of oil) in the region, since these could not be competitive on the world market? . . .

Friedrich List's answer in the 19th century, which Lyndon LaRouche has sharpened in crucial respects more recently, is essentially this: The goal and measure of economic activity is not to acquire various commodities at the lowest possible cost, nor to gain the largest margin of monetary profit. Rather, the purpose is to accomplish the *highest rate of growth in the productive powers of labor*. Wealth resides exclusively in the expansion of those powers.

So, by concentrating its efforts on developing science and technology, and a higher level of education of its labor force, Germany became the most powerful industrial nation in the world. Crucial to this was List's dual tactic of protective tariffs and development of infrastructure. The tariff system of the German Customs Union, or Deutsche Zollverein, ensured that none of a broad array of industrial commodities could be imported and sold at less than the cost of production of those same commodities in Germany, plus a certain margin which the fledgling German industry required for investment into technological improvements. The relative price level maintained in this way is known as a "parity price." (There are other means to achieve the same effect of parity, but the principle involved is always the same.)

Naturally, at first this meant paying a much higher price for various commodities than the "world market price" as determined, essentially, by the City of London. Within a short time, however, the construction of railroads and other infrastructure, together with development of technology, boosted the productivity of German industry to the point that the costs of production became generally much less than those in Britain—despite the British Empire's vast exploitation of slave labor and looting of raw materials!

The same principles apply to developing the labor power of the Middle East and North Africa today. That is the second point. Were the equivalent of "parity prices" to be introduced in systematic fashion for a variety of agricultural and industrial products, combined with crash programs of water and other infrastructure development, we would see an unprecedented boom in the internal economies of the region—despite the relatively high apparent costs of water.

This brings up a deeper point concerning "cost."

We must consider, both on the local level of individual regions and nations, as well as on the level of the human race as a whole, how we can achieve the highest rate of development of the productive powers of labor. For, ultimately, in real economic terms, "cost" has only the significance of the difference in rate of development of the powers of labor resulting from alternative courses of policy. We "pay" for a wrong policy in a deficit of that development which would have occurred had we followed a more correct policy. Whereas, properly considered, we do not "pay" for a correct policy at all, but only gain from it.

The restoration of the Lake Chad basin

by Yves Messer

The following was adapted from a 1990 Schiller Institute study in France on "The Role of Europe in Promoting an African Renaissance":

Geography: Lake Chad is in a strategic position for Africa as a whole, situated at the crossroads of the largest axes between west and east (from Dakar to Djibouti) and from north to south (Tunis to the Cape of Good Hope). Bordered by Chad, Niger, Nigeria, and Cameroon, the basin is surrounded by a mountainous massif or by plateaus that open out toward various directions: in the north toward Libya, in the east toward Sudan, in the south toward the Central African Republic, in the west toward Niger.

History: Lake Chad, and in a larger sense the pan of the Chadian basin, has often played the role of historical crossroads for civilizations, for trade of goods, merchandise, and ideas. According to Kotto Essomé and other historians, it was around Lake Chad that the Bantu civilization split up in its progression toward the south and east.

Geology: The Chadian basin is the result of the collapse of the Pre-Cambrian crystal shield, probably during the Ice Ages. A part of the glacier would have been trapped giving rise to an inland sea. Four different incursions over the last 50,000 years have produced different sediment beds which make up the natural soil richness of the Chadian basin.

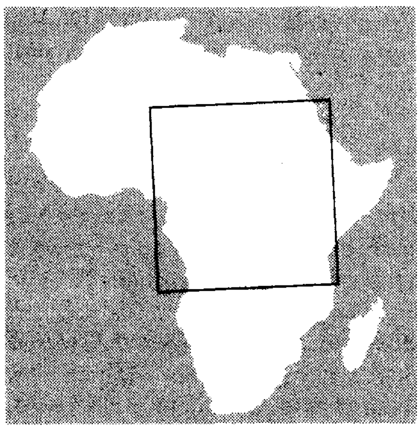
Climate: The dry climate we are familiar with today is far from what this region always had; during the last Ice Age, that is, from about 32,000-20,000 years before the present (BP) up to 14,500 BP, major pine forests accompanied by grasslands were dominant all over the Sahara. Since this period, up to about A.D. 200, we see an alternating succession of dry and wet periods, both over the Sahara and the Chadian basin. After this date, the two climates came into phase toward a dry climate.

