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ON
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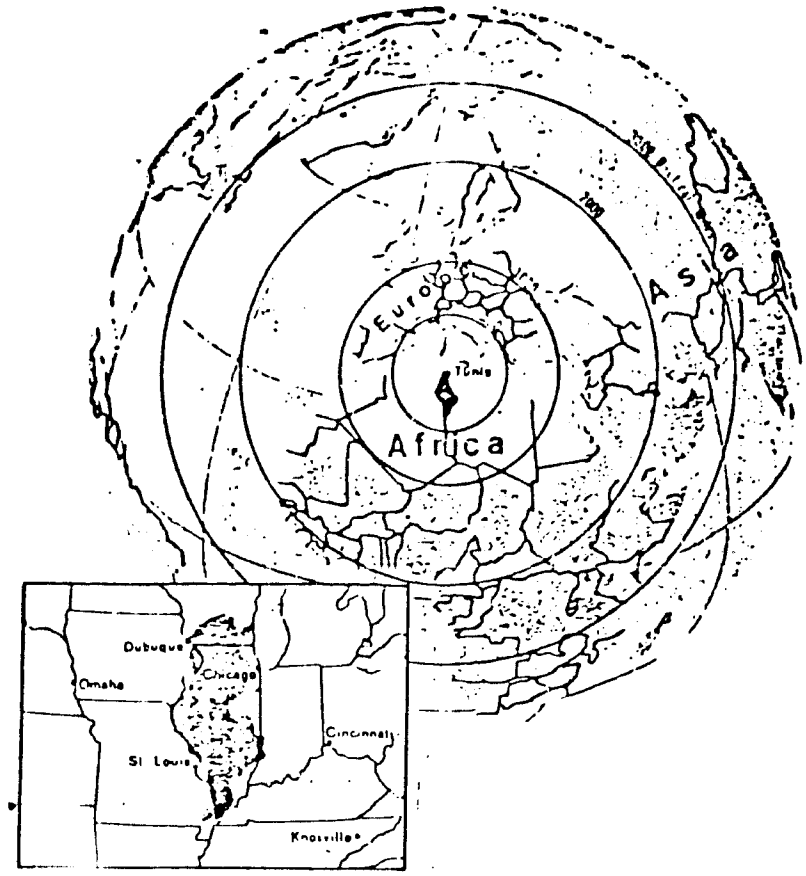

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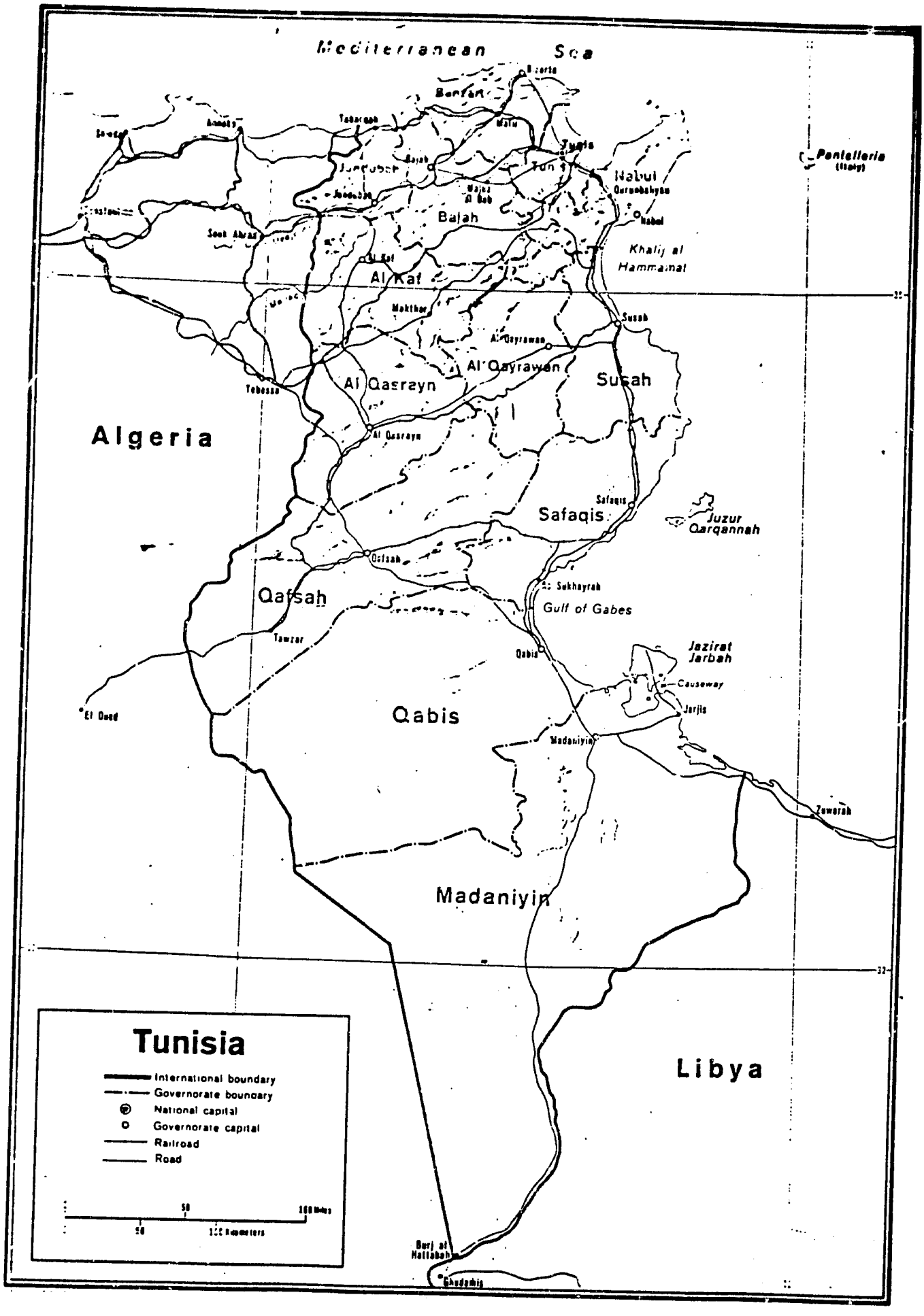
Mediterranean Sea
Bizerte
Bonfan
Tabarqah
Ashaqah
Sawqah
Malu
Tunis
Pantelleria (Italy)
Nabul
Qurunbalyah
Nabul
Bajah
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Qafsah
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Tawzar
Qabis
Jazirat Jarbah
Causeway
Jarjis
El Oued
Qabis
Madaniyin
Zuwarah
Madaniyin
Tunisia
International boundary
Governorate boundary
National capital
Governorate capital
Railroad
Road
50
100 Miles
50
100 Kilometers
Libya
Burj al Hattabah
Ghudamis

SUMMARY

With the exception of the Tell region in the north of the country, Tunisia is an arid land subject to great variation in amounts of rainfall from year to year. A small country to begin with, 20 percent of its land area is judged to be completely unproductive, and another 18,000 hectares of land is estimated to be lost to the desert each year. The basis of support for Tunisia's population is literally being eroded from under them, while the population grows at a rate of 2.3 percent per year.

The major environmental problems of Tunisia begin with this critical one of erosion:

1. loss of agricultural land, existing or potential, through erosion caused by damaging cultivation practices and inadequate management of floodwaters;

2. degradation of range and forest lands through uncontrolled grazing, extraction of fuelwood, and erosion that follows removal of the vegetative cover;

3. overcrowding in urban centers, caused by migration of people fleeing the deteriorating situation in the countryside, and producing problems of pollution of the public water supply and spread of diseases related to poor sanitation;

4. industrial pollution, apparently so far limited in extent, but noted as factory effluents are discharged into the Lake of Tunis and the refinery at Bizerte and the numerous factories in Tunis lower air quality in the region;

5. the potential of increasing groundwater salinity by saline irrigation waters percolating down to the water table; and

6. finally, lack of adequate protection for native flora and fauna, thus impoverishing the national and global pool of genetic resources.

The Tunisian government has passed legislation to address most of these problems but the means of achieving compliance of the local population has not yet been found. The challenge of improving Tunisia's environment is to find ways of fulfilling the immediate needs of the people while encouraging them to adopt land use practices that will sustain the natural resources of Tunisia indefinitely.

A. Paige Grant
Compiler

1.0 General Description [1]

1.1 Geography

Tunisia is the smallest and most easterly of the three Maghreb countries of North Africa. (The other two are Algeria and Morocco.) With an area of 163,610 square kilometers, it is bordered on the east by Libya, on the west by Algeria, and on the north by the Mediterranean Sea. The border with Algeria is strictly a political one. The mountains of northern Tunisia are an extension of the twin Atlas ranges of Algeria, which run northeastward into the Cap Bon peninsula, extending to within 145 kilometers of Sicily. In the south, high steppes and sandy deserts are found on both sides of the border.

Tunisia is divided into the following four geographical regions:

1.1.1 The mountainous Tell region of the north

The Tell region contains the River Majardah, the only perennial stream in the country. Precipitation in the Tell region ranges from 40 to 100 centimeters annually, with a high of 150 centimeters in the Kroumirie Mountains, making that the wettest spot in North Africa. For centuries, the broad alluvial valleys of the Majardah system have been cereal-raising areas. The wetter, less accessible hillsides are still covered with indigenous oak forest; otherwise, lower rainfall and overgrazing give rise to a meagre scrub cover.

1.1.2 The central steppes

The more southern of the two Tell ranges, the Dorsale ("backbone"), separates the Tell region from the steppes. The steppes are characterized by annual precipitation of 20 to 40 centimeters. This region consists of vast stretches of esparto grass, used for making paper, and pasturage for goats, sheep, cattle and camels. Outside of a few irrigated areas, farming is not well developed. After heavy rains, the steppes are traversed by ephemeral streams, but they usually fan out and evaporate in salt flats before reaching the sea.

[1] Sources: Agency for International Development, Office of Housing. 1979.
UN Conference on Desertification. 1977.
Europa. 1979.

1.1.3 The Sahel region of the east coast

The Sahel extends along the east coast. The climate is mild and reliable, with precipitation ranging from 20 centimeters in the north to 50 in the south. Olive groves are common, especially in the stretch between the cities of Sousse and Sfax. Further norther there is cultivation of citrus and other fruits, vines, market gardens, cereals and fodder crops.

1.1.4 The Tunisian Sahara, the wedge-shaped southern section of the country with its northern limit at the enormous Shott al-Jarid

South of the steppes and inland from the Sahel lives a great lowland occupied by two large seasonal salt lakes, or shotts, which are below sea level. The low plain runs south into the Sahara, a full desert with less than 20 centimeters of rain annually, great extremes of temperature and of wind, and completely empty of vegetation over extensive areas. At a few points, supplies of underground water create oases and allow the cultivation of dates.

1.2 Population [2/]

The indigenous population of Tunisia is Berber, but, beginning in the seventh century A.D., Tunisia became the most thoroughly Arabized of the Maghreb coutries. Pure Berber and Bedouin communities are limited to a few isolated rural sites. Most Tunisians today consider themselves to be of Arab origin, profess Islam, and speak Arabic, with French as a second language taught to all schoolchildren. Europeans account for one percent and Jews less than one percent of the population.

The relatively humid north and the coast are the most populous parts of the country. The capital city of Tunis, located near the site of ancient Carthage, is by far the largest and most important city. It contains over half the country's industries and had a population in 1975 approaching one million. The next most important population centers are Sfax (257,000), Sousse (80,500), Jerba (74,600), and Bizerte (68,300). In 1978, the population of the country was estimated at 6,235,000 and growing at a rate of 2.3 per cent per year. The urban growth rate is even higher, estimated

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[2] Sources: Agency for International Development. Office of Housing. 1979.
Agency for International Development. 1979.

Reese, H. C. et al. 1970.

at 4.7 percent, reflecting heavy migration from rural areas to the cities. In 1976, 47 percent of the population were urban dwellers.

Considering that the average productivity of the farm population is about a third that of non-farm workers, it is not surprising that many young men move to an industrial center in hope of employment. Surveys of areas of spontaneous settlement around Tunis show a high proportion of males, with 54 percent of the population below age 20. For many of them, the hope is unfulfilled; unemployment was estimated at 12.8% in 1976, and underemployment, a measure of those working less than four days a week, at 14%. The problem is that the number of available jobs has not kept pace with the number of people entering and staying in the job market, despite the assignment of top priority status to the unemployment issue in the government's Fifth Development Plan of 1977-1981. The problem is exacerbated by the fact that outmigration to Europe is less of an option than formerly, as Europe reaches saturation with migrants from the Near East and Middle East seeking work.

