

COOPERATIVE RESEARCH POTENTIAL
IN THE MIDDLE EAST

a report to

U.S. Agency for International Development
Near-East Bureau

by

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PREFACE

The U.S. Agency for International Development (USAID) contracted with the University of Arizona to contribute to a comprehensive study designed "...to determine the potential for cooperation in the environment and natural resources sciences between the various countries of the Middle East, with particular emphasis on Israel and the neighboring Arab countries [Egypt, Iraq, Jordan, Kuwait, Lebanon, Saudi Arabia, Sinai, Syria and West Bank], and to identify and evaluate potential regional projects and activities in the environmental and natural resources sciences." This report consists of the authors' conclusions and recommendations and of supportive documents.

Contained herein is a description of information collection activities undertaken to support recommendations relevant to Middle Eastern regional cooperative environmental and natural resource sciences programs. Following discussions with the AID Contract Monitor, it was agreed that on-site visits would be restricted to Egypt, Jordan and Israel. It was agreed further during these discussions that, because of time limitations, some information requested in the contract would be culled by AID from existing documents. For example, most of the information requested in Line Item 3 is available in Indicators of Scientific and Technological Efforts in the Middle and North Africa which was published in draft form by Computer Horizons, Inc., in 1978. None of that material is reproduced herein.

No distinction has been made between those activities which may be feasible now, those which may be feasible during the interim between now and that time when a peace settlement is reached, and those which may be feasible following a comprehensive peace settlement. Some discussions of timeliness may be included in the recommendations, but not as concisely as requested within the language of the contract.

I. CONCLUSIONS AND RECOMMENDATIONS

A. General

1. The general consensus of Egyptian scientists, even those who appeared eager to collaborate with "some" Israelis, was that cooperative ventures "...will not be undertaken until the Palestinian issue is resolved."
2. Although the topic of cooperative research with Israel was not approached directly, discussions with Jordanian researchers indicated clearly that joint Jordanian-Israeli research projects are not feasible now or in the near future.
3. Cooperative research projects between Arab institutions offer considerable promise. Information gleaned by the authors during their brief visits leads them to believe that Sudanese researchers should be included in potential cooperative studies as well as the other Arab states listed in the contract Statement of Work. Of special importance is the potential for joint Egypt-Sudan research programs.
4. Specially organized scientific workshops focusing on specific, shared problems such as health, water management or economic botany seem to be unlikely vehicles to carry participants into regional, cooperative ventures at this time. The authors further foresee little of scientific value being generated in such workshops.
5. Politically oriented "how-do-we-approach-regional-cooperation" workshops which only incidentally address such topics as health, water management or economic botany might have some chance of success. The authors do not recommend funding any workshops at this time; however, if workshops are the agreed upon early vehicle, we feel they must be oriented to the how to obtain regional cooperation, not to the technical topics.
6. Funding similar or nearly identical research projects in more than one of the Middle Eastern countries seems to offer more promise of generating cooperative studies than attempting to force their immediate integration. After a year or so of project activity, findings of each project could be discussed among the various researchers during a meeting arranged by the funding source(s). It is conceivable that these somewhat informal exchanges of research findings might produce a "natural" evolution of follow-up, successful collaborative undertakings.

B. Environmental Projects

1. All countries visited and studied under terms of the contractual Statement of Work experience environmental degradation problems related to desertification, air pollution, water pollution and urban waste disposal. All of these Middle Eastern countries could benefit from enlisting U.S. aid but only Jordan and Israel appear to have official, legal interests in controlling pollutants. In Egypt and many other countries studied, considerable time would be necessary to identify specific problems and develop ameliorative programs.

2. A specific proposal developed by Jordan and presented to USAID to mitigate Jordanian environmental problems was rejected by USAID/Jordan in the recent past. It was a proposal that, if implemented, would be beneficial immediately to Jordanians, that has high priority nationally, and that should demonstrate the potential of further future collaborative environmental research in the Middle East. Part of that bilateral proposal follows:

A committee was formed on 13 December 1976 to study the problems of environmental pollution in Jordan, especially in the industrial region between Amman and Zarqa. The committee consisted of representatives from: Ministry of Health, Ministry of Industry and Commerce, Ministry of Municipalities and Villages, Amman Municipality, National Planning Council, Natural Resources Centre, and Royal Scientific Society.