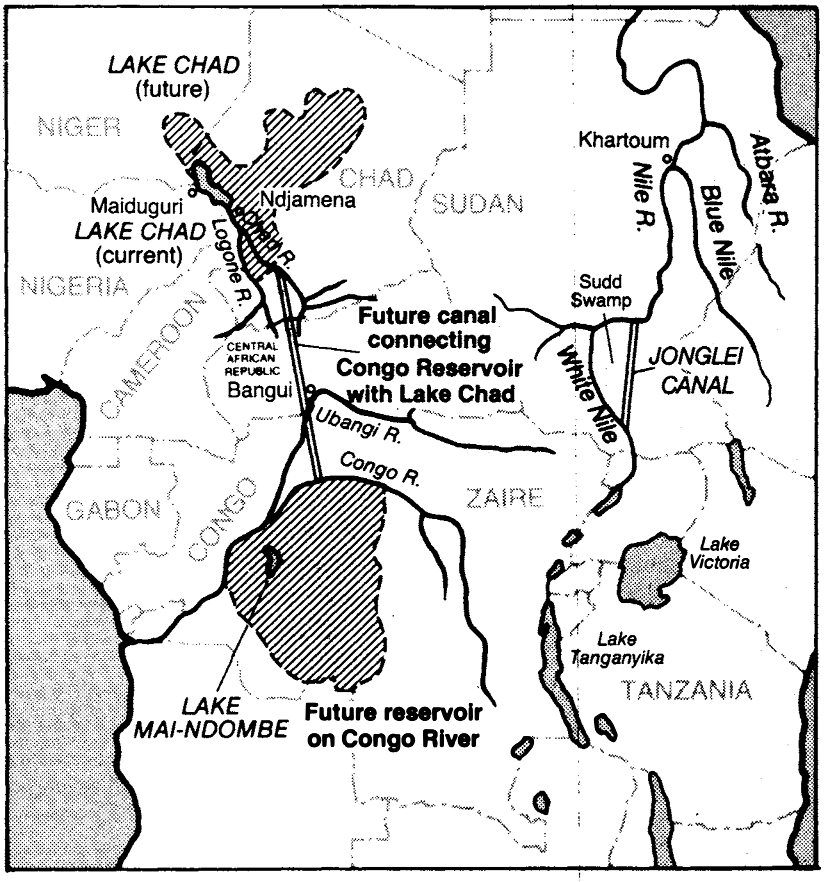
Lake Chad is at an advantageous location from the climatic standpoint, at the inter-tropical front between the dry air masses from the Sahara and the tropical air masses. This singularity allows Lake Chad to directly act as a lever to change the continental climate.

The present situation

The lake has lost over 90% of its surface area, of open water, going from 22,000 km^2 before 1970 to less than 2,000 km^2 only 15 years later. This loss corresponds to 15 years of

FIGURE 1
Lake Chad-Congo Basin, and Jonglei Canal projects





continual drought, most recently over 1984-85; the annual deficit of the Chari-Logone network alone decreased 60% between these two periods, and 85% for 1984-85. Economically, the results have been dramatic: loss of exploitable land areas, inability to graze herds, soil erosion, and famine.

1) **Saving populations:** Urgent measures must be taken to provide immediate food and sanitation.

2) **Revitalize the lake:** It is necessary to restore its 22,000 km^2 (with a depth of 283 m and an estimated volume of 80 billion m^3). A study of river supply (essentially the Chari and Logone) and rainfall (the latter representing one-sixth of the total supply) shows that a critical threshold is reached at a supply of about 50 billion m^3 per year, assuming an average flow of 1,580 m^3/second. Above this flow, the volume of the lake grows; below that, it shrinks, even with a slight rise in inflow from one year to the next, if this rise remains below the critical 50 billion m^3 level. With these last measures reaching an average annual supply for the Chari-Logone of 530 m^3/sec. (compared with an average of 1,380 m^3/sec. for 1955-69!), and figuring the supply from rainfall as practically nil, the lake must be fed with an average annual flow of roughly 1,000 m^3/s; which comes out to (in the worst years) only one-third of the supply from the Ubangi River.

The latter is not the sole source of supply; a part could still be levied directly from the Zaire River toward the Ubangi; the seawater could be desalinated and fed into the Bénoué, a tributary of the Niger, while diverting the direction of the flow toward the Logone. An array of pumping conduits over the 200 km that separate the Chari-Logone and Zaire basins will allow the supply of the Ubangi to be multiplied in order to feed the Chadian basin. By making use of the natural infrastructure afforded by one or more tributary river beds to the Chari, it should be possible to reestablish the water levels at 283-284 meters within several years. This presumes the creation of one (or several) weirs upstream from the town of Bangui, Central African Republic, and the creation of powered pumping units. These pumps should be supplied by nuclear energy.