The government of Tunisia has initiated a policy of industrial decentralization in order to correct the imbalance of population concentration and economic status that exists in the country. In addition, Tunisia was one of the first Third World countries to introduce family planning, in an attempt to bring the population of the country into balance with its capacity to provide for its citizens. This effort has shown some results. The 1966 census showed the percentage of the population under five years of age to be less than the percentage between five and fourteen years of age for the first time in Tunisia's history. The gap widened in the following decade, showing that a significant cultural and demographic reversal has taken place.

1.3 Economy [3]

In 1970, despite the move to the cities, just under half of the Tunisian work force was engaged in agriculture. Agriculture contributed 16 percent of the GDP in 1976 and was responsible for 40 percent of export earnings, mostly due to olive oil exports. Fruits and grains are exported in years of adequate rainfall, but staples must be imported in dry years. A massive water development scheme is being financed by the World Bank, intended to raise irrigated area in the country to more than 200,000 hectares of the 9 million hectares of arable land. This will amount to 2 1/2 times the area currently irrigated and should allow higher and more predictable levels of agricultural production.

Government policy aims at self-sufficiency in foodstuffs, but the means of attaining this goal has been a subject of dispute for two decades. The sixties saw a major attempt at collectivization, but political reversals cancelled the program. The reduction of allow-

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[3] Source: Europa Publications. 1979.
AID All data on Tunisia. 1979.

able size of individual landholdings continued, but in 1970, 10 percent of landowners held 53 percent of the land, while another 10 percent owned half a percent of the land.

The fisheries industry, often considered with agriculture, is undergoing steady growth, and represented .86 percent of the GDP in 1977 as opposed to .66 percent in 1974.

Minerals are Tunisia's most important earner of foreign exchange, and reserves of natural gas and petroleum should keep the country self-sufficient in fuels for several decades. Tunisia is the world's fourth largest producer of phosphates. Phosphate production is sensitive to market demand, but still rose 13 percent in 1977 when the world price fell 18 percent. This sector is under the overall financial control of the government.

Petroleum was first discovered in Tunisia in 1964, and developed rapidly to become the country's major export. A number of sites have been discovered since, and a refinery was built at Bizerte with a capacity of 1.2 million tons per year, to be expanded to 4 million tons. The government maintains about half control of the industry.

Mining and electricity contributed to a steady growth of industry in the 1970s. The government is emphasizing export-oriented industries in order to rebalance the serious trade deficit that exists. The chemicals industry is receiving special attention, particularly uses of phosphate. At the same time, major projects are underway to reduce Tunisia's dependence on imports. Cement production should be adequate for internal needs by 1980, a nuclear reactor is planned for Gabès to desalinate water and provide electricity, and a gas compression plant is to be built at Cap Bon to process Tunisia's share of gas being piped from Algeria to Italy.

Planning for development began in 1961, and focused on two major problems: (1) population growth, and (2) the trade deficit, which was so high that 40 percent of development expenditure in the sixties had to come from foreign aid. There were some hopeful economic signs in the following decade: domestic savings financed more of the 1973-76 Plan than had been projected, more jobs were created than planned, and tourism developed into the second largest earner of foreign exchange for the country. Yet despite these achievements, the balance of trade has worsened since the mid-seventies, due largely to a fall in oil prices and a slump in demand for phosphates. Inflation in 1977 was believed to be running from 14 to 20 percent. Prices are controlled on certain basic commodities, and, following widespread strikes in 1976, the government, unions, and industry together drew up a "social contract" for the period of the Fifth Plan, to specify wage rises in all sectors and a one-third increase in the minimum wage. The government is turning to further international loans and foreign aid to finance major industrial developments. The principal unilateral donors are France, West Germany, the U.S., and the Arab Gulf States. The debt service ratio is rising steadily and is expected to reach 17.4 percent in 1981.

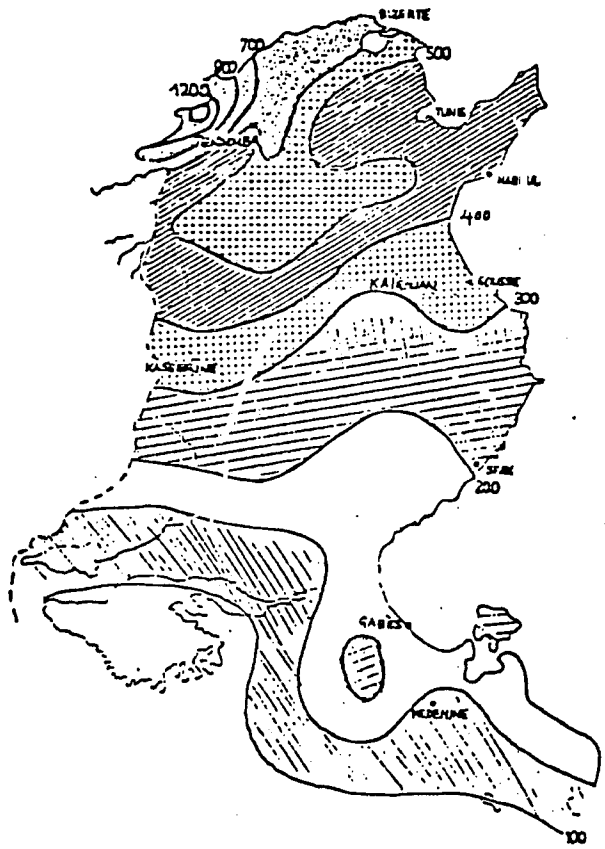
2.0 Environment and Natural Resources

2.1 Water

2.1.1 Water Resources

2.1.1.1 Surface Water [4]

The isohyetal map below summarizes the rainfall regime of Tunisia.



Isohyetal map of Tunisia. Values in millimeters of rainfall per year, average, computed from records of years 1901-1960. From US A.I.D. Office of Housing, 1979. p. 9.

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[4] Sources: Chaabouni, Z. 1979.

The relatively high rainfall in the north supports the perennial flow of the Majardah River, but much of the precipitation in the country evaporates, is transpired by plants, or runs off during floods before it can be put to use. Annual evaporation figures run from 1400 millimeters in the north to 3000 millimeters in the south; potential annual evapotranspiration virtually always exceeds annual precipitation. [5] Even with the year-round flow of the Majardah River, 30 to 85 percent of its discharge is in floodwaters. In the dry wadis of the central or southern part of the country, between 60 and 99 percent of the flow is a flood. These floods can be extremely damaging. An extraordinary storm in the fall of 1969 resulted in the loss of 260 million tons of soil from a watershed of 8,577 square kilometers. In an average year, the same watershed loses about 590 tons per square kilometer, or an equivalent depth of .5 millimeters skimmed from the land surface every year.

Clearly, Tunisia must be concerned with storage and control of surface waters, both to reduce their destructive potential and to provide water to a predominantly arid land. The following map shows the location of existing and planned dams in the country.

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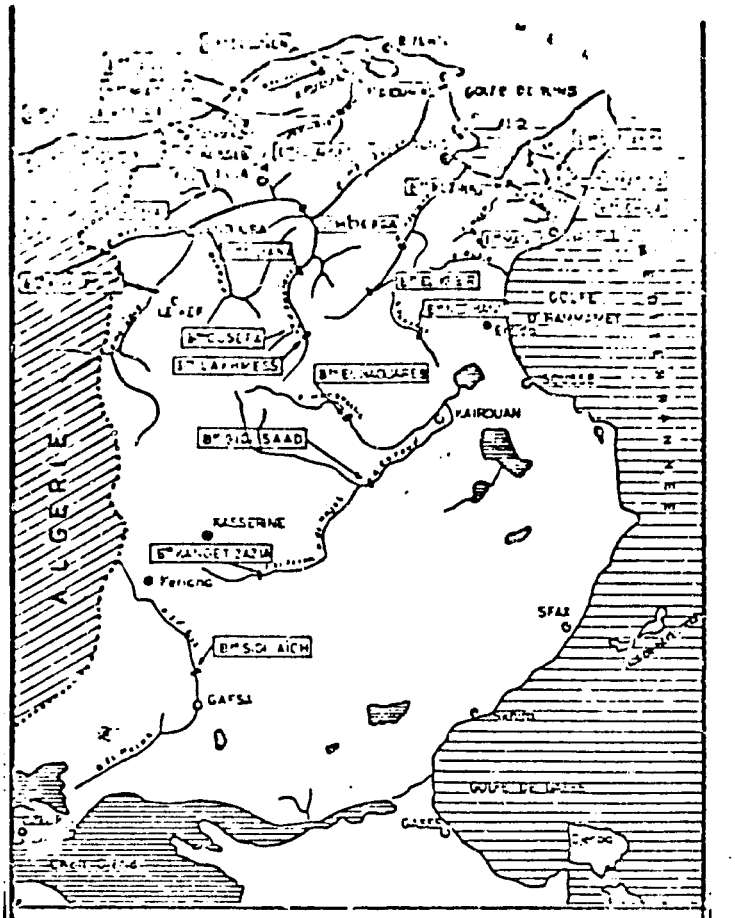
[5] Source: Harbridge, W. et al. 1976.



DAMS IN TUNISIA AS OF 1976

LEGEND	NAMES	V 10^6	NAMES	V 10^6
• Built	O Méléque	120	OO Sou Hourma	50
•• Under construction	O Béni M'tir	45	O Sidi Salem	530
O Planned	O El Kébir	10	O Djoumine	70
"Barrage" (dam)	O Nethana	25	O Sedjénane	68
	O Kasseb	42	O Medène	40
	O Bir Mcherqua	40	O Zarga Kébir	14
	O Bézirk	3,5	O Bélif	15
	O Chiba	4	O Zéroud	40
	O Masri	3,9	O Merguellil	5
Scale: 1/2250000	O Lakhmess	7	O Abid	3,8
	O Abida	2,5	O El Gueiche	3,7
	O Khergua Zouia	20	O Sidi Aich	5
	O Ousefa	10	O Siliana	14

after Chaabouni, Z. 1979. p. 25.

2.1.1.2 Groundwater [6]

Due to the paucity of its surface water reserves, most of Tunisia has long been dependent on groundwater. The groundwater reserves of the country are considerable: 54 aquifers have been identified at the water table level and 34 at greater depths. However, the quality of water yielded from these reservoirs varies greatly, limiting its application for certain uses.

The mountains north of the Majardah Valley contain no aquifers of any significance. South of the Majardah, however, and in the other ranges and steppes of Tunisia, the highlands bear limestone aquifers. One of them delivers part of the water supply of Tunis. In the valleys and plains, the principal aquifers are: (1) fill formations in subsident blocks, sometimes containing artesian reservoirs; (2) alluvial fills in the valleys, and (3) aeolian sands.

The plains are underlain by Miocene sediments up to 2,000 meters thick, containing coarse sandstone formations. The latter are good aquifers, especially along faults delimiting collapsed zones. The Kasserine spring is located at one of these, and its discharge is 300 liters per second. The plains also contain some subsidence troughs, such as the Kairouan trough, which hold permeable continental sediments in which there are some groundwater bodies under some pressure. Dutcher and Thomas, [7] reporting on the Susah region of the central coast area, state that the complex faulting and folding of the rocks there gives rise to a large number of groundwater basins. Shallow wells yield water throughout the region, but much of it is too saline to use. Saline lakes, called "sebkhas," and salt-filled depressions are common, due to extremely high evaporation. Most of the precipitation that falls does so on the mountains, and between rapid runoff and evaporation, very little of it is left to recharge the water table. The water resources of Susah were apparently inadequate even for the population of 447,000 in 1968.

The Sahara throughout North Africa is underlain by two huge aquifer systems: the deep Continental Intercalary, and the Terminal Complex lying closer to the surface.

---

[6] Sources: Pallas, P. 1972.

UN Dep. of Economic and Social Affairs. 1973.

[7] Source: Dutcher, L. C. and H. E. Thomas. 1968.

The combined capacity of these aquifers is estimated at 60 million million (6×10^{13}) cubic meters, which is something on the order of a hundred thousand years' supply at the present rate of withdrawal. However, it is doubtful that the deepest water will be tapped, because of the high cost of drilling and pumping. Also, the present rate of withdrawal must increase to provide a more reasonable quality of life for inhabitants of the region. Consequently, the volume of the sub-Saharan aquifers should be read as a much lower figure.

The Continental Terminal and Continental Intercalaire aquifers feed springs and wells that irrigate the oases of southern Tunisia. The Continental Intercalaire, which produces artesian wells with a discharge of at least 100 liters per second, has its natural outlet at the Shott Djerid.

