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STATE OF THE ENVIRONMENT REPORT – 1980

SAUDI ARABIA

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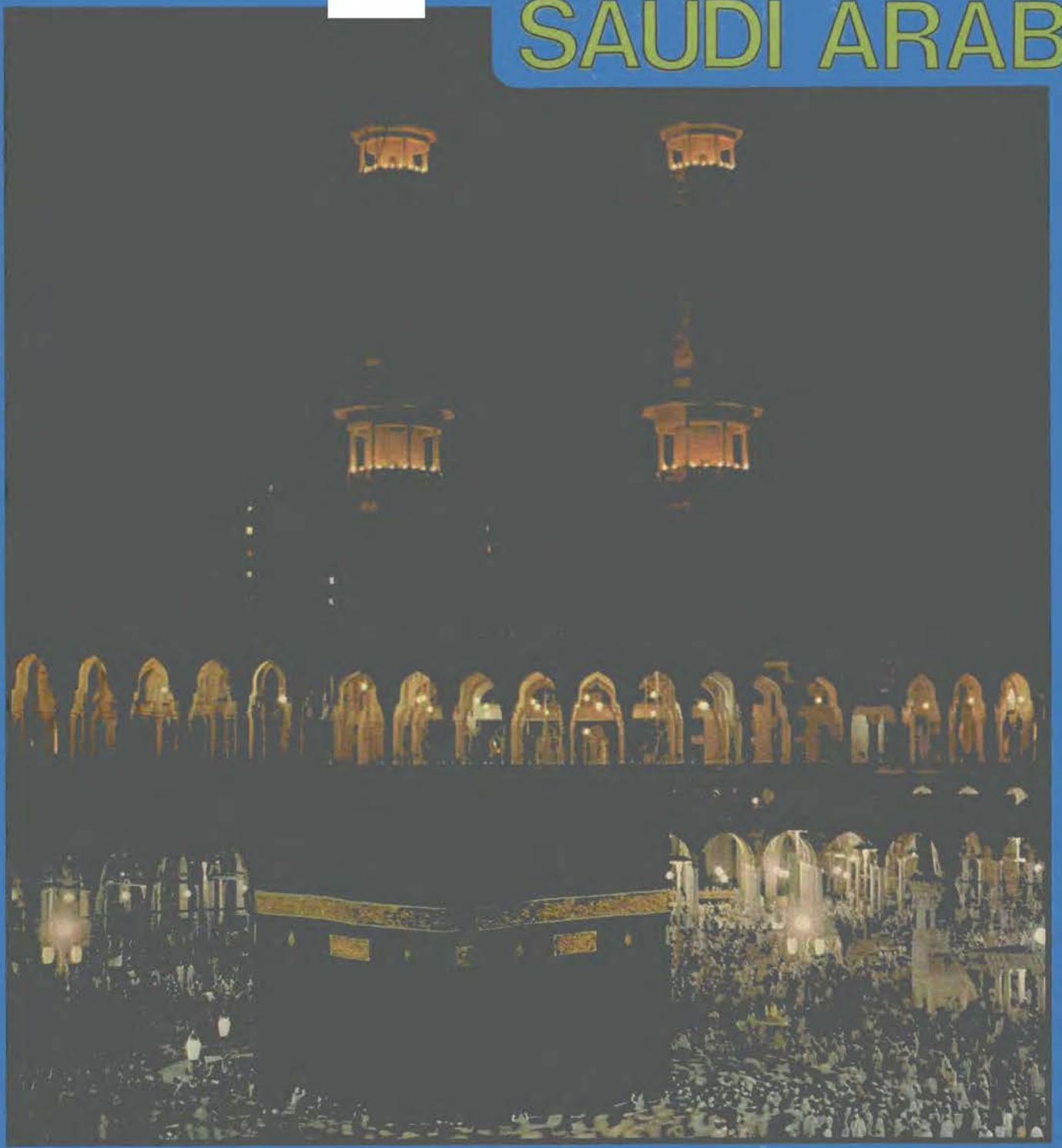
SAUDI ARABIA



STATE OF ENVIRONMENT REPORT - 1980

THE KINGDOM OF SAUDI ARABIA

UNEP REGIONAL OFFICE FOR WESTERN ASIA
BEIRUT, LEBANON

COUNTRY:SAUDI ARABIA

CONTENTS

1	COUNTRY: KINGDOM OF SAUDI ARABIA
GENERAL INFORMATION: Area, Physical feature, Climate, Population (urban, rural), National income (GNP), Major income basis, Capital, Universities and research centres (national, regional and international).	Area: 2,400,000 sq. km. (1), (2). Physical Features: Saudi Arabia has an area of about 2.4 million sq. km. Structurally the country may be likened to a tilted block whose highest corner is in the south-west. On the west the highlands rise abruptly from the narrow coastal plain of the Red Sea, the Tihama with an average width of 50km., and drop north-eastwards in a series of steep steps to the sand and gravel plains of the interior. North of Mecca these highlands are broken into separate massifs but to the south they form a continuous range, the Asir Mountains 2400-2700 m. high, extending into Yemen. Inland a rugged, curved ridge, the Jabal Tuwayq and Najid highlands, rise some 300m. above the surrounding plains and are flanked on either side by a narrow belt of dune sands, the Nafud to the west, and it is covered with dunes with a few watering places and the Dahana which provides fairly good grazing during the winter seasons to the east. These connect the vast sand waste of the Rub'al Khali or the Empty Quarter basin which covers about 650,000 km^2 in the south-east to the much smaller Nafud Desert in the north. These sand deserts consist mainly of linear dunes, 90 - 150m. high, aligned N.E. to S.W. North of the Nafud, stony, desert pavements extend into Syria and Iraq. A vast network of dry river valleys (wadis), relices of a better climate, drain north-east and provide on important source of underground water. Surface water is found only in the highlands where storms may cause devastating local flooding. (2) Another mostly barren plateau lies between the Dahana and the eastern coast. Finally on the Gulf coast are the lowlands of El-Hasa and Sikaka where water is found near the surface. In this coastal area some of the richest oil fields in the world are located.

1	COUNTRY: SAUDI ARABIA

GENERAL INFORMATION:

Area, Physical features, Climate, Population (urban, rural), National income, (GNP), Major income basis, Capital, Universities and research centres (national, regional and international).

Climate:

Saudi Arabia is known for its hot climate with great variations in humidity between the coastal belts and the interior of the country. (17) The climate is arid and extreme. Although average temperatures are high, 21°C in the north and 26°C in the south, there is an enormous daily range and night frosts are not all uncommon in the north and highlands. Day temperatures rise to 45°C; 48°C and more may be experienced in the sand deserts. In the north the country is open in winter to the cold, north-easterly 'shimal' winds and in the south the hot, southerly 'khamsin'is experienced. Both are associated with sand storms. Temperatures along the coasts are less extreme than those inland but the high humidity makes them unconfortable. Rainfall is sparse and uncertain except in the southern Asir high-lands. (2)

The southern Tihama region and the mountains ranges east of it receive periodic rainfall caused by the monsoon winds. In other parts of the country rainfall is erratic and completely dry years are known in some parts of the country. (17)

In the north, showers usually fall in winter and in the south in occasional summer thunderstorms. (2)

Population:

- Total population (de facto)	7,227,000
- Urban population	20.8%
- Population of the capital agglomeration	18.2%
- Population under 15 years	44.7%
- Population 65 years and over	2.7%

1	COUNTRY: SAUDI ARABIA
GENERAL INFORMATION: Area, Physical features, Climate, Population (urban rural), National income (GNP), Major income basis, Capital, Universities and research centres (national, regional and international).	- Illiteracy rate of the population aged 15 years and over - Male 65%* - Female 98%* - Economically active population 1,522,000 - Economically active population in percent of the total population 21.0% Source: (3) GNP: Per capita income 2,830 US$. (3) Major Income Basis: Oil. Capital: Riyadh: the capital; Jeddah: the diplomatic capital. University and Research Centres: Islamic University, Riyadh University, King Abdul-Aziz Private University, University of Petroleum and Minerals. Saudi Arabia Centre of Science and Technology (SANCST).

* Rough estimates.

