

From Roudaire's 'Inland Sea' Project to the Blue Revolution

by Yves Paumier

Nov. 2, 2010—In 1874, the *Revue des Deux Mondes* published an article by French officer and topographer François Elie-Roudaire (1836-1885) titled “An Algerian Inland Sea,” which would later be popularized by Jules Verne (1828-1905), in his 1905 novel *The Invasion of the Sea*.

Roudaire was convinced that he had discovered a vast depression of salty marshlands (the “chotts”) extending over nearly 400 kilometers, from Algeria to the Gulf of Gabès in Tunisia (Figure 1). With the backing of the architect of both the Panama and Suez Canals, Ferdinand de Lesseps (1805-1894), he proposed to bring seawater back in by digging a 240 kilometer canal. Among other advantages, Roudaire argued, the introduction of such a huge volume of water would change the local climate, and could transform the whole region into a “bread-basket.” For various reasons, some good, some bad, the project failed at the time. Today, however, from the standpoint of a higher cognitive and scientific “platform,” that undertaking can now at last succeed.

Prologue

The peoples of North Africa, in this, the first decade of the 21st Century, are shattered. National economies are in a shambles, while the egoism pervasive in modern culture has worsened the disaster. Although the fundamentals of the relevant economies are different, they have one point in common: their dependence on an outside world, defined by the collapsing neoliberal paradigm. Internally, the consequences are disastrous: corruption, lower living standards, discrimi-

nation, a lost generation, etc.

Escape from this prison lies along the path laid out by American economist and statesman Lyndon LaRouche:

- Regain control over world finances by returning

FIGURE 1
Location of the ‘Inland Sea’ Project



to a public credit system and the separation of banks (the Glass-Steagall standard introduced by U.S. President Franklin Roosevelt in 1933) in order to break the imperial rule of a monetarist oligarchy.

- Remove from power the agents of that oligarchy, in the White House and elsewhere.
- Reconstruct the world economy through great infrastructure projects, based on the most advanced technologies, and fundamentally transform the biosphere.

The decisive momentum for such a Renaissance could be given by implementation of the North American Water and Power Alliance (NAWAPA), a project to divert rainwater in the north-west of America to the arid regions of the United States, as well as Mexico.

This is not just a colossal project, involving land and resource improvement, but an actual cultural revolution. In that spirit, we wish to take up Roudaire's brilliant idea, with the improvements needed. His idea may be 140 years old, but its underlying principle goes back thousands of years, to a time when mankind had to change the environment through agriculture. By mobilizing creative powers thusly, man asserts his freedom.

To bring this story to life, we now project ourselves into the future.

Roudaireville-les-Palmiers, 2050

Our beautiful city of Roudaireville-les-Palmiers will very soon have half a million inhabitants. Over the last 40 years, the youth of the Maghreb have settled here, rather than fleeing to the suburbs of Paris, Berlin, Amsterdam, or London. After all, the jobs are well paid, and children have access to the best health care. Over those four decades, thousands of jobs were created in the agro-chemical industries and space research.

All of this thanks to the "Great Blue Revolution," which made water abundant. What a change! In this very spot, at the beginning of the century, lay the vast arid breadth of the Sahara, the world's largest desert!

Even if patches of desert are still to be found here and there, lakes have emerged from mirages, and thousands of oases have been created since 2011, under the Paumier-Roudaire plan. Today, each oasis shelters one or several new cities, all interconnected by a rapid transportation network reaching out to distant countries. Cheap vegetables and the most beautiful orchards in the world! Such is today's Roudaireville-les-Palmiers!

FIGURE 2



A ship arrives at the port of Gabès, carrying a strange object.

Our children are curious: "Daddy, tell me again about the four phases of the Blue Revolution.

Phase A. Tunisia: From Gabès to Djeridville

Let us begin at the beginning. One morning, in 2011, a ship arrived from the great north carrying unusual cargo (**Figure 2**). It anchored off the coast at Gabès, the Tunisian fishing port, which also exports phosphates. Although the appearance of the ship worried the elders and the tourists sun-bathing on the island of Djerba, the young people came over to have a look at the strange object.

The ship's arrival made a greater impression on the coastal population, especially since it had been carefully prepared. Months earlier, a huge concrete reservoir had been installed atop the hills overlooking the coastline, with a large conduit descending down to the bay, and then to the mooring (**Figure 3**).

One month later, the sound of water was heard near the reservoir, which was quickly filled up. People were doubly surprised: first; to see a reservoir installed on top of a hill, when rivers do not run uphill; and second, to see it fill up with seawater! Where did the salt water come from? That's when the elders discovered that the strange floating object was not a ship, but a small nuclear power station able to pump water uphill!