Agriculture makes by far the greatest demands on Tunisia's water resources. The cultivated oases alone (mostly date-raising) accounted for 15,500 hectares in 1970, irrigated at a rate of 8.8 cubic meters per second. Population growth and the redistribution of land among agricultural workers will necessitate a two-and-a-half-fold increase in irrigated area, hence an equivalent increase in groundwater withdrawals in the south. In the north the necessary increase can be drawn partly from development of dams and possible groundwater recharge. Withdrawals of groundwater are already causing the water table to retreat. Pallas predicts that between 250 and 400 new boreholes will be needed by the turn of the century to replace those that are drying up. [8] There is a risk that, over the long term, salinity of groundwater will increase with increased withdrawals. It is also worth noting a risk of interference in the Algeria/Tunisia border region due to withdrawals from the same aquifer.

In addition to meeting agricultural demand, water supplies must be increased to meet the needs of the growing industrial sector and to improve the supply for domestic uses. In 1970, an estimated 83 percent of the rural population did not have access to adequate water supplies. Only 4.9 percent of all Tunisians had access to safe drinking water. [9] Water to fill these needs must be drawn from the same sources as irrigation waters, unless desalinization is developed as an alternative. A first step in this direction is the large desalinization/electrical generation plant planned for Gabes; the plant would be nuclear-powered. [10]

---

[8] Source: Pallas, P. 1972.

[9] Source: AID, All data on Tunisia. 1979.

[10] Source: Europa, 1978-79.

2.1.2 Water Quality

Salinity and turbidity are encountered in various degrees throughout Tunisia. In the Majardah River system, salt concentrations vary between 0.25 and 2.0 grams per liter and suspended sediment runs from 10 to 40 grams per liter. In the wadis of the central region, salt concentrations can be as high as 9 grams per liter at low flow, but the value drops to around 0.5 grams per liter at flood stage. Suspended sediment in such streams is estimated at about 40 grams per liter.

Such sediment loads cause serious problems with siltation of reservoirs. For certain situations, an inflatable dam has been proposed,[11] which allows the sediment-laden bottom flow to bypass the intake and which can be flushed seasonally of accumulated sediment by deflating the dam. A number of legislative attempts have been made to require that conservation practices be employed in upland areas to reduce erosion, but the turbidity problem persists.

With regard to the salinity situation, a number of studies have been done to assess the feasability of using saline water for irrigation. The conclusion is that a number of food and forage crops can be grown on many different soil types irrigated with water containing up to 25 grams of salt per liter. The crop yields will be less than if they were irrigated with pure water, but the additional area that can be put into agriculture under saline irrigation more than compensates for this loss. Although soil salinity has increased under saline irrigation trials, it has never reached dangerous proportions, and could always be reduced by leaching and by crop rotation.[12]

The chemical content of drinking water in most of Tunisia exceeds WHO standards. Perhaps a more immediate problem, however, is the spread of fecaloral disease through public water sources, due to inadequate facilities for excreta disposal and the increased density of the population in many towns and cities. An increase in the number of sanitation-related diseases is believed to be related to there being less water available for more people. There has also been an increase in the incidence of schistosomiasis; the danger of spreading this disease should be a consideration in planning water resources projects.[13]

Tunisia has passed a number of laws that prohibit discharge of noxious substances into public watercourses, and is a signatory of two international conventions to prevent pollution of the Mediterranean Sea. (See Section 3.2.1.2).

[11] Source: Schroder, W. and P. Sulser. 1977

[12] Source: Forges, J. M. de. 1970.

[13] Source: Beamer, L. G. and M. L. Anderson. 1975.

2.1.3 Specific Water Problems

2.1.3.1 The Lake of Tunis[14]

The Lake of Tunis is actually a marine lagoon. It has probably been subjected to longer continuous man-made pollution than any other lagoon in the world. With an area of 45 square kilometers, the shallow lagoon is bisected by a navigation canal which prevents circulation of the water on either side of the canal and restricts the outlet of the lagoon to the sea. Reefs built by polychaete worms further restrict circulation. About 50,000 cubic meters of wastewater (usually secondary-treated, but not always) are discharged into the lagoon, which also receives industrial effluent, the flow of several storm sewers, and discharge from a couple of ditches and intermittent streams that drain farmlands and an area of urban development.

In the summer, high evaporation and reduced exchange of lagoon waters with seawater causes an increase in salinity, which produces an algal bloom, which in turn raises the biological oxygen demand in the Lake. When the oxygen content of the water is exhausted, there is a huge production of chromic sulfide bacteria, and Tunis becomes pervaded by a sulfurous odor. Techniques proposed to improve the condition of the Lake of Tunis include: 1) increasing the capacity of Tunis' sewage treatment plant; 2) discharging the effluent in the navigation canal or into a nearly sebkha; 3) improving water circulation in the lagoon; and 4) harvesting algae before its peak die-off period to decrease the accumulation of organic matter.

2.1.3.2 Lake Ichkuel[15]

Lake Ichkuel is the most important waterfowl wintering site in all of northwest Africa. Its 88,000 hectares of lake and marsh area are refuge to 300- to 400,000 waterfowl and hundreds of thousands of birds of other species each year. Located near the industrial and port city of Bizerte, the lake has been designated a national park.

Six rivers drain into the lake and an open channel, the Tindja, connects it to a salt lagoon, the Lake of Bizerte. Seasonal fluctuations in water level of Lake Ichkuel

[14] Source: Harbridge, W. et al. 1976.

[15] Source: Dep. of State telegram #05186.

cause the salt water/fresh water inundations that maintain the productivity of the marsh. This regime will be altered by the construction of a dam on the Djouminie River and on the Sedjanane River which flow into the lake and marsh area. Reduced flow of fresh water into the lake will alter the vegetation types, shrink the marsh and cause it to be more saline.

To protect the area, it has been suggested that a sluice gate be built on the Tindja to regulate the level of the lake after the dams are constructed.

2.2 Soils[16]

By and large, Tunisian soils are characterized by a pH of about 7 and some amount of calcium. Organic matter, when present, is usually well decomposed but contributes only slightly to the structure of the soils. When there is any relief, the soils are generally unstable and very prone to erosion.

In the sub-humid and semi-arid regions of the north, brown calcareous soils predominate. Other soils containing less calcium are characterized mainly by the leaching of iron and clay. These are classified as brown forest soils, brown leached soils, and leached podzolic soils. In addition, soils deposited above marlaceous deposits often contain vertic clays.

In the central part of the country, with semi-arid and sub-arid bioclimatic regimes, the soils are brown soils and subtropical isohumic soils (brown steppe soils).

In the south, where there are soils at all, they tend to be gypsum-bearing calcimorphic soils and chermozems. The Tunisian Sahara is marked by dunes and rock outcrops lacking any soil cover.

Some exceptions to the above classifications are a few hydromorphic soils, vertisols and halomorphic soils which occur at points throughout the country. Their total area comes to about 1.5 million hectares.

Of Tunisia's 18.2 million hectares of land area:

- 3.2 million hectares is cultivable (1.2 million hectares for annual crops) although there is a problem of good soils being located where water resources are poor, and vice versa;[17]
- 1.0 million hectares is appropriate for forest, maquis and forest fringe;
- 0.9 million hectares is in esparto grass;

[16] Source: Chaabouni, Z. 1979.

[17] Source: Johnson, H. and J. Johnson. 1977.

6.2 million hectares is in forest borderlands;

and the remaining 3.7 million hectares is unproductive land, due either to its aridity, salinity or high erodability.

The Soils Division, created in 1943, has thoroughly inventoried and mapped the soils of Tunisia. [18]

2.3 Land Use and Erosion

2.3.1 Natural Vegetation

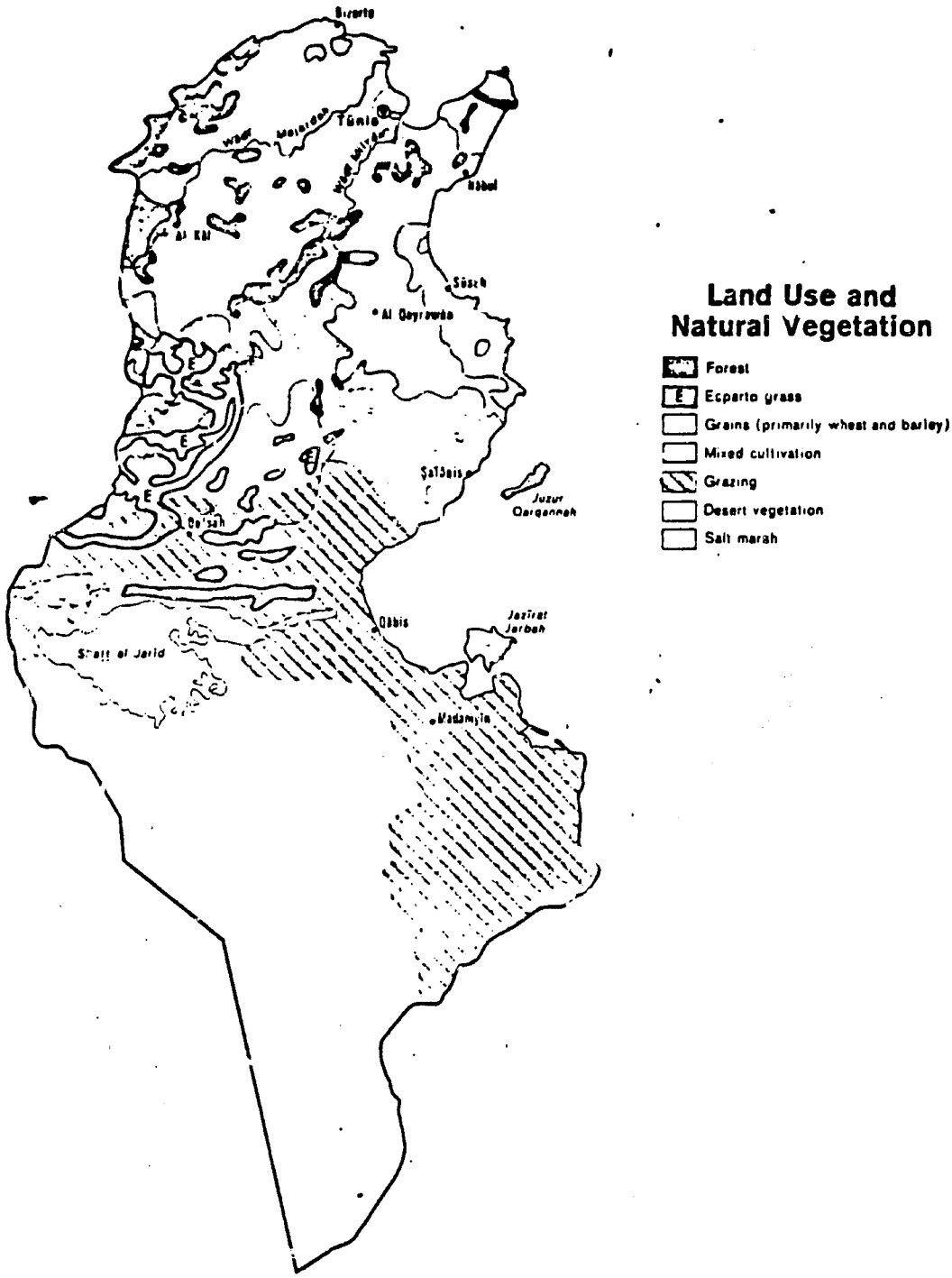
After millenia of human occupation, there is no part of Tunisia that is free of human influence. By "natural vegetation", the writer has in mind vegetation which is more less indigenous and would reestablish in an area if protected from disturbance.

Only two groupings of such plant communities appear in the literature: the forests of the northern mountains, and the vegetation of the steppes. The former consists principally of cork oak and live oak, with heather undergrowth, in the Kroumirie Mountians; in the Central Tell, there are a few remaining mastic trees, wild olives, and jujube trees; and the High Tell supports some Aleppo pine and other evergreens, plus the northernmost population of gum trees in the country.[19] The steppe vegetation is characterized by (1) esparto grass on rocky mountains and calcareous soils, with some Aleppo pine, live oak, juniper and gum trees; (2) Artemisia herba alba on loam soils; and (3) on sandy soils, a community of Rhantherium suaveolens, Aristida pungens, etc. In addition, there are about ten types of gypsophytic and halophytic steppes.[20] The following map indicates the location of forests, both "natural" and planted; the steppe vegetation is listed here as esparto grass and grazing lands. Clearly much of the natural forest and steppe vegetation has been replaced by cultivation.

[18] Source: Paylore, P. 1977.

[19] Source: Reese, H. C. et al. 1970

[20] Source: Floret, C. et al. 1978.