In addition to annual regulation, by supplying subterranean water table that depends on the lake, we will need seasonal and daily regulations which include polderization of the lake to increase cultivable land and to prevent silting, and flood control of the Chari-Logone network, which has tremendous losses during the rainy season.

Pump-priming the water cycle

Through studies at the beginning of the century, the French engineer Hyppolite Dessoliers demonstrated how overcoming evaporation in certain areas could generate rain. He even elaborated a strategy for the rollback of the Sahara.

In this study, since ignored, he showed that the tops of the mountains, such as Tibesti, Ennedi, or Aïr, were the starting point for daily storms and precipitation. From his observations, accumulated in his work *Refoulement du Sahara* (*Rolling Back the Sahara*) published in 1930, he proposed a series of solutions to increase the rainfall over entire regions, which center around a climatic principle one could dub the "Dessoliers paradox," which goes something like this: How can one force precipitation from a humid air mass? Either one can raise the relative humidity, or cool it down such that it reaches the temperature limit of saturation. But if the air mass is not humid enough, paradoxically, it must be heated. In effect, rain is a phase change; hence, the effect of work. By superheating a sufficiently humid air mass, thermal energy is transferred in the form of "latent heat." This latent thermal energy produces the work of elevating this air mass, and hence its energy potential. If this energy potential is sufficiently great, the humid air mass will rise to the colder levels of the troposphere. By convection, but also by expansion (the principle of refrigeration), the air will cool off enough to attain the temperature limit of saturation, to precipitate in the form of rain drops. This precipitation also causes the release into the atmosphere of part of the accumulated latent heat in the form of water vapor. Dessoliers observed that the more humid and warm the air, the more it will "potentially" hold, and the higher and greater the cloud formations.

This is the principle behind climatic thermodynamics and therefore the water cycle.

Dessoliers conceived of the construction of coordination centers of superheated air (large solar reflector surfaces) fed by water vapor (by siting them near forests, lakes, and farmlands). The superheated air would draw in air that would be channeled toward the center by a conical metal structure, in order to create a localized cyclonic low pressure area.

Today, we could suggest using towers similar in form to those used in nuclear plants. Their hyperbolic form will be a necessary element to reach the required altitude with a minimum of starting energy (latent heat).

Adapted to the problem of Lake Chad, this principle will allow us to recover, bit by bit, by daily rains, part of the 50 billion m^3 of water (some 2 m of depth) that are lost every year to the Saharan winds and seepage.

In order to develop a new water cycle, we must take the following measures:

- reforesting the mountain heights in order to humidify the natural air drafts in the plains;
- irrigation works;
- greenhouse agronomy, using a system of filtering all solar wavelengths except those absorbed through photosynthesis, permitting a temperature drop favorable to all growth.

Water projects on the drawing boards

by Marcia Merry

Africa is part of the world's greatest dry land region, due in part to unique geographical features. The vast expanse from east of the Atlas Mountains in North Africa, extending through Southwestern Asia to the Indian Desert, is an area without close exposure to ocean-related rainstorm patterns. However, rivers and lakes can be created as two important proposals for water development were described in EIR, *Sept. 28, 1990:*

The Jonglei Canal

In southeastern Sudan, where the upper White Nile River rises, before joining the Blue Nile and flowing on as the Nile River into Egypt, there are extensive marshy areas known as the Sudd swamp (see map, page 73). Construction of a channel from Jonglei, at the swamp, downwater to Malakal, and construction of a canal system, would regulate the swamps of southern Sudan, where large quantities of water are now lost by evaporation. Much of this water would be conserved, and the flow of the White Nile increased. Hundreds of thousands of acres of prime farmland would be created in the process in Sudan.

The project was started, then halted because of funding problems, and the obstructionism of the ecology movement, which has made preserving swamps and "wetlands" the excuse for stopping water improvement programs.

Groundwater development

In 1984, satellite overflights of the Mideast and North Africa, and use of the "Big Camera" infrared sensing (from Itek Optical Corp.), confirmed the location of significant bodies of underground water, whose existence was previously known only in part. The satellite data give only the location; the depth, quality, and size of the water deposits must be confirmed by on-site hydrological measurements.

Subsequent tests show quantities of underground water in the western Egyptian desert that could provide sweet water for 50 years of agriculture. One proposal is to undertake the construction of strings of oases, forming corridors of agriculture and settlement, and converting the sands of the desert into sod. The siting and archeological features of these water deposits indicate the existence of rivers flowing northward into the Mediterranean Sea from highlands in central Africa.

In the western Sahara there are at present extensive underground flows of water, whose direction and quantities could be programmed for use.