2	COUNTRY: SAUDI ARABIA

ENVIRONMENTAL POLICIES:

a) Problems: Air, Fresh water, Seas, Soil, Fauna, Flora, Forest Vegetation Rangelands, Desertification, Natural disasters, Urban growth and environmental Problems resulting from urbanization and industrialization, etc.

b) Policy Status:
   i) an overall policy for environment;
   ii) in relation to development planning;
   iii) concerning major resource areas: Land use, natural range, agriculture, forestry, water, minerals, fisheries, energy etc..:
   iv) on area development: Human settlements, rural development, river basins, water-shed management;
   v) on science policy for environmental management;
   vi) training for the necessary infrastructure;
   vii) establishment of the necessary research centres and laboratories equiped with competant staff and equipment.

a) Problems

Water:

In the Riyadh area, some sources indicate that the water table is falling at the rate of 2m/year. Traces of salt began to appear. Wells are getting even deeper as much as 1400m. The water is hot i.e. between 36°C - 53°C. (4)

Soil:

Much of the country is desert. No information available about soil problems in Saudi Arabia. (1)

Rangelands:

In 1970 in Saudi Arabia only 5% of the range were classified as excellent, 10% as good (50 - 75% of the original productive plants present), 25% as fair (25 - 49% of the original productive plants present) and 60% as poor (24% or less better plants present). (5) Pasture land is scarce in general. (1)

Flora:

Available information of the flora of Saudi Arabia is scrappy, often very outdated and inadequate and a great effort is required in this field. For this reason, considerable development of botanical and phytosociological studies is recommended. (6)

Fauna:

No inventory has yet been made of the fauna of the arid zones of Saudi Arabia, with the exception of birds and, to some extent, marine animals. (6)

2	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL POLICIES: a) Problems	Forests: Saudi Arabia suffered during the past 15 years deforstation of about 100,000 hectares, leaving barely 1 - 6 million hectares "forested" in this vast country. (5) Urban Growth and Environmental Problems: The situation of human settlements has deteriorated in the Kingdom during the period immediately preceeding the the launching of the second five-year development plan due to rapid urban growth, the shortage and rising cost of labour, land and material. The lack of institutions dealing with planning, finnancing and housing construction further worsened the situation. (4) The number of registered vehicles has increased to 800,000 in 1978 from 112,000m of 1974. The Jeddah traffic department has claimed that 25% of these vehicles are registered in the city. (7)
b) Policies i) an overall policy for the environment. ii) in relation to development and planning. iii) Concerning major resource areas: Land use, natural range, agriculture, forestry, water, minerals, fhisheries, energy	b) Policies i) and ii) Information is not available at the present. iii) The Saudi Arabian Second Five Year Plan (1975-1980) does not mention protection of the environment as a priority area in its overall plan to develop agriculture. Briefly it states "Protection of the environment from the pollution caused by agricultural activity". The Five Year Plan also indicates the Governments intent to proceed with a master plan for the development of the agricultural potential of the Asir Province through the Asir Directorate for Agriculture and water headed by Mr. Mohammed Aquil Khan (a focal point of the Asir Kingdom Park project). A survey of the natural resources of the area is also given priority, as well as programmes for bee-keeping over an area of 15,000 hectares planted with fruit trees, and renovation of pastures and their management over the area of 100,000 hectares. (2)

2	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL POLICIES: b) Policies: iii) concerning major resource areas;	Much attention is being given to underground water resources and to desalination projects. (8) Saudi Arabia plans to spend up to 15 billion during 1976 - 1980 to increase its desalinization capacity to 1.9 million cubic meters/day, approximately doubling present world capacity. (9) A large scale survey of water resources is under way covering 1,248,000 square km. in six regions. Work is in progress according to an established plant to develop sources of drinking water supply. Several means are adopted to reach this goal. Additionally great progress has been made in terms of water purification and pipe network projects, and in the area of sea water desalination. Work is undertaken by the Ministry of Agriculture and Water Resources, through a group of international companies to make a complete survey of land in search for new sources of water and to determine the nature of the soil, where these surveys are completed. It will be possible to prepare an extensive agricultural development programme or sound economic basis that will contribute to the process of changing the deserts of Saudi Arabia into a land of verdant yields. The Government is distributing land to farmer nomads. For town planning purposes, six offices have been established, planning has become the reference index of the needs of towns and cities in the Kingdom. It is the link between the various agencies operating in the field of municipal service. (1)
iv) on area development: Human settlements, rural development, river basins, watershed management;	iv) Sewage and waste disposal systems, storm water drainage, municipal building, slaughter houses, vegetable and meat markets and other similar facilities will be provided during the plan period. It is proposed to pave, illuminate and provide sidewalks for about 1,820 kilometers of streets in the Kingdom, complete sewage systems in Riyadh, Jeddah, Mecca

2	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL POLICIES: b) Policies: iv) on area development	Medina and six similar cities, and to complete storm water drainage facilities in six similar cities. Regional and urban planning will continue. (10) A rural development plan has been launched in Saudi Arabia to raise life standards in rural areas and thus stop the movement toward cities. The Government started conducting a survey to assess the needs of different rural communities in the Kingdom. This survey was essential for appropriate development plans "because the management of different regions should take into consideration the specific environmental and social characteristics". (11)
v) on science policy for environmental management:	v) In Saudi Arabia, the setting up of a national science and technology authority with functions in the area of transfer of technology is envisaged. (12) Its Second Development Plan (1975-1980), contains under its chapter "Plan Management and Implementation" a sub-chapter on science and technology. The chapter outlines: (i) present conditions related to available and non-available technology as well as constraints in the development of such technology. (ii) Objectives and policies of science and technology development with regard to available and non-available development: and (iii) programmes and projects related to available and non-available technology. The proposals outlined in the chapter are concerned primarily with actions required for developing an indigenous capacity. It falls, however, far short of a national plan since it does not provide targets, inputs, etc. The proposals worked out by the Central

2	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL POLICIES: b) Policies: v) on science policy	Planning Organizations could form, however, the basis for such a national plan, which may be developed during the coming years once the planned national institutions for this purpose and functioning. (12)

3	COUNTRY: SAUDI ARABIA
IMPLEMENTATION STATUS: a) Legislation b) Environmental Machinery c) Enforcement of Laws.	a) Legislation - Law of 1968 regulates the distribution of all cultivated land. Article N° 12 of the Law concerning "Forestry and Range" forbids cutting of trees and anything that might harm trees and flora, like burning it or cutting its leaves etc. - A legislation was approved late May (1978) in Saudi Arabia, forbidding the cutting down of trees and regulating the protection of forest resources. Any exploitation of such resources should have prior approval of the Ministry of Agriculture. The legislation imposes strict penalities against those who violate the regulations. (14) - There exist laws concerning coastal marine environment and fisheries forbidding pollution of the sea by oil. (Royal Decree N° 27 dated 24/6/1384 A.H.) An official committee presented to the Saudi Government two draft bills which regulate building activities and town planning in Saudi Arabia. The bills impose strict measures on building activities "to control the rapid development of cities, thus ensuring better quality of life". (11) b) Environmental Machinery i) A committee for the coordination of Environment Protection in the Kingdom of Saudi Arabia which has been identified in coordination with High Committee for Administrative Reform (Council of Ministers). This Committee is under H.R.H. The Minister of Defence and Civil Aviation (or whom he designates). The Committee includes: 1) Ministry of the Interior 2) Ministry of Municipal and Rural Affairs 3) Ministry of Industry and Electrical Power

3	COUNTRY: SAUDI ARABIA
IMPLEMENTATION STATUS: b) Environmental Machinery	4) Ministry of Planning 5) Ministry of Health 6) Ministry of Petroleum and Mineral Resources 7) Ministry of Agriculture and Water 8) Ministry of Communications 9) The National Centre for Science and Technology 10) Meteorology and Envrionmental Protection Authority (MEPA) ii) Within the MEPA, an organization is provided for a Directorate General for Environmental Protection; as well as a national centre for meteorology and environment; iii) The Directorate General for Environmental Protection is further subdivided into: environmental measures, human environment and natural resources; iv) Elaborate and careful work has been done for the protection of the environment. Such work is being accomplished through Ministrial decrees until final machinery and legislation are approved and decree by the Council of Ministers;
c) Enforcement of Laws.	c) Enforcement of Laws Complete information will be available hopefully in the next issue; for much is being done in this respect; formalization by decrees is to be expected.

4	COUNTRY: SAUDI ARABIA

ENVIRONMENTAL ACTIVITIES AND SITUATION

a) Human settlements and environmental health.

b) Dry farming agriculture, irrigated agriculture, forestry, range management, combating desertification.

c) Resource Status:
 i) Agriculture - Soils, forests, range, water, crops, reserves, animal husbandary;
 ii) Fisheries - inland water, coastal zones, oceans, reserves;
 iii) Industry and Shipping
 iv) Labour force.

d) Environment & development:
 i) Environmental management;
 ii) Environmental law;
 iii) ES & AT;
 iv) Industry and Environment;
 v) Oceans;
 vi) Energy;

e) Socio-economic Problems.

a) Human Settlements

- Housing and Human Settlements:

Approximately two thirds of the population are nomads or practise transhumance, and 12% re sedentary farmers. (6) The rest are townsfolk. Settlement is almost entirely confined to the Mecca/Medina area of Hijaz, the Asir highlands, the Najid and the oil-fields, of the Gulf Coast. Riyadh, the capital, has 350,000 inhabitants; Jeddah, the diplomatic capital, 300,000; Mecca, 250,000; and Medina, 100,000. In the east the oil centres of Dammam and Dahran have about 60,000 each and Al-Khobar, the residential suburb for expatriate employees in the industry, numbers around 70,000. (2)
About 75,000 houses are built in 1971-75 compared to a need for 154,000 new and replaced dweelings.

The central planning organization has indicated that the Kingdom's urban housing need for the 2nd development plan (1975-80) will be approximately 338,000 units.