Land Use and
Natural Vegetation
Forest
Esparto grass
Grains (primarily wheat and barley)
Mixed cultivation
Grazing
Desert vegetation
Salt marsh
Tunis
Nabeul
Al Qayrawan
Sousse
Sfax
Gabès
Qabis
Madamyin
Jazirat Jerbah
Shatt al Jarid

2.3.2 Agriculture

The table below shows the chief Tunisian crops and production levels for several years in the past decade. The great variations in productivity demonstrate the dependence of Tunisian agriculture on the unpredictable rains. It is not surprising that so much government effort and foreign aid is being placed in irrigation schemes. (See Sec. 1.3).

AGRICULTURE[21]
PRINCIPAL CROPS
('000 metric tons)

	1974	1975	1976	1977
Wheat	755	976	919†	604
Barley	171	260	230†	95
Potatoes	100	106†	105†	90
Olives	525	680	530†	n.a.
Tomatoes	238†	267†	275*	270
Chillis and peppers	103	113†	118*	120
Onions	33*	35*	37*	n.a.
Water melons	150	160†	160*	210
Grapes	180	155†	155*	n.a.
Dates	44	45	46*	48
Sugar beet	47	65	83†	85
Apricots	22	23†	24*	28
Oranges	59	76	86	72
Tangerines and mandarines	17	24	31	38
Lemons and limes	18	15	19	25
Almonds	23	24.2†	24.7*	26
Tobacco	3	3*	3*	4

* FAO estimate. † Unofficial figure.

There are a number of advantages to increasing and improving agriculture in Tunisia. (1) It will improve the country's balance of trade to be able to count on exporting agricultural produce rather than having to import even basic food stuffs in dry years. (2) If agricultural development is organized to maximize social benefits, it could significantly improve the economic and nutritional status of the Tunisian population. (3) Some experts argue that agriculture, properly managed, is a more efficient and less destructive land use than pastoralism (to compare only those activities from which the Tunisians have traditionally derived their livelihood). To quote Wagner, (page):[22]

> "Meat products, both through direct use and sale which enables market food purchase, contribute about a third of the family's annual caloric need (Bedoian 1977) from 80 percent of the land. Two-thirds of the family's annual based on caloric production per unit of land, pastoralism is only about one'sixth as efficient as grain cultivation.

[21] Source: Europa. 1978

[22] Source: Wagner, F. 1978.

A fifty percent increase in the minor fraction of land under cultivation would provide the same family income as now provided by livestock."

2.3.3 Fisheries

Sfax is the center of the fishing industry, which employs about 14,000 men and commands a fleet of some 4,000 boats. The Bureau of Fisheries is working to modernize fishing methods, and foreign aid has been channelled to the developing industry. A record of the catch from 1971 to 1974 is presented below.

FISHING [23]
('000 metric tons, live weight)

	1971	1972	1973	1974
Inland waters	0.1	0.1	0.8	0.3
Mediterranean	27.4	28.0	31.0	42.4
TOTAL CATCH	27.5	28.1	31.8	42.7

2.3.4 Pastoralism [24]

Except for the relatively humid Tell region, which has served as a granary since Roman times, most of Tunisia was the domain of nomadic herdsmen up until the late 19th century. With such a large area at their disposal, the herders could move their flocks as the range became depleted in one spot. Since precipitation can vary greatly between two points just sixty kilometers apart, a two-day journey could bring them to better pasture. The vegetation at the first point would be able to restore itself during this period of respite, and thus productivity of the range could be sustained indefinitely.

This pattern was disrupted when the French colonized Tunisia beginning in 1881. The tracts of land taken by the colonists restricted the movements of the herders, and the concept of private land ownership was introduced. Since that time, the development of wells, agrarian reform, and public housing arrangements have added to the incentives for sedentarization. True nomadism has now disappeared. People will only move as a last resort in a period of extreme drought.

Sedentarization has brought great pressures to bear on the pasturelands. Now, in a dry year, rather than roaming to find a more productive range, the herd stays in one place and strips all of the vegetation there, reducing its restorative ability. Estimates of livestock numbers and their requirements for feed are given below:

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[23] Source: Europa. 1979.

[24] Source: Wagner, F. 1978.

LIVESTOCK

(FAO estimates-'000 head)

	1974	1975	1976
Horses . .	102	104	106
Asses . .	190	193	195
Cattle . .	830	870	880
Camels . .	180	180	195
Sheep . .	3,300	3,400	3,526
Goats . .	790	850	900

Source: Europa. 1979

Dry weight of natural vegetation consumed per ha by adult sheep and goats on the Chaabania Area, 1972-73 to 1976-77

Year	Adult sheep and goats/ha (a)[1]	Kg forage consumed/ha (b=a x 365)[2]	% natural veg. in diet (c)[2]	Kg nat. veg. consumed/ha (d = b x c)
1972-73	0.27	99	57	56
1973-74	0.35	127	84	108
1974-75	0.49	179	100	179
1975-76	0.55	201	100	201
1976-77	0.58	212	72	153
Means	0.45	164	83	139

1. Stocking dependent on forage production, dependent in turn on rainfall

2. Forage is supplemented with feeding of grain straw, olive boughs, hay and/or barley when forage production of range is inadequate

Source: Wagner. 1978.

Net production of the range, measured in a protected plot, varied from 128 kilograms of dried plant material per hectare in a one-year period, to 1,244 kilograms per hectare. The lower figure represents the first year in which the plot was protected from grazing, and it was a dry year; the high figure was after four years of protection and good rains for the year.

A rule of thumb used in range management in North America suggests a stocking rate of one animal unit (equal to five adult

sheep or goats, with or without young) per inch of rainfall per square mile per year. Converted into metric units and assuming average annual precipitation to be ten centimeters, this rule would allocate four animal units (twenty sheep or goats) to 2.63 square kilometers per year. Instead, a study of a representative rangeland in Tunisia found stocking to be three to eight times greater than this ideal rate. At the same time, due to this heavy use, the ecosystem is estimated to be producing at only about half its capacity.

Estimates of livestock products for 1974 through 1976, are given below.

LIVESTOCK PRODUCTS

('000 metric tons)

	1974	1975	1976*
Beef and veal	25†	26†	26
Mutton and lamb	33†	34†	35
Cows' milk	185	186	191
Wool (greasy)	5.9	6.1	6.4
Cattle hides	5.6*	6.0*	6.0
Sheepskins	5.5*	5.7*	5.9

*FAO estimates. †Unofficial figure

Source: Europa. 1978.

2.3.5 Forests

Forested land was reported to cover only 3.2 percent of Tunisia's total land area in 1977. Tunisia lost a third of its forest in 60 years, and much of what remains is degraded. This rate of loss of vegetative cover is the highest of the Maghreb countries. [25]

The government has focused on this problem more in terms of the increase in erosion caused by this reduction of vegetal cover than in terms of loss of a potential forest industry. Still, there has been a considerable amount of research on species that would serve not only to reduce erosion losses, but to be

[25] Source: Bensalem, B. 1977.

tapped for resin or harvested for timber. *Pinus halepensis* especially is under study for these purposes.[26] The present scale of the Tunisian forest industry is indicated in the following table. Reforestation efforts are described in Section 2.3.5.

FORESTRY

ROUNDWOOD REMOVALS
('000 cubic metres)

	1974	1975	1976
Sawlogs and veneer logs	13	8	4
Mine timber	4	-	2
Pulpwood	22	12	12
Other industrial wood	71	73	73*
Fuel wood	1,685	1,725	1,725*
TOTAL	1,795	1,818	1,816

*FAO estimate

Source: Europa. 1978.

2.3.6 Erosion/Desertification[27]

2.3.6.1 The Problem:

An estimated 18,000 hectares of potentially productive land in Tunisia is lost to the desert each year. This process has been dubbed "desertification", defined by Bensalem[28] as ". . . the decline of soil productivity as a result of unwise land use practices under the marginal

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[26]Sources: Dahman, M. 1975.
Hadri, H. and H. Tschinkel. 1975.
Tschinkel, H. 1976.

[27]Sources: Bensalem, B. 1977.
Chaabouni, Z. 1979.
UN Conference on Desertification. 1977.

[28]Source: Bensalem, B. 1977.

climatic and edaphic conditions prevailing in southern parts of (the country)." This advance of the desert is perhaps the most spectacular soil erosion problem in Tunisia, but erosion is not by any means limited to the desert fringe. Roman wheat fields on the slopes of the High Tell are now only marly and calcareous outcrops; their soil washed down to the plains below.

Erosion in all parts of the country is set in motion by disturbance of the vegetation cover. This occurs through (1) removal of wood for fuel; (2) clearing land for agriculture; (3) leaving land fallow between crops; and (4) overgrazing.

Removal of the vegetation exposes the soil to the forces of sun, wind and water. The best topsoil is rapidly removed, leaving a poorer growth medium, so that the vegetation, still under pressure from the activities which disturbed it originally, is also under stress from the point of view of orient supply. This is only one of the cycles of environmental degradation caused by non-conservative uses of land.

Agriculture is a continuous source of erosion problems, especially since the advent of mechanized farming (greater soil disturbance) and the burning or grazing of crop stubbles, rather than letting them stand to hold the soil. Traditional practices are also damaging, such as the fact that cultivation is rarely carried out on the contour, and that steep slopes unsuited to cultivation are often farmed.

Overgrazing indicates another cycle of deterioration. The worsening condition of rangeland is due largely to sheer numbers of livestock grazing or browsing the vegetation and trampling the exposed soil, so that its capacity to absorb rainfall is reduced and a larger percentage of rainfall runs off over the surface at erosive velocities. But part of the problem is the timing of grazing: if the animals are on the pasture during the period when the plants are flowering or actively growing, the next year's production will be substantially reduced, the hungry animals will strip the plants further, and so on.

Both water and wind erosion are serious problems in Tunisia. Water erosion is the most serious, apparently because the land is steepest where the rainfall is highest. The parent rock is sedimentary, easily erodible, and, when the vegetation cover is degraded (as it is in virtually all of the country), great erosion events occur. Mass wasting and gullying are common in the Tell region. Mean annual solid transport of the Majardah River measured at Medjez El Bab, some 75 kilometers upstream of the mouth, is 21.5 million tons, with a mean concentration fo 30 grams

per liter. The rate of erosion then is 1020 tons per square kilometer per year. In the central region of the country, although rainfall is generally less than in the north and the topography not as steep, the deterioration of the range and increasing agricultural activity has set up a situation in which the occasional violent storm causes catastrophic floods carrying millions of tons of sediment.

Wind erosion occurs throughout the country, but it is critical in the south, where the advance of the desert is marked by the movement of dunes. Strong winds below both from the north and from the south; the latter, the sirocco, a hot spring wind blowing out of the Sahara, is especially destructive. Although wind erosion has not been quantified, its grave effects on life are apparent. Oases have been completely "fossilized" under dunes.

2.3.6.2 Counter-Erosion Activities

Just as erosion begins with the removal of vegetation, returning the land to health begins with restoring the vegetation cover. If the land could be left alone, it might very well accomplish this on its own. Rangeland which was protected from grazing for four years increased its productivity by two to five times, and dunes which were active outside of the fenced enclosure were stabilized in the protected plot.

But it is not feasible to consider total protection as an alternative. What is necessary is to strike a balance between use of the country's natural resources and accomodation to the natural processes which will keep those resources productive.

In agriculture, this will entail:

1) contour plowing on all slopes greater than two percent;

2) crop rotation, rather than allowing a fallow period when the soil is laid bare to erosive forces;

3) mulching, by leaving crop stubble standing to reduce sheet erosion;

4) strip cultivation, so that bands of grasses or small grains act as a filter for eroded soil. These last two devices require the exclusion of grazing, a condition that is not usually met.

5) mechanical structures where appropriate, to heal gullies or construct terraces. Terraces have often been constructed in Tunisia on clay soils or in

other situations where they are not appropriate and, in fact, increase rather than reduce erosion.

In rangeland:

1) reduce or avoid grazing during the growing season;

2) graze different species of livestock separately and alternate them on different pastures, so that different plants or parts of plants favored by one type of animal would be rested while another animal is on the range (this is an experimental approach, and not all of the results are yet in);

3) reduce animal numbers. This can only be effective where another viable livelihood is available to the pastoralists.

