

Environmental Profile
of



prepared by the

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for

U.S. Man and the Biosphere
Department of State
Washington, D.C.
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DRAFT

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ENVIRONMENTAL REPORT
ON
MOROCCO

Prepared by the
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THE UNITED STATES NATIONAL COMMITTEE FOR MAN AND THE BIOSPHERE

Department of State, IO/UCS

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An Introductory Note on Draft Environmental Profiles:

The attached draft environmental report has been prepared under a contract between the U.S. Agency for International Development (A.I.D.), Office of Science and Technology (DS/ST) and the U.S. Man and the Biosphere (MAB) Program. It is a preliminary review of information available in the United States on the status of the environment and the natural resources of the identified country and is one of a series of similar studies now underway on countries which receive U.S. bilateral assistance.

This report is the first step in a process to develop better information for the A.I.D. Mission, for host country officials, and others on the environmental situation in specific countries and begins to identify the most critical areas of concern. A more comprehensive study may be undertaken in each country by Regional Bureaus and/or A.I.D. Missions. These would involve local scientists in a more detailed examination of the actual situations as well as a better definition of issues, problems and priorities. Such "Phase II" studies would provide substance for the Agency's Country Development Strategy Statements as well as justifications for program initiatives in the areas of environment and natural resources.

Comments on the attached draft report would be welcomed by USMAB and DS/ST and should be addressed to either:

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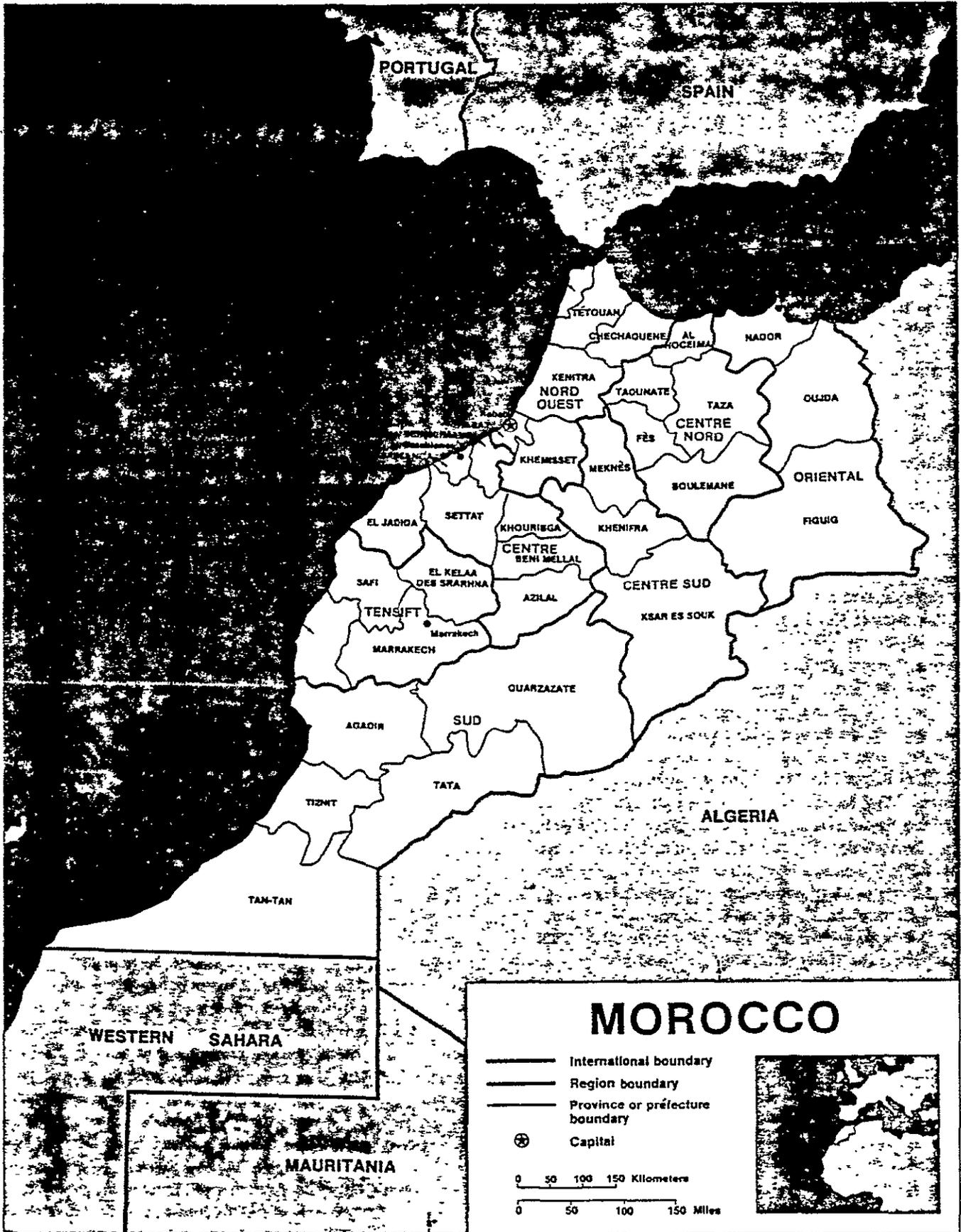
ENVIRONMENTAL PROFILE OF MOROCCO (revised draft)

Table of Contents

Summary

1.0	Introduction	1
2.0	General Description	2
2.1	Geography	2
2.2	Population	3
2.3	Economic Characteristics	3
3.0	The Environment and Natural Resources	5
3.1	Environment and Health	5
3.2	Fauna	5
3.2.1	Native Terrestrial Fauna	
3.2.2	Marine Resources and Fisheries	
3.2.3	Wildlife Protection	
3.2.4	Protected Areas	
3.3	Flora	10
3.3.2	Forest Products	
3.3.2	Forest Destruction	
3.3.3	Forest Protection	
3.3.4	Grasslands, Rangelands, and Desert Vegetation	
3.3.5	Consequences of Vegetative Denudation	
3.3.7	Measures to Combat Desertification	
3.4	Mineral Resources	16
3.5	Soils	18
3.5.1	Soil Types	
3.5.2	Soil Erosion	
3.5.3	Soil Conservation Measures	
3.6	Water Resources	21
3.6.1	Surface Water	
3.6.2	Groundwater	

3.6.3	Tables Detailing Water Resources	
3.6.4	Water Pollution	
3.6.5	Water Management	
3.6.6	Sea Water	
4.0	Environmental Problems and Prospects	31
	Literature Cited	33
	Appendices	37
A.	Population	37
B.	Economy	43
C.	General Maps	49
D.	Legislation Governing the Environment and Natural Resources	55
E.	Organizations	63
F.	Current U.S. AID Projects in Morocco	73
G.	Bibliography	79



U.S. DEPARTMENT OF COMMERCE Bureau of the Census

Names and boundary representation are as of July 1979 and are not necessarily authoritative

Source: Country Demographic Profiles: Morocco. U.S. Bureau of the Census. 1980. 57pp.

SUMMARY

Morocco is a land of predominantly arid and semiarid climate. Vegetation consists of extensive areas of a variety of desert grasslands and some forests in the three mountainous regions. Surface water resources are the most plentiful of arid Africa. Recent expansions in phosphate mining activity, agricultural production, and industrialization and a population growth rate of 3% are causing environmental pressures. Intertwined causative factors make it difficult to determine ultimate responsibility for environmental degradation. For example, increased population results in a need for both more agricultural areas and more livestock grazing. The expansion of agriculture into previously marginal areas pushes grazing into previously pristine forested areas. This intensive land use results in vegetative denudation, culminating in serious soil erosion. The creation of unproductive soils in arid regions is commonly referred to as desertification, and is occurring extensively in Morocco.

The major environmental problems of Morocco are as follows:

1. soil erosion - results from a variety of land misuse practices, such as farming in marginal areas, overgrazing, vegetative denudation for firewood, agriculture, or fodder, and inappropriate water management practices
2. vegetative denudation - results from grassland and forest destruction
3. overgrazing - destroys soils, grasslands, and watersheds
4. inappropriate water management - massive irrigation developments are resulting in the silting of reservoirs and an increased incidence of diseases such as malaria and bilharzia; ignorance of small-scale water management practices is contributing to watershed destruction
5. wildlife destruction - occurs on a large scale, due to destruction of habitat and hunting pressures
6. pollution - major cause is urban sewage; oil pollution of coastal waters is also a problem

Morocco has a matrix of environmental laws that address some of these problems. The Ministry of Planning considers environmental protection an integral part of development. There appears to be an awareness of the extent of environmental problems, and also an administrative structure within which to instigate corrective measures. Overcoming resistance to changing traditional land use practices that have become destructive in light of a more fragile environment than formerly, when population pressures were less, poses perhaps the greatest obstacle.

Susan A. Parker
Compiler

1.0 Introduction

This draft environmental profile has been revised from an earlier version which was completed in February 1980. The procedure utilized in compiling the information contained herein was basically a literature review of information available in the United States. Comments on the first preliminary version were solicited and incorporated into this revision where appropriate. This profile is intended to assist the generalist in evaluating environmental issues in Morocco; neither its scope nor depth are amenable to a critical review by a specialist in any of the subject areas covered. However, if specialists detect gross inaccuracies or suspect that the broad review conveys an incorrect impression of the status of any resource discussed herein, we would certainly appreciate comments to that effect.

This profile constitutes the first step in the process of developing an environmental profile for use by the U.S. Agency for International Development and government officials of Morocco. The next step in this process should be a field study to evaluate the information in this report, obtain additional information, define issues, problems, and priorities, and provide direction for future efforts in the management, conservation, and rehabilitation of environmental resources in Morocco.

The information and interpretations presented in this report are preliminary and are not intended to be sufficiently detailed or accurate for development planning. This study represents a cooperative effort by the entire staff of the Arid Lands Information Center, but the primary focus, research, and writing were done by Susan Allen Parker. The cooperation of personnel at U.S. AID and the U.S. National Park Service is gratefully acknowledge, particularly from James Corson, AID/MAB Project Coordinator and from Stephen Lintner, AID Environmental Officer for the Near East and North Africa. Comments from Jonathan Sleeper, Environmental officer for USAID/Morocco were especially helpful.

2.0 General Description ^{1/}

2.1 Geography

Morocco lies at the northwest corner of Africa, with coasts on the Atlantic Ocean and the Mediterranean Sea, thereby sharing the gateway of the Mediterranean with Spain. The lengthy coastline of 1200 miles, along with several ports and a system of international airway connections, provides access to Europe and the rest of the world.

Morocco covers an area of about 442,000 square kilometers (170,000 square miles), not including the 65,000 square kilometers (25,000 square miles) of former Spanish Sahara claimed and controlled by Morocco since 1976. This boundary is still disputed by some countries and not yet completely recognized internationally. The boundary with the Saharan region of Algeria is not demarcated.

There are two distinct topographic regions in Morocco. These are the agriculturally rich coastal plains of the northwest and the economically depauperate mountain and plateau region of the east and south. The coastal plains and plateaus, with some 350 miles of Atlantic coast, are separated from the interior by three mountain ranges. Peaks of the High Atlas and Middle Atlas Ranges rise to altitudes of 13,600 feet, and peaks of the Rif rise from the coast to 7,000 feet. These coastal plains are the most densely populated region of Morocco, and most major urban centers are located here. Beyond the mountains, eastern Morocco is a series of arid plateaus, gradually dropping into the Sahara Desert proper in the south and southeast.

Morocco has the most extensive river system in North Africa. The principle rivers with outlets to the Atlantic are the Sebou, Oumer Rbia, Bou Regreg, Tensift, and Sous. There are only two main rivers flowing south into the Sahara; these are the Ziz and Rheris. The largest river is the Sebou, the watershed of which represents nearly half of Morocco's surface water resources. None of the rivers are navigable.

The Rif and Atlas ranges serve as a climatic barrier between the coastal western region and the eastern regions. Winter westerlies blowing from the Atlantic cause snow in the western mountains and rains along the coast. Summer climate is uniformly hot and dry, except for the humid Mediterranean Coast and the cooler mountains. April to October is the dry season, with precipitation slight and highly irregular, accounting for less than twenty percent of annual amounts approaching 80 centimeters.

¹ Sources: American University, Foreign Area Studies. 1978.
U.S. Agency for International Development, Office of Housing. 1978.
U.S. Department of State. 1978.

2.2 Population

The population was estimated at 18,914,000 ^{2/} in 1978, with a growth rate of at least three percent. This is among the world's highest, even though the government sponsors an active family planning program. Over one-half of the population is under age twenty, and the urban sector constitutes more than forty percent. Arabs and Berbers are the largest ethnic groups. The official language is Arabic and French is spoken extensively. About forty percent speak one of the Berber dialects; hence bi- and trilingualism are common. Islam (Sunni) is the official religion.

There are currently eleven primary urban centers with a population of more than 100,000. All but one are located west of the Atlas Mountains. The exception is Oujda, which is close to the Algerian border. Seven of these eleven cities are coastal, with Agadir, Safi, Casablanca, Rabat-Sale, Kenitra, and Tangier on the Atlantic coast, and Tetouan on the Mediterranean Sea. Inland are Marrakech, Mekne, and Fez, at the foot of the Atlas Mountains. Eight additional towns will attain the status of primary urban centers by 1982. Two of these, El-Jadida and Nador, are coastal. The towns El-Kelaa, Settat, Khouribga, Khemisset, and Beni-Mellal will make the west-central region the most concentrated urban area of the country. The city of Taza will join Nador and Oujda in a north-eastern settlement triangle.

Rabat is the nation's political capital, with a population of 75,000. Casablanca, the economic capital, has 2.1 million residents. The rural to urban trend is not expected to abate until the beginning of the next century. Industrial development along the seacoast has induced a heavy migratory flow.

2.3 Economic Characteristics ^{3/}

The Moroccan economy is characterized by a fundamental imbalance between a demographically small but highly productive modern industrial sector and a large agricultural sector. Almost seventy percent of the labor force is engaged in agriculture, which accounts for only 35 percent of domestic production. The agricultural sector supplies much of the domestic food requirements and 33 percent of total merchandise exports. Within the sector itself, however, are great extremes of productivity. About 34 percent of Morocco's agricultural land is held by 3 percent of the farming population, and is utilized in large-scale farm operations. These modernized agibusiness operations produce over 85 percent of commercial production, including almost all of the citrus fruit, fresh vegetables, wine, and other agricultural export products. In spite of the application of modern agricultural technology to cultivation of the most

² Source: World Bank. 1979.

³ Sources: U.S. Agency for International Development, Office of Housing. 1978.
U.S. Department of State. 1978.

promising export products, agriculture remains greatly dependent on Morocco's frequently extreme variations in annual rainfall. In addition, the vast majority of Moroccan farms are small and family operated, and problems inherent in production include water shortage, fragmentation of land ownership, primitive methods of cultivation, and difficult terrain.

The phosphate industry is Morocco's most important economic asset. Morocco has over 70 percent of the world's proven phosphate deposits and is the world's largest phosphate exporter. Over the long term, Morocco's planners hope to stimulate overall economic development on the basis of the phosphate industry. In spite of recent declines in economic growth due to several factors (poorer markets for phosphate than expected, a bad 1976-77 crop year, and a sluggish European market) the government intends to press forward with development plans. High priority items are phosphate mining treatment facilities, cement plants, port facilities, hydroelectric plants, and agriculture. Considerable efforts are being made to bring more land under cultivation for expansion of irrigated, rain-fed, and dryland farming systems. It is expected that the agricultural industry will be less labor intensive and will rely more heavily on mechanized farming techniques.

3.0 The Environment and Natural Resources

3.1 Environment and Health ^{4/}

The health environment in Morocco is generally poor. Rapid and uncontrolled urban growth has made conditions even more precarious. Economic disparities, inadequate housing, overcrowded conditions, unsafe water supply, and inadequate sanitary conditions in the urban centers contribute to an environment conducive to the spread of disease.

As far as general health conditions are concerned, major health indicators suggest a steady improvement in the health of the Moroccan population as a whole. Diseases such as smallpox have been eradicated, while cholera and malaria have been brought under control. The death rate has dropped and life expectancy has increased, although the birth rate continues to be high.

To date, communicable diseases and gastrointestinal infections are the major causes of morbidity and mortality. Other modern, life-style related diseases such as heart disease and cancer are of rising concern as well. The overall health picture may be slightly too optimistic, however, since only 50 percent of the population are reflected in available health statistics.

Potential health hazards are endemic in the over-populated areas. Living conditions increase the risks of tuberculosis and other respiratory ailments caused by poor or non-existent ventilation of dwelling units. Contaminated water and poor sanitary conditions are conducive to the high rate of upper respiratory and gastrointestinal infections. Exposed waste materials, prevalent in and around the settlements, promote insect born diseases with a constant epidemic threat. Poor economic conditions, overpopulation, and uncertainties of the future are the cause for higher incidence of social diseases and mental health problems.

3.2 Fauna

3.2.1 Native Terrestrial Fauna ^{5/}

Morocco has a natural heritage of diverse faunal resources, due in large part to the conjunction of the Saharan and Mediterranean life zones and the pressure of high mountains. However, many animal species have disappeared or are near extinction. Strict protective laws exist to regulate hunting and fishing,

⁴ Source: U.S. Agency for International Development, Office of Housing. 1978. pp. IV-8 - IV-9.

⁵ Sources: Johnson, H. and J. Johnson. 1977.
Mills, S. P. 1977.

but in the main are not respected. Illegal hunting in particular is done on a large scale. In addition, where wildlife and forestry conservation issues conflict, forestry takes priority. Moroccan authorities have drawn up a list of protected birds and mammals, and all wildlife functions have been consolidated in the national forestry office.

There is no information available on the status of wildlife outside reserves; this would warrant investigation. Another topic of critical interest which does not appear to have been studied is the use of wildlife as a protein resource for the human population.

Listed below are some mammals considered in danger of extinction by the U.S. Fish and Wildlife Service.

Endangered and Threatened Wildlife in Morocco*

<u>Common Name</u>	<u>Scientific Name</u>
Cheetah	<u>Acinonyx jubatus</u>
Gazelle, Cuvier's	<u>Gazella cuvieri</u>
Gazelle, Mhorr	<u>Gazella dama mhorr</u>
Gazelle, Moroccan (Dorcas)	<u>Gazella dorcas massaesyala</u>
Gazelle, Rio de Oro Dama	<u>Gazella dama lozanoi</u>
Hyena, Barbary	<u>Hyaena hyaena barbara</u>
Leopard	<u>Panthera pardus</u>

*Source: U.S. Department of the Interior, Wildlife Service. 1979.