After inspecting the facilities of these institutions, it was agreed that the Royal Scientific Society facility would be the study center for environmental problems and that it would be responsible for solving technical problems related to the environment.

After preliminary study the work plan outlined below was drawn up.

Phase I

Phase I will involve short-range and long-range studies to identify and control specific problems and to establish a planned national program of water quality and environmental management for Jordan.

Phase II

Phase II activities will consist of:

Review of the physical characteristics of environment and water resources of Jordan;

Chemical analyses to determine bacteriological and other biological composition of wastes and water resources;

Detailed study of industrial processes during various manufacturing stages, covering raw materials used and quantity and quality of wastes produced during and at the end of processing;

Classification of industries with respect to wastes;

Determining requirements for pretreatment of wastes; and

Determining the methods of disposal of wastes.

Phase III

Phase III will involve: Establishing a sampling network for the collection of data; organizing and analyzing data and information; establishing an environmental analysis laboratory.

3. Pollution in the Red Sea is an extremely important topic that will be discussed in the report to be prepared by the National Oceanographic and Atmospheric Administration.

C. Natural Resource Projects

Natural resource development programs suggested below are listed in priority order as perceived by the authors based upon discussions held with various scientists and government officials during the authors' visits and as a result of research undertaken by the authors to fulfill the Statement of Work clause of this contract. It should be noted once again that funding for some of the suggested projects could reap greater returns if it is allotted simultaneously on a country-by-country basis (Please refer to Paragraph A.6.). Some of the suggested projects are amplified in Appendix A.

1. Research should address using saline waters to irrigate saline-tolerant plants that have economic potential as crops for animal forage (e.g., Atriplex spp), or the use of saline waters to irrigate economic crops which are not usually accustomed to saline-water irrigation.

2. Research should address developing arid-adapted plants having industrial potential such as jojoba (*Simmondsia chinensis*), quayule (*Parthenium argentatum* Gray) and Euphorbiaceae).
3. Research should address building arid-land settlements having appropriate arid-adapted designs with low-cost, indigenous materials.
4. Research should address developing fisheries in fresh-water ponds, brackish-water ponds, the Red Sea, the Nile and Lake Nasser.
5. Research should strive to preserve and continue management of natural biological reserves. Examples are the scientific work underway in the Sinai and at al-Azraq, Jordan.
6. Research should address both surface and underground water management with special emphasis on those regions that experience small amounts of precipitation, regions that will have to consider water harvesting or groundwater development to expand land use or, in some cases, even to survive.
7. Research should address developing desertification containment measures such as dune stabilization, reforestation and afforestation, and range management.
8. Research should address range management, breeding, and feedlot development to increase sheep production in the Middle Eastern countries to provide more meat and wool products.
9. Research should address developing new energy resources including solar, wind, and biomass energy.
10. Research should address creating new channels for disseminating information throughout the Middle East.
11. Research should address enhancing the capabilities of the Desert Center Development Program at Aboes, Egypt, to further the possibilities of collaborative research within the Middle Eastern countries (See Appendix A).

II. SURVEY OF EXISTING CONDITIONS

The survey of existing conditions based on on-site visits to Egypt, Jordan and Israel is in the preceding section and Appendix A (Trip Report). The following observations relate to the existing state-of-the-art in various specific subject areas within the natural sciences, geology, and environmental studies, as reflected by a survey of the literature produced by each country (See Appendix D).

Scientific efforts concerning the environment and natural resources in Egypt, Iraq, Israel, Jordan, Kuwait, Lebanon, Saudi Arabia, and Syria vary greatly, apparently due in large part to the institutional resources available in each country and to the amount of fiscal resources directed toward environmental subjects. For all countries except Israel and Jordan this formal governmental commitment is nonexistent. Jordan is promoting an officially sanctioned survey of its natural resources and the development of environmental pollution identification and control. Israel has very active natural resource programs, but its environmental pollution abatement program appears to be quite low in priority and inadequately staffed.

Expressed in Table 1 are international science indicators as determined by the National Science Foundation. When differences in reporting statistical data are corrected for and S & T data are normalized for size of country and degree of GNP inflation, it can be seen that Israel performs far above expectation, not only according to averages with the region, but on a worldwide level. Egypt ranks next in overall S & T capability and commitment according to these criteria. The authors admit to beliefs developed by looking at the institutional and personnel research capabilities that lead us to rank Jordan much higher. Possibly quality and depth are not adequately distinguished by such analyses.

