). Under applicable agreements, this increment of water would be shared 50-50 by Sudan and Egypt.

The draw-off of 25 million cubic meters daily from the feed waters of the Sudd would reduce the swamp area by an estimated 36%, from an average total swamp area (1905-80) of 16,900 square kilometers down to 10,800 square kilometers. The designed flow rate is 3.5 km per hour to inhibit weed growth.

The canal is designed to vary in width from 28 to 50 meters, and to vary in depth from 4 to 7 meters, to accommodate boat traffic. Parallel to the canal there is intended to be an all-season roadway, and ancillary projects include slipways, bridges, ferries, civil works for crossings and regulation, and other infrastructure.

Proposals for the Jonglei Canal, and other major Sudd and Nile Basin projects, go back generations. In many cases, engineers under British rule were the most enthusiastic designers and advocates of improvement projects, but imperial "hydropolitics" blocked development initiatives at every turn.

For example, in 1904, Sir William Garstin, inspector general of irrigation at the Egyptian Ministry of Public Works, proposed what became known as the "Garstin Cut" to channel the White Nile; but it and successor designs were blocked, until Sudan became independent and took action on its own. In 1876, a member of the British Royal Engineers, Gen. F.H. Rundall, proposed a high dam at Aswan. But it took the development policy of Egyptian President Gamal Abdel Nasser to make this happen.