Houses tend to be rather large in Saudi Arabia, in the neighbourhood of 200-300 sq.m. which are beyond the means of the average Saudi urban dweller. (4)

Bids for building 30,000 homes in five cities have been submitted by international firms to Ministry of Public Works and Housing. The homes will include both villas and apartment buildings. (7)

Schools, hospitals and other public utilities are being built. The distribution is: 8,000 in Riyadh; 15,000 in Jeddah; 4,500 in Al-Khobar; 1,500 in Qatif and 1,500 in Al-Khafji. (7)

The traditional low cost building material has been mud, a suitable material for its excellent response.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION f) Supporting Measures: i) Earthwatch (IRS, GEMS, IRPTC); ii) Environmental education and training, public information; iii) Research activities concerning natural resource management and environmental protection.	to the best of Saudi Arabia Climate. Cement and cement produces are now replacing mud as the main building material. Insulation is almost never used. Air-conditioning is widely practiced. (4) - Water supply in human settlements: The source of water supply are surface and ground water, and desalination. The first phase of the development of the water supply facilities has covered the installation of water distribution facilities in villages, small communities and bedouin settlements. 50 projects for water improvements are planned for small communities. Privately owned tankers retail water. The rate of water consumption in Saudi Arabia is estimated at 100 l/c/d. (4) The municipal water demand projection for the year 2000 is 360 l/c/d. (32) - Waste management and human settlements: 1) Liquid wastes: on record, several major towns are partially sewered and plans are underway to call tenders for sewage disposal and rainwater drainage projects in eleven medium and small towns, plans are also being prepared for 22 other towns. In all 37 communities are going to have or already have plans for liquid waste disposal. With regard to the Riyadh sewage system, only main lines have been completed and 35,000 cubic meter with eventual expansion to 100,000 cubic m. 80% BOD reduction is planned. The effluent is to be used for irrigation although no plans are elaborated as the system has not yet started functioning. Digested sludge is also to be used as fertilizer. When cess pits are full, the sewage is trucked to the treatment plants and deposited there. Septic conditions of sewage accelerate corrosion of pipes. These are partly caused by insufficient amount of water in the system. Apparently per capita water consumption is not as high as design figures show (100 l/c/day) as opposed to design 250 l/c/d. (4)

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION a) Human settlements and environmental health.	Minister of Municipal and Rural Affairs has signed a contract worth 225 million of secondary sewerage at Riyadh. (15) 2) Solid Wastes: Poses great diffuculties. Adequate and complete system of garbage collection does not exist. The government has retained the services of an anglo American consortium to collect and dispose 1 garbage in Riyadh. This is to be collected from individual homes and buildings and disposed of by sanitary land fill. - Energy in Human Settlements: Electricity is the main form of energy used in settlements. It is produced and sold by private companies. Plants are underway to provide electricity to approximately 170 villages. Continuing rapid expansion of the privately owned electric utilities serving the urban areas of the Kingdom will be required. Total generating capacity added during the plan period will amount to 1.6 times the total installed at the present time. This will improve existing services standard and help to eliminate the currently uneconomic practice of individual, commercial, industrial and governmental organizations providing their own generating systems even when central station service is available. An organized effort will be made to provide electricity to reasonably accessible communities of over 2,000 population. Government's role will be to provide up to 75 per cent of the capital required by interest-free long term loans. The remaining capital requirement would be provided by pribate local induviduals. The establishment of an electric service needed for the development of the Kingdom. The standardization of voltage and frequency of the electric industry is a major programme that will be undertaken during the plan period. (10) Within Saudi Arabia very little R&D work is undertaken to harness renewable sources of energy for human settlements.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION a) Human Settlements.	Transportation in Human Settlement: There is almost no public transportation systems in the sense of it being provided or franchised by public authorities. Even those with cars have great difficulty as congestion is a major problem. Leading Institutions in Human Settlements Technology: 1. Ministry of Housing and Public Works. Central Laboratory. 2. Ministry of Municipal and Rural Affairs. 3. College of Engineering - University of Riyadh. Research Centre. 4. The Meteorology and Environmental Protection Authority (MEPA). Ministry of Defence and Aviation. The Directorate is being reorganized. Its responsibilities will be to monitor the environment and to demonstrate environmentally sound technologies. (4) Public Health: Saudi Arabia is at an intermediate stage of development; widespread epidemics are not threats but some groups of diseases are not yet under control and continues to sap the vitality of the populace. However, health officials agree that malaria, tuberculosis, gastro-intensinal diseases, tetanus, eye diseases and typhoid pose the principal medical problems. Programmes of public health, priority for improvement of public health have been identified as: 1. Mother and Child Care; 2. Health Education; 3. Bilharzia Control; 4. Small-pox Control; 5. Malaria Control; 6. Pilgrimage Health Services. For the past several years, the Ministry of Education has been operating a school health.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION a) Human Settlements	Service for students and school staff. By 1970 there were 26 health units operating with at least one assigned to each of the school districts throughout the country. (10) Needs: The present Gulf coastal population of Saudi Arabia is estimated at some 500,000 with a strong industrialization programme underway, the combined natural and in-migration growth rate adds between 15 - 20% to this coastal population annually. This would require some 17 sq.miles of habitation land and facilities to be added annually, distributed over some 7 major growth locations and a number of minor centre. (16)
b) Dry farming agriculture, irrigated agriculture, foresty, range management, combating desertification.	b) Dry farming agriculture, irrigated agriculture, forestry, range management, combating desertication. Desertification: The Government of Saudi Arabia is planning to spend $12 billion of its oil wealth in an effort to turn the eastern Saudi desert green. This ancient oasis 180 miles east of the Capital City Riyadh is the centre of the grandiose desert reclamation programme, which is part of a $143.5 billion, five-year development plan. According to Taher Ebeid, Under-Secretary of Agriculture. "We havd the money, we have the water sources. What we don't have is an adequate infrastructure to carry out this unltimate objective". Today, only 570,000 hectares of farmland are cultivated in this desert monarchy. According to Ebeid, the Government envisions improving and regulating underground water resources and unstalling an efficient drainage network to reduce salinity in various areas. The Most Arid Zones are: The Rub'al Khali, the largest sand desert in the sorld, which measures over 1,000 km. from east to west and 500 km. from north to south.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. b) Dry farming agriculture, irrigated agriculture, forestry, range management, combating desertification.	The Nufud, to the north west, a red sand desert, intersected with broad, flat, salty stretches, including the famous "Anvil"; the Dahna, a long strip of sand the Rub'Al Khali; The Summan, Nejd and Hejaz, made up mostly of "reg", rocky escarpments, mountains, some of which are volcanic and clay foothills covered with sparse pseudo-steppe vegetation. Schemes for Combating Desertification: 1. Al-Hasa Sand Dune Stabilization Scheme: Al- Hasa oasis (near the Gulf Coast), traditionally known for its fertile lands, was threatened by moving sand dunes from the north and northwest. The oasis derives its water from underground aquifers. Objectives of the Scheme was: - to check sand dune movement and stabilize them; - to reclaim impaired lands (soil deterioration and water-logging); - to extend cultivable area. In the experimental phase three methods to combat sand dunes were tested: a) mechanical removal; b) utilization of chemicals including asphalt and a combination of asphalt and concrete layers; c) afforestation. Afforestation proved effective and practicable Implementation (First phase): A number of nurseries were established (total area about 18 acres, producing 600,000 sapling per year). Six species (2 native: Tamarix galica, T. aphylla and 4 introduced: Acacia cyanophylla, Parkinsonia aculeata, Prosopis Juliflora, Eucalyputs camaldulensis) were used.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. b) Dry farming agriculture, irrigated agriculture, forestry, range management, combating desertification.	25 shallow (2.5m.) wells and 83 deep (50 - 200m.) wells were dug. A network of cement-lined irrigation canals (total 12 km.) and a system for drainage were established. About 70 km of roads. Achievements: - The sand dune encroachment from the north and northeast is checked. - 14 villages menaced by sand dunes are protected. - Drainage of swamps and water-logged ground. - Afforestation of 1250 acres (10 million trees). - Establishment of a national park (El-Sheibani). Implementation (Second phase): The second phase is to establish a green belt across the north and north-eastern territories. A government fund of 6,000,000 Rials was provided in the 1973/1974 budget. The green belt will cover 10,000 hectares. (18) 2. Wadi Jizzan Development Scheme: Wadi Jizzan is a drainage system collecting run-off water from the Yemen-Saudi Arabia highlands and traversing the Coastal plain. It discharges its ephermeral torrents into the Red Sea (c. Lat. 17°N). The district is a part of the Red Sea Coastal desert, average rainfall in 440 mm/year, mostly in April (150 mm) and September (180 mm). Objectives of the Scheme was: Conserve, store and utilize the ephemeral water flow of the Wadi by establishing a dam across it this will provide an experimental model for dams to be built in other wadis;

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. b) Dry farming agriculture, irrigation agriculture, forestry, range management, combating desertification.	Development of natural resources (and food-producing potential) for the benefit of local inhabitants. The proper choice of crops and fruit trees to be grown will determine to a great extent the success or failure of land development projects under dry farming conditions. Farmers have started to increase the areas grown with citrus trees due to their high income. Such trees usually consume a much larger amount of water when compared with olive, fig, grape or almond trees which are quite successful in that area. (18) 3. King Faisal Scheme for Nomad Settlement, Harrad: Part of Wadi Sahba, 265 km southeast of Riyadh, area 1 km. wide and 40 km. long (40 sq.km. = 4000 hectares), desert climate (rainfall less than 50mm/year). Objectives: Experiment on settlement of nomads within a framework of integrated development of natural resources and of human society; Development of a model for similar schemes of management of natural resources in desert areas. (18)
c) Resource Status: i) Agriculture - soils, forests, range, water, crops, reserves, animal husbandary.	c) Resource Status i) Agriculture: Even in agriculture more resources exist than many had believed possible before area studies and resources inventories were undertaken. These have revealed: 1. Additional land resources which can be used for the increased output of crops and; 2. Subterranean water resources that can be exploited at varying costs for irrigation.