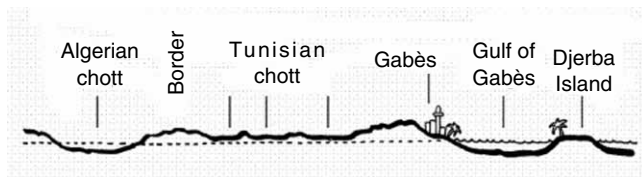
In fact, the reservoir itself was only to be used as a water tower for the next phase. When the water runs back down to the sea, hydroelectric power can be generated.

FIGURE 3



A concrete reservoir is placed at the top of the hills overlooking the coastline.

FIGURE 4



One month later, new noises were heard, the humming of the hydroelectric turbines in the tower to generate electricity for the city, and especially for a new desalinization plant. The newly produced freshwater was first distributed to the city's waterworks. Since then, the rays of the Sun have joyfully danced on the sparkling water of the public fountains.

Let us now look inland, toward those areas which were only desert, and the arid regions where only sheep could be herded. This is where the real work began! First, an aqueduct was placed around the el-Fejal Chott, and filled with freshwater produced in Gabès.

Just what is a "chott"? In the south of Algeria and Tunisia, at the foot of the Aurès mountain range, near the Sahara, was a vast depression, some 400 kilometers long, which, in the rainy season, was transformed into marshland and sometimes even small lakes. The depression was partially covered with salt crystals and divided into secondary basins, which the Arabs called chotts (from the Arabic word "*chatt*," or coast) (**Figure 4**).

Now, the Herculean task was to begin: getting rid of the salt which had accumulated in the soil of these basins for thousands of years. When the aqueduct poured freshwater into the first chott, that water rinsed the soil, and carried the salt water to the sea, via specially built underground conduits the size of a man. Rainfall accelerated the overall process of carrying the salt to the Mediterranean.

The joy of the city dwellers in Gabès, delighted with their fountains, paled in comparison to the joy of the rural inhabitants: The prospect of having fresh and abundant water every day of the year, instead of brackish water on the floor of the chotts, was truly revolutionary. While it all seemed strange and confusing at first, the doubts soon disappeared. The Blue Revolution was clearly on the march.

However, the water needed considerable time to complete its work. No

bulldozer could have done the job, because the salt that is so deeply encrusted in the soil cannot be extracted quickly. However, as planned, the freshwater moved the salt upwards, month after month. Most had been eliminated, but not all. We had a solution for that, too. Agronomists planted halophytes, plants that like to grow in saline areas and absorb the salt.

Only recently has it become possible, thanks to biotechnologies, to create halophyte varieties of rice. That represented a world revolution, quiet but real. Since then, a halophyte variety of the main grains has been developed and is now a staple.

So, after a few years of rinsing, a real lake replaced the first chott, which is a much better solution than Rou-daire's "inland sea," which would have increased the soil's salinity. Then, pretty much in the same way as the famous Dutch polders, where large areas of useful farmland were won from the sea: By using a network of hundreds of small irrigation canals, land was won over and water evaporation decreased. This new area was then transformed into cropland. At first, halophytic plants and bushes specially developed for the purpose, were planted. They were replaced, a short time ago, by palm trees.

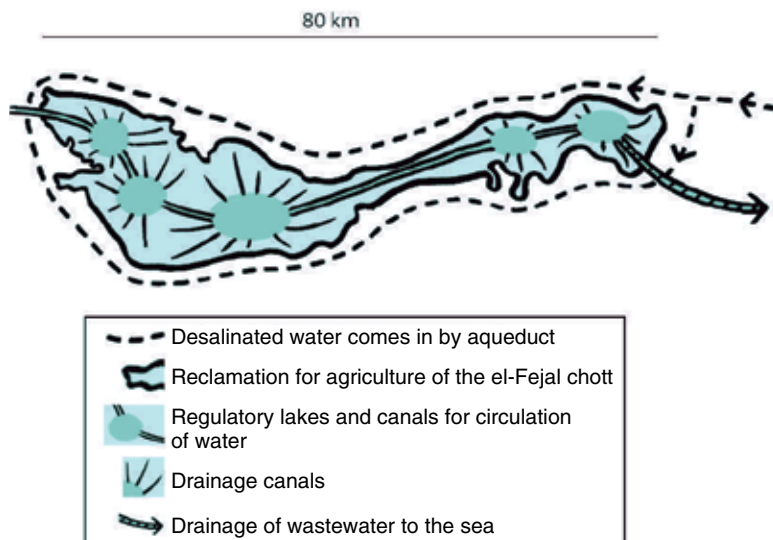
Earlier, cattle-raising had been drastically cut back, due to lack of fodder and pasture land. Only poor people still herded sheep, and practiced seasonal migration on a local level. But the soil was not arid, and the effects of the lakes quickly reduced the pressure on the fallow land, which began to regenerate (**Figure 5**). The now-confident peasants shifted progressively to other types



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Agronomists plant halophytes, plants that like to grow in saline areas, to absorb the salt. Shown: a clump of *Spartina alterniflora*.