However, many other species are being reduced. One cause is the rapid conversion of diverse forested regions to monotypic plantations of fast-growing pines. This practice has reduced habitat for breeding birds such as Dartford warblers (Sylvia undata) and short-toed eagles (Circaetus gallicus). The remaining small pockets of highland deciduous woods maintain diverse populations of breeding birds, whereas the newly planted sterile pine plantations are depauperate. One mammal species closely tied to the quality and quantity of forest is the Barbary macaque. In addition, there does not appear to be much respect for wildlife, particularly for birds, among local peoples. ^{6/}

Drainage of west coast marshlands in order to irrigate agricultural areas has reduced considerably the numbers of birds such as

⁶Source: Mills, S. P. 1977.

crested coots (Fulica cristata), purple herons (Ardea purpurea), marbled ducks (Anas angustirostris), and white-headed ducks (Oxyura leucocephala). Numbers of wild game have been lost following aerial dusting of cereal crops with strychnine; this practice has been suspended.

3.2.2 Marine Resources and Fisheries ^{7/}

Morocco possesses the largest fisheries industry in Africa. Major exports include sardines, fish meal, and fish oils. Among predominantly exploited saltwater species are sardines, tuna, mackerel, and anchovies. The catches began to decline in the late 1960s and in 1973 the territorial limits were extended to 70 miles. Late in the 1977 the government suggested an extension to 200 miles. The fishing industry is well-regulated by the government.

There is some freshwater fishing where lakes, rivers, and streams are stocked with food fish. Such stocking is strictly controlled, and the government hopes to stimulate this aspect of the fisheries industry for domestic consumption.

3.2.3 Wildlife Protection ^{8/}

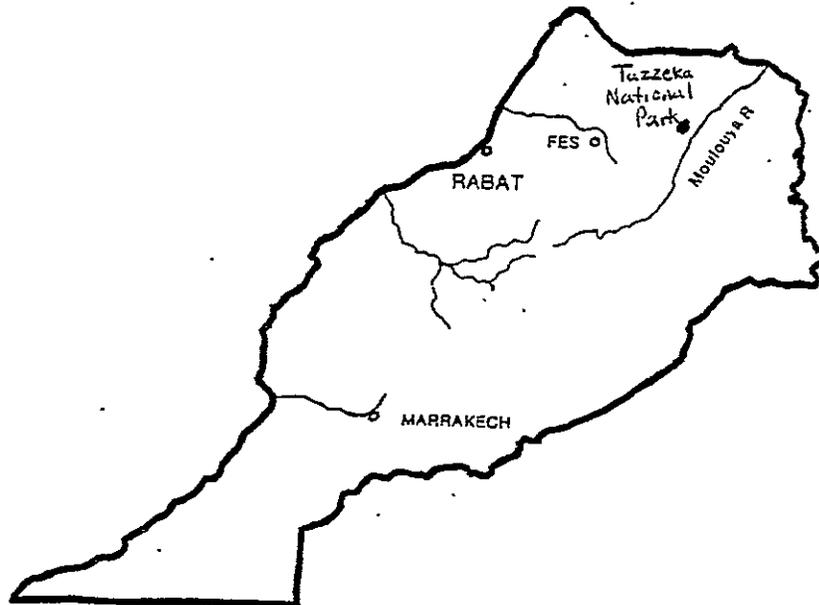
- Protection is given to migratory birds, rare species of birds, and birds useful to agriculture. The capture and destruction, exportation, detention, sale, buying, etc. of such birds is prohibited.
- Protection as described above is accorded certain mammals, including panther, caracal lynx, hyena, and Barbary deer. Special protection is given to three rare species of gazelle (Gazella dorcas, G. gazella cuvieri, G. dama mhorr).
- The hunting and exportation of the mouflon (Ovis montanus) is prohibited.
- Complete protection is given to the francolin, wild guinea fowl, and two species of bustard.
- The sale, selling, transport, and export of the following game animals is prohibited: wild boar, partridge, rabbit, and hare. Special authorization must be received in order to hunt these species.
- Total protection is given to eggs, nests, nests of eggs, and young of all wild animal species.

⁷Source: American University, Foreign Area Studies. 1978. p. 179.

⁸Source: Johnson, H. and J. Johnson. 1977.

3.2.4 Protected Areas ^{9/}

Tazzeka National Park



Source: IUCN. 1971. p.353.

The park comprises 580 hectares, which is below the U. N. requirement for national park size in relation to population density. Protection is almost total within the park. The only human occupation is at a rader installation at the highest point in the park, which usually has only one occupant. Cultivation, grazing, hunting, fishing, and wood-cutting is prohibited. The park staff comprises three officers of the Water and Forest Service and a fire-watcher from July to November. The park was established in 1950 as state forest land, freed from any incubus of customary rights. An 8 km branch track from a tourist route gives access to the summit of 1980 meters, which is snow-covered from December to April. No construction of tourist facilities has been permitted, although there is a camp 15 km away. There are no specific information or education facilities. The park receives about 200 visitors a year.

The area is mainly of botanical interest, with a number of endemic species. The cedars (Cedrus atlantica) are relic-tual, separate from those of the Rif and the Atlas. There is good natural regeneration on south-facing slopes. Wildlife include wild pig (Sus scrufa), occasional leopards (Panthera pardus), hare (Lepus atlanticus), rabbit (Oryctolagus cuniculus), and fairly abundant Barbary partridges (Alectoris barbara). Scientific research to date includes a botanical study, geological studies, and geobotanical research on cork-woods.

⁹ Source: International Union for the Conservation of Nature and Natural Resources (IUCN). 1971. pp.352-354.

- Toubkal National Park (36,000 hectares)

This park is not considered a success by the IUCN. Although there are no permanent habitations, the area is visited by large numbers of nomads. Heavy grazing pressure in spring and summer aggravates erosion and denudation problems. Poachers have made inroads on game and fish resources have been depleted. The park consists of a high mountain rising to 4,617 meters, the slopes of which are covered with Quercus ilex woods at lower elevations, succeeded by Juniperus thurifera at higher levels, and finally by alpine meadows and scree. Among those wildlife species now exceedingly rare or vanished from the park are Barbary sheep (Ammotragus lervia), mountain gazelle (Gazella g. cuvieri), striped hyena (H. hyaena) and leopard (Panthera pardus). The flora still presents a tendency towards endemism, but the effects of over grazing are reflected in the progressive disappearance of many endemic species.

- La Doura Reserve (200 hectares)

This reserve contains a remnant of the botanical associations once typical of the Tadla plains before they were developed by irrigation.

- Partial Reserves

- 87 permanent 'de facto' faunal reserves (284,000 hectares)
- 380 legally constituted faunal reserves (200,000 hectares) of various sizes
- Khnifiss Bay Reserve, a bird sancturay in an area of swamps and lagoons, with numerous breeding waders and waterfowl
- Skhirate Island, known as the 'Bird Island' on the Atlantic coast
- Aftenourix Lake in the Middle Atlas
- several botanical sites, such as the olive groves of Beni-Mellal and the palm groves of Marrakesh

3.3 Flora^{10/}

3.3.1 Forest Products

Approximately 8 million hectares (20 million acres)* of Morocco is forested. Dominant species include cork oak, green oak, cedar, argan, eucalyptus, acacia, and various pines. In addition, 2,800,000 hectares (7 million acres) are covered with esparto grass and European dwarf fan palm. All forests are owned by the state, but exploitation is allowed with proper authorization. Related industries are cork factories and wood plants that produce packing cases and plywood, in addition to a paper pulp industry.

Cork forests produce for both local use and export. Eucalyptus species were introduced initially to combat soil erosion and now supply cellulose for the paper industry. The argan Argania sideoxylan (= A. spinosa), a tree endemic to Morocco, spreads over 68,000 hectares (1.7 million acres) in the Sous region of the southwest. This spring evergreen of the ironwood family (Sapnaceae) produces a plum-sized fruit which is consumed by cattle and goats. Oil extracted from the seed serves as an olive oil substitute. Other forest products include esparto grass, which is cut and baled for the paper pulp industry, and vegetable horsehair, a fiber obtained from the leaves of the European dwarf fan palm. Morocco is the world's leading producer of this product, which has a wide foreign market as a stuffing for mattresses and upholstery.

3.3.2 Forest Destruction

Depletion of forests for land clearing, construction, and fuel has been underway since the eleventh century. Extensive deforestation has taken place in the Rif region for the last 40 years, and remaining forests, which include evergreen oak (Quercus ilex), cork oak (Q. Suber), the rare Moroccan fir (Abies pensapo), and cedar (Cedrus atlantica), are small, open, and discontinuous. Some of the better remaining forest stands are in the Middle Atlas region. Here are the finest high-elevation (2000 meters+) mixed cedar and evergreen oak forests of North Africa. In the southern mountains are scrubby evergreen oak stands. Degraded areas of the Mediterranean region include the open forests of Aleppo pine (Pinus halepensis). Areas of Phoenician juniper

¹⁰ Sources: American University, Foreign Area Studies. 1978. pp.179-180.
Johnson, H. and J. Johnson. 1977.
Mills, S. P. 1977.
de Vos. 1975.

* figures vary greatly; this, the largest, is from American University, Foreign Area Studies. 1978. p.179.

(Juniperus phoenicea), rosemary (Rosmarinus spp.), alfa grass (Stipa tenacissima), and cist (Cistus libantis) are relictual on the whole.

Deforestation is continuing to proceed rapidly, partly because the utilization of formerly marginal lands for agriculture has reduced available grazing area, which has in turn increased grazing pressure on forested regions. Grazing leads to changes in forest composition. Through lack of natural regeneration stands become even-aged and non-productive. Continuous exploitation of forested areas without sufficient conservation or reforestation has caused a rapid consumption of forest resources. Many areas became bushy stands, eventually turning into open shrublands where soil has eroded to the extent that only subsoil exists. The steppes of arid North Africa, lying between the isohyets of 250 and 400 mm. are in fact degenerated forests that used to contain pines and junipers.

3.3.3 Forest Protection

The government is attempting to halt deforestation through reforestation measures. Current aims are to replant 20-30 thousand hectares annually. All forest products are taxed 10 percent to help defray the costs of reforestation programs. Forests are protected by law (see Appendix D) and several botanically important areas have been granted national park or reserve status (see 3.2.4). Education programs include an annual forest festival, the purpose of which is to disseminate knowledge of forest protection techniques and to establish, restore, and amplify forest areas. Various species are protected individually, including alfa, walnut trees, dwarf palms, and carob trees.

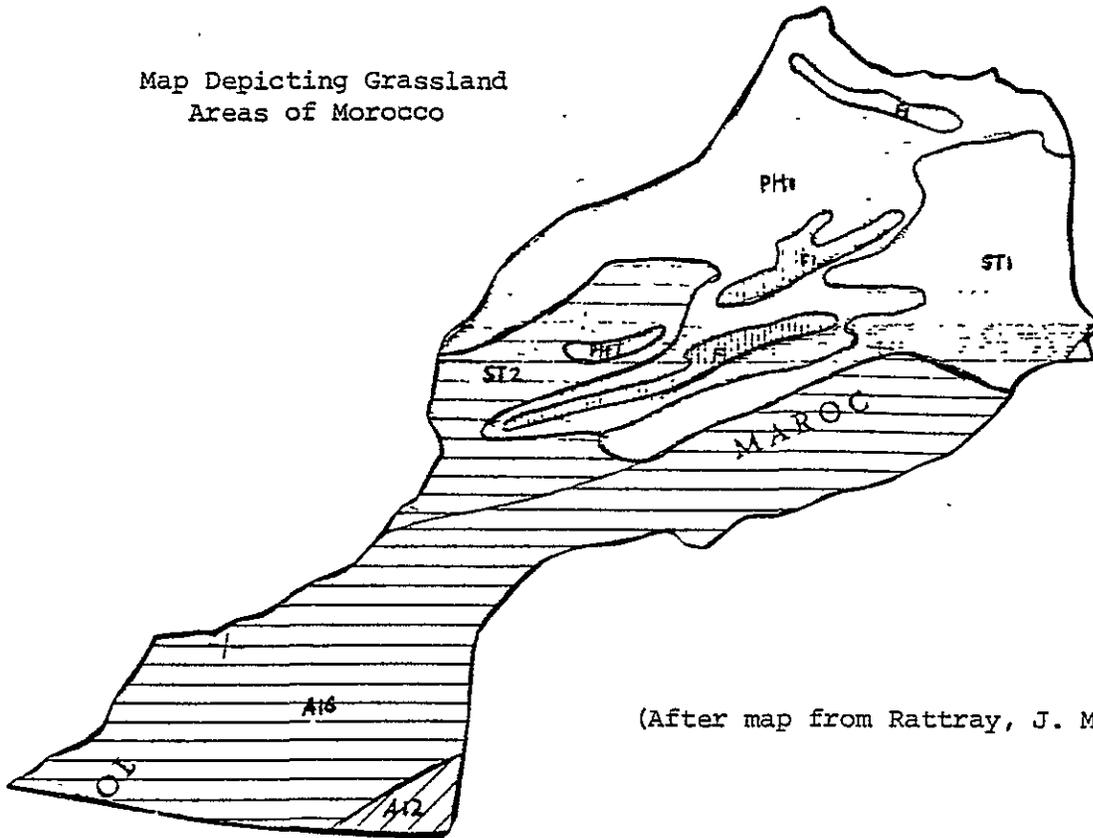
3.3.4 Grasslands, Rangelands, and Desert Vegetation

-Description

Major grassland types of Morocco ^{11/} include Stipa grasslands, Stipa steppe regions, Stipa associated with shrub steppes, Phalaris grasslands, Festuca associated with woodland, Aristida steppes, and Aristida desert.

¹¹ Source: Rattraz, J. M. 1960.

Map Depicting Grassland
Areas of Morocco



(After map from Rattray, J. M. 1960)

Legend: A12 - Aristida desert (A. pungens, A. plumosa, and also Panicum urgidum in wadis)

A16 - Aristida steppes (A. plumosa, A. obtusa, A. acutiflora, A. ciliata, and A. pungens on dunes)

Note: these grasses are associated with Acacia trees and dwarf shrubs, and Stipa, Genista, and Artemisia in wadis. Winter rainfall 260 mm.

PH1 - Festuca woodland

Note: This perennial grass cover is associated with woodland of varying densities of Cedrus or Juniperus, depending on winter rainfall (400 to 600 mm.), at altitudes above 3,000 m. (10,000 ft.).

ST1 - Phalaris grassland (Ph. minor, Ph. brachystachya, Ph. paradoxa, Lolium rigidum, Oryzopsis miliacea, Hordeum bulbosum)

Note: This annual grassland is composed of fallow lands which are rarely uncultivated for more than two years. With protection, a more perennial type of grassland could develop, characterized by Phalaris tuberosa and Dactylis glomerata. Currently Stipa capensis occurs on the most disturbed areas. This grassland was originally dense forest of Olea, Pistacia, Chamaerops, Quercus suber, and Q. ilex, but intensive cultivation has removed all trees and grassland is almost entirely composed of annual species which provide grazing for one or two years before the land is once again cropped. Grazing is available for only three or four months per year, depending on the soil type.

ST2 - Stipa grassland - (S. tenacissima and Lygeum spartum on gypsum soils)

Note: This perennial grassland, associated with Artemisia herba-alba on heavy soils and A. campestris on sandy soils, has been derived from open woodlands of Juniperus, Pinus halepensis, or Pistacia atlantica, which are still found in more mountainous areas. Cultivation is not as intense as in type PH1 and lands may lie fallow as many as five years. The carrying capacity is one sheep to 4 or 5 hectares (10 to 12 acres) per year. Improved areas may carry one sheep to 1 hectare. Grazing period is short but transhumance is practiced from winter grazing here to summer grazing in the north. Altitudes are 0 to 2,000 meters, with winter rainfall of 200 to 400 mm.

ST2 - Stipa steppes (S. capensis)

Note: This steppe vegetation is derived from an open forest of Zizyphus and Pistacia in the north and Argania in the south. In appearance it seems to contain open grassland with clumps of trees; in fact each clump is one tree that has been periodically covered with sand through which new branches are continually thrust. It therefore is considered a steppe type with scattered trees and an annual grass cover. Grass is present only 5 to 6 months and is green for about half this time. For the rest of the year the ground is bare. Altitudes are 0 to 200 meters with winter rainfall of about 250 mm. (10 inches).

-Range Deterioration ^{12/}

Years of mismanagement and overstocking have reduced the forage production of Morocco's 30 million acres of rangeland.^{13/} In addition to overstocking, the increase of temporary cereal cultivation and the uprooting of woody species for fuel have contributed to the deterioration. A major consequence of overgrazing is soil erosion and depletion with the decline of natural grazing areas and with a paucity of fodder cultivation, increased livestock production has been possible only at the expense of a decline in the quality of natural forage and of inroads into forest areas. It has been estimated that, for the whole of North Africa, about 100,000 hectares annually are being rendered useless by overgrazing. Reductions in stocking rates by as much as 90 percent in some areas are needed to bring the numbers of livestock down to the carrying capacity of the reduced grazing areas.

Currently in Morocco fallow fields and grain stubble are used for grazing. No feed is stored; hence disasters follow drought years. Rangelands are used continually without rotation and without stored fodder as a supplement. There is nearly no interchange between the raising of livestock in the steppes and the possibility of fodder production in irrigated areas. Expansion of fodder crops would permit stockpiling for disaster years and also supplemental feeding of lambs and herded animals. Mainly due to unfavorable feed conditions, the quality of livestock is low.

-Management Practices for Range Improvement

The planting of spineless cacti (Opuntia ficus-indica) has provided additional forage. Opuntia plantations produce 10 to 50 metric tons of green fuel per hectare per year, which are rather substantial yields for arid areas. Saltbushes (Atriplex spp.) provide another source of potential forage, especially in non-irrigated areas. They are drought resistant, produce well, have high feed value and good palatability. Rotational exploitation of rangelands includes control of grazing pressures, attention to carrying capacities, rotation and deferred grazing strategies, and availability of reserve feeds.^{14/}

Recent studies in Morocco ^{15/} show that management practices such as improved grazing systems, animal health programs, and range reseeding can improve range quality and livestock production in the steppe areas.

12 Source: de Vos. 1975. p.63.
Stubbendieck, J. 1978.

13 Source: U. S. Agency for International Development. 1979. p.865.

14 Source: de Vos. 1975. p.66.

15 Source: Graves, W. L. et al. 1978.

3.3.5 Consequences of Vegetative Denudation ^{16/}

Accelerated population pressure in Morocco and unchanging land use practices have combined to cause severe deterioration of vegetated areas, largely through reduced productivity of ecosystems, extreme soil erosion, overgrazing, and forest destruction. Deterioration of alfa grasslands (Stipa tenacissima), for example, is estimated at 10,000 hectares per year. The direct consequences of vegetative denudation can be enumerated by the following sequence of events: stripping of upslope watersheds, damage of downslope water regimes, creation of ephemeral runoff, causation of serious soil erosion. Soil erosion by both wind and water complicates the rejuvenation of vegetation and causes the spread of dunes, which make land unsuitable for cultivation. This entire process, along with other poor land use practices, causes desertification, a term used to describe man's unintentional efforts to turn grazing lands, agricultural lands, and forest lands into desert.