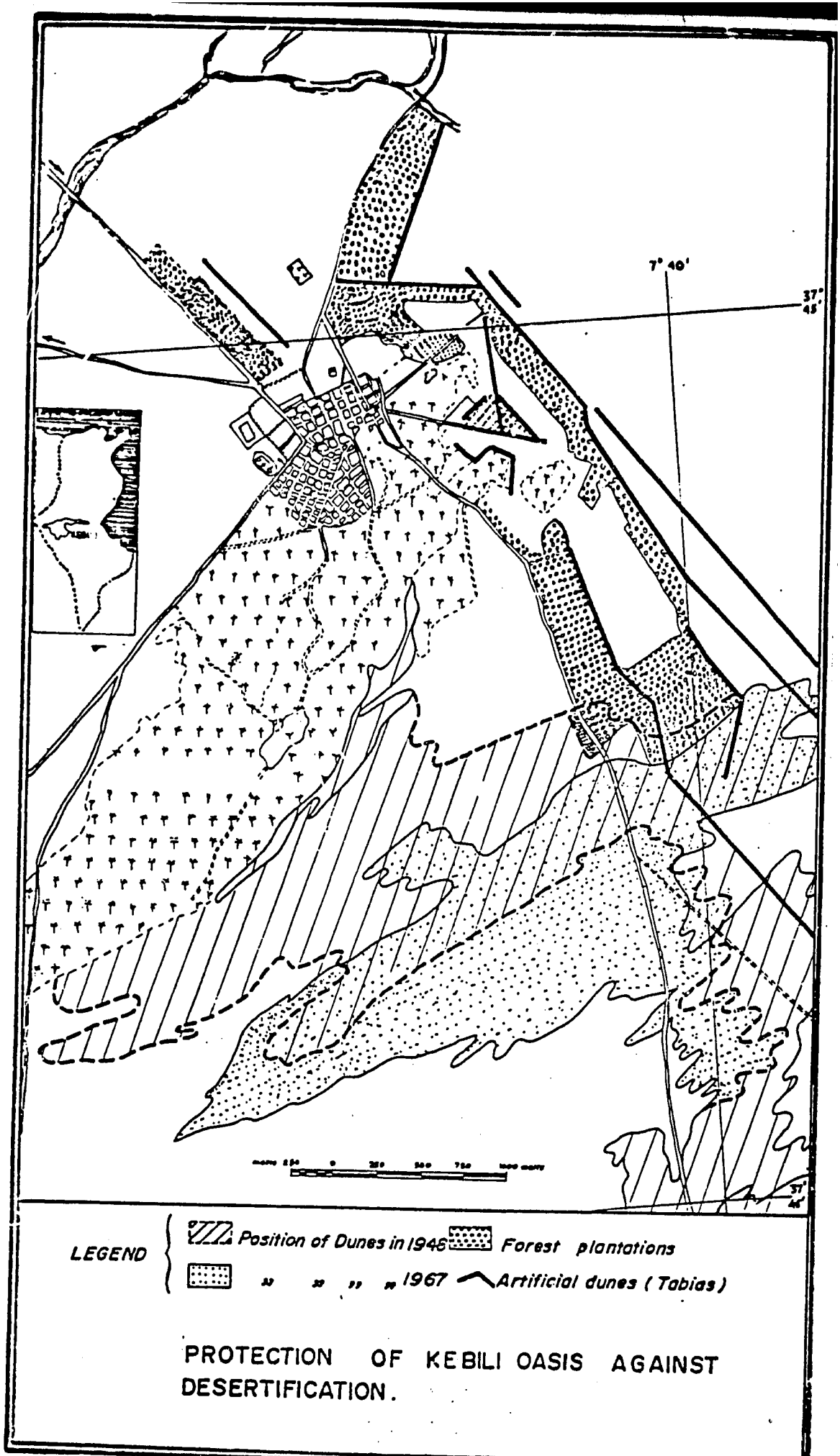
4) plot studies were conducted in the mid-1970s to plan the development of the "natural ranges" and to control the use of the esparto grass lands. The latter will be integrated within comprehensive rural development, and will have to balance the uses of esparto grass for grazing and for paper production.

General protection activities:

1) Sand Dune Stabilization

To stabilize coastal dunes, the Department of Forestry has established forests that produce five to eight cubic meters per hectare. Acacia species are planted first because they improve soil conditions. After twenty years, pines (Pinus halipensis and Pinus pinea) and eucalypts are planted. 30,000 hectares of coastal dune forest had been established in 1977, with 7,000 more hectares to be planted in the next five years.

Continental sand dunes in the deep south are similarly treated, but on a much smaller scale (2700 hectares) and with a somewhat different and more varied species mix. Attention is also given to stabilizing dunes around oases. An earthen wall a meter high, called a tabia, is constructed 300 meters away, and then topped by a barrier of palm leaves or cement sheets. The upper barrier is raised as the dune rises to cover it. A strip of forest averaging 50 meters wide is then planted between the barrier and the oasis. The cost of such a project is roughly US $500 per kilometer. An example of sand dune fixation at Kebili oasis is shown below:



PROTECTION OF KEBILI OASIS AGAINST DESERTIFICATION.

Source: UN Conference on Desertification. 1977.

2) Afforestation

More than 30 million seedlings are produced annually by the government and the private sector and provided at nominal prices to growers. About 6000 hectares are planted annually, principally in Pinus halipensis, P. Pinea, P. maritima and Eucalyptus spp. The main goals of afforestation have been to restore the degraded P. halipensis forest and to rehabilitate and protect watershed areas.

There are 45 experimental arboreta producing great quantities of data which has yet to be thoroughly analyzed.

3) Reclamation of Mountain Areas

Small rock dams are constructed at appropriate points in small valleys, so that soil washed down by rainfall will be deposited in small "oases" where fruits, forage and cereal crops can be cultivated. Some 37,500 of these dams were built between 1968 and 1976, bringing over 12,500 hectares under cultivation.

4) Alternate Fuels

It is Tunisian government policy to substitute petroleum products (presumably kerosene) for fuelwood for cooking. This would address a major source of devegetation. At present, even roots are unearthed for fuel in some places.

5) International Cooperation

In 1977, Tunisia signed a protocol with its North African neighbours (Algeria, Libya, Egypt, and Morocco) on cooperation in antidesertification activities. The protocol set up a Permanent Joint Committee which was to be responsible for coordination of national projects, exchange of technical information, collaboration on training activities, and disbursal of funds contributed by member states and foreign aid organizations.

A major activity proposed to be coordinated by this committee is the development of a transnational "green belt": a zone comprising a variety of devices for the prevention of further degradation of the ecosystems. The green belt would include windbreaks and shelterbelts of trees, conservation farming, and carefully managed rangeland. The width of the green belt would vary according to

local climate and topographic conditions, but generally speaking the location would be at the isohyets of 150 to 250 millimeters of annual rainfall.

2.4 Wildlife/Wildlands[29/]

2.4.1 Protected Areas

There are four parks in Tunisia, but none meet the standards of the IUCN as an adequate preserve for the vegetation and wildlife contained therein. The reserves are:

1. Parc National Djebel Chambis

2. Parc National des Iles Zembra et Zembretta: two islands at the mouth of the Gulf of Tunis.

3. Parc National de l'Ichkuel: a major waterfowl and migratory bird refuge (see Sec. 2.1.3.2) near the city of Bizerte.

4. Bou-Hedma State Park. Located nearly in the center of the country, west of the Sfax and north of the Shott Djerid, the park has an area of 11,625 hectares. It contains a relict population of gum acacias, together with a rich and varied steppe flora. The Dorcas gazelle survives on the plains and Barbary sheep in the highlands; there are a number of rodents including porcupine, gundi, gerbils and jerboas. Bird life includes the only Tunisian occurrence of the Mauritanian subspecies of magpie Pica p. mauretanica, and the fulvous chatterer Turdoides fulvous. The park is still somewhat degraded by grazing activities, which in 1971 had not been altogether excluded.

2.4.2 Wildlife

The Kroumirie mountains harbour Barbary stag, Barbary sheep, mouflon and other varieties of gazelle. The Barbary leopard may still exist in the northwestern mountain forests. A World Wildlife Fund project to protect the Atlas deer has brought a

[29] Sources: Department of the Interior. 1979
Department of State telegram #05186.
Fisher, J., N. Simon, and J. Vincent. 1969.
IUCN. 1976
IUCN. 1971.
Johnson, H. and J. Johnson. 1977.
Personal communication, James Corson, MAB Washington, D.C.
Reese, H. et al. 1970.

near-extinct population of this species back to flourishing; and water buffalo are being reintroduced into their original wild habitat. There are hunting associations to regulate indiscriminate shooting and forest guards to prevent poaching. However, to a very large degree, the status of wildlife is dependent on the condition of the wildlands, and there are very few parts of Tunisia that provide a viable habitat.

The IUCN Red Data Book lists the following Tunisian animals as rare or endangered species:

Hyaena hyaena barbara	Barbary hyena
Panthera pardus tulliana	Barbary leopard
Cervus elaphus barbarus	Barbary deer
Gazella dorcas massaesyla	Moroccan dorcas gazelle
Gazella cuvieri	Cuvier's gazelle
Gazella leptoceros	Slender-horned gazelle

2.5 Minerals

Minerals are Tunisia's most important source of foreign exchange. Some 24,000 people are employed in mining and quarying alone Some production figures are given below:

MINERAL	1974	1975	1976	1977
PETROLEUM (CRUDE)	≈4 MILLION MT*	5 MILLION MT	3.7 MILLION MT	4.6 MILLION MT
CALCIUM PHOSPHATE	3.8 MILLION MT	3.5 MILLION MT	3.3 MILLION MT	3.8 MILLION MT
PHOSPHORIC ACID		102,000 MT	237,000 MT	
NATURAL GAS	201 MILLION M^3	210 MILLION M^3	214 MILLION M^3	250 MILLION M^3
IRON ORE (METAL CONTENT)	422,000 MT	326,000 MT	N.A.	N.A
LEAD ORE (METAL CONTENT)	12,500 MT	17,100 MT	17,000 MT	N.A.
ZINC ORE (METAL CONTENT)	6,200 MT	8,800 MT	9,800 MT	N.A.
SALT	300 TO 22,000 TONS PER YEAR			

*MT = METRIC TONS

Petroleum was first found in Tunisia in 1964 near the southern Algerian border. A number of sites have been located since, including some on the continental shelf east of Sfax and in the Gulf of Gabès. The latter has been the cause of a dispute between Tunisia and Libya over ownership of the oil. A number of foreign companies have conducted and are conducting explorations and development of petroleum reserves in Tunisia, but the Tunisian government retains roughly 50 percent control of the industry. Total recoverable reserves were estimated at 53 million tons in 1971. There is a refinery at Bizerte capable of processing 1.2 million tons a year; its capacity is to be expanded to handle four million tons per year. Petroleum is Tunisia's main export.

The second largest export is phosphates and phosphate products. Tunisia is the world's fourth largest producer of calcium phosphates. The government is promoting development of new resources and the manufacture of fertilizers and phosphoric acid. There are plans to acheive a production capability of 7.5 million metric tons of phosphate fertilizers annually. The Abu Dhabi Fund for Arabic Economic Development is financing a plant to produce phosphoric acid and diammonium phosphate, and eventually ammonia, nitric acid and monoammonium phosphate. The plant is to be fueled with local reserves of natural gas. Phosphate mining is under the financial control of the government.

Natural gas fields are found in Cap Bon and in the original petroleum fields at El Borma, as well as in some offshore fields. Supplies are estimated to be adequate for local needs for 20 years. In addition, Tunisia will receive a share of the natural gas being piped from Algeria to Italy.

There are a number of deposits of rich non-phosphorous iron ore, especially at Djerissa and Douaria, but reserves are dwindling. The same is true of zinc supplies, but a new mine opened in 1978 should boost production again.

3.0 Environmental Legislation[30]

3.1 Summary of Areas Covered by Environmental Legislation:

	Protection	Regulation of Use and/or Rights
Air		
Fresh Water	X	X
Sea Water	X	
Soil		X
Land Use		X
Vegetation	X	X
Wildlife/Wildlands	X	X
Fisheries		X
Non-renewable Resources		X
Hazardous Substances		X
Solid Waste Disposal		X

3.2 List of Laws

3.2.1 Water[31]

3.2.1.1 Domestic Regulations

Decree of 24 September, 1885 (four years after establishment of the French Protectorate), relative to the Public Domain. Waters specified to be in the Public Domain are:

- sebkhas--small saline lakes
- watercourses and the land within their overflow banks
- springs

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[30]Source (unless otherwise indicated): Johnson, H. and J. Johnson, 1977.

[31]Source: Caponera, D. A. 1973. p. 162-190.

- public aqueducts, wells and watering places, and their appurtenances

- navigation, irrigation and drainage canals constructed in the public interest; also the land within their overflow banks, and their appurtenances.

Decree, 1920: the Water Code (since modified). Covers all aspects of water management, including the establishment of a Special Water Department, an Agricultural Hydraulics and Industries Fund, and a Water Committee.