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ENVIRONMENTAL ACTIVITIES AND SITUATION.

c) Resource Status:

i) Agriculture

Moreover, on existing cultivated land, higher yields and the production of higher value crops are possible. There is also potential for increasing the productivity of range land. (10)

Utilization of Agricultural Resources:

About a third of the Kingdom's land area is desert. By far the greatest proportion - perhaps more than 60 per cent - of the land area is semi-desert rangeland. A small proportion of the area is in permanent grass-land, and some forest land exists. Range and forest land are largely in public ownership. About 765 thousand hectares or one-third of one per cent of the national area, is in private agricultural holdings. Of this, slightly more than half (396 thousand hectares) is cultivated land.

Crops:

The major crop products in Saudi Arabia are dates, wheat, fruit, hides and wool. (8)
Data on the area devoted to the main crops are summarized in the following table:

Land utilization, 1380 to 1386 (1960 to 1966)
Thousand of Hectares

Crop	Area
Rice	0.79
Sesame	22.54
Millet	101.12
Sorghum	155.90
Other summer crops	0.33
Total	280.68

Source: (10)

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: i) Agriculture	Agricultual expansion includes schemes for improving livestock and irrigation schemes such as Al-Hasa and Wadi Jizzan. (2) The 70 million Al-Hasa irrigation and draingage programme increased the cultivated areas around Hofuf from 8,000 to 20,000 hectares. Hofuf was once a rest area for nomadic bedouins, and the Government has earmarked $30 million for resettling these tribes. (19) Cultivated land in Saudi Arabia is estimated to be 0.5 - 0.6 million hectares. (20) Even so, the country would be short of foodstuffs as only small percentage of the area is potentially cultivable. Agricultural Population: Agricultural Population in 1960 was 4,247,000 while in 1970 it was 5,109,000. The share of agricultural population to that of total population in 1960 was 71% while in 1970 it was 60% indicating a drop of 5%. The estimates of nomad or semi-nomadic population in Saudi Arabia in 1970 range from 500,000 to 2,000,000. (5). Soils: Very little is known about soil distribution in Saudi Arabia or even about the different types of soil found there. The few studies that have been made are mostly agronomic. They consist of fertility analysis or research on different salts, and as the methods used in carrying them out have varied fairly considerably, the results are not always easy to compare. They are concerned with only few types of soil and always in regions where agficulture has been practised for a long time; they hardly ever give an idea of the genetic classification of the soil studied or of their evolution. (6)

4	COUNTRY: SAUDI ARABIA

ENVIRONMENTAL ACTIVITIES AND SITUATION.

c) Resource Status:

i) Agriculture

Land and Soil Charateristics in Saudi Arabia:

The Kingdom of Saudi Arabia can be divided into 5 main regions:

1. The Najd region
2. The Arabian Sheild region
3. The Eastern region
4. The Red Sea Coast region
5. The Empty Quarter.

The Najd Region comprises the majority of arable land. These lands occur in desert plains and valleys. The limiting factors for agricultural potential of these soils are soil texture, soil depth, the presence of hard pan or impermeable layers in the soil profile and surface topography plains, from alluvial sediments carried down slopes by runoff water. Unless there are drainage problems, these soils usually have good to excellent agricultural potential.

The Eastern Region's soil are generally of marine origin and the salinity level is generally high. Further from the coast the surface is often covered by dunes which limit agricultural potential. (1)

The Red Sea Coast Region has soils of alluvial origin which are deep and highly fertile. Salinity is a problem. (21)

In view of the variation in soil-forming factors within the Kingdom, a wide range of soils could be expected and is, in fact, found. A summary of the Kingdom's land area by uses is shown below:

Land Area of Saudi Arabia by Uses:

	Million of Hectares	Percent of total area
Arable lands (irrigated and rainfed)	0.4	0.2

4	COUNTRY: SAUDI ARABIA

ENVIRONMENTAL ACTIVITIES AND SITUATION.

c) Resource Status:

i) Agriculture

	Million of Hectares	Percent of total area
Permanent grassland (subhumid rainfed)	1.7	0.8
Forest and forest reservation	2.8	1.3
Semi-desert range-lands	140.0	63.6
Desert (barren)	75.0	34.1
Other lands (cities, towns, roads, etc..)	0.1	less than 0.1
Total land area	220.0	100.1

Source: (10)

Water:

The topography and soils of a large proportion of Saudi Arabia are suitable for much more intensive use than can now be made of the area. The limiting factor is water. The question of groundwater were adequate. The average rainfall in the Kingdom is estimated at about 90mm (3.5 inches) per year. Probably half the area average less than 50mm (2 inches). Only about 10 per cent of the land gets 100mm or more. In general, the highlands and south coastal regions receive rain in all months of the year, while other regions are likely to have little or no rainfall inthe period of summer months of May to June through October. The effectiveness of precipitation is reduced by the high temperature, bright sunshine and rather constant breezes that increase the rate of evaporation.

Water resource potential: Surface ($220 Mm^3$), ground ($1723 Mm^3$), desalinated ($128.8 Mm^3$) per year.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: i) Agriculture	Surface Water: As streams or rivers exists only after rains of sufficient intensity and duration to produce runoff. Rainstorms of enough intensity and duration to produce runoff fall on many watersheds with sufficient frequency to justify construction of storage structure. In addition, the runoff waters usually carry much silt, so that the useful life of most dams would be shortened by sedimentation. The principal watercourses are: Wadi Fatima, Dariyad, Jizzan and Wadi Rummah and its effluents. (6) 30 dams have already been built in Saudi Arabia. In 1978 the Minister of Agriculture and Water has signed $28 million worth of contracts for the construction of 4 dams and the supply of equipment for water schemes. The dams are: Houtat Bani Tamin Dam; Gheel Dam at Aflaf; the Sadoud Dam; and the Sanably Dam. (15) Ground Water: The ground water potential of the country was completely unknown. Most of the water-bearing sedimentary formations contain "Fossil water" whose age, determined by radioisotopes dating techniques, is as much as 19,000 years or older. Many of these deposits are represented by sandstones or cavernous limestone that contain a considerable amount of groundwater. Out of 28 sedimentary formations in the Kingdom, 18 are classified as water-bearing and half of these can be considered as prolific aquifers; these aquifers underlie most of the sedimentary two thirds of the country. Now studies have shown that underground water resources are far greater than were known or thought to exist as recently as early 1970-ies. The quality of available groundwater is not however, the same all over. It differs from quifer to aquifer

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: i) Agriculture	and sometimes it differs for the same aquifer depending upon the locality. Over one-third of the Kingdom, groundwater is scarce and unreliable. Even when the underground water is more plentiful, it may be at considerable depth thus the high coasts of drilling of wells and lifting the water must be considered. (10) The Al-Hasa Area,(Gulf coast) probably has the most important occurence of fresh groundwater of the entire coast. The reservoir underlies the Al-Hofuf and Al-Qatif oases and supports their agricultural activities, and also feeds the underground of nothern Bahrain. (16) Water from Icebergs: Prince Mohammed Al-Faisal says he will be ready to deliver icebergs "to any customer within two years". The prince has proposed towing a 100 million-ton iceberg from Antarctica to Saudi Arabia. The project would yield more water at a cheaper rate than envisaged in the $15,000 million desalinization programme. (7) Water demand projections for the year 2000 is as follows: - Agriculture 475 l/c/d. - Industrial 1000 l/c/d. - Municipal 360 l/c/d. Total 1835 l/c/day. (33) Forests: Although trees can be frown under irrigation almost anywhere in Saudi Arabia, the lack of rainfall limits forestry - the growing of trees as the exclusive use of the land - to the highlands in the southwestern part of the peninsula. Tree growth in other areas of the Kingdom includes date palms and fruit trees,

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: i) Agriculture	windbreaks, and scattered trees and woody shrubs that grow in the desert. (10) Reserves - Asir Kingdom Park: The U.S. National park service through JECOR are the prime contractors of the Asir Kingdom Park. In mid-1976 a broad study of the proposed sites by a group of Park Service experts was submitted to the Saudi Arabian authorities The report encouraged the establishment of a park in the Asir region, selected the appropriate sites, and stressed the importance of incorporating local customs into its planning and management. The architectural plans (Phase 1) have now been completed, with the construction (Phase2) to commence soon. The Asir Kingdom Park lies in the Southwestern cornerof the Arabian Peninsula, north of the Yemen border, in the vicinity of Abha, Kingdom of Saudi Arabia. The area is one of the best watered in the Kingdom, receiving at higher elevations approximately 550 millimeters annually. The Park includes a portion of the "Tehama", The Red Sea coastal plain, as well as mountains rising to an altitude of approximately 3,000 meters, their foothills, and the impressive escarpment formed by the Great Rift. To the east and top the escarpment, but beyond park boundaries, is the beginning of the plateau country typical of the western Arabian Shield. The purpose of the Asir Kingdom Park is to conserve for the people of Saudi Arabia an outstanding example to their natural and cultural heritage - as characterized by the Great Rift, its geology, plant and animal life, and cultural history - and to provide for the positive use of the region resources by such means as will leave them unimpaired for the enjoyment of future generations. The Asir Kingdom Park could become a prototype for what may develop into a system