3.3.6 Measures to Combat Desertification

A few measures are being undertaken to halt this process in Morocco. Extensive afforestation programs are underway, as are some reforestation programs. (Note: afforestation refers to planting forests on previously unforested sites; reforestation refers to replanting deforested areas). The following are some examples of efforts to prevent soil erosion and to establish vegetation:

The eastern tree belt in the Wajdah - Tazah area

This area is characterized by a dry climate, irregular rainfall, strong winds, stone-covered land, and loamy slopes. Mechanical soil preparation and careful planting and tending of seedlings of Eucalyptus spp. and Acacia spp. are being carried out.

¹⁶ Source: U. N. Conference on Desertification. 1977.

The Houz afforestation project

This project aims at afforestation and improvement of pasture land. The area receives 200 mm. of rainfall per year and has calcareous clay soil. Best results were achieved using Prosopis dulcis, P. chilensis, Acacia accuminata, Gleditshia triacanthos, Eucalyptus brockwayi, E. loxophela, E. sargentii, E. torquata, and Cactus incana.

The Dakhalah pasture improvement project

This Atlantic coastal strip, 20-30 km. wide, receives 350 mm. of rain per year and has poor soil. Shelterbelts 40-50 meters wide were successfully established at 250 meter intervals. The main species used was Eucalyptus gomphocephala, and the ultimate objective is to establish pastures by planting shrubs suitable for grazing.

Protection of grazing land

Grazing was prohibited in 172 areas (72,000 hectares) between 1948 to 1968. Improvements carried out in these areas included the planting of grazing shrubs and forest trees. The results varied according to species planted.

Arboreta and nurseries

Testing of newly introduced trees and shrubs is being carried out. Nurseries supply 32 million seedlings annually for planting, of which 7 million are planted on private land. An arboretum for eucalypts near Rabat contains more than 350 Eucalyptus spp., 25 Acacia spp., and a collection of white, black, and euphratic poplars.

Sand dune fixation

In the Atlantic coastal area mechanical stabilization is used the first year, followed by plantings of grasses and then shrubs in the following order from the sea: Acacia cyclops, A. cyanophylla, and Eucalyptus gomphocephala. The area receives 200 mm. of rain per year. The projected rotation period is 35 years.

Afforestation in tourist centers

For a pilot area of 22,000 to 25,000 hectares, the following conifers were planted: Pinus halepensis, P. maritima [P. pinea], P. pinaster, and P. canariensis.

Other measures in progress

- establishment of a national center for seed production on 200 hectares

- establishment of forest tree centers
- establishment of a national committee for pasture land
- planning for the development of 25,000 hectares of grazing land annually
- encouraging the participation of local people in arid land reclamation.

3.4 Mineral Resources ^{17/}

Morocco's most important mineral resource is phosphate rock, and the mineral industry is dominated by its production and export. Other minerals produced for export markets include antimony, cobalt, copper, iron ore, lead, manganese, silver, and barite. Export quantities of these minerals are small and the total value is one-tenth that derived from phosphate rock exports. The contribution of mineral industries to the Gross Domestic Product was 22 percent (\$1.3 billion) in 1974.

Mineral Resources of Morocco
Role in the world mineral supply
(Thousand metric tons, unless otherwise specified)

Map symbol	Major commodities	1974 production	Estimated share of production exported (%)	Share of world output (%)	Reserves	Share of total world resources (%)
Sb	Antimony.....	2	100	3	20	(1)
Co	Cobalt.....	1,800	100	6	7	(1)
Cu	Copper.....	5	98	(1)	200	(1)
Fe	Iron ore.....	500	100	(1)	50,000	(1)
Pb	Lead.....	100	96	2	1,500	1
Mn	Manganese ore.....	780	80	1	1,000	(1)
Ag	Silver (thousand troy oz).....	3,137	100	1	10,000	(1)
Ba	Barite.....	100	100	2	6,000	(1)
P	Phosphate rock.....	19,700	97	18	10,000,000	72

(1) Less than 1%.

Source: U. S. Department of the Interior, Bureau of Mines 1976. p.65.

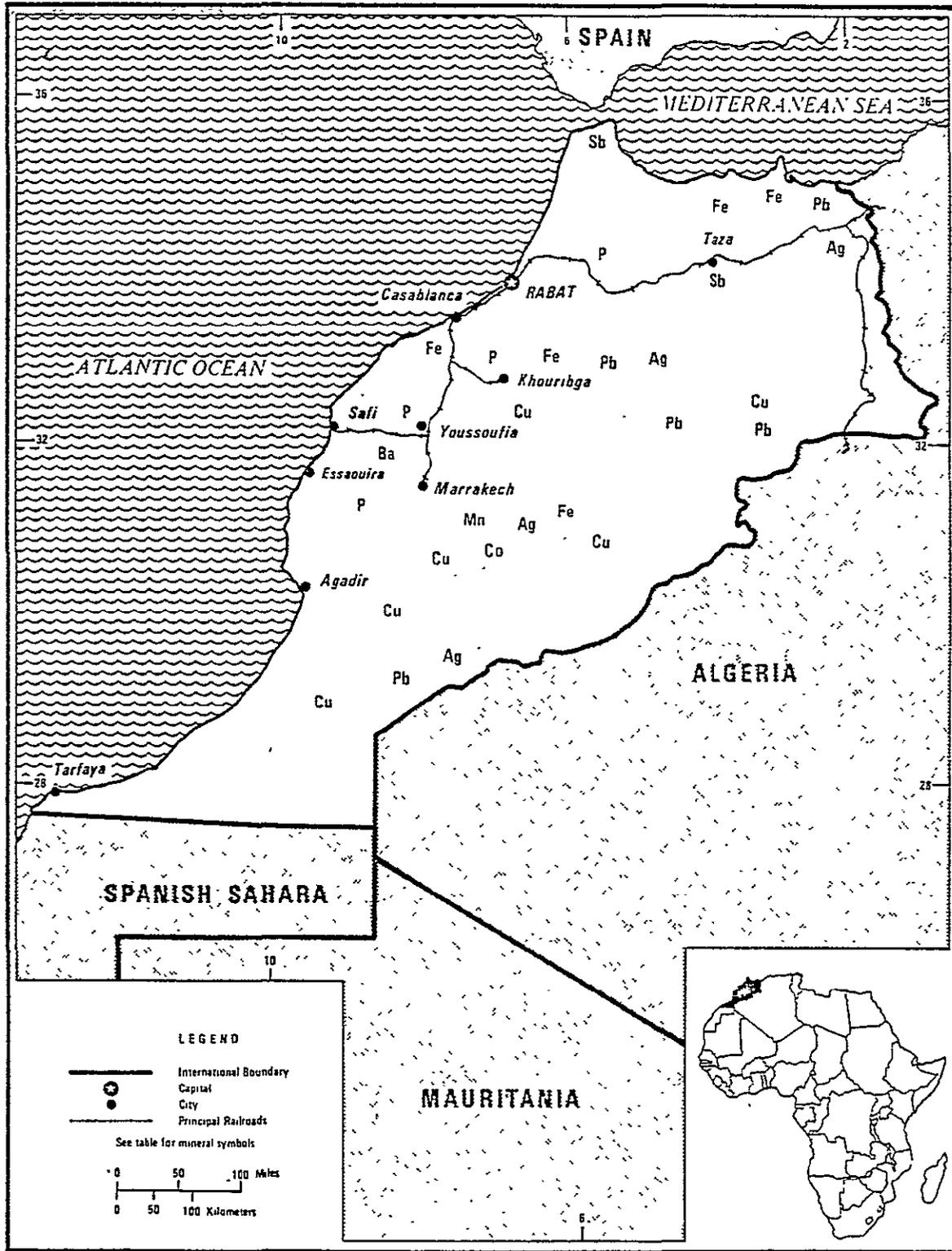
Phosphate reserves in Morocco comprise 75 percent of the world's known supply. - Phosphates are extracted at several locations, mainly near Khouribga, Youssoufia, and Benquerir. Phosphate is mined by both open-pit operations in Morocco. Underground mining operations are favored by the relative softness of the phosphate rock. Although referred to as "rock", the one is quite friable and sandy, requiring extensive timbering within mining shafts. Underground mining is highly mechanized. Open-pit mining permits large volumes of overburden and phosphate rock to be moved at low expense, and hence is becoming more prevalent than underground operations.

¹⁷ Sources: American University, Foreign Area Studies. 1978. pp.180-184.
Schreiber, J. F. Jr. and W. G. Matlock. 1978.
U. S. Department of the Interior, Bureau of Mines. 1976. pp.64-68.

Mineral Resources of Morocco

AREA 148,000 Sq.Kms.

POPULATION 17.5 Million



Source: U. S. Department of the Interior, Bureau of Mines. 1976. p.64.

Lead has become the second most important mineral export, and the 1978-1982 development plan proposes a foundry for processing lead ore in order to increase the export value. Large deposits of copper in Ouarzazate Province are to be mined at higher production levels once a new copper treatment plant is installed. Anthracite coal deposits and iron ore deposits in the northeast are mined for fuel and steel production. Deposits of pure rock salt are being exploited for chemical production. Morocco is one of the few African countries possessing and processing antimony and nickel. Uranium is mixed with some phosphate for uranium extraction. Domestic production of petroleum and natural gas meets only 4 percent of requirements, and production has been declining since the 1960s. Large quantities of oil shale exist but the technology for extracting and processing shale oil is too expensive to date, although government investigations are being made into the possibility of future exploitation.

Environmental problems associated with the utilization of mineral resources have not been explicitly addressed in Morocco. Continued investigations into oil shale development and utilization of uranium in nuclear reactors for electricity production should attend to appropriate environmental consequences. With respect to phosphate mining, there seems to be a prevalence of pulmonary disease among miners. ^{18/}

3.5 Soils ^{19/}

3.5.1 Soil Types

The main soil types found in Morocco are:

- isohumic, found in the Mediterranean region and characteristic of the plains, foothills, and plateaus of Atlantic Morocco
- red and brown Mediterranean, found in the mountainous zones
- vertisols, called "tirs", that cover vast areas of Atlantic Morocco, mainly Gharb, Chaouia, and Loukkos
- hydromorphic, characteristic of the Gharb and the central plateau
- halomorphic, found in the arid Saharan regions

3.5.2 Soil Erosion

Moroccan soil is becoming alarmingly degraded. Mountain areas are becoming highly populated and land-clearing is pushed insistently, often without elementary precautions, leading to serious loss of arable soil by erosion. Overgrazing and pas-

¹⁸ Source: Woodrow Wilson International Center for Scholars. 1972. p.64.

¹⁹ Sources: Bensalem, B. 1977.
FAO. 1975.
Johnson, H. and J. Johnson. 1977.

ture degradation by a large livestock population causes erosion and turns arid zones into nonproductive deserts (see 2.3.5).

Erosion caused by water is the most serious phenomenon. Water erosion results from easily erodible sedimentary parent rock, steep slopes, high rainfall intensities, and the destruction of the vegetative cover. The most important aspect in Morocco is that the proportion of land with steep slopes is highest where rainfall intensity is highest. In the Rif region, for example, 50 percent of the land has slopes greater than 50 percent incline, soils are predominantly clayey, and the annual rainfall is 900 mm.

Wind erosion is also common in Morocco and is further aggravated by the presence of prevailing winds from both north and south. Southerly winds are particularly harmful, as they have high speeds which allow the transport of substantial quantities of fine surface soil elements from the arid and semiarid southern regions. Strong winds blowing from the Atlantic have inhibited the development of many crops.

3.5.3 Soil Conservation Measures

-Reforestation

Due to high costs, low tree productivity, and lack of precise information on suitable species, reforestation has been of limited success. Where natural vegetation is removed for the purpose of planting monotypic plantations, erosion increased. Current thought is that reforestation is good for selected sites and in conjunction with mechanical and other resources (see 2.3.4.3).

-Tillage Practices

Practices in use for controlling water erosion on arable land include:

- contour plowing - The Moroccan government has enacted legislation (see 3.2.4), organized education campaigns, and published bulletins to promote contour plowing. The technique is still largely neglected among the general populace, however.
- crop rotation - This practical method of improving soil fertility increases soil resistance to erosion. Grain fallow for a short period is practiced, with a subsequent planting of a forage crop, which is usually a mixture of legumes and grains (Viscia-Avena). This technique is currently used only on a limited scale in Morocco.
- mulching - This technique reduces sheet erosion by leaving stubble standing after harvest. However, the practice of stubble grazing in Morocco vastly reduces the effectiveness of mulching.

- strip-cropping - Where contour plowing is judged insufficient to control erosion, strips of grain plantings are alternated with fallow strips. However, this technique is effective only if grazing is excluded, and in Morocco this is usually not the case.

-Mechanical Structures

Bench terraces, small walls, and terraces have been used for erosion control. Bench terraces are costly and therefore are restricted to the more populous mountain areas. Small walls designed to reduce the velocity of runoff and arrest siltation are highly efficient for improving rangelands. Small terraces called "banquettes" are currently used intensively throughout Morocco. A channel and ridge construction, these terraces store runoff before it attains erosive speeds or divert it to natural waterways. One problem in Morocco is that these terraces are constructed of clayey soils, which is dysfunctional. Some diversion terraces actually increase the rate of runoff flow. In the Pre-Rif region, about 60 percent of retention terraces have been destroyed. Of these, 40 percent were lost to gully formation and overflow and 60 percent were sliced down as a result of pressure increase.

-Physical Structures to Control Stream Erosion

Checkdams are constructed in waterways originating on steep slopes. Their purpose is to reduce the velocity of water and to arrest silt. When carefully designed, these structures result in a significant reduction in erosion. However, in Morocco the major sources of sediment are not existing waterways per se but rather the enlargement of these waterways and streambeds as a result of inappropriate land use practices.

Note: The Derro project in Morocco is an attempt to focus on small-scale erosion control measures and implement them in close cooperation with local people. An integrated approach is proposed, in order to replace harmful activities with nonharmful ones.

Hypothetically, such an approach on a country-wide scale would involve the replacement of wheat cropping on high slopes with permanent pastures, the planting of fruit trees on favorable soils, creation of fodder reserves, treatment of degraded lands and waterways, creation of new forage resources outside the watershed, increased agricultural activity downstream, and reforming communities within the watershed. Obvious practical deterrents are difficulties in changing land use systems, time for the planting

to become economical, need for stabilized animal populations, land tenure problems, and the need for increased competence required to undertake construction of physical structures and tree planting.

-Wind Erosion Control

The establishment of shelterbelts and the stabilization of sand dunes are the major wind erosion control measures being undertaken. In the shelterbelt project in southern Morocco (see 3.3.4) where Eucalyptus gomphocephala was planted, the farmers themselves carried out the plantings and realize an economic return by selling Eucalyptus logs for making fish boxes.

To date, sand stabilization methods (see 3.3.4) are labor-intensive and require quantities of dead shrubs to establish the first year of physical barriers before plantings are subsequently undertaken.

3.6 Water Resources ^{20/}

3.6.1 Surface Water

The Atlantic coastal plains are drained by several large rivers. Of these, the Loukkos drains the Loukkos plain; the Sebou and its tributaries the Ouerrha and Beth drain the Sais and Gharb plains; the Oum er Rbia drains the Tadla, Berrechid, Chaouin, and Douakkala plains; the Tensift drains the Haouz and Abda plains; and the Sous drains the Sous region lying between the Atlas and Anti-Atlas. Twenty-three dams and reservoirs are located throughout the country.

3.6.2 Groundwater

The main aquifers are the following:

- The limestones and dolomites (hard, fine-grained or oolitic) of Infra-Cambrian, Cambrian, Jurassic (Particularly Upper Jurassic) and Cretaceous (Cenamano-Turonian) age. In the Atlas Mountains these formations contain many springs and also feed the aquifers of the neighbouring plains through subsurface contact. The Liassic alone covers 10 percent of Morocco and yields one third of the spring water (25 cubic meters per second from some springs); it supports 80 boreholes yielding 1.5 cubic meters per second each. The Jurassic limestones contain artesian water in the high plateaux and their northern extension, the Triffa-Angad, and beneath the plain of Sais. They also carry water on the phosphate plateau.

²⁰ Sources: United Nations, Department of Economic and Social Affairs. 1973. pp. 119-121.
Van der Leeden, F. 1975. pp. 145-150.

- The sandstone formations contained in the Primary series, which have far more limited potential;
- Of the Tertiary and Quaternary formations, the Oligo-Miocene conglomerates of the piedmont areas; the Eocene limestones and sandstones; the Miocene and Pliocene limestones and coquina of the Atlantic coast; the Plio-Quaternary lacustrine limestones, sandstones, conglomerates and marly limestones of certain plains (Gharb, Saïs, Tadla, Benguerir, Berrechid, Sous, Tiznit, Tafilal and Haouz, Doukkala), which are tapped by numerous wells and drains and, when possible, by artesian wells. Sometimes, particularly in the arid southern regions, these formations are the only aquifers.

Most of the groundwater basins in Morocco have been developed, but overpumping is rare. The Atlantic coastal zone, between Mohammedia and El-Jadida, is the area most seriously threatened with sea water intrusion into the aquifer, which is far advanced in some places.

There has been a rise in the water tables in areas which are once again being irrigated by surface water (obtained from recently-built dams) and this has necessitated the installation of drainage systems. This has been the case in some parts of Triffa, Tadla, Gharb and the Doukkalas, areas where the groundwater bodies have inadequate outfalls. Various methods of drainage have been tried out in these areas, including pumping followed by injection into deep aquifers and the use of surface collectors. Some areas of Morocco, particularly certain limestone massifs, the areas of marl and flysch in the Rif, the regions where there are outcrops of crystalline or Primary shales and sandstones (central Morocco, south-east of Rabat, Bani), the hamadas du Dra and du Guir, and the Tarfaya plains, contain very little groundwater.

The water tends to be safe for human as well as livestock use, except in some desert areas where sediment concentration is high and in the outcrops of saliferous and gypsiferous Permo-Triassic formations. The water is often quite hard.