FIGURE 5



of livestock, although the risks were greater in uncertain times. The region also became an exporter of camel milk and cheese! Camel milk is much esteemed by young mothers, as babies digest it much more easily than milk from cows. In short, a new agro-business sprang up, but in opposition to that of the 20th Century, it is centered on the local farmer.

After the el-Fejal chott, the next to be reclaimed were the el-Djerid and el-Gharsa chotts. The freshwater available attracted great numbers of people, and, at the very place where mosquitoes used to proliferate, we founded Djeridville, the city that emerged from the mirages. With human civilization, the birds also came, in particular migrating birds which found the climes welcoming, after centuries of shunning them.

Then, yet another indispensable phase of the Blue Revolution took off. Derricks were installed alongside the network of aqueducts, not to pump oil, but to inject freshwater produced in Gabès, into the geological depths. In this way, the aquifer underneath what had been an arid desert, was revived. That aquifer allows our agriculture to flourish, and gives us water to drink every day (**Figure 6**).

Of course, the underground water had been there historically, and was the source of the oases in the middle of the Sahara desert. It also supplied seasonal moisture, but much less, to the chotts. However, from the beginning of the 21st Century on, the relative over-exploitation of these water resources increased the pressure on the aquifer. Without our intervention at that

time, the aquifer would have been lost. As a result of the fresh water injections into the depths, the rainwater falling on the mountain ranges some hundreds of kilometers away, and sinking into the acquifers, feed more oases, rather than reemerging in the now-filled chotts.

Phase B. Algeria: The Gabès-Roudaireville-les-Palmiers Irrigation Canal

All the work being done in Tunisia was not lost on those on the other side of the border, in Algeria. They saw slowly shrinking oases suddenly revive, and tree stumps, thought dead, sprouting buds. Then, Algeria launched her own Blue Revolution, by founding Gabès Roudaireville-les-Palmiers.

In the middle of the Melhrir chott, armies of workers had already prepared the ground, and a huge network of dikes was set up to subdivide the entire chott into smaller basins. To facilitate the gradual desalinization process, water was brought slowly into each new basin, one after the other. At the center of the system, an extra desalinization plant was built to extract the salt on the ground which had dissolved into the freshwater flowing in from Tunisia. The recrystallized salt was stored in a place set up for that purpose. When properly conditioned, that salt can be used as a support material, including for building roads.

Near space was also called upon to help, with space-based sensors allowing an overview of such a large area, with satellites monitoring the process step-by-step. In that way, Roudaireville and the whole region became a reference point for geology and space agronomy.

FIGURE 6



Aquifers under the deserts are revived by a system of aqueducts.

Meanwhile, in Tunisia, off the coast of Gabès, the floating nuclear power station was replaced by other nuclear power plants, ten times more powerful. Freshwater was produced in a desalinization plant, which was towed there, and now floats like an island in the gulf. For the workforce, another exceptional living area was created nearby, the island-city of Aquagabès.

This increase in power and size made it possible to enter the next phase: the creation of an irrigation canal connecting Gabès to the newly founded city of Roudaireville in Algeria. This canal, running through the south of Tunisia into Algeria, was designed as a manmade river, with derricks set up alongside to inject water into the underground aquifer.

With water now flowing generously in the Sahara, the population grew, including the bird population. Thanks to the Blue Revolution, Algeria recovered a certain sovereignty. Instead of exporting oil and gas resources cheaply, the gas pipeline was redirected to transit through the newly created cities in the chott area, whereas it used to go directly from Hassi Messaoud to the ports on the Mediterranean.

The state set up a large petrochemical facility in Roudaireville. The population boom in the region spawned many other activities, especially manufacturing and mining, once the roads and high-speed transportation had been built. The technology of the Tracked Air Cushion Vehicle (TACV—aérotrain), whose development was stupidly stopped in France in the 1970s, was put to excellent use here. Thanks to “development corridors,” the processing industry took hold.

Solar rays penetrating water is all it takes to get microscopic algae to grow, and here, they are produced in quantity, in large manmade lakes that also serve as resort areas. You just have to add a few nutrients, such as carbon dioxide, and combined nitrogen derived from gas, oil, and the local phosphates. The algae are used for fish farming as well as, to replace the fodder usually fed to livestock.