Decree, 1933 (since modified): regulates conservation and utilization of public domain waters. Exploitation is only permitted with prior authorization, except for wells less than fifty meters deep on private land. The decree further prohibits discharge of pollutants into public domain waters, as well as forbidding activities in the protected area of a water source which are liable to pollute the source.

Water quality is also addressed in a decree of 1968 concerning dangerous, unsanitary or incommodious dwellings. It is required of those filing for building permits, to specify the planned mode and conditions of refuse water drainage, use, and treatment.

A Municipal Law of Tunis specifically prohibits discharge of refuse or any other noxious substance into canals, sewers or rivers, on penalty of a year's emprisonment. Discharge into the sea from tourist resorts is also prohibited.

Currently, the Ministry of Public Health and the Pasteur Institute of Tunis apply World Health Organization (WHO) standards to controlling drinking water quality. These standards are useful in measuring bacteriological contamination, but the WHO standards for chemical concentrations are impossible to apply because of the quality of water resources, especially in the South.

Decree, 1936 (since modified): regarding organization of groups with hydraulic interests in common, into Water Users Associations.

Decree, 1953: regarding mines. Includes measures for water conservation.

Regulation, 1958: supports farmers in the creation and management of private water wells.

Law, 1959 (revised 1966): promulgates the Forestry Code (see Forestry, below) and State Promotion of Water Exploitation and Conservation.

Decree No. 64-77, 1964: regulates state support for irrigation from private water wells. Amplified by an Order in the same year.

Law No. 68-22, 1968: regarding creation of the National Society for the exploitation and distribution of waters; deals with potable waters.

Decree, 1970: issues water subscription regulations. Water rights may be revoked if water is wasted or misused.

Decree, 1972:[32] determines the amount of agricultural loans and subsidies for the promotion of water and land conservation.

Decree No. 73-227, 1973:[33] designates the tourist centers in coastal areas in which the national company for the management and distribution of water is to assume responsibility for wastewater installation operation.

3.2.1.2 International Agreements[34]

Barcelona Convention for the Protection of the Mediterranean Sea Against Pollution (16 February, 1976). By this convention, Tunisia and most other Mediterranean countries agree to control dumping of pollutants from ships, and to combat oil spills and other harmful substance pollution.

Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-Based Sources (1979). Fourteen Mediterranean countries including Tunisia agreed via this protocol to control release of land-based pollutants into their common sea. A number of

[32] Source: U.S. Environmental Protection Agency, 1976.

[33] Source: ibid.

[34] Sources: UN Environment Program/WG. 17/6
World Environment Report, 1979.

black-listed substances are not to be released at all, if possible; these include mercury, cadmium, used lubricating oils, phosphorus, persistent synthetic materials, carcinogenic or mutagenic substances, and radioactive substances. Discharge of a range of other substances, including metals and pathogenic micro-organisms, is monitored to ensure that it is below harmful levels. All of the signatories of the protocol bind themselves to exchange all information relevant to pollution of the Mediterranean.

3.2.2 Soil[35]

- Decree, 1949 (modified 1956): regarding protection and restoration of soils. Stipulated that on land with a slope greater than 20 percent, certain land uses could be prohibited in favor of conservation of the vegetative cover, and/or the landowner could be required to construct soil and water conservation structures. The decree provides that if local landholders organize themselves into an association to develop such works, they will be granted government loans or subsidies for the projects.

- Decree, 1957: regarding land improvement.

- Law No. 58-105, 1958: made it mandatory to carry out agricultural activities along the contour and to take measures to mend gullies, etc., on any land with a slope greater than 2 percent. As Caponera notes, however (p. 176), "The implementation of these measures encounters... certain difficulties on the part of the population concerned."

- Order, 1958: "relative to preservation and reclamation of soils";[36] presumably an administrative response to the above decree.

- Act No. 63-17, 1963: the Agricultural Development Act.

[35] Sources: Caponera, D. A. 1973. pp. 162-190.
Johnson, H. and J. Johnson. 1977.

[36] Sources: Johnson, H. and J. Johnson, 1977. 927620/03

- Order, 1964: regarding soil conservation and improvement.

- Law of 1966: the Forest Code (see Forestry, Sec. 3.2.4), in part, requires all landowners to assign 2 percent of their property to forest plantation to protect banks and beds of watercourses against scouring. Land-clearing, grazing in public forests, and management of alfalfa fields are also regulated.

3.2.3 Land Use

3.2.3.1 Domestic Regulations

- Law No. 58-63, 1958: Agrarian reform in the Majardah Lower Valley. (Note: agrarian reform and water law are closely allied. Minimum and maximum size of landholdings are determined partly by irrigation considerations.)

- Law No. 59-48, 1959: relative to the sequestration of insufficiently or inadequately cultivated land.

- Decree-Law No. 64-3: obligatory land registration.

- Decree No. 66-237. Regarding establishment and organization of an Association of Collective Interests (related mainly to water works). There are a large number of such collectives in existence to manage various aspects of water use. The three largest oases, Nafta, Tozeur, and Gabès, are managed by a Union of Oasis Owners.

- Decree No. 66-234, 1966: established a number of agricultural cooperatives.

- Law No. 69-56, 1969: places foreign-owned properties under domestic control and specifies the rights of exploitation of such land.

- Act No. 69-56, 1968: in part, regulates land distribution.

Decree No. 77-627, 1977:[37] determines the organization and operation of the Land Reform Board for public irrigation zones.

Decree No. 77-628, 1977:[38] prescribes the composition and operational procedures of the Commission responsible for examining appeals and observations arising out of the land reorganization plan, in the case of land in public irrigation zones.

3.2.4 Forests and Vegetation

- Decree, 1903: delimits Dominial wooded lands.
- Decree, 1948: verifies Forestry Regulations.
- Decree, 1948: alters legislation related to private rural state property.
- Order, 1953: a list of animal and plant pests noxious to crops.
- Law No. 57-64, 1957: regarding export of Esparto grass.
- Act No. 58-106, 1958: governs mandatory afforestation.
- Law No. 58-83, 1958: limits the raising of goats.
- Law No. 59-96, 1959: regulations covering state forests, the Forest Service, and forest conservation.
- Act No. 59-143, 1959: promotes destruction of jujube trees.
- Decree-Law No. 60-30, 1960: further regulates conservation and exploitation of Esparto grasslands.

[37] Source: FAO. 1979. p. 107.

[38] Source: ibid

- Decree-Act No. 60-21, 1960: regarding plant incineration.

- Order, 1960: regulates Rights of Usage in state forests.

- Order, 1960: specifies precautionary measures to be taken to prevent forest fires.

- Act No. 60-28, 1960: regarding the demarcation of land suitable for forest use and its classification as state land.

- Decree No. 66.212, 1962: establishes a list of plant and insect pests.

- Law No. 66-60, 1966: the Forestry Code. Regulates the conservation and exploitation of forest resources, including reforestation, stabilization of sand dunes, and management of esparto grasslands.

- ecree No. 66-526, 1966: amplifies forestry code regarding obligatory reforestation.

3.2.5 Wildlife/Wildlands

- Law No. 66-64, 1964: regulates animal slaughter and animal product sales.

- Law No. 66-60, 1966: the Forestry Code (see 3.2.4), including legislation on national parks and recreational forests.

- Regulation, 1966: regarding protection of birds.

- Regulation, 1966: established statutes of Regional Associations of Hunters, and provided for hunting guards.

- Regulation, 1966: regarding hunting regulations for specific land and forest areas.

3.2.6 Fisheries

- Decree, 1906: regulates coastal fishing.
- Decree, 1951: on maritime fishing. Amended in 1962 by Act 62-35, which defines Tunisian territorial waters.
- Regulation 1951: on inspection and regulative administration of maritime fishing.
- Regulation 1955, 1956: governs exploitation of sponge fishing.
- Regulation 1958: regulates fishing with fire.
- Order 1958: fishing regulation.
- Order 1960: regarding fishing with dragnets.
- Act No. 63-50, 1963: ratifies Tunisian/Italian fishing rights.

3.2.7 Minerals/Atomic Energy

- Decree, 1953 (modified 1955): all aspects of mining.
- Decree, 1955: regulates exploitation of quarries.
- Regulation (Arrête) 1955: amplifies above.
- Law 26, 1965. Petroleum Products Law.
- Law No. 66-46: approves a convention with AGIP mineraria to explore and mine mineral resources.

3.2.8 Hazardous Substances

- Law No. 69-54, 1969: regulates poisonous substances.

- Act No. 69-54, 1969: carries out above.

- Order, 1970: classifies poisons in Schedules and lists exemptions from the regulations concerning poisons.

3.2.9 Environmental Policy

- Decree No. 78-373, 1978: establishes the National Environmental Board (see 4.1.7).

4.0 Environmental Organizations[39]

4.1 Governmental

4.1.1 Ministère d'Agriculture (Ministry of Agriculture): the agency chiefly responsible for environmental research, protection and management. These activities are carried out through:

4.1.1.1 Direction de l'Enseignement de la Recherche et de la Formation des Cadres (DERFC) (Directorate of Research Training and Instruction of Cadres).
30, rue Aian Savory
Tunis

Institut National Agronomique de Tunisie (INAT)
(National Agronomic Institute of Tunisia)
43 ave. Charles Nicolle
Tunis

Provides postgraduate courses and conducts research in agronomy; maintains a library of 8000 volumes, 200 periodicals. 31 researchers and 68 technicians on the staff.

Institut National de Recherches Forestières (INRF)
(National Institute of Forestry Research)
B.P. 2
Ariana
Tunis

Eleven researchers conduct studies in forest ecology, forest soils, forest genetics, biometry, silviculture, wood technology, forest entomology, soil and water conservation. INRF owns 4,960 hectares of forest and pasture land. Four- to six-month training courses are available in silviculture, pastoralism and forest genetics. Publications: Annales de l'INRF, Bulletin d'information semestriel, and periodic research notes. Library of 2200 volumes, 100 periodicals.

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[39] Sources: Europa. 1978.
FAO. CARIS. 1978.
Paylore, P. 1977.
Sierra Club. 1976.
US Geological Survey. 1978.
United Nations. 1973.

Centre de Recherches et du Genie Rural (Center for Research and Rural Works)
Route de la Soukra
B.P. 10
Ariana
Tunis

Formerly a UNDP project established in 1962 under the name "Centre de Recherches pour l'Utilization de l'Eau Salée en Irrigation." The work of the Center deals principally with irrigation and drainage, particularly in use of saline water. Short courses in these topics are taught. Library of 5000 works with 112 periodicals. Publications: technical notes, reports of activities. The Center has 7 researchers and 20 technicians, and runs 4 experimental stations, at Cherfech, Hendi Zitoun, Chott Mariem, and Ksar Gheriss.

Institut National de la Recherche Agronomique de Tunisie (INRAT) (National Institute of Agronomic Research)
Avenue de l'Indépendance
Ariana

The principal Tunisian research institute on agronomy, INRAT employs 45 researchers and 105 technicians, utilizes extensive research plots and laboratory equipment, and maintains a library of 6000 volumes with 1200 periodicals. INRAT runs a laboratory for each of the following subject areas: zootechnology, entomology, plant physiology, phytopathology, industrial plants, vegetables, pharmaceuticals, fruit trees, chemistry, viticulture, bioclimatology, biometry, rural economy, fodder, virology, agronomy, botanical and ornamental plants, cereal genetics, cereal technologies. Publications: Annales de l'INRAT, reprints called Documents Techniques, and the Bulletin d'INRAT.

4.1.1.2 Direction des Forêts (Forestry Directorate)
86 avenue Hedi Chacher
Tunis

4.1.1.3 Direction des Ressources en Eau et en Sol (Directorate of Water and Soil Resources)
41 rue de la Manoubia
Montfleury Supérieur
Tunis

4.1.1.3.1 Sous-Direction de Ressources Hydrauliques (Sub-directorate of Water Resources)

Division des Ressources en Eau

Formerly the Bureau de l'Inventaire des Ressources Hydrauliques (Bureau of Water Resource Inventory). Ten hydrologists and four hydrogeologists conduct studies of streamflow regime, groundwater, flood-prone areas and development of water resources. Publication: Ressources en eau de la Tunisie. Library.

Service de Sondage d'Eau (Water-Drilling Service).

In 1973, this department had 18 reconnaissance drilling rigs, 25 exploitation drilling rigs, 40 drillers and 3 drilling engineers.

- Service de l'Hydraulique et de l'Equippement Rural (Hydraulic and Rural Supply Service)

Division des Sols (Soils Division)
Avenue de la République
Tunis-Port

Research in the Soils Division covers methods of study and mapping of soils and adaptations of such methods to the Tunisian context. Subjects include forest soils of the north, vineyard soils, citrus orchard soils, gypsum-affected soils, citrus tolerance to saline irrigation waters, the cereal-growing soils of the north, the study of soil evolution at the edge of irrigated fields, study of the erodability of soils and the phenomena of desertification, and study of the dynamic geomorphology of watersheds.