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: i) Agriculture	of Kingdom Parks and related reserves established to identify and protect significant scenic, natural, cultural and recreational resources in the Kingdom. (2) Animal Husbandry: Sheep are by far the most numerous, but expression in terms of sheep equivalents (to reflect size, weight, and food requirements) indicates that camels are of equal importance with sheep. About three-fourth of the livestock (in sheep equivalents) are found on rangelands. The rangeland livestock are the more important, not only because of their large numbers but also because they represent the only feasible way of harvesting the rangelands and sustaining human life from the area. (10) The size of livestock herd in Saudi Arabia during 1971/1975 was estimated as follows: - Asses 142,000 - Camels 581,000 - Sheep 3,166,000 - Goats 1,854,000 Source: (5) In Saudi Arabia dairy farms were established without the demand for fodder production being fully realized. At Buraidah, the Al-Mushaikih dairy farm, with 1,000 cows and 500 calves, is leading the industry in fodder production.
ii) Fisheries - inland water, coastal zones, oceans, reserves;	ii) Fisheries An abundance of commercial varieties of fish is present in both the Red Sea and the Arabian Gulf. Saudi Arabia has coastlines of some 1000 and 5000 miles

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: ii) Fisheries	length on these bodies of water, but their wealth of sea food has been tapped only to a limited extent for two reasons, one geographical and one institutional. (10) A Cornish boatbuilder has been asked to build the first two fishing boats specifically designed for Saudi waters: The order was placed by Brijadis White Fish Authority (WFA) for the Saudi Ministry of Agriculture and Water. The main part of the WFA's programme is to upgrade traditional coastal fishing methods. Experiments near Tuwwai produced catches about 5 times higher than those from traditional gill nets of smaller mesh. A study of the fishing communities on the Saudi Red Sea coast indentified 72 fishing communities, mainly between Umm Hajj and Jizzan. Compared to oil export, earnings from fishing is negligible, but the real value of fisheries is on giving employment and self-sufficiency. The WFA experts feel shark meat and other fish could be improved by smoking. Fish farms, both in the sea and on land, are projects which the WFA regards as feasible. The nominal catch of fish of the Saudi Arabia from its marine resources has amounted to 31,300 tons in 1973. (32) Saudi Arabia is cooperating with the FAO's Regional (Gulf) Fishery Programme. Coastal Zones: The Physical Environment of the Arabian Gulf and the Saudi Arabian Coastal Zone: The Arabian Gulf coastline of Saudi Arabia extends for an airline distance of a little more than 450 km. from Ras Al-Khafji in the northwest to Salwah in the southeast. On both physical and biological grounds this stretch of coast

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: ii) Fisheries	can be divided into two distinct sections of nearly equal length. The northern section, from Ras el-Mish'ab to Ras Tanura, forms part of a gentle arc which continues across the Bahrain islands to the northern tip of the Qatar Peninsula. This part of the coastline trends roughly northwest - southeast, and is exposed to waves generated by the prevailing northerly winds of the Gulf. Salinities along the open coast are those typical of the western part of the Gulf in general, and range according to place and season from about 38.5% to about 41%. Salinities are lowest at the northern end, and highest at the southern end of this section. Regular diurnal or semi-diurnal tides occur all along this part of the coast, and the maximum tidal range is a little over 2m. From Dammam southwards, the coastline has a more southerly trend and lies nearly parallel to the direction of prevailing winds. Almost all of this southern section of the coastline lies within the Gulf of Salwah, and is protected from wave action not only by its orientation, but also by the stretch of extremely shallow water lying between Saudi Arabia and Bahrain. These shallows also form a barrier to tidal water movements, and the tidal amplitude within the Gulf of Shlwah is much reduced. Salinities are high throughout this region, ranging from about 55% at the entrance to the Gulf of Salwah to upwards of 70% at its southern extremity. The biological character of this part of the Coast is much affected by the high Salinities and the extremely limited tidal circulation. Between Dammam and Ras Tanura, at the junction between the northern and the southern sections of the

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: ii) Fisheries	Saudi Arabia coastline, lies Tarut Bay. Though sharing many features of the numerous other bays along the coast, Tarut Bay is in some respects unique, particularly in the high productivity of its tidal flats and grassbeds which make it a major shrimp nursery. The Gulf has three important features. It is, in the first place, an extremely shallow sea, with an average depth of only 35m. and a maximum reaching only 100m. The floor of the Gulf thus lies entirely within the depth range normally considered as belonging to the continental shelf. The surface waters and coastal shallows undergo wide rapid temperature changes in response to daily and seasonal cycles of heating and cooling. These fluctuations are not damped, as they are in most seas, by the thermal inertia of a large mass of deeper water. On the contrary, strong winds result in frequent and thorough mixing of the entire water column, and vertical temperature gradients are usually small, except in late summer when some density stratification can occur. Most Gulf biotopes are therefore subjected to far greater temperature fluctuations, especially on a seasonal basis, than similar marine environments elsewhere in the world. Surface theperature in Saudi Arabian coastal waters can range from 10°C in winter to 35°C in summer, and even well offshore the ranges is from 15°C to 33°C. Secondly, the land masses surrounding the Gulf are very arid. Rainfall is low throughout the region, and as a result the loss of water from the Gulf by evaporation far exceeds the input from rivers and run-off. The Gulf, therefore, is considerably more saline than other seas. Further increases in salinity occur locally wherever areas of shallow water occur in partially enclosed bays and lagoons. By far the largest such enclosure is the Gulf of Salwah, lying between Saudi

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: ii) Fisheries	Arabia and Qatar Peninsula, and nearly cut off from the Arabian Gulf proper by the island of Bahrain and the shallows on either side of it. High salinity is one of the most important environmental factors controlling and limiting the occurrence and ditribution of marine life in the Gulf. Thirdly, the Gulf is connected with the adjacent Indian Ocean only by a narrow passage at the Strait of Hormuz. Consequently, the high salinities and wide temperature fluctuations of Gulf waters are not damped to any great extent by exchange of waters with neighbouring seas. The Gulf has a so-called Mediterranean circulation pattern, in which heavy, salty Gulf water flows out through the bottom of the Strait of Hormuz, while a compensating quantity of lighter and less saline Indian Ocean water flows inward at the surface. The volume of this exchange is modest, however, and the resulting "steady state" conditions within the Gulf continue to differ drastically from those of the ocean at large. Arabian Gulf marine life therefore inhabits a stressful environment, characterized by temperature extremes and by high, often fluctuating salinities. As a result the biota is said to be "restricted"; that is, many kinds of organisms are unable to exist at all, and the diversity of biological communities in the Gulf is thought to be low compared with that of similar communities living under more equable conditions elsewhere. However, it has become apparent that Arabian Gulf marine life is considerably richer than was expected, and that many of the animals and plants are able to tolerate remarkable extremes of temperature and salinity. (31)

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: ii) Fisheries	- Beach and Coastal Plain Associations in the Red Sea: Along the shoreline of the Red Sea distinct boundaries of plant forms are apparent, and generally the result of the availability and salinity of soil moisture. Within the park in several areas, beaches with protected coves are fringed by dense groves of the mangrove, Avicennia marine. Inland from the mangroves, or in places where they do not occur behind the low primary shore dunes, are level flats. Some of these flats are periodically inundated by sea water driven inland by high winds. The lowest of these flats often become encrusted with evaporites afterwards, and are generally barren. Other areas fringing these flats are vegetated by Halopeplis perfoliata and the herb Cressa cretica. Other plants able to tolerate higher salinity levels within the beach associations are Aeluroupus lagopoides, Slicornia fruticosa, and Panicum turgidum. Seperating the beach communities from the more xeric coastal plain communities is a community typified by salt bushes, including Salsola forskalii, Salsola bottae, and Salsola foetida, or the palm, Hyphaene thebaica. Between the beach associations and the base of the foothills are gently sloping plains of undulating sands and alluvial gravels, sometimes overlain by tongues of lava or a pavement of evenly spaces basalt boulders. Gravel surfaces areas are either dissected by wadis or are of such gently slope that they are subject to sheet-flooding. Closest to the beach on areas on wind-blown sands are the tussock grass associations. Two species dominate: Lasiurus hirsutus and Panicum turgidum, with the latter being more common. In the vicinity of wadis, such as Wadi Itwad southwest of Ad-Darb, are found sand dunes two to four meters high,