3.6.3 Tables Detailing Water Resources ^{21/}

Table 1: Discharge Characteristics of Major Watershed Basins

River and station	Basin area km ²	Mean monthly discharge, m ³ /s												Year	Period of record
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.		
Mediterranean Sea															
Moulouya, Mechra Homadi	51,950	55.4	56.6	74.8	92.6	102	62.2	18.5	14.1	26.2	21.9	33.5	44.7	50.2	1951-64
Atlantic Ocean															
Sebou, Azib El Soltane	17,250	200	191	178	133	68.6	49.5	27.4	22.3	16.2	21.6	54.3	124	90.6	1959-64
Oum Er Rebia, Im Fout	30,000	114	150	187	191	138	72.8	41.9	36.4	42.4	52.9	74.8	106	101	1941-64
Souss, Ait Melloul	16,150	5.3	5.4	3.8	6.3	1.3	0.9	0.7	0.7	0.9	0.6	0.8	54.1	6.8	1963-64
Dra, Zagora	20,130	3.6	4.2	0.3	5.0	1.2	0.3	0.2	0.2	0.0	0.0	0.0	3.0	1.5	1963-64

Table 2: Discharge Characteristics of Major Rivers

River basin	Basin area km ²	Annual precipitation mm	Period of record	Station or location	Mean annual flow m ³ /s	Mean flow during driest month m ³ /s
Sebou	39,000	710	1932-1964	Mouth	200.0	20.0
Oum Er Bia	34,400	480	1918-1966	Mouth	130.0	30.0
Moulouya	53,700	300	1952-1966	Mouth	44.0	4.0
Loukkos	3,800	950	1961-1967	Mouth	42.0	0.5
Tensift	20,100	365	Calculated	Mouth	29.0	0.3
Bou Regreg	7,800	600	1930-1968	Mouth	20.0	0.4
Martine	1,220	935	Calculated (1963-1967)	Mouth	14.5	0.2
Draa	15,100	190	1936-1967	Zaouia-Nurbaz	13.5	1.0
Lau	920	980	Calculated (1963-1967)	Mouth	13.0	2.0
Neckor	960	590	Calculated	Mouth	9.0	1.0
Kerte	3,080	355	Calculated	Mouth	8.0	0.5
Rhis	800	595	Calculated	Mouth	7.5	0.8
El Had	600	825	Calculated	Mouth	7.2	0.8
Hachef	650	905	Calculated	Mouth	6.3	0.0
Ziz	4,600	290	1948-1966	Ksar es Souk	6.0	0.5
	186,730	Oueds with discharge greater than 6 m ³ /s			550.0	62.0
	113,270	Other oueds			110.0	3.0
Total General	300,000				660.0	65.0

²¹ Source: van der Leeden, F. 1975. pp. 145-150.

Table 3: Annual Withdrawal and Losses of Groundwater

Hydrogeologic basin	Ground water withdrawn		Ground water lost		Type of losses
	Rate m ³ /s	Volume 10 ⁶ m ³	Rate m ³ /s	Volume 10 ⁶ m ³	
Couloir sud-riifain and recharge basin of Moyen Atlas	14.0	441.0	1.0	31.5	Evaporation following drainage.
Souss, Chtoukas, Massa	10.0	315.0	2.0	63.0	Losses to ocean and evaporation.
Haouz Mejate	9.0	283.5	—	—	—
Haut-Atlas central and piedmont	6.0	189.0	—	—	—
Tadla	4.5	142.0	1.0	31.5	Evaporation from drains and canals.
Rharb, Mamora, Dradere	4.0	126.0	6.0	189.0	Evaporation following drainage and losses to ocean.
Tafilalet - Maidere	3.2	100.0	5.0	157.5	Evaporation and losses to desert.
Coastal zone Rabat-Azemmour	2.0	63.0	—	—	—
Mediterranean coastal basins (R'i, Bareg, Bou Areg, Neckor)	2.0	63.0	3.0	94.5	Losses to sea and evaporation.
Foums of Antri Atlas	2.0	63.0	1.0	31.5	Evaporation
Bahira	2.0	63.0	1.5	47.0	Evaporation
Couloir Taourirt-Oujda	1.6	50.0	1.0	31.5	Losses across border and evaporation.
Berguent	1.5	47.0	1.0	31.5	Decompression of artesian aquifer and evapotranspiration of seeps.
Moyenne and haute Moulouya	1.2	38.0	1.0	31.5	Evaporation of seeps.
Sillon Quarzazate-Boudentib	1.0	31.5	1.0	31.5	Losses across borders and to desert.
Plain of Berrechid	1.0	31.5	1.0	31.5	Evaporation
Basin Essaouira-Chichaoua	1.0	31.5	2.0	63.0	Losses to sea.
Plains of Loukkos and R'Mel	1.0	31.5	0.5	16.0	Losses to sea.
Doukkala and coastal Sahal	—	—	4.0	126.0	Losses to sea.
Total major aquifers	67.0	2,109.5	32.0	1,000.0	
Other aquifers	10.0	315.0	1.0	31.5	
					Withdrawn and lost
Grand Total	77.0	2,424.5	33.0	1,039.5	110 m³/s or 3,500 x10⁶m³/yr

Table 4: Dams and Reservoirs

Name of dam	Year of completion	Location		Length of crest m	Volume of dam 10 ³ m ³	Gross capacity of reservoir 10 ³ m ³	Purpose 2)	Maximum discharge capacity of spillways m ³ /s
		River	Nearest city					
Sidi Maachou	1929	Oum-er-R'bia	El-Jadida	150	32	2,000	H/S	4,500
Oued Mellah	1931	Mellah	Casablanca	138.50	25	18,000	I/S	300
Ali Thelat	1934	Laou	Chaouen	320	52.4	25,000	I/H	500
El Kansera 1)	1935	Beht	Sidi-Sirmane	177.50	200	297,000	I/H	1,750
Lalla Takerkoust	1935	N'Fis	Marrakech	357	150	52,000	I/H	2,000
Ouezzane	1937	Bou Droua	Ouezzane	235	75	400	S	
Imfout	1944	Oum-er-R'bia	Settat	200	130	83,000	I/H	3,500
Zemrane	1950	Mellah	Khouribga	112.50	7.8	600	S	
Daourat	1950	Oum-er-R'bia	Settat	125	50	24,000	H	3,500
Bin-El-Quidane	1953	El Abid	Beni-Mellal	290	365	1,500,000	I/H	2,500
Ait Ouarda	1954	El Abid	Beni-Mellal	120	28	3,800	I/H	2,750
Mechra Homadi	1955	Moulouya	Oujda	215	125	42,000	I/H	7,000
Taghdout	1956	Taghdout	Quarzazate	21.8	0.93	3,000	I	
Nakhla	1961	Nakla	Tetouan	240	159	9,200	I/S	700
Safi	1965	Sahm	Safi	323	63	2,100	I/S	200
Mohammed V (Mechra Klila)	1967	Moulouya	Nador	305	323	730,000	I/H	7,000
Grou	1968	Grou	Rabat	500	300	18,000	S	2,300
Moulay Youssef	1970	Tessaout	Marrakech	725	5,300	200,000	I/H	3,000
Hassan Addakhil	1971	Ziz	Ksar-es-Souk	785	5,800	380,000	I	1,700
Mansour Eddahbi	1972	Draa	Quarzazate	285	160	560,000	I/H	7,200
Youssef Ben Tachfine	1973	Massa	Tiznit	670	3,700	310,000	I	3,400
Kriss 1er	1973	Inaouene	Fes	447	450	1,270,000	I/H	2,400
Bou-Regreg	1974	Bou-Regreg	Rabat	340	3,000	570,000	S	5,000

1) Raised 5 m. in 1969

2) H Hydropower
S Water supply
I Irrigation

Table 5: Water Use, 1972-2000

Category	Annual water requirements, million m ³	
	1972	2000
Public water supply	300	1,300
Industry	200	700
Agriculture	7,500	10,000
Total	8,000	12,000
Available water resources	16,000	16,000
Percent utilized	50	75

Table 6: Water Balance Diagram

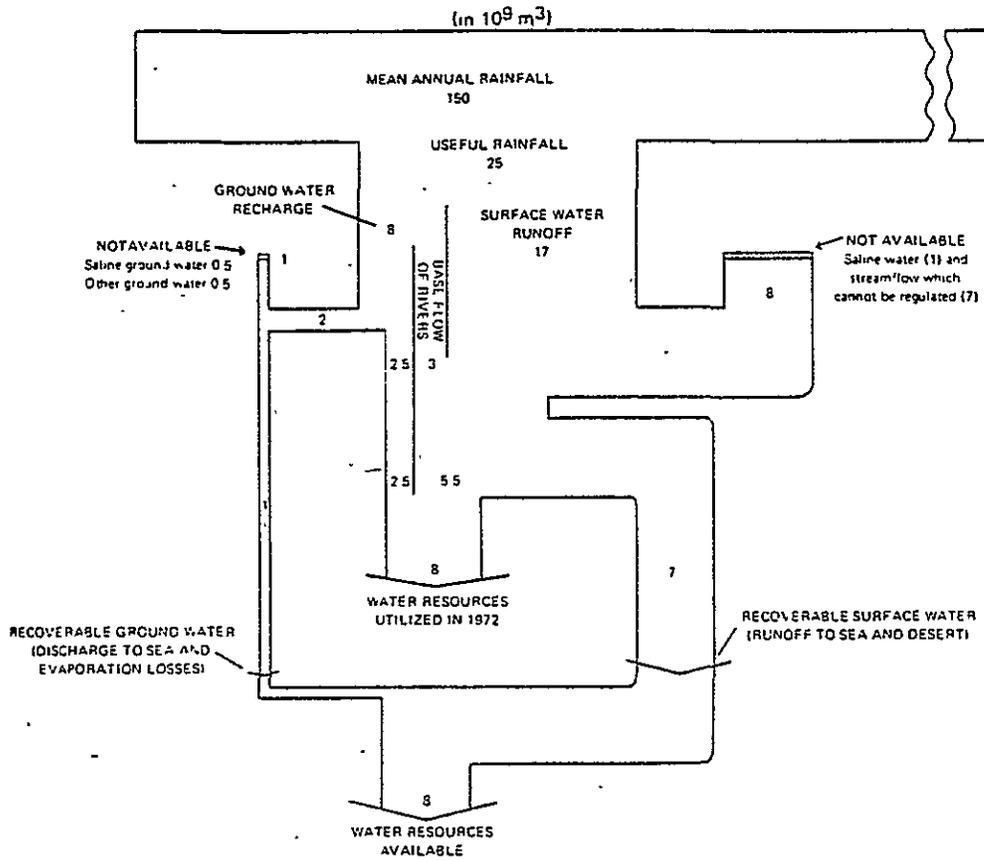


Table 7: Municipal Water Supply System

City or town	Population in 1952	Quantity of water distributed in 1960 (l/s)			Aquifer
		Surface water	Ground water	Total	
North Flank Atlas Mountains					
Oujda	115,446	—	150	150	Liasic
Berkane	18,830	—	15	15	Liasic
Nador	26,300	—	30	30	Andesite and Quaternary
Jerada	17,400	—	120	120	Liasic
Taza	24,000	—	85	85	Liasic
Fes	235,000	—	680	680	Liasic
Meknes	190,000	—	415	415	Liasic and Quaternary
Quezzane	24,500	8	8	16	Oligo-Miocene
Sidi Kacem	18,500	—	18	18	Quaternary
Larache	43,000	—	35	35	Plio-Quaternary
El-Ksar-El-Kbir	36,000	—	50	50	Plio-Quaternary
Tanger	140,000	100	200	200	Plio-Quaternary
Tetouane	100,000	40	25	65	Plio-Quaternary
Casablanca **	750,000	1,350	250	1,600	
Mohammedia *	30,000	—	—	—	
Bou-Znika *	—	—	—	—	
Temara *	—	—	543	543	
Rabat *	180,000	—	A. Rehoula 160 and Bab Tamesna	160	
Sale *	100,000	—		50	
Kenitra *	100,000	—	—	—	
Settate	27,000	—	40	40	Cenomanian-Turonian
Khouribga	50,000	12	58	70	Precambrian
Beni-Mellal	27,000	—	30	30	Lias
Safi	76,000	—	85	85	Hauterivian and Plio-Quaternary
Marrakech	220,000	20	410	430	Quaternary
El-Jadida	35,000	115	—	115	—
Es Saouira	21,000	—	36	36	—
Agadir	32,800	—	130	130	Cenomanian-Turonian
Total	2,638,176	1,645	4,473	5,168	Plio-Quaternary
South Flank Atlas Mountains					
Quarzazate	2,856	3	—	3	Quaternary
Ksar es Souk	5,500	—	10	10	Quaternary

* Coastal communities supplied by Fouarate pipeline.
 ** Partially supplied by Fouarate pipeline.

3.6.4 Water Pollution ^{22/}

Water pollution is caused by effluents from sugar refineries, tanneries, cellulose plants, and urban sewage. The latter is the major source of water pollution. Existing sewage systems are over age and inadequate, and drain without treatment into rivers. At times even groundwater aquifers are contaminated. Current development plans provide for sewage treatment plants for Casablanca, Meknes, Rabat, and Tangiers.

3.6.5 Water Management ^{23/}

The objective of the Moroccan government is to expand irrigated acreage to 2.5 million acres, or one-eighth of Morocco's total cultivable area, by 1985. Twenty-three major dams are scattered throughout the country, representing 50 percent of the manageable water resources. Financing of the dams has been accomplished through domestic and foreign means.

The lag between dam construction and the realization of ultimate irrigation potentials is considerable, due to constraints imposed by traditional infrastructures, attitudes, and land use systems. Attainment of the full goal of 2.5 million utilized acres will probably be achieved after 1990. Meanwhile, dam construction also provides flood control, hydroelectric power, and potable water for human and livestock consumption.

Organization of irrigated regions is under the direction of the Ministry of Agriculture, which assumes responsibility for installing irrigation equipment, land preparation activities, providing subsidies and loans where necessary, and promoting education and extension programs.

Land use objectives include boosting irrigated citrus acreage to 203,000 acres, irrigated grain acreage to 321,000 acres, and fourfold increases in the irrigated acreage devoted to cotton, sugarbeets, and vegetables to 198,000, 222,000, and 185,000 acres respectively. The goal of 490,000 acres for forage crops is a considerable boost from the present level of 25,000 acres. Problems in meeting this goal include inadequate research in adaptable forage crop varieties, inadequate livestock-breeding programs, widespread animal diseases and parasites, and traditional attitudes about feeding and husbandry practices.

²² Source: Johnson, H. and J. Johnson. 1977.

²³ Source: Williams, D. G. 1972.

Several recent studies reflect current water management priorities in Morocco. J. S. Dajani, in a project undertaken for U.S. AID ^{24/}, assesses the technical feasibility of rehabilitating 400 rural wells in eight Moroccan provinces. Major emphasis is placed on narrowing the projected scope and on combining water source improvements with improvements in waste disposal practices. In a second study, D. A. Phoenix of the U.S. Geological Survey ^{25/} investigates water resource development strategies for Morocco. Factors such as expanding industrial and municipal water requirements, limited ground-water supplies, increase in irrigated acreage, repetitive flood damage, reservoir siltation, and aggravated salinization necessitate greater investments in water resource management strategies.

In view of the rapid expansion of irrigated acreage in Morocco, the benefits and hazards of irrigation should be examined. A recent report by the United Nations Environment Program ^{26/} details the environmental impacts of irrigation in arid and semiarid regions. The benefits applicable to Morocco include:

- increased agricultural production
- soil conservation (see 3.5.3)
- improved microclimate by increasing relative humidities and lowering temperatures and evaporation rates; and
- wildlife conservation, by providing habitat for aquatic animals, crops as food for birds and mammals, and hedgerows as habitat and cover

Detrimental effects pertinent to irrigation in Morocco include:

- inappropriate water resource development, such as diversion, storage in surface reservoirs (among detrimental effects are land inundation, population translocation, destruction of wildlife, disease, silt entrapment, increased salinity of the reservoir and of surrounding aquifers), and the pumping of groundwater; and
- hazards from various irrigation practices, which include disease, contamination of food crops with sewage effluents, pollution of groundwater, pollution of surface runoff, over-irrigation, siltation, and soil erosion.

²⁴ Source: Dajani, J. S. 1979.

²⁵ Source: Phoenix, D. A. 1967.

²⁶ Source: United Nations Environment Program. 1979.

3.6.6 Sea Water ^{27/}

The government of Morocco is highly interested in research to lower the cost of desalination of sea water as a potential potable water resource. Current sea water pollution problems stem from sea dumping of oil by tankers. Morocco has enacted legislation regulating such pollution (see Appendix D). The government of Morocco participates in the Blue Plan sponsored by the UN Environment Program and is a signatory to the 1975 Mediterranean Action Plan for development of the area in such a way as to eliminate environmental despoliation.

²⁷ Source: Johnson, H. and J. Johnson. 1977.

4.0 Environmental Problems and Prospects

Most environmental problems currently facing Morocco are caused by destructive land use practices stemming from increasing population pressure on the land. Increased use of marginal lands for grazing and increased fuelwood demand are two of the most important destructive forces caused by population growth, and their ultimate effects are soil deterioration and loss of the native flora and fauna. Pollution problems, although currently not as pressing as land use problems, will probably become progressively more severe as plans for increased industrial development are put into effect.

Land use problems are frequently generated by an interlocking chain of cause and effect. Deforestation, for example, is ultimately caused by increased demand for agricultural land, which displaces grazing animals to forest lands. Because seedlings are consumed by grazing animals, grazing of forests inhibits natural regeneration, leading to even-aged stands. Even-aged stands have little production potential, and are rapidly diminished as demand for fuelwood increases. Furthermore, range deterioration increases as woody species are uprooted for fuel and expanded cultivation destroys natural grasslands. These processes all contribute to the destruction of natural vegetative communities, which in turn causes the loss of native wildlife. Finally, the loss of vegetative cover exposes soil to erosion by both wind and water (see Section 3.5.2), completing the process of desertification.

Morocco has recognized the urgency and severity of the land deterioration process, and has taken steps to restore damaged lands and prevent further damage. Land is being reclaimed by afforestation and reforestation, prohibition of grazing, shelterbelt planting, and dune stabilization (see Section 3.3.6). Improved tillage practices such as contour plowing, crop rotation, mulching, and strip cropping are being employed to prevent soil damage (see Section 3.5.3), and proposed irrigation projects (Section 3.6.5) can alleviate pressure on marginal lands by permitting more intensive agricultural production.

These steps to improve land quality are encouraging, but they have not been an unqualified success, nor have they addressed some of the most fundamental problems. Reforestation programs, for example, have caused the diverse native forests to be replaced by pine plantations in which such native wildlife as the short-toed eagle and the Barbary macaque cannot survive. Irrigation projects on the west coast have drained marshes, causing further habitat loss. Proposed irrigation projects are also likely to create larger threats to human health by promoting the spread of such water-borne diseases as malaria and bilharzia. Little or nothing has been done to combat range deterioration, one of Morocco's most important land use problems. Rangelands are severely overstocked, with as many as ten times as many animals on the range in some areas compared with what the land could comfortably bear. Pasture rotation is not practiced, and there is no storage of fodder, causing severe grazing pressure and major herd losses in dry years. These problems may be among the most difficult to address, since they involve changing the traditional practices of herdsman.

Pollution problems are today limited primarily to water supply contamination by urban sewage and some oil pollution of coastal waters. However, high priority industrial projects, including mining treatment facilities, cement plants, port facilities, and hydroelectric plants, (see Section 2.3), and the increased general industrial development that these projects imply, are likely to cause more severe pollution problems in the near future. This is particularly likely if no environmental standards are adopted, and if no action is taken to monitor the environmental effects of these industrial projects. Morocco currently has the advantage of being able to anticipate the environmental consequences of increased industrial development, and to take the less costly strategy of preventing pollution, rather than cleaning up afterwards.