Facilities:

(a) 2 large laboratories for soil and water analysis; equipment for prospecting and field measurements

(b) a specialized library on pedology and earth sciences, and a document center open to the public

(c) experimental stations of the Ministry of Agriculture; irrigated plots throughout the country

(d) long and short courses for Tunisian and foreign trainees.

Publications: annual bulletin, Sols de Tunisie; maps and special reports.

The work of the Soils Division is carried out by four departments:

a. Service Cartographique (Mapping Service)

b. Service de Recherches et Experimentations Pedologiques (Pedological Research Service)

c. Service Géomorphologique (Service of Geomorphology)

d. Laboratoire d'Analyses des Eaux et des Sols (Soil and Water Analysis Laboratory)

4.1.1.4 Direction des Pêches (Directorate of Fisheries)

Institut National Scientifique et Technique d'Océanographie et de Pêche (INSTOP) (National Scientific and Technical Institute of Oceanography and Fisheries)
Salambô

INSTOP is the principal Tunisian research institute on the subjects of oceanography and fisheries. It employs 12 researchers and 20 technicians, maintains equipment for oceanographic research and a library of 25,000 volumes and 800 periodicals. Research programs include marine biology and ecology, evaluation and estimation of stocking, aquaculture, pollution, and fishing techniques. Publication: Bulletin de l'INSTOP.

4.1.1.5 Mission d'ORSTOM auprès du Ministère de l'Agriculture (ORSTOM Mission to the Ministry of Agriculture. ORSTOM is the French Office of Overseas Scientific and Technical Research)
18 rue Charles Nicolle
Tunis Belvedere

Conducts studies in pedology, hydrology, geology, phytoecology, economics, and geography. Library.

4.1.1.6 Office of Environmental Affairs[40]

Responsible for liason and coordination of all national and international environmental affairs. Ensures that projects with potential impact on the environment be assessed.

[40]Source: US Department of State telegram #05186

4.1.2 Ministère de l'Éducation Nationale (National Education Ministry)

4.1.2.1 Institut de la Recherche Scientifique et Technique (Institute of Scientific and Technical Research)

Centre d'Études des Zones Arides (Center for Arid Zone Studies
Avenue du Sahel No. 11
Tunis

Four researchers, five technicians. Mainly research in plant physiology.

4.1.3 Ministère de l'Économie Nationale (Minsitry of the Economy)
195 rue de la Kasbah
Tunis

4.1.3.1 Direction de l'Énergie (Energy Directorate)

4.1.3.2 Direction des Mines et de la Geologie (Directorate of Mines and Geology)

Office National des Mines

4.1.4 Sous-Secretariat d'État au Plan à l'Industrie et au Commerce (Undersecretariat of State for Planning of Industry and Commerce)
Tunis

4.1.5 Ministry of Health

4.1.5.1 National Office of Environmental Sanitation

4.1.6 Commissaryship of Atomic Energy

4.1.7 National Environmental Board[41]

This body was set up by presidential decree No. 78-373 in 1978. Chaired by the Prime Minister or his representative, the Board is composed of representatives from each department (province), from a number of governmental agencies, from non-governmental environmental organizations, and from several unions and political parties. The decree stipulated that the Board would meet at least once every three months to advise on environmental policy, legislation, and other activities.

4.1.8 National Planning Council[42]

4.1.9 Libraries:

4.1.9.1 National Archives
Présidence de la République
place du Gouvernement
Tunis

Contains 19th century manuscripts in Arabic, Turkish, French, Italian and English.

4.1.9.2 Bibliothèque Nationale (National Library)
B.P. 42
20 Souk-el-Attarine
Tunis

500,000 volumes in 12 languages, 7000 periodicals, 25,000 Arabic and Oriental manuscripts. The depository of books published in Tunisia or written by Tunisians. Offers a bibliographic service. Publications: Bibliographie Nationale, Informations Bibliographiques, Catalogue Général des Manuscrits, and occasional bibliographies on Tunisian subjects.

4.2 Quasi-Governmental

4.2.1 University of Tunis
94 Boulevard du 9 Avril 1938
Tunis

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[41] Source: Department of State telegram 5/31/78.

[42] Source: Frame and Sprague. 1978. Noted as principal influence in science and technology in Tunisia, without elaboration.

Publications: Cahiers de Tunisie (each semester) and Annales de l'Université de Tunis (annually).

4.2.1.1 Environmental Science Related Faculties:

- Faculty of Mathematics, Physics and Natural Sciences.
- Faculty of Law, Political and Economic Sciences.
- Faculty of Medicine

There are faculties situated in other towns, including: Sousse (medicine) and Sfax (medicine, science and technology).

4.2.1.2 Constituent Schools and Institutes:

- Institut de Recherche Scientifique et Technique (Institute of Science and Technology Research)
  Tunis-Carthage

  Develops peaceful applications of nuclear energy; conducts scientific and technical research.

- Institut National de Carcinologie (National Institute of Cancer Research)
  Bab-Saadoun
  Tunis

- Centre d'Études et de Recherches Économique et Sociales (Center for Socio-economic Research)
  rue d'Espagne
  Tunis
  publication: Cahiers

- École Nationale d'Ingénieurs de Tunis (Tunis National School of Engineering)
  Campus Universitaire

- École Nationale d'Ingénieurs (National School of Engineering)
  Gabès

- Centre de Recherche Scientifique (Center for Scientific Research)
  11 avenue du Sahel
  Tunis

  Formerly Centre de Recherches sur les Problèmes de la Zone Aride (Research Center on the Problems of the Arid Zone).

4.3 Non-Governmental

4.3.1 Association pour la Protection de la Nature et de l'Environnement (Association for the Protection of Nature and the Environment)
Ancien Casino de Belvedere
Tunis

Member of IUCN.

4.3.2 Association Tunisienne du Planning Familial (Tunisian Association for Family Planning)
80 avenue Hedi Chaker
Tunis

4.3.3 Fédération des Associations Régionales de Chasse (Federation of Regional Hunting Associations)
rue Charles de Gaulle
Tunis

4.4 Governmental/Nongovernmental Status Unclear

4.4.1 École de l'Aviation Civile et de la Météorologie (School of Civil Aviation and Meteorology)
Tunis

4.4.2 École Nationale de la Statistique (National School of Statistics)
Tunis

4.4.3 Institut d'Économie Quantitative Ali-Bach-Hamba (Ali-Bach-Hamba Institute of Quantitative Economics)
2 rue Benghazi
Tunis

Quantitative studies, methodological research in planning and documentation, social and economic fields.

4.4.4 Institut National de Nutrition et de Technologie Alimentaire (National Institute of Nutrition and Food Sciences)
120 avenue de la Liberté
Tunis

4.4.5 Institut Artoing
Tunis

Veterinary research.

4.4.6 Institut National de Nutrition
12 rue de Rome
Tunis

Research in population nutrition, nutritional pathology, food industry; planning of food production and establishment of nutritional standards; teaching of nutrition and food technology.

4.4.7 Institut National de Recherches Vétérinaires (National Institute of Veterinary Research)
Tunis

4.4.8 Institut Pasteur
13 place Pasteur
Tunis

The principal Tunisian research center in parasitology. Scientific staff of 16, library of 4500 volumes. Publication: Archives de l'Institut Pasteur de Tunis.

4.4.9 Office de la Topographie et de la Cartographie (Office of Topography and Mapping)
13 rue de Jordanie
Tunis

4.4.10 Service Géologique (Geological Service)
95 avenue Mohamed V
Tunis

Geological map-making. Staff of 26; library of 1200 volumes, 500 periodicals. Publications: Annales des Mines et de la Géologie, Notes du service géologique.

4.5 Cabinet representatives of relevant ministries (as of June 1978)

Minister of Agriculture: Hassan Belkhodja
Minister of Industry, Mines and Energy: Rachid Sfar
Minister of Health: Mongi Ben Hamida
Minister of Education: Mohamed Mzali

4.6 National Committee for the Man and the Biosphere (MAB) Programme (as of May 1977)

Chairman: M. El Ali Hili
Faculté des Sciences Mathématiques, Physiques et Naturelles

Members:

Dr. Zakaria Ben Mustapha
Directeur de l'Enseignement, de la Recherche et de la Formation des Cadres
Ministère de l'Agriculture
30 rue Alain Savary
Tunis

M. Kamel Belkhodja
Chef, Service Pédologique
Ministère de l'Agriculture

M. Slaheddine Kacem
Chef de Service
Direction des Forêts

M. Jalaleddine Ben Aissa
Chef de Service
Direction des Forêts

M. Noureddine Chelbi
Maître de Conférences
Faculté des Sciences

M. Abdelaziz Kammoun
Maître de Conférences
Faculté des Sciences

M. Abdelkader Klibi
Directeur, Maison de la Culture Ibn Khaldoun
Tunis

M. Mohamed Skouri
Chef de la Division de la Recherche
Direction de l'Enseignement et de la Recherche
Ministère de l'Agriculture
Tunis

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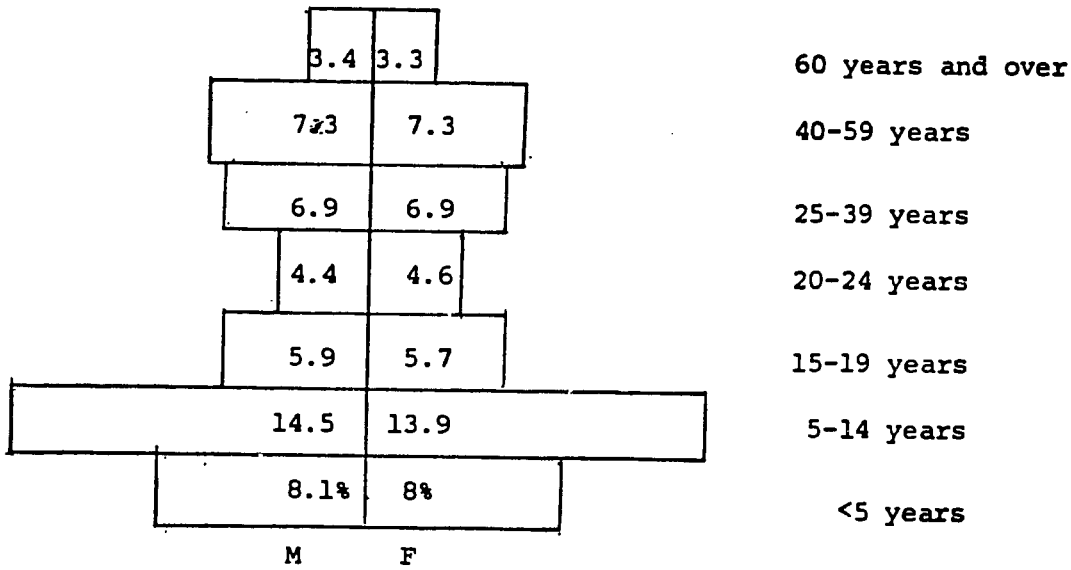
APPENDIX I

Population Data

Appendix I: Population Data

Population Structure, Tunisia, 1973.



Data from AID, All data on Tunisia. 1979.

Average life expectancy in 1973: 54.1 years.

A SUMMARY OF POPULATION INFORMATION FOR THE GOUVERNORATS AND THE 20 LARGEST CITIES

Gouvernorat	Population 1975	Percentage Urban 1960	Percentage Urban 1975	City	Population 1975	Projected Population 1986
District of Tunis	925,000	92	94	1. Tunis	925,000	1,310,000
Sfax	474,879	58	56	2. Sfax	174,900 (The metropolitan area had a population of 257,000 in 1975.)	247,300
Sousse	254,601	67	71	3. Sousse	80,500	113,800
Medenine	292,970	14	23	4. Jerba	74,600	105,500
Bizerte	343,708	47	53	5. Bizerte	68,300	96,600
Kairouan	338,477	21	22	6. Kairouan	56,400	79,700
Gafsa	237,844	53	57	7. Gafsa	45,300	65,600
Bizerte	See above			8. Menzel Bourguiba	43,900	63,600
Gabes	255,717	35	37	9. Gabes	43,100	62,400
Beja	238,770	23	28	10. Beja	41,000	59,400
Sousse	See above			11. M'Saken	33,200	49,000
Monastir	223,150	72	77	12. Monastir	33,100	38,900
Nabeul	368,114	45	48	13. Nabeul	32,300	47,700
Le Kef	233,515	21	23	14. Le Kef	30,700	45,300
Mahdia	218,217	26	35	15. Mahdia	27,200	40,100
Monastir	See above			16. Mornine	26,000	38,500
Kasserine	238,499	16	21	17. Kasserine	25,100	37,000
Sousse	See above			18. Kalaa Kebira	23,200	34,300
Sfax	See above			19. Sakiet Ezzit	22,300	32,900
Jendouba	288,989	12	15	20. Jendouba	20,900	30,800

From: Aid, Office of Housing. 1979.