When subjects of scientific study that pertain to natural resources or environmental research are examined, the situation as expressed in Table 2 results. These data are extracted from compiled bibliographies of studies done within each country on specific subjects within the natural sciences or geology that are pertinent to the region. When particular projects for cooperative efforts are proposed, the potential for input from each country will depend on its subject expertise.

A. Environmental Policies, Planning and Legislation

Most Middle East governments have expressed some degree of concern about environmental matters. This concern manifests itself through the official actions taken, institutions established and international conferences supported which focus on the protection of the environment. The scope of activities varies widely among the nations of the region. A review of the literature reveals a dearth of pertinent information from many Arab countries, while reports of Israeli activities in environmental matters are relatively numerous. It is possible, of course, that much information from Arab states does not find its way into the journals reviewed during this study. However, it must be concluded that comprehensive and formal attention to environmental problems is much more in evidence in Israel than in the neighboring Arab countries. For example, an analysis of 27 issues of Summaries of Foreign Government Environmental Reports published by the U.S. Environmental Protection Agency (EPA) between 1974 and 1978 reveals that 22 of the 23 references relating to the area (excluding Turkey and Iran) pertained to Israel, the one exception being Syria. Also, based on information available, Israel appears to be the only nation in the region which has established a government agency, the Environmental Protection Service, similar to our EPA.

A recent indication of the extent of formal commitment by Arab states to pursue policies which lend themselves to both national programs and regional cooperation in environmental matters is detailed in a UNESCO document (UNESCO, 1978). This report contains a summary of actions taken by various Arab governments on the recommendations made by the 1976 Conference of Ministers of Arab States Responsible for the Application of Science and Technology to Development (CASTARAB). CASTARAB recommendations Numbers 14 through 21 concern ecological matters and the 1978 summary of actions taken indicates the degree of participation by various Arab states and UNESCO. A foundation for future regional cooperation among Arab nations appears to have been established through CASTARAB. Activities to date have emphasized planning, training sessions, workshops and UNESCO staff support. Some attention has been devoted to establishing centers of competence for specific scientific and technical objectives, but the eventual success of such proposals cannot be projected.

There is a nucleus of competence within each participating Arab state involved in environmental planning under the auspices of UNESCO. The experience these groups have gained should contribute to the success of any cooperative arrangements that may evolve in the future.

B. Summary

Analysis of the information available regarding the existing conditions within each of these countries with respect to environmental issues suggest a wide variation in research capability and current expertise. It is thus necessary to carefully examine proposals with respect to each country's ability. Unless the government attitudes toward the role environmental policies play in development are oriented toward environmental protection, it appears that environmentally oriented projects hold little promise. Exceptions are pollution in the Red Sea and assistance with establishing environmental analysis and control capability such as that requested by Jordan.

APPENDIX A

REPORT OF VISIT TO
THE ARAB REPUBLIC OF EGYPT, ISRAEL AND
THE HASHEMITE KINGDOM OF JORDAN

October 12 - 25, 1978

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INTRODUCTION

In order to conduct an on-site inquiry into the research projects currently being conducted in the Middle East states of Egypt, Israel and Jordan, their expressed research priorities and to examine the potential for regional cooperation in the areas of natural resources and environmental sciences, visits were made to these countries during the period October 11 through October 25, 1978. An assessment of institutional capabilities for research was also conducted as a second level of inquiry. At the same time a literature search of published information available on these subjects was conducted by OALS in support of the field activities.

EGYPT

(October 12-16, 1978)

In Egypt discussions were held with staff at the American University in Cairo, the Desert Research Institute of the Ministry of Agriculture, the Land Reclamation Authority, Ain Sahms University, and the University of Cairo. A visit was made to the Abees land reclamation project which is also the proposed site of a Desert Development Demonstration and Training Program to be coordinated by the American University in Cairo.

Currently, natural resources development research in Egypt is primarily focused upon obtaining self-sufficiency in food production and, in so doing, utilizing currently non-productive lands such as the Mediterranean littoral and New Valley portion of the Western Desert. Consequently, primary research project interests emphasize water resources management, saline and drought-tolerant crops and use of saline and brackish water in irrigation, and the improvement of agricultural management in desert areas.