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APPENDIX A

Population

1. Demographic Characteristics
2. A Comparison of the Age Pyramid of Morocco with that of Industrial Countries (1975)
3. Population of the Ten Largest Cities (1936, 1960, and 1973)
4. Population by Age and Sex (1971)
5. Urban and Rural Population by Province and Prefecture (1975)

DEMOGRAPHIC CHARACTERISTICS*

1. Total population (1978)	18,819,000
2. Rate of population growth (1977)	2.9%
3. Life expectancy (1973)	52.9
4. Infant mortality (1973) (deaths/1000 births)	130.0
5. Percent of population under 15 years of age (1973)	46.4%
6. Percent rural population (1976)	62.0%
7. Percent urban population (1976)	38.0%
8. Per capita income (1978) (from World Bank. 1979.)	670.0
9. Percent literate (1971)	24.0%
10. Population density per square mile (1975)	96.0
11. Population density per square mile of arable land (1974)	210.0

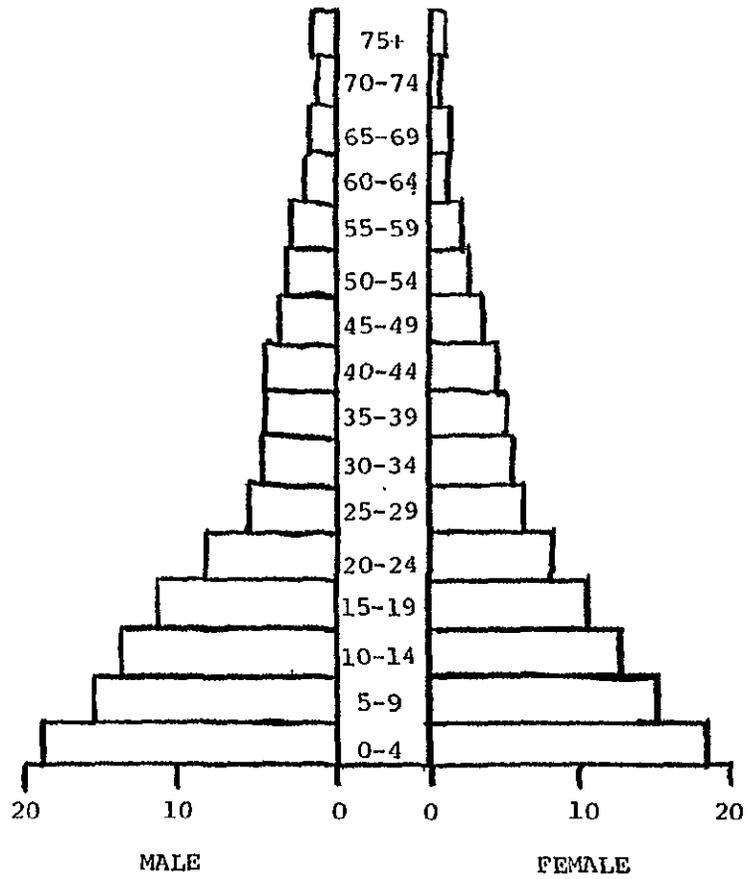
*unless otherwise indicated, all data taken from Selected A.I.D. Official Data as of 07/16/79 (available from files at U.S. Department of State, Agency for International Development, Washington, DC)

2. A Comparison of the Age Pyramid of Morocco with the Characteristic of Industrial Countries

AGE PYRAMID
(MOROCCO)

1975

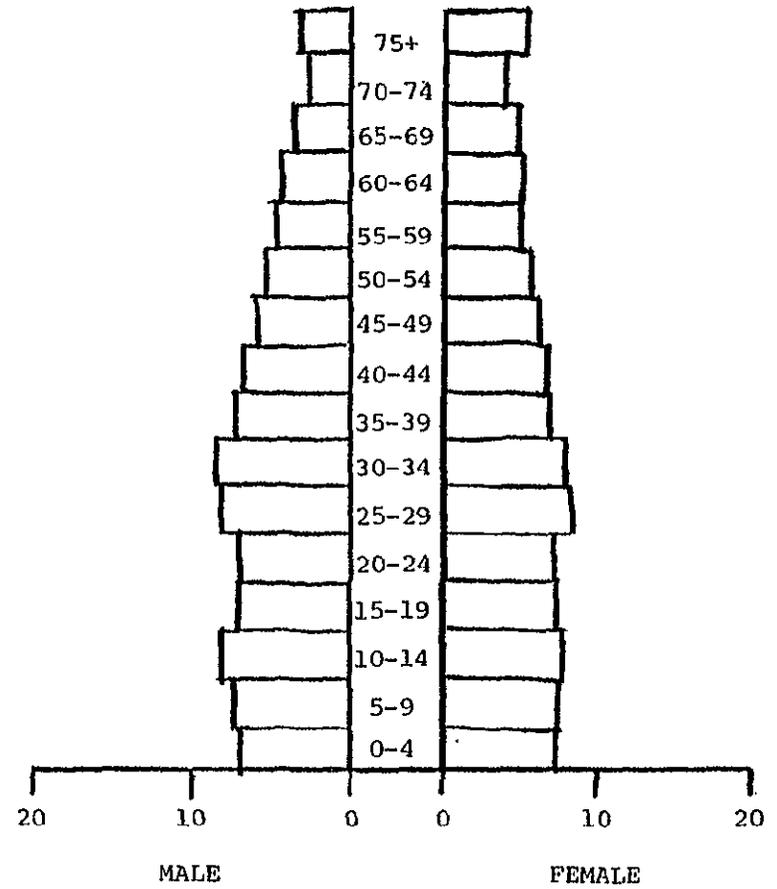
AGE



AGE PYRAMID
(INDUSTRIAL COUNTRIES)

1975

AGE



39

Source: The Futures Group. undated.

3. Population of the Ten Largest Cities (1936, 1960, and 1973)

City	1936 ¹	1960 ¹	1973 ²
Casablanca	257,430	1,000,287	1,625,000
Rabat	83,379	303,244	555,000
Marrakech	190,314	243,134	360,000
Fès	144,424	216,133	335,000
Meknès	74,702	175,943	290,000
Tangier	- - - ³	141,714	200,000
Oujda	34,523	128,645	180,000
Tétouan	- - - ⁴	101,352	150,000
Kenitra	17,601	86,775	160,000
Safi	25,159	81,072	160,000

¹Census figures.
²Estimate.
³In international zone.
⁴In Spanish zone.

Source: American University, Foreign Area Studies. 1978. p.332

4. Population by Age and Sex (1971) (in thousands)

Age-Group	Male	Female	Total
0-4	1,554	1,518	3,072
5-9	1,322	1,303	2,625
10-14	1,099	1,097	2,196
15-19	910	926	1,836
20-24	756	754	1,510
25-29	610	608	1,218
30-34	498	497	995
35-39	421	419	840
40-44	361	343	704
45-49	292	292	584
50-54	240	241	481
55-59	180	198	378
60-64	147	145	292
65-69	95	111	206
70-74	60	60	120
Over 75	43	60	103
TOTAL	8,588	8,572	17,160

Source: American University, Foreign Area Studies. 1978. p.330

5. Urban and Rural Population by Province and Prefecture (1975)

Province and Prefecture	Urban	Rural	Total
Agadir	164,000	683,900	847,900
Al Hoceima	33,000	240,000	273,000
Azilal	22,100	343,000	365,100
Beni Mellal	142,400	347,300	489,700
Boulemane	11,200	118,600	129,800
Chaouen	30,700	247,900	278,600
El Jadida	121,600	534,300	655,900
El Kelaa-Sraghna	57,300	458,400	515,700
Essaouira	51,200	353,700	404,900
Fès	463,200	666,800	1,130,000
Figuig	24,900	73,700	98,600
Kenitra	320,100	723,400	1,043,500
Khemisset	67,000	320,600	387,600
Khenifra	71,000	204,100	275,100
Khouribga	173,200	198,800	372,000
Ksar es Souk	43,100	323,800	366,900
Marrakech	423,300	686,000	1,109,300
Meknès	386,700	300,300	687,000
Nador	63,300	468,000	531,300
Ouarzazate	46,000	535,400	581,400
Oujda	356,600	313,100	669,700
Safi	193,500	401,800	595,300
Settat	146,700	597,400	744,100
Tangier	240,900	89,800	330,700
Tarfaya	32,700	47,000	79,700
Taza	95,800	492,600	588,400
Tétouan	293,200	314,200	607,400
Tiznit	44,200	345,200	389,400
Casablanca Prefecture	1,864,400	146,400	2,010,800
Rabat Prefecture	635,700	110,100	745,800
TOTAL	6,619,000	10,686,000*	17,305,000*

* Figures do not add to total because of rounding.

Source: American University, Foreign Area Studies. 1978. p.329

APPENDIX B

Economy

Contents

1. Economic Characteristics
2. Principal Products of Foreign Trade, in Percent (1972-76)
3. Production of Selected Commodities, in Thousands of Tons (1972-76)
4. Production by Sector, in Percent (1971-76)
5. Distribution of Economically Active Population by Economic Sector (1971)
6. Economic Activity (mid-1970's)

1. Economic Characteristics

1. GNP at market prices, in US\$ millions (1978)	12,610
2. GNP per capita in US\$ (1978)	670
3. % growth in GNP per capita (1970-77)	4.2%
4. rate of inflation (1977)	13%

(Sources: World Bank. 1978 and U.S. Department of State. 1978)

2. Principal Products of Foreign Trade, in Percent (1972-76)

Product	1972	1973	1974	1975	1976
Exports					
Phosphate	22.8	21.1	55.1	55.3	39.8
Citrus fruit	14.6	13.2	5.2	6.6	10.8
Canned fish	4.5	5.1	3.3	2.8	4.2
Legumes and pulses	4.7	4.8	2.1	1.9	3.4
Clothing	1.6	1.4	1.2	1.6	2.9
Carpets	2.0	2.2	1.2	1.8	2.8
Canned fruits and vegetables	3.8	3.5	2.2	2.4	2.7
Tomatoes, fresh	6.1	6.1	2.5	2.8	2.3
Potatoes	1.6	1.5	1.1	1.2	1.5
Olive oil	3.8	2.7	2.0	1.5	1.2
Lead	3.1	2.7	2.2	1.0	1.2
Cotton	1.4	1.1	0.3	0.1	0.9
All other	30.0	34.6	21.6	21.0	26.3
TOTAL EXPORTS	100.0	100.0	100.0	100.0	100.0
Imports					
Industrial equipment	18.7	16.9	16.0	22.8	28.6
Crude oil	4.8	4.8	11.9	8.6	9.0
Metal products	8.1	7.8	7.8	6.2	7.0
Wheat	3.8	10.2	8.5	9.2	6.2
Sugar	4.7	5.2	7.6	9.3	5.2
Automobiles and parts	4.8	4.2	3.0	4.8	5.2
Chemicals	3.4	3.1	2.9	2.6	2.3
Lumber	2.8	2.9	2.3	1.7	2.1
Edible oils	2.9	3.6	5.1	3.9	1.9
Domestic appliances	2.3	2.1	1.4	1.3	1.7
Synthetic yarn	2.9	2.8	1.9	1.3	1.6
Dairy products	1.9	1.5	1.4	1.1	1.2
All other	38.9	34.9	30.2	27.2	28.0
TOTAL IMPORTS	100.0	100.0	100.0	100.0	100.0

Source: American University, Foreign Area Studies. 1978. p.336

3. Production of Selected Commodities, in Thousands of Tons (1972-76)

Product	1972	1973	1974	1975	1976
Barley	2,466	1,255	2,389	1,587	2,400
Cement	1,542	1,619	1,914	2,028	n.a.
Citrus fruit	1,013	839	602	745	727*
Coal	547	565	574	658	719
Cobalt	11	10	12	14	7
Copper	4	4	5	5	4
Cottonseed	17	16	12	12	15*
Crude oil	25	42	24	20	10
Dates	92	92	93	94	n.a.
Fish oil	6	13	12	5	4*
Iron	234	375	531	554	343
Lead	146	159	142	104	99
Manganese	96	146	175	131	117
Meat	105	175	170	168	166
Milk	492	543	521	520	532
Phosphate	14,500	16,600	20,500	17,700	14,800
Potatoes	226	226	230	200	207
Sugar, raw	248	220	272	255	310
Tomatoes	460	270	250	215	215
Wheat	2,161	1,574	1,853	1,575	2,400
Zinc	36	33	27	36	30

n.a. — not available

* Preliminary

Source: American University, Foreign Area Studies. 1978. p.335

4. Production by Sector, in Percent (1971-76)

Sector	1971	1974	1975	1976
Agriculture, forestry, and fishing	31.3	28.2	24.5	24.8
Commerce	22.5	23.2	24.0	23.4
Transportation and services	18.2	18.2	18.7	18.0
Manufacturing	14.1	14.3	14.9	14.7
Construction	6.0	5.7	9.3	10.9
Mining	8.6	6.8	4.9	4.5
Fuels and energy		3.6	3.7	3.7
TOTAL	100.7*	100.0	100.0	100.0

* Figures do not add to 100 because of rounding.

Source: American University, Foreign Area Studies. 1978. p.335

5. Distribution of Economically Active Population by Economic Sector
(1971)

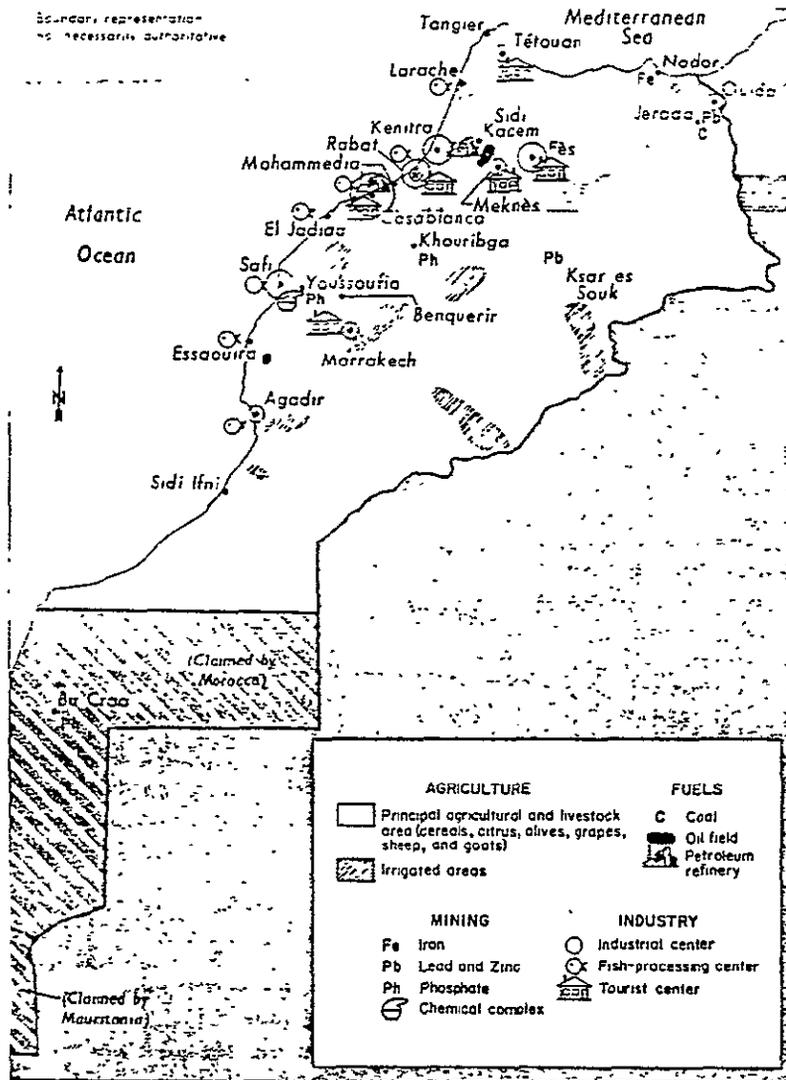
Economic Sector	Employers and Self-Employed	Salary and Wage Earners	Family Workers	Others and Status Unknown	Total	Percent
Agriculture, forestry, hunting, and fishing	894,033	418,732	672,444	2,851	1,988,060	50.0
Mining and quarrying	3,481	39,891	974	194	44,540	1.1
Manufacturing	124,085	214,238	25,485	5,456	369,254	9.3
Electricity, gas, and water	571	9,946	122	171	10,810	0.3
Construction	29,395	138,305	2,752	1,243	171,695	4.3
Wholesale and retail trade, restaurants, and hotels	193,284	78,704	14,920	2,174	289,082	7.3
Transport, storage, and communication	26,968	71,400	1,527	530	100,425	2.5
Financing, insurance, real estate, and business services	2,597	2,881	93	31	5,602	0.1
Community, social, and personal services	34,697	445,624	19,036	2,371	501,728	12.6
Activities not adequately described*	29,832	65,173	6,638	53,719	155,412	3.9
Unemployed	343,900	8.6
TOTAL	1,338,943	1,484,894	744,041*	412,640*	3,980,518	100.0

not applicable.

*Figures do not add to total, figures as given in source.

Source: American University, Foreign Area Studies. 1978. p.331.