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: ii) Fisheries	stabilized by Tamarix Aphylla. Other common plants of these areas include Acacia ehrenbergiana and Salvadora persica. Inland toward to foothills are scattered shallow nollows where coarser soils have accumulated among the sands. In these areas common plants include Acacia ehrenbergiana and Acacia tortilis, Maerua crassifolia, Indigofera spinosa. Although the foothills and escarpment areas at higher elevations receive greater rainfall than the coastal plain, runoff transmitted to the plains from the foothills allows many plants to survive in areas of relatively low rainfall. Such is the case on the gravel plains. The area dissected by wadis host vegetation of the Acacia-Commiphora association whereas areas uncut by wadis but subject to sheet flooding are vegetated by Acacia-Maerua associations. (2)
iii) Industry, Mining and Shipping	iii) Industry, Mining and Shipping Saudi Arabia has been acquiring increasing control of its oil industry. The Saudi Oil Company, also runs refineries, a tanker company, a sulphuric acid plant, a steel mill and a fertilizer company. A petro-chemicals plant is to be built at Jubail, and numerous other projects are planned. (8) PETROMIN is currently performing feasibility studies for the production of ammonia and Potash in Saudi Arabia. A sulphuric acid plant is under construction at the Petromin Industrial Site in Dammam. It is designed to produce 17 metric tons of sulphur and 50 metric tons of sulphuric acid per day, also feasibility studies on the production of phosphoric acid from rock phosphate are being performed. A joint stock company (the Petromin Sulphur Company) has been set up in 1972/1973. As for petrochemical intermediate

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: iii) Industry, Mining and Shipping	agreement was signed between Petromin and ANTC for the manufacture of various petrochemicals, It is anticipated that a plant to produce ethylene, propylene and butadienne will be located in Dammam. (10) Petroleum and natural gas offer cheap sources of power for industry and transport, and are the principle raw material used in the production of petrochemicals and nitrogenous fertilizers. (10) Industrial estates are located at Riyadh, Jeddah, and Dammam and others are planned at Mecca, Al-Zaseem, Al-Jubail and Yanbou. Jubail on the Gulf Coast is seen as a vast petrochemical centre with a 3.5 million ton capacity iron peletizing plant and an aluminium smelter all fueled by natural gas. Yanbou, on the Red Sea Coast, is to be the main centre in the West. (2) At the industrial estate of Jeddah, there are three cement works, a 100,000 ton steel rolling mill, and the Saudi Arabian Fertilizer Company's Plant. Petrochemicals: The availability of the raw materials - natural gas naptha, and other petroleum products in abundant quantities at very low costs, and the location of the Kingdom close to the highly populated developing areas of Asia and Africa have placed petrochemicals among the top considerations of Petromin. Also, the pressing need to find a commercial application for the natural gas necessarily released from crude oil during the gas-oil separation process gives Petromin the incentive to explore the possibilities of establishing an industry for producing petrochemicals - including fertilizers, sulphuric and phosphoric acids, sulphur and intermediates. (10) On march 1978 a contract of $60 million was signed for construction in 30 months of the first

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: iii) Industry, Mining and Shipping	phase of the Riyadh industrial estate. The project including water, sewerage and electricity networks, and roads cover 2 sq. km. Some 35 factories are already under construction in the area. The first Saudi plant for assembling vehicles was opened in Jeddah on 12 April, 1978. It will assemble 6,500 Mercedes trucks a year. It will employ 575 workers and has a water-recycling plant which will save up to 35,000 gallons a day. (7) Manufacturing Industries: The term manufacturing industries exclude petro-chemicals, fertilizers and basic metal industries. Thus the Saudi Arabian Economy is still largely unindustrilized and the number of manufacturing is largely based upon imported materials. Construction Industry: The construction industry is almost entirely an activity of the private sector. It is characterized by diversity in size and capabilities, and includes construction companies, foreign as well as domestic. The expenditures on construction in Saudi Arabia for 1980 show that civil engineering accounted for approximately 47.5% of the total expenditure, and remaining 52.5% going to building construction. The Saline Water Conversion Corporation (SWCC) has awarded two contracts for desalination plants at Haql and Khafji. The Haql plant on the West Coast near Jordanian border will have a capacity of 120,000 gallons per day, and that Khafji 300,000 gallons per day, near the Kuwaiti border. (15)

4	COUNTRY: SAUDI ARABIA

ENVIRONMENTAL ACTIVITIES AND SITUATION.

c) Resource Status:

iii) Industry, Minig and Shipping.

Existing or proposed industries for the coastal areas - Gulf.

	Population (1000's)		Industry by 1985	Utilities/ Ports
Khafji	1980:	31	Petroleum complex, 2 phases	Desalinizer ($114 m^3/d$; 300 MW).
	1985:	50		
	1995:	78		
New Town (Ras Mishab)	1980:	20	-	-
	1985:	29		
	1995:	40		
New Port	1995:	95	TiO_2: Mg plant; Ethylene/methanol.	New Port
Safamya	1985:	11		
	1995:	40	-	-
Manifa	1985:	55		
	1995:	82	Petrochemical complex, PO_4 fertilizer; EDC MVC.	
New Town	1995:	30	-	-
Al Jubail	1980:	95	Gas-Liquids plant. Low fuel refinery; Steel mill; Petrchemical complex; 3 refineries; Methanol plant; Cement plant	Desalinizer (200 Km^3/d, 525 MW) Utilities; $\$62 \times 10^6$ New Port ($\$5 - 10 \times 10^6$)

4	COUNTRY: SAUDI ARABIA				
ENVIRONMENTAL ECTIVITIES AND SITUATION. c) Resource Status: iii) Industry, Mining and Shipping.	Qatif	1980: 1985: 1995:	32 51 92	Cement plant; EDC MVC..	Utilities, 63.10^6
	Dammam - Al-Khobar	1980: 1985: 1995:	227 303 432	Tires; Steel pipe; basic chemicals; fertilizer plant; Al Smelter; LNG; Ethylene - methylene.	Desalinizer (370 km^3/d, 520 MW), Utilities, 440.10^6 Enlarge port ($5 - 10-106)
	Al Hasa	1980: 1985: 1990:	116 141 204	Sugar refinery; Cement plant	Utilities; 210.10^6
	Al Ugayr	1995:	20	-	Desalinizer (95 km^3/d, 250 MW)
	Salwan	1980: 1985: 1995:	14 20 40	Misecellaneous petroleum.	New Port.

Note 1: (Km^3)/day = 1000 m^3/day; MW - Megawatt; Utilities = Water + distribution + sewerage + storm drainage).

Note 2: The given cost estimates of these industries approaches US$ 14,000,000,000. (Source: 1 Draft Master Plans, Eastern Region, Ministry of Municipal and Rural Affairs, by Candelis/ METRA, and 2) Development Plan 1395 - 1400 (1975 - 1980) by Central Planning Organization of Saudi Arabia . Additionally, the investigators of the Mission estimate the total investments needed in the future for

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: iii) Industry, Mining and Shipping.	all infrastructure, complementary industries and essential social service for expanded community, multiplying by a factor between 2 and 3, resulting in US$ 40,000,000,000. (16) Mining and Quarrying: On the Arabian Peninsula, the Arabian Shield is a crescent, arising from northwest to southwest, and it shows strong evidence of widespread mineralization. The pre-cambrian shield and younger coastal rocks of the western region are known to have mineral deposits, such as silver, copper, lead, zinc, iron and fluorite. Basic studies and work have been carried out for the development of mineral resources. The geological evidence resulting from this work suggests that many locations appear to be favourable for the discovery of important new mineral occurrences. Among these are the following: 1) Sulphide deposits in volcano-sedimentary units. 2) Deposits related to basic and ultrabasic rocks. 3) Metalliferous possibilities in granited rocks. 4) Base metals in tertiary formations. 5) Base metals in Pre-Tertiary formations overlying the basement. 6) Other sedimentary deposits. 7) Non metallic mineral deposits. (10) A survey by the French Minerological Research Bureau indicates that there are important mineral deposits including several rate ores. Iron ore reserves are estimated at four million tons. (2) Here's a list of Raw-Material of Commercial Values: 1) Iron ore - Jabal Idsas region, medium scale 2) Copper ore - Jabal Sayid, Nougrah n. & s. large scale 3) Nickel ore - Wadi Qatan region, small scale

4	COUNTRY: SAUDI ARABIA

ENVIRONMENTAL ACTIVITIES AND SITUATION.

c) Resource Status:

iii) Industry, Mining and Shipping.