Once these production sites were in operation, the phosphate plant that polluted Gabès was shut down and relocated here, where it doesn’t pollute any more, but offers many useful minerals. A complete biochemical branch dealing with algae has developed, and the skills required in that field intersect tropical agronomic re-



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“Oasis farming” was developed, featuring grainfields and citrus orchards growing under the palm trees. Shown: a Libyan desert oasis.

search. The old port of Gabès now attracts mainly tourists and amateur geologists.

The cooperation between Tunisia and Algeria, in the course of the Blue Revolution, also brought about a revolution in international law. Since water flows ignore manmade borders, a new body of property law was developed, based on water law and on the 1648 Treaty of Westphalia. The latter put an end to the Thirty Years War and replaced the notion of “might makes right” with that of mutual development corresponding to natural law, i.e., the “advantage of the other.”

According to Prof. Aly Mazaheri, “water law” comes to us from Persia. The fact that there are aqueducts in Iran, Turkey, Andalusia, or Algeria today, that distribute freshwater fairly to many users, or allow irrigation one day here, and somewhere else tomorrow, is because this principle was adopted, and adequate regulation authorities were set up. In fact, a law evolved historically in the Persian desert region, which disregards the surface area of your land, but is careful to identify where the water in your well is coming from, and how it was discovered.

Besides being nests of spies, most international organizations created at the end of the 20th Century to manage water conflicts in border areas, treated the issue in the same way the right of the sea had been treated: by respecting the right to piracy established by the historic power, the British Empire, with its common law and empiricist approach. In other words, “positive” law,

based on “might makes right,” was created.

Now, the principles underlying the new law on the right to water allowed us to end border conflicts by applying the principle of mutual development, something the modern positive law of the West could never allow.

Phase C. The Sahara: Beyond Water, Opening Up the Continent

Almost every day, a new town cropped up out of a former oasis, lost in the sands and pebbles. Generally, they were on the mountain slopes, which were more hospitable, while the plains remained desert. Geologists made considerable progress, and their knowledge of the underground aquifers allowed them to predict where the next new city would be. What at first appeared to be one great uniform mass turned out to offer many different opportunities, each one giving a specific resource to the new talents attracted to this El Dorado.

Beyond the Blue Revolution as such, two major road and rail transportation axes gave access to the remote areas of the Sahara. The first one linked the Algerian-Tunisian area to Lake Chad and Central Africa, the second connected the Morocco-Algerian region to the inland Niger delta and to West Africa. All this activity put an end to the exodus towards the North, and some of the young populations of the Maghreb left the overpopulated coasts of the Mediterranean to settle in these now inviting places.

“Oasis farming” was developed, featuring grain fields and citrus orchards growing under the palm trees. Morning dew could be seen here and there. Hundreds of microclimates were created out of nothing. What was once a desert, inhospitable to any form of life, now feeds not only North Africa but also distant continents. Progressively, bamboo, grasses, and algae are used instead of oil to create plastics, and talso help build living soils. The winds of the Sahara are now rare and calm.

Phase D. Go Continental, from Gabès to Lake Chad

The Sahara was rolled back with the water coming from the northeast, first from Gabès, then from other areas of Algeria, Morocco, and Mauritania. The Liby-

ans, who were then pumping fossil water from the reserve in the desert, have recently decided to reverse the flow of their “great artificial river,” and bring freshwater to the south. Some years ago, Libya even launched another great project: the revival of the “second Nile,” a river that was dried up for centuries, and the course of which was discovered in 2009. Now, the waters of the second Nile again flow on Libyan ground.

The other radical transformation of the desert arose from the successful cooperation among Egypt, Sudan, and other countries further south, which have been working together to manage the great Nile River itself, for the past decade.

However, the most crucial link was to the efforts to revitalize Lake Chad, a project also launched early in this century. This lake, which is located south of the desert, is the mainstay of a system of aquifers running under Chad, the eastern part of Niger, one third of the Central African Republic, and parts of Cameroon and Nigeria (**Figure 7**).

From the standpoint of water, this system of aquifers constitutes a single entity: It is an endorheic basin, i.e., a continental zone where rainfall does not flow out into the

ocean, but is retained. It is only because we won the battle for this entity as a whole, that we were able to conquer the desert. Any local effort, limited to specific circumstances, but with no real future, would have been an illusion, and would have failed. As we already said, the reason that our countries today maintain neighborly relations, based on cooperation, is because we joined hands during the Blue Revolution. A culture of the common good, of a shared destiny, grew out of the fight for water, first created, then shared. That was the end of makeshift solutions, and every man for himself.

Today, in 2050, mankind is able to settle Mars, and our discoveries contributed to that: Now that life has been brought back to the desert sands, the terraformation of Mars is no longer a fearful prospect.

The French original of this article is posted at <http://www.solidariteetprogres.org/article7125.html>.

FIGURE 7



Major endorheic (closed drainage) basins which retain water, allowing no outflow to rivers or oceans.