6. Economic Activity (mid-1970's)



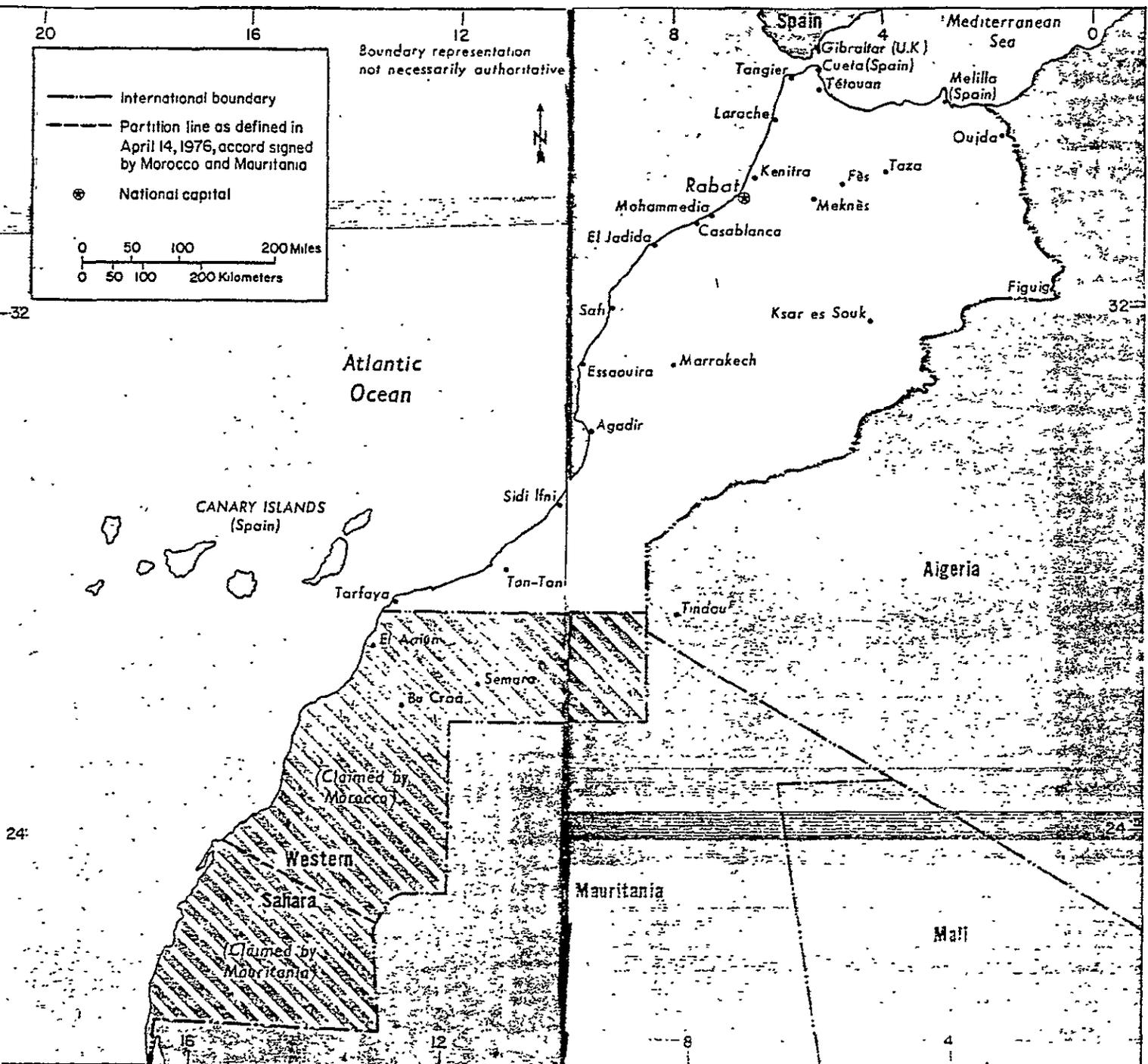
Source: American University, Foreign Area Studies. 1978. p.148

APPENDIX C

General Maps

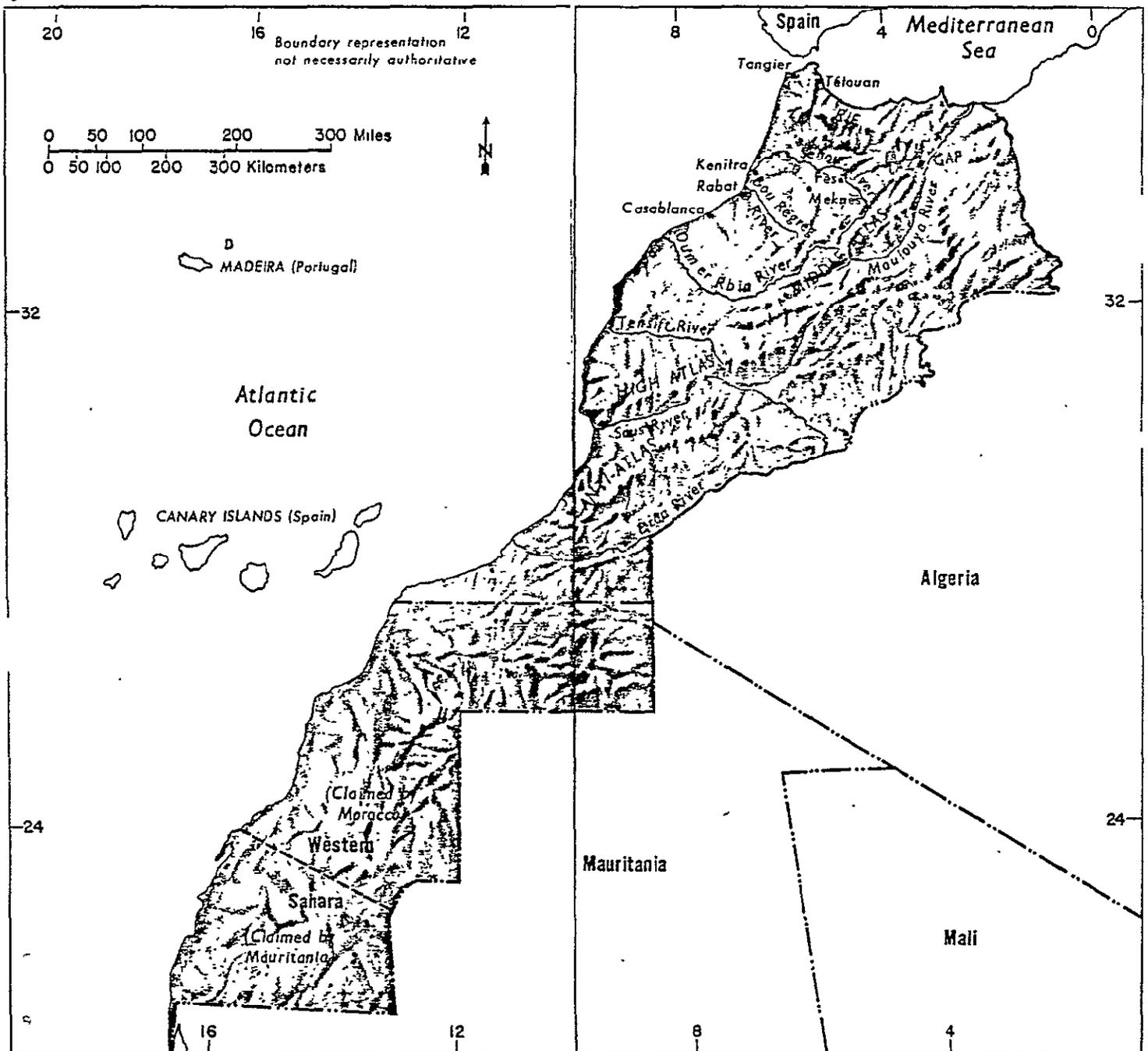
1. Morocco
2. Physical Features of Morocco
3. Land Use in the Maghreb
4. Annual Rainfall in the Maghreb
5. Natural Vegetation in the Maghreb

1. Morocco



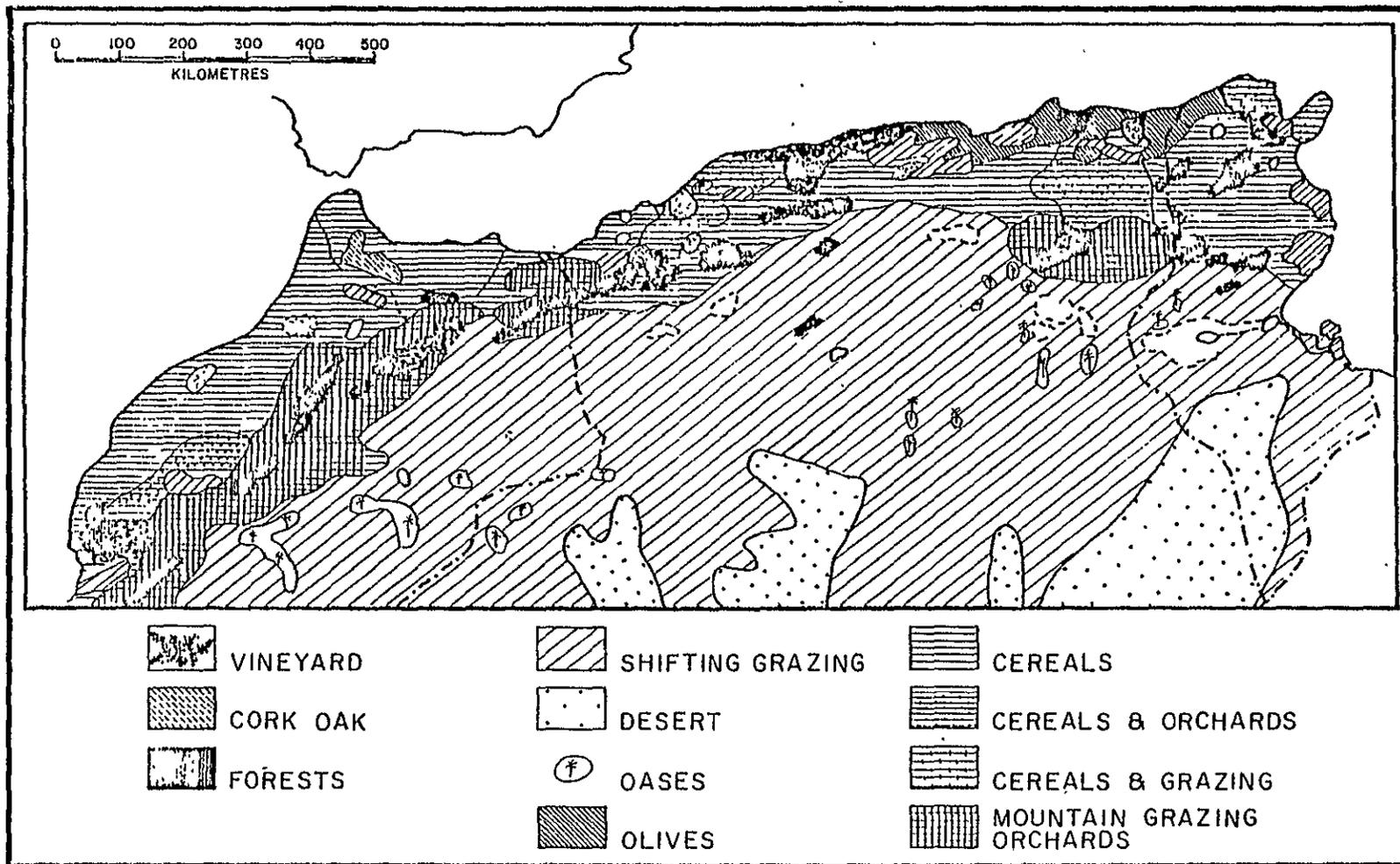
Source: American University, Foreign Area Studies. 1978. pp.xviii-xix

2. Physical Features of Morocco



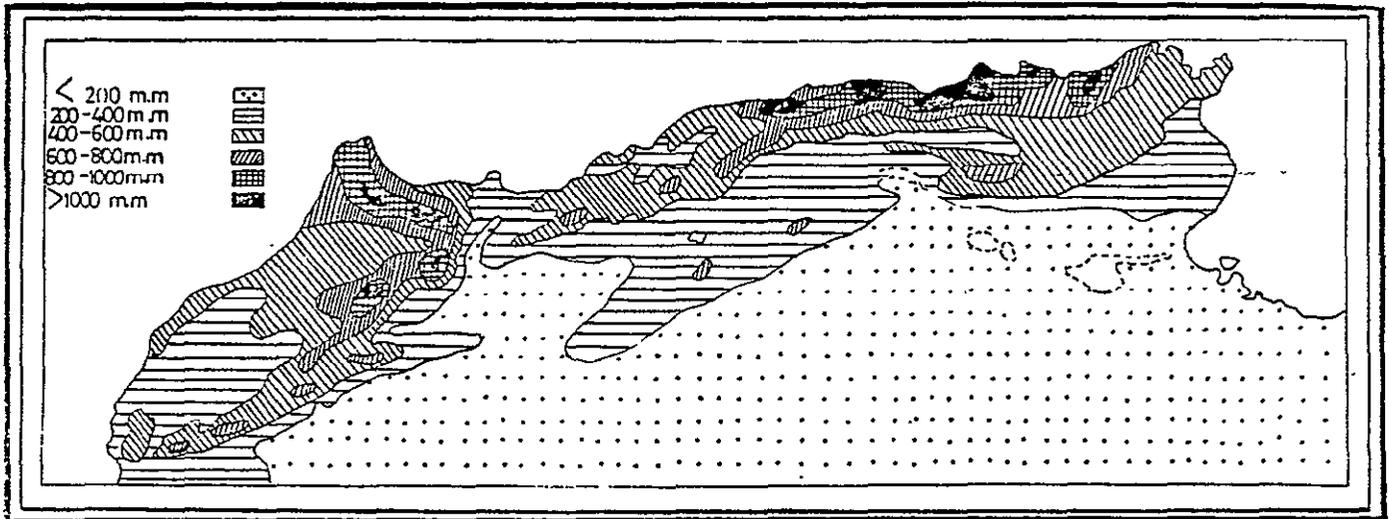
Source: American University, Foreign Area Studies. 1978. pp.88-87

3. Land Use in the Maghreb



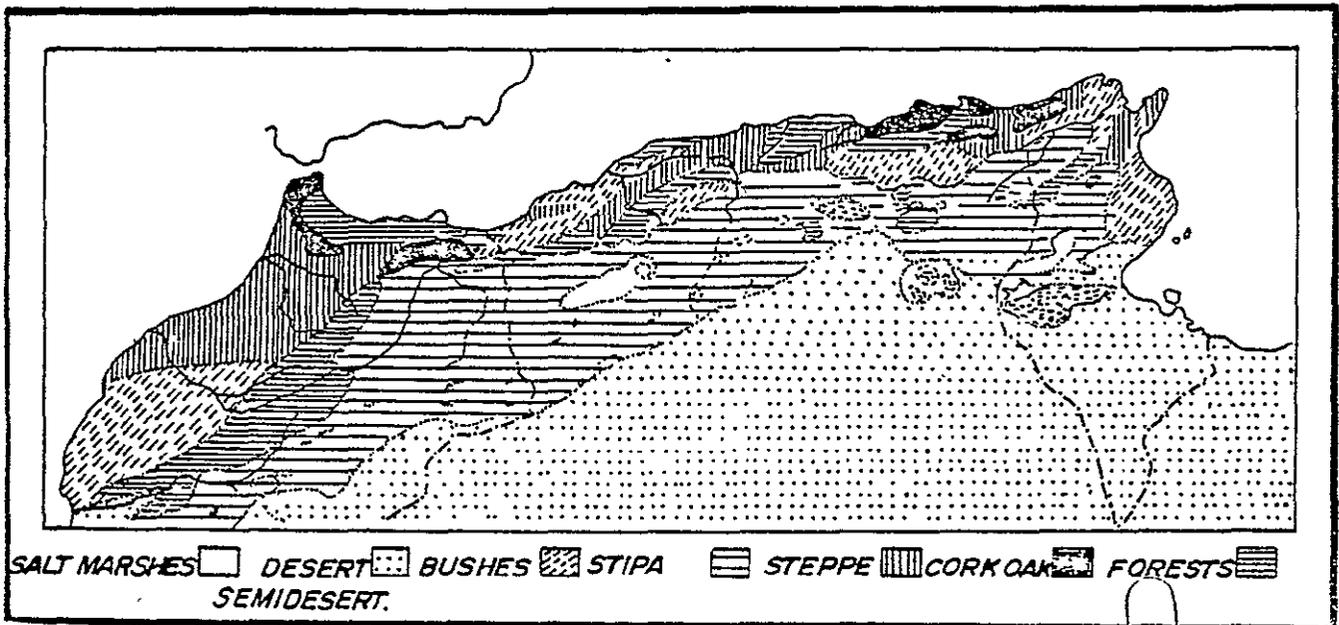
Source: U. N. Conference on Desertification. 1977.

4. Annual Rainfall in the Maghreb



Source: U. N. Conference on Desertification. 1977.

5. Natural Vegetation in the Meghrèb



Source: U. N. Conference on Desertification. 1977.

APPENDIX D

Legislation Governing the Environment and
Natural Resources

1. Summary of the Status of Environmental Laws
2. List of Laws
 - a. Air
 - b. Fresh Water
 - i. Water Rights
 - ii. Water Quality
 - iii. Groundwater
 - iv. Protected Zones
 - c. Sea Water
 - d. Soil
 - e. Fauna
 - f. Flora
 - g. Mineral Resources
 - h. Solid Waste Disposal
 - i. Hazardous Substances
 - j. Land Use Planning
 - k. Protected Areas

Appendix D

Legislation Governing the Environment and Natural Resources ^{28/}

1. Summary of the Status of Environmental Laws

	<u>Protection</u>	<u>Reserves</u>	<u>Regulation of Use and/or Rights</u>
Air	X		
Fresh Water	X	X	X
Sea Water	X		X
Soil	X	X	
Fauna	X	X	X
Flora	X	X	X
Non-renewable Resources			X
Solid Waste Disposal			X
Hazardous Substances			X
Land Use Planning			X
Protected Areas	X	X	

2. List of Laws

a. Air

Law dated 25 August 1914 and Presidential Resolution Decision dated 2 February 1960 regulate the installation and inspection of potential atmospheric polluters.

b. Fresh Water ^{29/}

i. Water Rights

Islamic law traditionally dictated an elaborate system of rules for governing the transfer and exercise of rights to fresh water. On 1 July 1914 a comprehensive government decree instituted the public domain in the area of water rights. The decree was amended on 8 November 1919 and is in force to this date. All water resources are part of the public domain and under the jurisdiction of the state. The major legal enactments directly or indirectly governing water resources conservation, development, and use are the following:

²⁸Source (unless otherwise stated): Johnson, H. and J. Johnson. 1977.

²⁹Source: Caponera, D. A. 1973. pp.121-143

- Decree of 1 July 1914 on the public domain
- Decree of 2 June 1915
- Vizierial Order of 26 May 1916 on the protection of the municipal water supply
- Decree of 8 November 1919 modifying the Decree of 10 July 1914 on the public domain, modified and completed by the Decrees of 2 July 1932 and 9 October 1933, and by the Royal Decree of 5 August 1968
- Decree of 19 October 1921 on municipal water supply
- Decree of 11 April 1922 on inland fishing, modified by the Decrees of 27 May 1953 and 23 January 1975
- Decree of 1 August 1925 on water use authorizations
- Decree of 19 July 1929 creating the State Industrial Authority, as amended by the Decree of 18 February 1925
- Decree of 26 July 1939 regulating the drilling of wells
- Decree of 20 March 1951 on the use of mineral and spring waters, reinforced by Vizierial Order of 3 February 1953
- Decree of 16 April 1951 on minerals exploitation
- Decree of 21 July 1958 on the exploration and exploitation of hydrocarbons
- Decree of 13 April 1966 on the use of river ferries and water crossings
- Royal Decree of 22 October 1966 setting up seven regional offices for agricultural development, reinforced by Royal Decree of 29 December 1967
- Decree of 25 July 1969 (No. 1-69-172) on water conservation
- Decrees of 25 July 1969 (Nos. 1-69-25 and 2-69-37) on agricultural investments
- Decree of 25 July 1969 (No. 1-69-170) on land reclamation and conservation

ii. Water Quality

Under the terms of the Vizierial Order of 26 May 1916 certain activities are prohibited in water running in or near aqueducts, conduits, irrigation trenches, artificial channels, reservoirs, or wells for water supply. These activities include washing clothes and other items, swimming, bathing, disposing of garbage, installation of latrines, crossing open aqueducts with animals in vehicles at other than so designated points, constructing water intakes, removing material, and erecting construction. It is also generally prohibited to dump any substance harmful to people or animals in any watercourse.

iii. Groundwater

Although groundwater is part of the public domain, land owners may dig trial boreholes and small wells without special authorization. Authorization is needed, however, for wells from which withdrawals will exceed 200 cubic meters per day. The government, municipalities, and authorized concession holders are allowed to sink trial boreholes on private property and may expropriate such property for public utility if necessary. Saline groundwater is part of mineral reserves and, as such, forms part of the public domain.

iv. Protected Zones

Decrees issued on the proposal of the Minister of Agriculture, following consultations with the Minister of the Interior (the latter being the authority responsible for collective organizations in Morocco) and the Minister of Finance, may declare collective land lying within semi-arid regions as areas in which facilities are provided by the State for the purpose of rendering them to some extent suitable for farming. Such facilities, intended to improve water use, consist of the construction of small retention dykes, rainwater collection structures and flood-water spreading facilities.