4) Gold and Silver -Samrah area, small scale
5) Phosphate - Theniyat and Turayef areas, medium and large scale respectively
6) Rock salt - Jizan area, exceptionally large scale
7) Magnesite - Jabal Al-Rakham and Sarayghit - Zaraghat areas, small scale
8) Barite - Rabigh area, small scale
9) Marble - Babra and Wadi Fathma region, exceptional, and madragah region large scale
10) Gypsum and Anhydrite - Al-Khay area, exceptional scale. (23)

Petroleum Production:

World's largest field -- Saudi Arabia's Ghawar -- was discovered in 1948, and by 1950 the area supplied more than 16 per cent of world production. In response to a growing world energy demand, more oil was pumped and more reserves were discovered, until the region's share of world production stood at 36 per cent in 1975. (16)

Equally impressive is the rate of change of production in recent years as illustrated by the following tabulation of index values based on the year 1950:

Crude-Oil Production: Indices

Year	World	All countries	Saudi Arabia
1950	100.0	100.0	100.0
1960	2.2.2	303.8	242.1
1970	436.2	794.8	707.0
1975	508.5	1,114.0	1,312.4

Source: (16)

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: iii) Industry Mining and Shipping.	In the indicated 25-year period, world production increased about five times, whereas that of the eight countries combined increased eleven times and that of Saudi Arabia (as a single example) increased thirteen times. The situation of gas production is quite different. Most of the associated gas in the region is either flared or reinjected for gas drive and there is little use (yet) of the dry gas reserves. (16). Saudi Arabia has proven reserves of some 110 billion barrels of crude, probable reserves of another 67 billion barrels and lots more still to be found. Oil operations are run by ARAMCO. It is now about to be taken over completely by the Government. (24) Shipping: In 1976 - 1977 total length of roads in Saudi Arabia were 9500km, agricultural roads 5700 and the length of railways were 577 km. The programme for road construction will continue at the current rate. The amount of roads to be constructed during the plan period, will total 4,312 kilometers. The study of the feeder road programme will be completed and about 900 km of these roads will be constructed by the end of the period. A programme to bring maintenance standards up to an acceptable level will be undertaken. The adoption of a proposed system to limit and enforce weight of trucks should heop reduce the maintenance requirements for the roads. The construction programme now underway at Jeddah and Dammam, plus the additional expansion prepared for Dammam, will provide sufficient capacity at these two major ports for the remainder of this century. As expansion of Yanbou Port will be undertaken if economically feasible. Studies are now in progress to determine which other Red Sea minor ports should be developed during the plan period.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. c) Resource Status: iii) Shipping iv) Labour Force.	For the increase in ships size, sea islands have been made connected to shore by sub-marine pipelines such as in Ras Tanura. (25) iv) Labour Force Rapid growth has brought with it a growing demand for manpower at all levels. This demand has inevitably out-placed the supply. As a result large numbers of foreign personnel are employed in many important areas of the economy, particularly those requiring high levels of education and training. Employment of foreign personnel provides only a partial solution to the manpower problems of the country. Throughout both the public and the private sectors, the numbers of Saudi Arabian employees with levels of education and training high enough for the demands placed upon them by rapid development is relatively low. One of the main actions the Government has taken was the creation of the High Committee for manpower development to deal with this acute problem. This committee, supported by an advisory committee of senior officials, is currently reviewing all major problems relating to manpower development and utilization and the means by which these problems may be resolved or alleviated. Unlike many other countries, Saudi Arabia does not face problems such as a chronic high unemployment rate but it does face an acute problem in the development and utilization of manpower as experienced in a number of other developing Countries due to the following factors: 1. Shortage of educated and tained personnel; 2. Lack of emprehensive data on the labour force;

4	COUNTRY: SAUDI ARABIA

ENVIRONMENTAL ACTIVITIES AND SITUATION.

c) Resource Status:

iv) Labour Force.

3. Low levels of participation in employment or, once employed, of productivity among some sectors of the adult population;
4. Social and cultural resistance to some of the efforts structure and occupational composition of the Labour Force; and
5. Influxes of people with little if any education and without occupational skills from rural to urban areas. (10)

The distribution of the Labour Force in Saudi Arabia by Economic Activities present the following situation: (1970)

Economic Activity	000
Agriculture, etc.	476.6
Mining and Quarrying	28.7
Manufacturing	51.8
Construction	141.5
Electricity, Gas, etc.	12.2
Commerce	130.2
Transport and communication	62.1
Services	137.5

Source: (26)

Percentage of females in the total active population is 2.2%. (3)

Only one out of every 10 engineering graduates from Saudi Universities remains in the profession; the rest go into business, management or administration. 530 engineers had graduated from the Riyadh University in the 10 past years and the same number was expected in the next four years. (28)

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION.	
d) Environment & Development:	d) Environment and Development
i) Environmental management	i) Environmental Management: Land development and conservation activities include: 1. Al-Hasa Irrigation and Drainage Project in the Eastern Province. 2. Faisal Settlement Project at Haradh. 3. Sand-dune Stabilization Project at Al-Hasa. 4. Land Distribution for Development. 5. Wadi Jizan Water Conservation and Irrigation Scheme.
ii) Environmental Law	ii) Environmental Law: Saudi Arabia had taken steps to combat oil pollution and was a party to the 1954 International Convention for the Prevention of Pollution of the Sea by Oil. The Kingdom is a member of the Kuwait Action Plan.
iii) ES & AT	iii) ES & AT: (Environmentally Sound and Appropriate Technology. Application of Solar energy in Saudi Arabia are growing on ever larger scales. Also refer to Section 4(f)(iii).

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. d) Environment & Development iv) Industry & Environment: v) Oceans vi) Energy	More than 200 oil-wells are sealed because of the corrosive effects of salt produced with the oil But there are plans to alleviate this problem over the next few years. (30) Some industrial plants recycle their wastewater. v) Oceans: Saudi Arabia participates in the Kuwait Action plan for the management of Gulf marine environment. Also it is concerned with the environmental problems of the Red Sea. vi) Energy: Saudi Arabia is well-endowed with material resource. Large reserves of petroleum and natural gas have already been discovered - proved reserves of petrolrum are enough to sustain present production levels for over a century - and vast areas of sedimentary geological formations with potential for further discoveries remain to be explored. (10) Oil: Saudi Arabia has the largest known reserves of petroleum in the world and a vast area, still largely unexplored which may add significantly to these reserves. Petroleum and natural gas offer inexpensive power for industry and transport and are the basic raw materials in the production of petrochemicals and nitrogenous fertilizers. It is the largest producer of crude oil in the Middle East and the third largest in the world. It is also the world's leading oil exporter. Average daily production of crude oil during the first half of 1974 rose to 8.34 million barrels compared with 7.45 million barrels during the corresponding period in 1973. But with the world demand for oil falling in 1975, the average daily production decreased. (8)

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. d) Environment & Development: vi) Energy	Production capacity in 1979 was about 10.5 million b/d. The target for 1982-83 is 14 million b/d. Even at 14 million b/d, the Saudi fields were capable of sustaining production for "many, many years". Solar Energy: Saudi Arabia has co-operative arrangements with the United States, France, Switzerland and Australia to exploit solar energy. The University of Riyadh College of Engineering has established a solar energy group, while the College of Petroleum and Minerals in Dammam, has had an energy conversion team functioning for sometime now. Under its 1976-1980 development plan, Saudi Arabia has planned to make determined efforts to use solar energy for a variety of purposes. (12) For research activities refer to Section 4(f)(iii). Nuclear Energy: Saudi Arabia has no intention at present to introduce nuclear energy on a commercial scale, but considerable emphasis is being up on research. A training reactor of 5 MW is being negotiated with France. A nuclear medicine centre was recently established in Riyadh. A large multipurpose national nuclear research centre is planned by the Ministry of Petroleum and Minerals which is at present in control of nuclear energy affairs, pending the establishment in the near future of an atomic energy commission. Research is also starting at three universities. The IAEA, however, predicts that a 150 MW unit would be operating in the country by 1990. (27) France is becoming closely involved in Saudi nuclear energy projects. Minatome of France is looking for uranium in Saudi Arabia. (28)

4	COUNTRY: SAUDI ARABIA

ENVIRONMENTAL ACTIVITIES AND SITUATION.

d) Environment & Development:

vi) Energy

Electricity:

Installed capacity of industrial and public electric generating plants in Saudi Arabia in 1976 presented the following situation:

- Industrial	80,000 K/Watts
- Public	375,000 K/Watts
Total	455,000 K/Watts

all of which are of thermal type.

e) Socio-economic Problems

e) Socio-economic Problems

No information available.

f) Supporting Measures:

i) Earthwatch (INFOTERRA, GEMS, IRPTC).

ii) Environmental education and training, public information.

iii) Research activities concerning natural resources management and environmental protection.

f) Supporting Measures

i) Earthwatch (INFOTERRA, GEMS, IRPTC):

Saudi Arabia has not named its INFOTERRA (International Referral System) national focal point but they did have an observer at the first INFOTERRA Seminar for NEP's held in Nairobi 29 September - 3 October. 1975.

The national correspondent for IRPTC is not nominated yet.

ii) Environmental Education and Training, Public Information:

No information is available on environmental education.