Two schools of thought exist in Egypt in this regard. One, which is still primary, is trained in the use of Nile Valley soil and water resources and agricultural techniques. The second, an apparently enlarging portion of the science and technology community, is concentrating on the adoption of new techniques necessary for development of desert areas of northern and western Egypt. Institutionally, it was expressed that a larger proportion of the science and technology community will need to acquire an expertise in desert-appropriate perspectives before large-scale successful development in these geographic areas will take place.

The Desert Research Institute of the Ministry of Agriculture is one of the leading Egyptian institutions regarding the acquisition and application of appropriate technologies for desert development. Currently, their focus is upon resources inventory activities such as the preparation of regional soils and geohydrologic maps with emphasis upon the hydrologic provinces of Egypt. They also have a strong interest in the areas of saline water in irrigation and the improved salt tolerance of selected crops. They are currently involved in projects of watershed improvement to both augment groundwater and irrigation resources of Wadi al-Arish in Sinai and installation of drip irrigation systems at its unit in Southwest Sinai. Other projects of interest are their development of plans for the establishment of a greenbelt across North Africa as a land reclamation scheme with components of watershed and range improvement and management, livestock management and the use of non-conventional energy for rural electricity and water supplies. The Institute is also interested in the improvement of local sheep for meat production as the objective of raising of this animal shifts from wool to meat. This would also include introduction of breeds of proven meat production potential.

Specific research projects recommended for regional collaboration during discussions at DRI include:

- The use of saline water in irrigation and development; and improvement of salt-tolerant crops
- The improvement of Awasi sheep for meat production, to coordinate ongoing research activities in Jordan, Iraq, Syria, Egypt and Israel
- Development of a regional clearinghouse for scientific and technological research information and promotion of wider dissemination on current research. This would also include funding of distribution of information to professionals who, due to lack of funds, do not have access to the full range of current information
- A state-of-the-art program, perhaps by clearinghouse staff, to collate information on selected subjects of priority interest among regional participants

Focus at the American University of Cairo is on their establishment of a Desert Development Demonstration and Training Program in South Tahrir Province at Abees. Abees is the location of one of Egypt's oldest and most successful land reclamation projects using Nile River diversions. Currently, funding is being sought to develop this integrated development and training project which will concentrate on those technologies appropriate for development in those desert regions outside the traditionally farmed Nile basin. It will be the first major non-governmental demonstration project in Egypt devoted to desert development. It will seek to integrate the various technologies necessary for successful desert living and agriculture with water as the limiting factor. The Program will also link the application of existing knowledge, research and education and will serve as a training ground for students and scientists from Egypt and abroad.

The demonstration and training program will be primarily concerned with desert technologies appropriate for Egypt's climate, its physical, human and capital resources, its environmental concerns, and its socio-economic and traditional patterns. Modifications of these technologies could be made, as appropriate, to suit conditions in neighboring countries of the Arab World which wish to cooperate in the program.

- The program emphasis will be on desert agriculture where water supply is the limiting factor. Optimum land and water resource management is a major goal.
- The program will also be directed at the establishment of small-scale agriculturally based industries.

- The program will include the production of energy for rural communities and the most appropriate design of habitats for hot, arid environments.
- Raw materials resources will be surveyed, particularly to judge suitability of indigenous materials for construction and other development activities.

Desert communities, based on alternative patterns of development, particularly agricultural and water-use practices, will be established in an integrated rural development context. Social science research will go hand in hand with technical research to ensure a productive, viable life style during the development of these communities.

The program will be located at some distance from existing population centers but will have adequate social services.

A nucleus of professional staff will live in the community from the outset, so as to be aware of local needs and to tie the program closely to the community.

The site selected for the first phase of the program is in the South Tahrir region on 500 feddans, donated by the Government of Egypt through the Ministry of Land Reclamation. The totality of the program will cover an area of 7,000 feddans called "Intallaaq," or "Take-off."

A multidisciplinary outreach program will extend the impact of the results of the program to desert, arid land, and oasis development projects and studies throughout Egypt, and appropriately modified programs will be designed for experts and students from neighboring countries with similar programs.

Specific research activities of the proposed Program are outlined below.