Special protected areas may be established in the case of soil erosion and waterlogging. These are respectively known as Soil Conservation and Land Reclamation Areas and as Drainage Areas. Both types of areas are declared as such by Decree issued by the Minister of Agriculture after consultation with the Ministers of the Interior and of Finance. Land and water use within each area is regulated by ministerial orders. Decrees No. 1-69-171 and 29-2-312 of 25 July 1969 relate to the creation of range management zones.

cc Sea Water

-Law (1-68-519) concerns the adhesion of the Kingdom of Morocco to the International Convention for the Prevention of Pollution of Sea Waters by Hydrocarbons of 1951, amended by the London Conference of 13 April 1962.

-Law of 23 November 1923 (No. 1-73-255) details sea fisheries regulations. Aspects include prohibition of water pollution and prohibition of use or discharge into the water substances likely to destroy or contaminate marine species.

^{30/} Morocco is a signatory party to the Convention for the Mediterranean Sea Against Pollution signed at Barcelona, Spain on 16 February 1976. As such Morocco has agreed to

³⁰ Source: United Nations Environment Program. UNEP/WG.17/6, Annex IV (incomplete citation) 58

"take all appropriate measures to prevent, abate and control pollution of the Mediterranean Sea Area caused by discharges from rivers, coastal establishments or outfalls, or emanating from any other land-based sources on their territories."

d. Soil

-Law of 29 July 1969 (No. 1-69-170) is titled Soil Conservation and Restoration Areas of National Interest.

-Law of 25 July 1967 (No. 1-69-172) relates to the conservation of water on collective lands situated in semi-arid regions, and thereby affects soil conservation. (See also 3.2.2.3)

e. Fauna

-The Legal Letter on the Protection of Rare Animals, dated 29 July 1903, prohibits exportation.

-Protection is given to terrestrial and aquatic mammals by the laws of 21 July 1923 and 6 August 1949 relating to the regulation of hunting.

-The Ministerial Decree of 18 April 1957 regulates fishing in Morocco's continental waters.

-Decree No. 215-72 of 29 February 1972 regulates the annual fishing of continental waters and establishes closed seasons and fishing reserves.

-Law No. 1-69-61 ratifies and publishes the convention on sea fisheries concluded between Morocco and Spain that was signed at Fez on 1 April 1909.

-Decree of 14 March 1955 prohibits and fixes the hunting rights of rural estates.

-Law of 23 November 1973 (No. 1-73-255) details sea fisheries regulations, including prohibition of fishing, general rules for the conduct of sea fisheries, classification of nets for the purposes of the enforcement of the provisions of the law, prohibited bait and fishing procedures, regulations governing the size of fish taken, shipping and law enforcement rules applicable to fishing vessels, sea fishery establishment and associated rules, and aspects of sea water pollution (see 3.2.3.2).

-Law of 21 July 1923 governs hunting regulations.

f. Flora

- Laws of 10 October 1917 and 17 April 1959 (No. 1-58-382) concern the conservation and exploitation of forests.
- Law of 10 October 1927 relates to the administration, protection, conservation, and exploitation of forests.
- Laws of 4 March 1925, 28 March 1951, and 4 December 1954 concern the natural regeneration of forests.
- Vizierial Order of 10 July 1955 specifies regulations concerning the exploitation of walnut trees in Morocco.
- Decree of 7 July 1959 permanently institutes the celebration of a forest festival throughout the country during the month of July every year.

g. Mineral Resources

- Royal Decree of 10 March 1967 (No. 658-66) regulates the use of mineral fuels.
- Law of 26 July 1939 regulates drilling.
- Law of 16 April 1951 regulates mining.

h. Solid Waste Disposal

- Decrees of 13 October 1933 and 12 March 1955, under the law of 25 August 1914, regulate the conditions for storage and destruction of solid wastes and residues from industries and other establishments.

i. Hazardous Substances

- Decree of 10 January 1969 states the conditions for agricultural use of certain toxic phytopharmaceutical preparations.
- Decree of the Minister of Public Health of 3 November 1966 (No. 171-66) lists all toxic substances used as medicine for humans or animals.
- Royal Decree of 10 May 1967 (No. 170-66) modifies a law of 2 February 1922 by establishing rules for the importation, sale, and use of toxic substances.
- Order of 12 December 1958 details the phytosanitary control of plants infested by certain noxious insects.
- Law of 12 October 1971 (No. 005-71) regulates protection against and use of ionizing radiation.

-Order of 10 January 1969 (No. 27-69) authorizes and controls the use of carbon disulfide for soil treatment and disinfection of certain foodstuffs.

-Order of 10 January 1969 (No. 28-69) authorizes the use of carbon tetrachloride for the disinfection of cereal grains and the seeds of leguminous crops.

j. Land Use Planning

-Law No. 1-60-063 regulates the development of rural agglomerations.

-Law of 23 January 1935, amending a law of 27 January 1931, concerns the management of centers and suburbs of towns.

-Law of 20 January 1970 (No. 1-69-314), amending a law of 30 July 1952, regulates methods of construction, necessary permits, and modifications of existing structures in urban areas.

-Law of 30 June 1916 and 26 March 1941 regulates the cutting of trees in urban areas.

k. Protected Areas

-Law of 21 July 1945 relates to the conservation of historical monuments and sites.

-Law of 26 September 1934 establishes the procedure for the creation of national parks.

-Law of 21 July 1945 regulates the conservation of historical monuments and sites, inscriptions, art objects, objects of antiquity, and the protection of ancient towns and regional architecture.

APPENDIX E
Organization

1. Governmental Organizations Responsible for Environmental and Natural Resource Activities
2. Nongovernment Organizations
3. Universities
4. National Committee for the Man and the Biosphere Program

1. Government Organizations Responsible for Environmental and Natural Resource Activities:

a. Ministère de l'Agriculture et de la Réforme Agraire (Ministry of Agriculture and Agrarian Reform) ^{31/}

The Ministry of Agriculture and Agrarian Reform contains two divisions with jurisdiction over environmental activities. These are the Institut National de la Recherche Agronomique (Division of Agronomic Research) and the Direction des Eaux et Forêts et de la Conservation des Sols (Division of Water, Forests and Soil Conservation). The latter is concerned with forestry, fisheries, water resources, soil conservation, and general ecological research.

Institut National de la Recherche Agronomique (DRA)
B.P. 415
Rabat

The DRA is organized into the plant technology service, the zoology service, and the ecology service. Each of these services is divided into central research stations and laboratories which draw upon a network of experiment stations located throughout the country. The DRA contains a library of some 10,000 items and publishes Cahiers de la Recherche Agronomique, Al Awaima, Collections Techniques, and Fiches Techniques. The central stations, laboratories, and experiment stations are listed below.

Station Central de Recherche sur les Céréales d'Automne
DRA B.P. 415
Rabat

Station Centrale des Céréales de Printemps
DRA B.P. 415
Rabat

Station Central des Légumineuses Alimentaires
DRA B.P. 415
Rabat

Station Central des Plantes Sucrières
DRA B.P. 415
Rabat

Station Central des Plantes Oléagineuses
DRA B.P. 415
Rabat

Station Centrale des Plantes Textiles
DRA B.P. 415
Rabat

Station Centrale de Recherches sur les Plantes
Fourragères
DRA B.P. 415
Rabat

Station Centrale de Recherches sur l'Olivier
DRA B.P. 415
Rabat

Station Centrale de Recherches sur le Theier
DRA B.P. 415
Rabat

Station Centrale des Améliorations Cultureles
DRA B.P. 415
Rabat

Station Centrale de Phytiairie
DRA B.P. 415
Rabat

contains Laboratoire d'Entomologie, Laboratoire de
Virologie, Laboratoire des Maladies des Semences,
and Laboratoire de Malherbologie

Station Centrale de Technologie
DRA B.P. 415
Rabat

Station Centrale de la Cartographie des Sols
DRA B.P. 415
Rabat

Station Centrale de Phytoécologie
DRA B.P. 415
Rabat

Station Centrale de Bioclimatologie
DRA B.P. 415
Rabat

Laboratoire des Physique des Sols
DRA B.P. 415
Rabat

Laboratoire de Chimie des Sols
DRA B.P. 415
Rabat

Laboratoire de Microbiologie des Sols
DRA B.P. 415
Rabat

Laboratoire de Minéralogie des Sols
DRA B.P. 415
Rabat

Station Centrale des Recherches sur les Arbres
Fruitiers Divers
DRA B.P. 415
Rabat

Service de Contrôle et de Multiplication des
Semences des Plantes
DRA B.P. 415
Rabat

Service de Zootechnie
DRA B.P. 415
Rabat

contains Laboratoire de Nutrition Animale, Station
Centrale des Bovins, Station Centrale des Ovins,
Station Centrale d'Apiculture, and École Profes-
sionnelle d'Apiculture "Prince Sidi Mohamed"

Centre Régional de la Recherche Agronomique - Kenitra
14, rue Abou Temman
Kenitra

Centre Régional de la Recherche Agronomique de
Meknes - Fes
3 Esplanade du Dr. Giguet
Meknes

Centre Régional de la Recherche Agronomique - Tangier
Bd. de Paris
Tangier

Centre Régional de la Recherche Agronomique
d'El Jadida
B.P. 40
El Jadida

Centre Régional de la Recherche Agronomique de
Beni-Mellal
Beni-Mellal

Centre Régional de la Recherche Agronomique de
Marrakech
B.P. 533
Marrakech

Centre Régional de la Recherche Agronomique - Agadir
B.P. 124
Inezgane (par Agadir)

Station Centrale de Recherches sur les Plantes
Maraîchères/Ait Melloul
Centre Régional de la Recherche Agronomique
B.P. 124
Inezgane

Station Centrale de Recherche sur les Agrumes
km. 9 Nord de Kenitra
Route Kenitra/Sidi-Kacem

Station Centrale d'Agronomie Saharienne
Centre Régional de la Recherche Agronomique de Marrakech
B.P. 533
Marrakech

Station Centrale de Recherches par les Radioéléments
Centre Régional de la Recherche Agronomique
Bd. de Paris
Tangier

Station Centrale de Sériculture
Ain-Taojdate
Meknes

Station Centrale de Recherche de Viticulture
Ain Barka
Bouknadel

Laboratoire de Campagne d'Entomologie
École Nationale d'Agriculture
Meknes - Banlieue

Station Régionale de Cartographie des Sols et de
l'Érosion
Centre Régional de la Recherche Agronomique
Bd. de Paris
Tangier

Section de Cartographie des Sols et de l'Érosion -
Inezgane
Centre Régional de la Recherche Agronomique
B.P. 124
Inezgane (par Agadir)

Section Régionale de Cartographie des Sols et de
l'Érosion - Meknes
École Nationale d'Agriculture
Meknes - Banlieue

Section Régionale d'Entomologie du Tadla -
Beni-Mallal
Centre Régional de la Recherche Agronomique a
Beni-Mallal
6 Afomer par Beni-Mallal

Section Régionale d'Arboriculture de Marrakech
Centre Régional de la Recherche Agronomique
B.P. 533
Marrakech

Section Régional de l'Horticulture - Kenitra
14, rue Abou Temman
Kenitra

Section Régionale de Zootechnie - Souihla
Centre Régional de la Recherche Agronomique
B.P. 806
Marrakech

-Direction des Eaux et Forêts et de la Conservation des Sols
Rabat

-Station de Recherche et d'Expérimentations Forestières
Avenue Omar Ibn Khattab
B.P. 763 Agdal
Rabat

publications: Annales de la Recherche Forestière au Maroc, Nature et Forêt

-Division de la Conservation du Sol et du Reboisement
Quartier Administratif
Rabat

activities: afforestation, terracing, construction of windbreaks, etc.

-Service de Parcours et de l'Alimentation
Direction de l'Elevage
Quartier Administratif
Rabat

-Direction de l'Hydraulique
Division de Ressources en Eau
B.P. 525 Rabat-Chellah
Rabat

subunit: Centre des Expérimentations d'Hydraulique Agricole
461 Avenue Hassan II
Rabat

includes Station Expérimentale de Mise en Valeur Agricole des Ouled Garou and Station Expérimentale de Mise en Valeur Agricole de Boughriba

-Direction de l'Enseignement Agricole et de la Formation Professionnelle
Rabat

subunit: École Nationale d'Agriculture de Meknes
B.P.S. 40
Meknes

École Nationale Forestière d'Ingénieurs de Salé

Institut Agronomique et Veterinaire Hassam II
Rabat

b. The following government organizations have functions similar to that of the U.S. Geological Survey:^{32/}

-Division de la Géologie
Ministère du Commerce, de l'Industrie, des Mines,
et de la Marine Marchande
Rabat

subject: geology

-Direction de la Recherche Agronomique
Service Cartographique des Sols et de l'Erosion
B.P. 415
Rabat

subject: cartography

-Ministère de l'Agriculture et de la Réforme Agraire.
Conservation Foncière et du Travaux Topographiques
Division de la Carte
Avenue Mohammed V, Quartier Administratif
Rabat

subject: cartography

-Direction de l'Hydraulique
Division de Ressources en Eau
B.P. 525 Rabat-Chellah
Rabat

subject: hydrology

-Division des Mines
Ministère du Commerce, de l'Industrie, des Mines,
et de la Marine Marchande
Avenue Mohammed V, Quartier Administratif
Rabat

c. Other government agencies concerned with natural resources and the environment:^{33/}

-Ministère de la Santé Publique
Rabat

-Ministry of Urbanism, Housing, Tourism, and Environment
Rabat

³² Bergquist, W. E. et al. 1978.

³³ Trzyna, T. C. and E. V. Coan, ed. 1976.

d. Pertinent cabinet-level personnel: ^{34/}

Minister of State for the Interior
Minister of Agriculture and Agrarian Reform
Minister of Health
Minister of Energy and Mining Research
Minister of Tourism

2. Nongovernment Organizations: ^{35/}

-L'Association Marocaine de Planification Familiale
6, rue Buffon
Quartier des Orangiers
Rabat

-Association Nationale pour la Protection de l'Environnement
et de la Nature (ANAPEN)
13, zankat El Madani ben el Housni
(km. 3,250, route des Zäer)
Rabat - Souissi

-Institut Scientifique Chérifien
avenue Moulay-Chérit
Rabat

includes: Comité National de Géographie du Maroc, Société
des Sciences Naturelles et Physiques de Maroc, Departments
of Entomology, Geography, Geology, Seismology, Geomagnetism,
Phanerogamy, and Zoology

-Mission ORSTOM au Maroc
Direction de la Recherche Agronomique
B.P. 415
Rabat

note: this is the Moroccan mission of the Office de la
Recherche Scientifique et Technique Outre-Mer
(ORSTOM) (Office of Scientific and Technical Research
Overseas) of France

-Morocco is also a member of the IUCN (International Union for
Conservation of Nature and Natural Resources). The IUCN main
address is:

IUCN Secretariat
1110 Morges, Switzerland

³⁴ Europa Publications Limited. 1978a.

³⁵ Tryzna, T. L. and E. V. Coan, ed. 1976.

-Société d'Horticulture et d'Acclimation du Maroc
P.O.B. 854
Casablanca

-Institut Scientifique de Pêches Maritimes
rue de Tiznit
Casablanca

3. Universities ^{36/}

-Institut Agronomique et Vétérinaire Hassan II
B.P. 704
Rabat

library resources: 10,000 volumes, 600 periodicals

publications: Hommes, Terres et Eaux, Rapport l'Activities Annual

-Université Mohammed V
Moulay Chérif
Rabat

note: The Faculté des Sciences conducts a research program specializing in the flora and fauna of arid areas, animal physiology, ecology of arid soil microorganisms, geophysics, geography, and geomorphology. Facilities include laboratories, an herbarium, a library, experimental plots, and visitor accomodations.

publications: Bulletin (of the Société des Sciences Naturelles et Physique du Maroc)

-Université Quaraouyine
B.P. 60
Fez

-Université Mohamed Ben Abdallah
Dhar Mehraz
Fez

-Université Hassan II
Casablanca

³⁶ Source: Europa Publications Ltd. 1978b.

4. National Committee for the Man and the Biosphere Program

Chariman: M. Abdallah Benkali
Director, Institut Agronomique et Vétérinaire Hassan II
B.P. 704
Rabat Agdal

Members: M. Mohamed Benbachir
Commission Nationale Marocaine pour l'Education et
la Culture
B.P. 420
Rabat

M. Tamri
Director, Station de Recherche Forestière
Rabat

M. A. Zaki
Coordination-Synthèse et Documentation
Ministère de l'Agriculture et de la Réforme Agraire
Rabat

M. Ghanem
Chef du Service de Pédologie
Direction de la Recherche Agronomique
Rabat

M. Khalil
Doyen de la Faculté des Sciences
Rabat

M. Msougav
Directeur, Institut Chérifien
Rabat

M. Tijani
Directeur, Ecole National Forestière d'Ingénieurs de
Salé
Salé

M. Kassa
Directeur de la Recherche Agronomique
Rabat

M. Pascon
Sociologue
Institut Agronomique et Vétérinaire Hassan II
Rabat

M. Donddieu
Ecologiste
Institut Agronomique et Vétérinaire Hassan II
Rabat

M. Berkat
Pastoraliste
Institut Agronomique et Vétérinaire Hassan II
Rabat

APPENDIX F

Current U.S. AID Projects in Morocco

 * COUNTRY/BUREAU: MOROCCO PROJECT: 6080126 SUB-PROJECT: 00 *
 * TITLE: MOROCCO-TRIFFA HIGH SERVICE IRRIGATION INITIAL FY: 76 FINAL FY: 78 *

PROBLEM: IT IS ESSENTIAL THAT THE GOVT OF MOROCCO FULLY EXPLOIT THE GROWTH POTENTIAL OF THE AGRICULTURE SECTOR IF FOOD PRODUCTION IS TO KEEP PACE WITH THE GROWTH IN DOMESTIC DEMAND. EFFORTS THAT ARE BEING MADE TO BRING IRRIGATION TO THE SMALLER FARMER ARE HAMPED BY THE SIGNIFICANT LAG IN COMPLETION OF ON-FARM AND OFF-FARM IRRIGATION WORKS.

STRATEGY: EXTEND LOAN TO GOVT OF MOROCCO TO FINANCE CONSTRUCTION OF AN IRRIGATION SYSTEM.