Demographic characteristics:

1.	Population density per square mile of arable land (1975)	189
2.	Percent of population that are urban dwellers (1975)	45%
3.	Percent literate (1972)	32%
4.	Per capita share of GNP (1976)	840$
5.	Average daily per capita caloric consumption (1974)	2,440
6.	Infant mortality (1974)	52 per 1,000
7.	Population per practising physician (1973)	5,210

Demographic characteristics:

1.	Population density per square mile of arable land (1975)	189
2.	Percent of population that are urban dwellers (1975)	45%
3.	Percent literate (1972)	32%
4.	Per Capita share of GNP (1976)	840$
5.	Average daily per capita caloric consumption (1974)	2,440
6.	Infant mortality (1974)	52 per 1,000
7.	Population per practising physician (1973)	5.210

APPENDIX II

Economic Characteristics

Appendix II:

Economic Characteristics [43]

ECONOMICALLY ACTIVE POPULATION*
(1975 census, sample tabulation)

	Males	Females	Total
Agriculture, hunting, forestry and fishing	456,620	69,410	526,030
Mining and quarrying	26,780	430	27,210
Manufacturing	115,820	124,820	240,640
Construction	139,560	1,180	140,740
Electricity, gas, water and sanitary services	11,160	520	11,680
Commerce	118,210	9,130	127,340
Transport, storage and communications	54,530	2,850	57,380
Services	169,930	47,800	217,730
Activities not adequately described	133,940	20,010	153,950
Total	1,226,550	276,150	1,502,700

* Figures refer to persons aged 15 years and over, excluding those seeking work for the first time, numbering 119,120 (males 91,760, females 27,360). In addition, the economically active population included 107,240 persons (males 65,210, females 42,030) aged 10 to 15 years. The total labour force was thus 1,729,060 (males 1,383,520, females 345,540).

Source: International Labour Office, *Year Book of Labour Statistics.*

AGRICULTURE
PRINCIPAL CROPS
('000 metric tons)

	1974	1975	1976	1977
Wheat	755	976	919†	604
Barley	171	260	230†	95
Potatoes	100	106†	105†	90
Olives	525	680	530†	n.a.
Tomatoes	238†	267†	275*	270
Chillis and peppers	103	113†	118*	120
Onions	33*	35*	37*	n.a.
Water melons	150	160†	160*	210
Grapes	180	155†	155*	n.a.
Dates	44	45	46*	48
Sugar beet	47	65	83†	85
Apricots	22	23†	24*	28
Oranges	59	76	86	72
Tangerines and mandarines	17	24	31	38
Lemons and limes	18	15	19	25
Almonds	23	24.2†	24.7*	26
Tobacco	3	3*	3*	4

* FAO estimate. † Unofficial figure.

Source: FAO, *Production Yearbook.*

Figures for 1977 are provisional ones issued by the Ministry of Agriculture.

[43] Source: Europa. 1978.

STATE BUDGET EXPENDITURE
('000 dinars—1976)

Ministry	Current Budget	Capital Budget
Prime Minister's Office	3,980	225
Finance	125,833	3,914
Education	86,600	19,258
Defence	26,880	n.a.
Public health	31,259	23,506
Interior	27,790	14,401
Agriculture	23,923	17,000
Public works	10,423	27,500
Social affairs	8,200	4,472
Youth and sports	6,251	2,363
Communications and transport	5,285	1,267
Information	4,662	574
Cultural affairs	3,438	n.a.
Justice	3,552	2,184
Planning	1,339	67,136
Total (incl. others)	385,500	255,500

INDUSTRY

		1973	1974	1975	1976*
Superphosphates	'000 metric tons	400	400	304	345.7
Phosphoric acid	" " "	93	124	102	236.7
Cement	" " "	528	540	615	478.3
Lead	" " "	26	26	23	23.4
Electric power	million kWh.	963	1,099	1,204	n.a.
Town gas	'000 cubic metres	19.0	18.9	20.2	21.7
Beer	'000 hectolitres	340	362	308	n.a.
Cigarettes	millions	4,329	4,549	4,863	n.a.
Wine	'000 hl.	1,096	950	n.a.	n.a.
Olive oil	'000 metric tons	141	100	117	90.0
Semolina	" " "	186	193	221	n.a.
Flour	" " "	224	254	267	n.a.
Esparto pulp	" " "	23	23	n.a.	n.a.
Refined sugar	" " "	52	53	60	n.a.
Cast iron and bar iron	" " "	389	n.a.	n.a.	n.a.
Lime	" " "	187	261	283	318.5
Petrol	" " "	86	130	140	137.5
Kerosene	" " "	73	91	84	127.6
Diesel oil	" " "	291	301	350	323.7
Fuel oil	" " "	425	492	483	486.5

* *Source:* Institut National de la Statistique.

NATIONAL ACCOUNTS
(million dinars at current prices)

Economic Activity	1974	1975	1976	1977
Agriculture and Forestry	279.2	292.3	318.0	298.0
Fishing	10.1	13.4	15.0	18.2
Crude Petroleum and Petroleum Products	117.8	116.2	102.2	122.5
Other Mining and Quarrying	57.6	55.9	26.2	27.0
Manufacturing*	151.4	155.9	177.0	200.3
Electricity, Gas and Water Supply	19.7	23.9	27.8	32.3
Construction	98.1	136.3	163.7	196.7
Transport and Communications	73.8	81.0	102.8	118.8
Tourism	44.2	65.7	68.7	68.7
Owner-occupied Dwellings	66.4	73.8		
Public Administration and Defence	160.6	201.7	522.8	606.2
Wholesale and Retail Trade	266.1	315.4		
Other Producers and Services†				
Gross Domestic Product at Factor Cost	1,345.0	1,531.5	1,653.9	1,818.5
Indirect Taxes‡	205.1	215.6	255.0	308.0
Less Subsidies	23.1			
Gross Domestic Product in Purchasers' Values	1,527.0	1,747.1	1,908.9	2,126.5
Imports of Goods and Services	542.0	629.7	715.2	813.0
Less Exports of Goods and Services	547.4	545.6	551.1	612.0
Available Resources	1,521.6	1,831.2	2,073.0	2,327.5
Government Final Consumption	202.9	245.3	288.0	n.a.
Private Final Consumption	964.7	1,050.9	1,175.0	
Increase in Stocks	36.0	85.0	40.0	
Gross Fixed Capital Formation	318.0	450.0	570.0	

* Excluding petroleum products.
† Including financial institutions, business services and community, social and personal services.
‡ Including import duties.

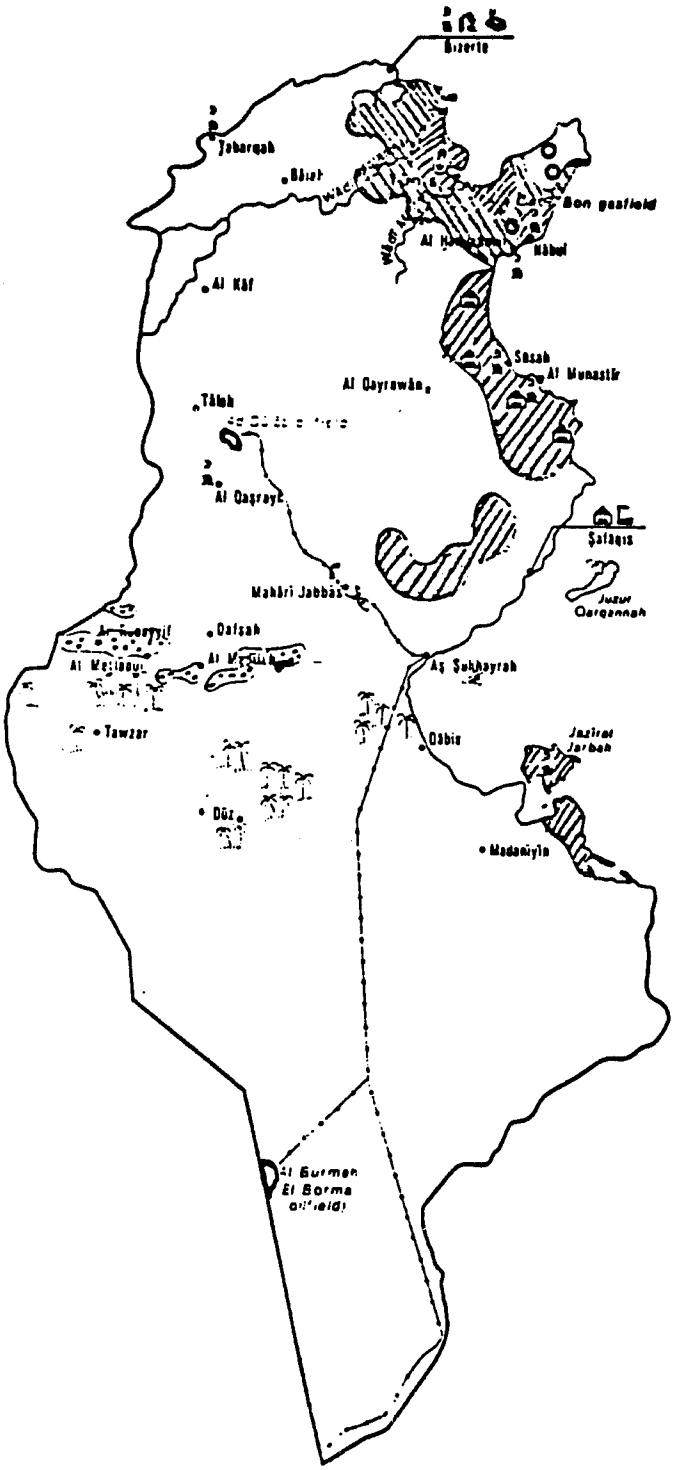
EXTERNAL TRADE
('000 dinars)

	1971	1972	1973	1974	1975	1976	1977
Imports	179,958	222,219	286,087	488,658	572,815	656,718	757,000
Exports	113,304	150,327	178,835	397,695	345,580	338,262	390,074

PRINCIPAL COMMODITIES
('000 dinars)

Imports	1974	1975	1976
Wheat and meslin (unmilled)	17,949	14,454	16,466
Sugar (raw and refined)	24,299	25,038	25,741
Soybean oil	15,562	16,334	545
Crude petroleum	32,287	34,469	45,650
Petroleum products	18,566	n.a.	n.a.
Pharmaceutical products	9,040	11,324	11,709
Wood	17,033	9,280	16,569
Raw cotton, cotton yarn and fabrics	14,037	n.a.	n.a.
Plastics and products	8,540	9,445	11,018
Iron and steel	24,883	39,213	41,869
Machinery (non-electric)	54,054	n.a.	n.a.
Electric machinery	21,041	n.a.	n.a.
Tractors	7,064	9,104	7,309
Road motor vehicles	12,740	17,134	19,690
Aircraft and air equipment	5,417	5,549	10,060
Optical and scientific equipment	6,355	8,995	10,927
Total (incl. others)	488,658	572,815	656,718

Exports	1974	1975	1976
Fresh fruit	6,130	n.a.	n.a.
Olive oil	70,335	31,031	36,275
Wine	6,396	6,940	4,631
Natural phosphates	47,579	47,309	26,269
Crude petroleum	136,904	144,557	138,516
Phosphoric acid	15,636	14,662	19,811
Superphosphates	33,845	16,659	12,068
Cotton fabrics	4,504	3,089	5,781
Clothing and accessories	8,518	11,812	21,199
Iron and steel	7,517	n.a.	n.a.
Refined lead	6,383	3,695	3,971
Total (incl. others)	367,695	345,580	338,262



Economic Activity

INDUSTRY

- Tourism
- Petroleum refinery
- Petroleum pipeline
- Natural gas pipeline
- Steel mill
- Olive oil processing plant
- Superphosphate plant

MINING

- Oilfield
- Gasfield
- Phosphate deposits

COMMERCIAL AGRICULTURE

- Significant olive-growing area
- Significant vineyard area
- Date palm
- Citrus

Appendix III

Bibliography
of
Selected References
on the Following Topics

1. Desertification, Erosion and Counter-Erosive Activities
2. Development
3. Forestry
4. Land Use
5. Minerals
6. Range
7. Social Aspects
8. Soils
9. Water

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