A tree planting-week was organized in Riyadh between 15 and 21 March. Students cooperated in planting more than 20,000 trees all over the city. (27), (28)

Responsible officials of Marine Science Programme at Universities of the Arab World, met recently in Jeddah and recommended that Marine Science sections in Arab Universities should be strengthened and

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. f) Supporting Measures ii) Environmental education and training, public information.	provided with the necessary staff, equipment, reference books and periodicals. The meeting called also for more cooperating among Arab universities, especially in research activities. Concluding its recommendations, the meeting called the Arab Governments to support a special fund "for regional research on the marine environment in the Mediterranean, the Red Sea and the Gulf". (29) A meeting on the Environmental Problems of the Red Sea was held in Jeddah on the 24th November - 1 December 1974. A water conference was held in Riyadh from 29 December 1978 to 3 January 1979.
iii) Research Activities concerning natural resources management and environmental protection.	iii) Research Activities Research Institutions: A. Institutions having activities in Combating Desertification. Ministry of Agriculture and Water, Riyadh: a) Agricultural Research and Development Department - Qatif Experimental Station; - Hofuf Agricultural and Animal Production Research Centre. b) Public Land Department: Range Division; Forestry Division. c) Water Resources Development Department. d) Water Projects and Executive Department. e) Water Conservation Department. f) University of Riyadh, Faculty of Agriculture. g) University of King Faisal, Faculty of Agriculture.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. f) Supporting Measures: iii) Research Activities concerning natural resources management and environmental protection.	B. Leading Institutions dealing with Human Settlement Technology: 1) Ministry of Housing and Public Works. Central Laboratory. 2) College of Engineering - University of Riyadh Research Centre. 3) Directorate of Meteorology and Environment - Ministry of Defense and Aviation. C. Organization dealing with Marine Research: 1) Marine Research Centre (Jeddah): Marine Research in Red Sea, Fisheries Research - Pollution (research vessel). D. Organization dealing with Industry and Energy Matters: 1) Ministry of Industry, Industrial Studies and Development Centre. 2) College of Petroleum and Engineering (Dahran): It deals with Mechanical engineering, solar energy application (solar energy group and energy conversion team), nuclear laboratory. 3) Ministry of Petroleum and Mineral Resources deals with nuclear technology, radiosotopes. Saudi Arabian National Centre for Science and Technology (SANCST) has been established recently with the government of United States. (12)

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. f) Supporting Measures: iii) Research Activities	Research and Technology Activities Agricultural Research Activities: Research will continue on locust control, testing of plant varieties, formulation of better packages of crop production practices, improved nutrition and disease control for livestock and other subjects. Consolidation of the Research and Development Department's network of experimental farms into research centres is planned to provide more effective research administration. (10) Five research centres have been set up: In Jeddah, Riyadh, Al-Hasa, Qatif and in Hofuf. They operate model farms and carry out experiments dealing with fishing, insecticides, fodder, seeds, fertilizer and poultry. The recently established university of Riyadh has a faculty of agriculture where in 1972/73 the total enrolment was 258 students. (19) Range Management Research Activities: Six area studies were made on possibilities for Development and Management of Public Rangelands encompass by a vast area of 1,257,000 square Kilometers, about 98 per cent of the total area surveyed are primarily only usable as grazing lands for domestic livestock. Other important uses are for woodland, wildlife, and recreation. The surveys show that 60 per cent of the rangelands are in badly depleted condition resulting mainly from unrestricted grazing and destructive gathering of trees and shrubs without regard to conservation. The relatively small area of formerly valuable forest lands (32,000 km^2) are reported to be largely destroyed to the extent of presently having little commercial value. Also the reports indicate that of a population of some three and a quarter million in the six areas, about 787,ooo are

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. f) Supporting Measures:	nomads or semi-nomads. While the bedouin represents only 23 per cent of the total population in these areas they control about 60 per cent of the livestock. (10) Solar Energy Research Activities: - In Saudi Arabia, activities in solar energy were initiated at the University of Petroleum and Minerals in the late 1960's. The different projects that have been carried out or are currently being undertaken are: Heliohydroelectric Power Generation, Solar Energy Availability, Segregated Precipitation of Magnesium Chloride, Studies in Solar Energy Storage, Direct Solar Conversion into Electricity, Solar Housing Studies, Testing of commercial collectors. - Solar energy activity at the University of Riyadh started at the Department of Mechanical Engineering in the early 1970's. A solar energy demonstration laboratory where undergraduate students work on water distillation, water heating, space heating, crop drying, solar concentration and space cooling was developed. - The interest of King Abdul-Aziz University (Jeaddah0 in solar energy began in 1976. The most important accomplishment has been the convening of a national solar energy conference in January 1978. - The pace of Solar Energy Research in Saudi Arabia is now set by the Saudi Arabian Centre of Science and Technology (SANCST) in Riyadh which is managing along with the U.S.D.O.E. the Saudi Arabian-United States Program for cooperation in Solar Energy (SOLERAS). Each government has put $50 million over a period of five-years that started effectively in 1978. SOLERAS is directed by an eight-man executive board. four from each country. The projects that have bee approved by the Board are: Solar Energy availability in Saudi Arabia; the establishment of a 350 KW solar photovoltaic station; solar cooling in Saudi Arabia; Solar desalination and solar applications in agriculture; Educational activities include solar short courses for Saudi and U.S. students.

4	COUNTRY: SAUDI ARABIA
ENVIRONMENTAL ACTIVITIES AND SITUATION. f) Supporting Measures:	- The Ministry of Agriculture (Riyadh) has about sixty meteorological stations. Twenty of these measure global solar insolation on a horizontal surface. - The largest application of solar energy in Saudi Arabia is the solar powered heating complex for the Airborne School (Tabuk). To heat 14 of the 22 buildings of the 50 hectare school, the constructors will lay down solar collectors covering 4370 m^2. - In March 1980, the General Directorate of Telephones installed more than 300 photovoltaic emergency telephones on the Saudi highways. Marine Research: A research vessel, "sauna", has started its operations in the Red Sea, in cooperation between Saudi Arabia and the Sudan. The vessel is especially designed and equipped for a better utilization of the Red Sea's natural resources.

5	COUNTRY: SAUDI ARABIA
UN/BILATERAL PROJECTS (Global, regional and country level) - UNEP Fund.	Agriculture, Forestry and Fisheries: 1) -SAU/75/007-IPF. Water and Agricultural Development: to improve agricultural development in the Southern Tihama region by the successful construction and operation of an appropriate irrigation network scheme. 2) -SAU/75/005 Senior Agricultural Engineering and training Advisor. The project is intended to develop skilled and semi-skilled Saudi nationals in the agricultural sector. Also the project will contribute to an overall increase in agricultural production for Saudi Arabia. (22) Animal Health : 3) -SAU/75/003. Veterinary Training Centre. The project will assist with the development of the animal industry in Saudi Arabia by establishing an institution for the training and animal health assistance. (22) Education: 4) -SAU/75/004. Centre for Statistical and Educational Documentation: To provide statistical and documetation supporting services required for the development of education. (22) Science and Technology: 5) -SAU/69/523. (Phase II) June 1970 - August 1977. Objectives: - To develop curricula in such subjects as hydrogeology, engineering geology, and the economic geology of non-metalic minerals; - To create a nucleus of permanent faculty in applied geology and to constitute a team of researchers charged with studies related to mineral exploration; ground-water development and site investigations.

5	COUNTRY: SAUDI ARABIA
UN/BILATERAL PROJECTS (Global, regional and country level) - UNEP Fund.	Regional and National Physical Planning SAU/69/524 June 1973 - May 1976. Objectives: - To assist the Government in preparing, evaluating and implementing physical plans and in developing better coordination between the Department of Municipal and Rural Affairs and other Government departments at the national, regional and local levels. - To assist the responsible authorities in the evaluation and control of the work of contractors charged with developing detailed urban and regional plans.

6	COUNTRY: SAUDI ARABIA
UNEP Activities	- The Executive Director of UNEP (Dr. M. Tolba) paid an official visit to Saudi Arabia from 9-11 February 1979. In meeting with the Minister of Planning, Health and Municipal and Rural Affairs the following items were discussed: environment and development, cost-benefit analysis, environmental machinery, INFOTERRA, KAP, Combating desertification, problems of industrialization and urbanization, also the possible mandate and role of the propered Environmental Protection Machinery (MEPA)* in Saudi Arabia was discussed.

* Meteorological and Environmental Protection Authority.

7	COUNTRY: SAUDI ARABIA
AGENCY PROGRAMMES OF ENVIRONMENTAL RELEVANCE.	Environmental Unit - ARAMCO: The Arabian American Oil Company has been concerned for a number of years with minimizing land and water pollution from the oil industry. This is not suprizing considering that ARAMCO is the largest oil producing company in the region. A few years ago, an Environmental Unit was established to conduct research in areas of concern to ARAMCO. One of the first concerns of the Environmental Unit was to conduct a baseline study of the Saudi Coastline on the Arabian Gulf to determine what lives where. This study has now been completed and will serve as a valuable reference for future studies and investigations into the ecology of the area. Dr. John Burchard's on going project is concerned with coral reef ecology. He considers the coral reefs to be the most complex and most sensitive biotope found in the Gulf. This makes them the best "indicators" for overall pollution. In other works, any disturbance of the total ecosystem will probably show up on the coral reefs before it can be detected elsewhere, thus serving as an "early warning" system of the effects of pollution on marine ecology. (7)

8	COUNTRY: SAUDI ARABIA
AVAILABLE BACKGROUND INFORMATION ON ENVIRONMENTAL SOURCES a) Surveys, reports, reserves and their availability. b) Personnel and expertise.	a) Publications: The Industrial Studies and Development Centre in Riyadh, affiliated to the Ministry of Industry and Electricity, has published its 20th edition of project studies. The survey includes progress reports on local industries. (11) Also see Section 9: References b) Names of Personnel and Expertise: 1- Meteorological and Environmental Protection Authority (MEPA) - Sheikh Romaih M. Romaih - Dr. Abdul Bar Al-Gain Deputy Director-General 2- Other names of high officials specifically dealing with environmental activities and not as much meteorology will be provided in the next issue and after formalization of the MEPA by Decree.

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