SUMMARY: LOAN IS EXTENDED TO GOVT OF MOROCCO TO FINANCE CONSTRUCTION OF AN IRRIGATION SYSTEM TO PROVIDE WATER TO 6,270 HECTARES AND THE PREPARATION OF THE LAND FOR IRRIGATED FARMING. THE SYSTEM UTILIZES SIX PUMPING STATIONS TO LIFT THE WATER REQUIRED TO IRRIGATE SUCCESSIVELY HIGHER LEVELS OF LAND. WATER IS PUMPED THROUGH CONDUITS TO MAIN CANALS WHICH IN TURN FEED INTO SECONDARY AND LATERAL CANALS AND THEN INTO FARMER-PREPARED DITCHES. A NETWORK OF DRAINS IS INSTALLED, AND ACCESS ROADS ARE PROVIDED FOR THE MAINTENANCE AND OPERATION OF MAIN CANALS AND FOR FARMER ACCESS TO HIS LAND.

GOAL: AGRICULTURAL PRODUCTION, INCOME AND EMPLOYMENT ARE INCREASED IN THE TRIFFA HIGH SERVICE AREA BY 1978.

PURPOSE: IRRIGATED FARMING BEING PRACTICED ON 6,270 HECTARES IN TRIFFA HIGH SERVICE AREA BY 1978, WITH 77% OF THE FARMERS SERVED BY THE IRRIGATION SYSTEM HOLDING LESS THAN 10 HECTARES.

OUTPUTS: 1. IRRIGATION SYSTEM INSTALLED WITH 6 PUMPING STATIONS OPERATIVE. 2. WATER DISTRIBUTION SYSTEM FOR 6,270 HECTARES IN PLACE AND OPERATIVE. 3. 6,270 HECTARES OF LAND PREPARED FOR CONVERSION TO IRRIGATED AGRICULTURE.

 * COUNTRY/BUREAU: MOROCCO PROJECT: 6080127 SUB-PROJECT: 00 *
 * TITLE: DOUKKALA IRRIGATION INITIAL FY: 76 FINAL FY: 81 *

PROBLEM: SHORTAGE OF WATER SUPPLY (DUE TO LIMITED AND IRREGULAR RAINFALL AND INADEQUATE AGRICULTURAL PRACTICES) COMBINE TO CREATE LARGE FOOD IMPORT REQUIREMENTS AND SEASONAL UNEMPLOYMENT WITH LOW PER CAPITA INCOME AND UNPRODUCTIVE URBAN MIGRATION IN THE DENSELY POPULATED DOUKKALA AREA OF MOROCCO.

STRATEGY: INSTALL SPRINKLER AND DRAINAGE SYSTEMS; CONDUCT DOUBLE CROPPING USING HIGH VALUE CROPS WITH HIGH LABOR DEMAND; EXPAND AND STRENGTHEN AGRICULTURAL MANAGEMENT SERVICES AND AGRICULTURAL CREDIT; CONSTRUCT VILLAGE CENTERS, SCHOOLS, ELECTRICAL GENERATING STATIONS, ROADS AND STIMULATE GROWTH OF VILLAGE INFRASTRUCTURE; CONDUCT LAND CONSOLIDATION AND DISTRICTION PROGRAM.

SUMMARY: PROJECT DESIGNED TO CONVERT 15410 HECTARES IN NORTHWEST MOROCCO FROM WAY-FARMING TO MORE EFFICIENT, SPRINKLER-IRRIGATED FARMING. ANCILLARY BENEFITS: FARM ACCESS ROADS, RESERVOIRS, LAND PREPARATION/CONSOLIDATION, WINDBREAKS, SCHOOL, VILLAGE CENTERS, ODM EQUIPMENT, MARKETING/EXTENSION SERVICES, LIVESTOCK INDUSTRY, ELECTRICITY, COMMUNICATIONS. WHEAT, MAIZE, BEETS, COTTON, TOMATOES, FORAGE, LIVESTOCK WILL CONSTITUTE PRIMARY PRODUCTION COMMODITIES. ACTIVITIES CREATE EMPLOYMENT, IMPROVED LIVING CONDITIONS, INCOME, WATER SUPPLY, SCHOOLS FOR POPULATION 32000 (PREDOMINANTLY SMALL FARM FAMILIES). PROJECT WILL MOST BENEFIT FARMS LESS THAN 5 HA OR 70% OF DOUKKALA FARMS & CREATE 4100 MAN YRS/YR EMPLOYMENT. BILHARZIA CONTROL INCL.

GOAL: INCREASE AGRICULTURAL PRODUCTION FOR IMPORT SUBSTITUTION AND FOR EXPORT; INCREASE EMPLOYMENT IN RURAL AREAS.

PURPOSE: ESTABLISH IRRIGATED AGRICULTURE ON 15410 HA IN THE DOUKKALA REGION BY 1979.

OUTPUTS: 1. SPRINKLER IRRIGATION SYSTEM AND DRAINAGE SYSTEM INSTALLED. 2. EXPANDED AGRICULTURAL MANAGEMENT SERVICES AND AGRICULTURE CREDIT. 3. CONSTRUCTION OF PROJECT AND VILLAGE INFRASTRUCTURE.

 * COUNTRY/REGION: MOROCCO PROJECT: 6080131 SUB-PROJECT: 00 *
 * TITLE: DRYLAND FARMING INITIAL FY: 70 FINAL FY: 78 *

PROBLEM: AGRICULTURAL PRODUCTION IN DRYLAND AREAS OF MOROCCO IS NOT SUFFICIENT TO SUPPORT THE POPULATION, USING TRADITIONAL FARMING PRACTICES. STRATEGY: PROVIDE NECESSARY BASELINE DATA TO ASSESS AGRICULTURAL POTENTIAL OF MOROCCO'S DRYLAND AREAS.

SUMMARY: AID WILL PROVIDE MINISTRY OF AGRICULTURE AND AGRARIAN REFORM (MARA) WITH SERVICES OF A RESIDENT DRYLAND RESEARCH TEAM. CONSULTANT SERVICES WILL BE PROVIDED IN AREAS OF ASSESSMENT, SEED NURSERY FEASIBILITY AND EXTENSION EVALUATION. ALSO PARTICIPANT TRAINING AND LIMITED PROJECT-RELATED COMMODITIES. IT IS EXPECTED THAT A LOAN WILL BE APPROVED FOR PROJECT-RELATED EQUIPMENT IN FY 1978. MODEL FOR THE DEVELOPMENT OF A NATIONAL DRYLAND FARMING STRATEGY WILL BE WORKED OUT AND PRESENTED TO MARA.

GOAL: INCREASE BASIC FOOD PRODUCTION TO MEET THE NEEDS OF MOROCCO'S FAST GROWING POPULATION. PURPOSE: STRENGTHEN THE CAPABILITY OF THE GOVT OF MOROCCO TO PLAN AND IMPLEMENT PROGRAMS GEARED TO INCREASING FOOD PRODUCTION AND IMPROVING NUTRITION IN THE DRYLAND AREAS OF THE COUNTRY.

OUTPUTS: 1. PRODUCTION PRACTICES DEVELOPED THAT ARE ECONOMICALLY APPLICABLE TO INCREASE CROP YIELDS IN DRYLAND AREAS. 2. 16 MOROCCAN TECHNICIANS TRAINED TO CARRY OUT DRYLAND CROP PRODUCTION RESEARCH. 3. 38 MOROCCAN TECHNICIANS TRAINED TO EXTEND PRODUCTION PRACTICES IN THE DRYLAND AREAS. 4. REPORTS COMPILED ON ASSESSING AGRICULTURAL POTENTIAL OF MOROCCO'S DRYLAND AREAS, EVALUATION OF EFFECTIVENESS OF AGRICULTURAL EXTENSION SERVICE AND ON ESTABLISHMENT OF SEED NURSERIES.

75

 * COUNTRY/REGION: MOROCCO PROJECT: 6080078 SUB-PROJECT: 00 *
 * TITLE: LIVESTOCK AND RANGELAND IMPROVEMENT INITIAL FY: 68 FINAL FY: 74 *

PROBLEM: OVER-GRAZING, POOR CULLING AND INBREEDING, AND ALMOST NON-EXISTENT DISEASE CONTROL CONTRIBUTE TO THE LOW LEVEL OF LIVESTOCK PRODUCTION ON MOROCCO'S COLLECTIVE GRAZING LANDS. STRATEGY: A PILOT AREA ESTABLISHED IN EACH PERIMETER FOR INTENSIVE DEMONSTRATION AND RESEARCH IN ORDER TO DEVELOP A FEASIBLE LIVESTOCK AND RANGE MANAGEMENT IMPROVEMENT PROGRAM.

SUMMARY: AT THE OUTSET THE PROJECT WAS INTENDED TO REACH 12 PILOT AREAS COVERING 325000 HECTARES OF DEPLETED COMMUNAL RANGELANDS. SUCH A BROAD SCOPE PROVED UNWORKABLE. SCOPE WAS CHANGED TO 2 AREAS, 70000 HECTARES. STUDIES IN LAND MANAGEMENT, SELECTION TECHNIQUES, GRAZING SYSTEMS, EXPERIMENTAL PLANTINGS TO TEST VARIETIES OF FORAGE SPECIES, COLLECTING LIVESTOCK DATA, ATTEMPTED COUNCIL MEETING-7/71-PROJECT UNCERTAIN, 2/72, IT WAS AGREED THAT THE US FIELD TECHNICIANS WOULD NOT BE REQUIRED UNDER THE 1973-77 5-YR PLAN. FY74 PROJECT WAS REVISED TO ASSIST IN UPGRADING OPERATIONAL CAPABILITIES OF GOM ORGS FOR RANGE AND LIVESTOCK IMPROVEMENT, TRAINING, TESTING AND DEMONSTRATION OF METHODS OF RANGE IMPROVEMENT ACCOMPLISHED AS ORIGINAL OBJECTIVES.

GOAL: INCREASED LIVESTOCK PRODUCTION AND THE SOCIAL AND ECONOMIC DEVELOPMENT OF THE PASTORAL PEOPLE. PURPOSE: A FEASIBLE AND REALISTIC LIVESTOCK AND RANGE MANAGEMENT IMPROVEMENT PROGRAM DEVELOPED WHICH CAN BE IMPLEMENTED IN A SUBSTANTIAL PORTION OF THE COLLECTIVE GRAZING LANDS WITHIN THE GOVT OF MOROCCO'S ADMINISTRATIVE AND FISCAL CAPABILITIES. I

OUTPUTS: ESTABLISHMENT OF 2 DEMONSTRATION AREAS, RESEARCH PROGRAMS CARRIED OUT IN RANGE RESEEDING, ANIMAL HEALTH, GRAZING MANAGEMENT, LIVESTOCK IMPROVEMENT AND RANGE DEVELOPMENT PLANS FORMULATED FOR THE COLLECTIVE GRAZING LANDS, GOM INSTITUTIONAL CAPABILITY DEVELOPED TO MANAGE AND DEVELOP THE COLLECTIVE GRAZING LANDS, NATIONAL POLICY RECOMMENDATIONS AND OPERATIONAL PROCEDURES DEVELOPED FOR PROGRAMS, IMPROVED PRACTICES FOR THE REHABILITATION OF GRAZING LAND DEVELOPED AND DEMONSTRATED. I

 * EVALUATION DOCUMENTATION *
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 * COUNTRY/BUREAU: MOROCCO PROJECT: 6080078 *
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 * TITLE: LIVESTOCK AND RANGELAND IMPROVEMENT INITIAL FY: 68 FINAL FY: 74 *

DOCUMENT TYPE: PROJECT APPRAISAL REPORT
 TITLE: LIVESTOCK AND RANGELAND IMPROVEMENT
 AUTHOR:

PUBLICATION DATE: 11/15/70
 DIC REFERENCE CENTER NUMBER:
 ORGANIZATION: USAID/MOROCCO

PROJECTS (AND SUB-PROJECTS) EVALUATED: 608007800

ABSTRACT: IMPLEMENTATION HAMPERED BY THE INABILITY OF BOTH GOM AND USAID TO MEET THEIR MANPOWER COMMITMENTS. GOM'S ROLE WAS ONE OF FINANCIAL/LOGISTIC SUPPORT. COUNTERPARTS BELOW STANDARD DESIRED; IVS VOLUNTEERS DID LITTLE TO DEVELOP THEM. GOM LIVESTOCK SERVICE LACK OF LEADERSHIP SLOWED TRANSFORMATION OF IDEAS INTO ACTION. PARTICIPANTS TOO JUNIOR A LEVEL FOR POSITIONS.

DOCUMENT TYPE: PROJECT APPRAISAL REPORT
 TITLE: LIVESTOCK AND RANGELAND IMPROVEMENT-SPECIAL EVALUATION
 AUTHOR:

PUBLICATION DATE: 07/01/74
 DIC REFERENCE CENTER NUMBER:
 ORGANIZATION: USAID/MOROCCO

PROJECTS (AND SUB-PROJECTS) EVALUATED: 608007800

ABSTRACT: THIS PAPER IS A SPECIAL WRAP-UP EVALUATION OF THIS PROJECT. IT IS INTENDED TO CHART A POSSIBLE APPROACH FOR FUTURE US ASSISTANCE IN LIVESTOCK. IT TRACES US EXPERIENCE IN THIS SECTOR SINCE 1963 AND DEVOTES CONSIDERABLE ATTENTION TO THIS PROJECT. IT BRIEFLY DOCUMENTS PROJECT ACCOMPLISHMENTS AND SUGGESTS LESSONS TO BE DERIVED FROM THE EXPERIENCE.

 * COUNTRY/BUREAU: MOROCCO PROJECT: 6080045 SUB-PROJECT: 00 *
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 * TITLE: LOWER MOULOUYA IRRIGATION II INITIAL FY: 60 FINAL FY: 76 *

PROBLEM: SERIOUS FLOOD AND GEOLOGICAL PROBLEMS HAVE DELAYED COMPLETION OF WATER STORAGE, TRANSMISSION FACILITIES IN LOWER MOULOUYA IRRIGATION PROJECT.

STRATEGY: FINANCE COSTS OF COMPLETING LOWER MOULOUYA IRRIGATION PROJECT.

SUMMARY: 1960 AID LOAN TO FINANCE WATER STORAGE, TRANSMISSION FACILITIES IS BEHIND SCHEDULE. CURRENT LOAN FINANCES COMPLETION OF REMAINING WORKS REQUIRED TO IRRIGATE SECTORS WHICH OFFER OPTIMUM COMBINATION OF HIGHEST RETURN ON INCREMENTAL INVESTMENT AND EARLY COMPLETION. LOAN ALSO FINANCES SERVICES OF US AGRICULTURAL MANAGEMENT FIRM TO ACCELERATE ECONOMIC PAY-OFF, PERFORM MARKET STUDIES, TRAIN MOROCCAN STAFF. PROJECT WORKS CONSIST OF CONSTRUCTION OF MAIN CANALS, DRAINAGE WORKS, LAND PREPARATION IN SOME AREAS AND ESTABLISHMENT OF FARMER SUPPORT CENTERS, COMMUNITY FACILITIES.

GOAL: INCREASE PRODUCTION IN DRY-LAND AND IRRIGATED FARMING IN LOWER MOULOUYA RIVER BASIN.

PURPOSE: DEVELOP GRAVITY IRRIGATION SYSTEM OF LOWER MOULOUYA BASIN. I

OUTPUTS: 1. PHYSICAL INSTALLATIONS CONSTRUCTED TO SUPPLY IRRIGATION WATER TO 175,000 A. 2. LAND PARCELED, DEVELOPED AND FARMLAND IN PLACE. 3. US MANAGEMENT FIRM SELECTED TO MANAGE PROJECT, TRAIN MOROCCANS, ACCELERATE PRODUCTIVITY. I

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 * EVALUATION DOCUMENTATION *
 * COUNTRY/BUREAU: MOROCCO PROJECT: 6089999 *

DOCUMENT TYPE: SPECIAL EVALUATION REPORT PUBLICATION DATE: 07/01/72
 TITLE: FOOD FOR PEACE: AN EVALUATION OF PL480 TITLE II DIC REFERENCE CENTER NUMBER: 338.91C514V.1ANOV.2
 AUTHOR: ORGANIZATION: CHECCHI AND COMPANY

PROJECTS (AND SUB-PROJECTS) EVALUATED: 383999999 483999999 492999999 497999999 514999999 517999999 608999999 641999999

ABSTRACT: VOLUME I CONTAINS A GLOBAL ASSESSMENT OF THE PROGRAM. VOLUME II CONTAINS EIGHT COUNTRY REPORTS ON THE PHILIPPINES, MALAYSIA, COLOMBIA, THE DOMINICAN REPUBLIC, MOROCCO, GHANA, INDONESIA, AND CEYLON. THE OVERALL CONCLUSION OF THE EVALUATION IS THAT THE PL 480 TITLE II PROGRAM, AS IT NOW STANDS, IS GENERALLY SOUNDLY CONCEIVED, WELL-ADMINISTERED, AND MAKING A SIGNIFICANT IMPACT ON THE ECONOMIC AND HUMAN DEVELOPMENT OF RECIPIENT COUNTRIES. RECOMMENDED CHANGES ARISE PRIMARILY FROM OBSERVATIONS OF MISSED OPPORTUNITIES OR LESS THAN FULL UTILIZATION OF THE POTENTIAL INHERENT IN THE PROGRAM. POLICY RECOMMENDATIONS ARE: (1)GIVE INCREASED EMPHASIS TO TITLE II AS PART OF AID'S PACKAGE OF DEVELOPMENT ASSISTANCE; (2)EMPHASIZE NUTRITION IN TITLE II PROGRAMMING; (3)REVISE THE ORDER OF PRIORITIES OF TITLE II TO EMPHASIZE MATERNAL/CHILD HEALTH AND DE-EMPHASIZE SCHOOL FEEDING; (4)PROGRESSIVELY SHIFT PLANNING RESPONSIBILITY TO HOST GOVERNMENTS; (5)MAKE MULTI-YEAR COUNTRY PLANS THE BASIS FOR FOOD ALLOCATIONS AMONG RECIPIENT COUNTRIES; (6)ALLOW MORE PROGRAMMING FLEXIBILITY AT THE COUNTRY LEVEL; AND (7)BRING VOLUNTARY AGENCIES MORE CLOSELY INTO THE COUNTRY PLANNING PROCESS. THE EVALUATORS ALSO MADE OPERATIONAL RECOMMENDATIONS ABOUT VARIOUS ASPECTS OF THE PROGRAM.

APPENDIX G

Bibliography

Selected Literature References on the Following Topics:

1. General Bibliographic Sources for Africa
2. General References on Morocco (Including Maps)
3. Development
4. Environment and Natural Resource Management
5. Fauna and Flora
6. Geology
7. Mineral Resources
8. Range Management
9. Soils
10. Water

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- A: geomorphology.
- B: biogeography and climatology.
- C: economic geography.
- D: social geography and cartography.
- E: sedimentology.
- F: regional and community planning.
- G: remote sensing and cartography.

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