1. On-Site

A. Agricultural

- Plant materials: selection of grasses
- Native arid zone plants
- Testing adaptability of crops such as jojoba, guayule, and buffalo gourd
- Desertification control
- Dune stabilization: vegetative cover, windbreaks
- Controlled environment agriculture
- Biosaline research
- Alternative farming systems with various technology levels
- Environmental control for dairy cows, model dairy production
- Improving small ruminant production
- Water harvesting
- Optimization of water use on crops

- B. Industrial
 - Food processing
 - Use of solar energy
 - Drying and processing
 - Heating and cooling
 - Production of electricity (silicon cell, wind)
- C. Rural community development
 - Planning
 - Housing
 - Services
 - Government
 - Recreation

II. Off-site, or not site-specific

- A. Agricultural
 - Water harvesting, dune stabilization
- B. General
 - Coordinative plans for desert development
- C. Social
 - Aspects of integrated rural desert development

Other project interests specified during discussions in Egypt revolved around two areas: the development of fish as a food resource and the establishment and maintenance of natural environmental preserves.

Two areas of primary interest were indicated with respect to fish production. One revolved around the apparent current reduction in size and supply of fish in the Nile and Lake Nasser. Research needs were expressed which will address the resolution of this problem and a consequent improvement of the potential of the fish resources in these two areas. Second, the Red Sea's potential as a producer of fish needs to be tapped and further exploited. Management research in this area is of prime interest among the community of specialists interested in this area as a contribution to Egypt's food supply.

An interest was also noted with respect to the maintenance of the natural reserve which was established by the Israelis in the Sinai. Hope was expressed that emphasis would be given to the preservation of this reserve. At the same time, the establishment of similar areas in the Red Sea highlands area of Egypt was given expressed interest. A variety of wildlife and plant communities exists in this area which needs to be protected as development proceeds. Study of these communities would also be enhanced by the provision of reserve status of these areas.

Egyptian opinions on the feasibility of cooperation with Israel in the areas of science and technology are in one sense dichotomous. A large number of the scientists interviewed are anxious to collaborate professionally, as many of them have already done on an informal basis at conferences, etc., and feel that a great deal of mutual benefit would result. At the same time there is a political legacy of long standing which causes a hesitancy. At the heart of the problem is the broader issue of the Palestinians. Until the Palestinian issue is resolved many Egyptians will refuse to join hands with Israelis in research. It was stated also that the United States should not force scientific cooperation by "...dangling its dollars in front of hungry researchers." Furthermore any proposal involving the Sinai would be looked upon as a means of maintaining Israeli presence in the Sinai.

ISRAEL

(October 19-22, 1978)

In Israel emphasis was given to an overview of current development and research being conducted at the Ben Gurion University of the Negev at Beer Sheva.

Observations of agricultural developments between Jerusalem and Beer Sheeva and Beer Sheeva and Tel Aviv were made as well as research activities and facilities at the Ben Gurion Institute.

The Ben Gurion Institute is concentrating upon research related to the applications of technology to agro-industrial processes for the use of saline irrigation water, development of salt-tolerant plants primarily as forage, and desert settlement planning including appropriate locally available materials, desert architecture and solar energy. Emphasis on plant materials is on the technology of plant introduction and reproduction. Current work is being done on the salt tolerance and varietal spectrum of eucalyptus and the drought resistance of arid-adapted forages, especially Atriplex species and other halophytes. Work being done on low-rainfall irrigation of halophytes at the Institute's research farm is particularly noteworthy. The regenerative properties of two Atriplex varieties with only 85 mm of rainfall show very great potential and make their use for forage production in such areas particularly interesting. One variety of eucalyptus that was successful with up to 60,000 ppm TDS is another development of their adaptive research.

Industrial crops such as jojoba are receiving a commensurate amount of attention, and their success without irrigation is also noteworthy. Loess soils which are being used seem to show great potential for very limited irrigated production of this crop. Perhaps of most interest is the reproductive work being conducted on jojoba using tissue culture to produce seedlings instead of direct seeding.

Also noted as being of special interest for future development in Israel are gum-producing trees. Technology and experience there is very limited and an interest was expressed in acquiring Egyptian and Sudanese expertise in this area.

Another program being conducted at BGI is that of genetic research to extend the shelf life of produce being exported to foreign markets. The potential of this market, particularly the European produce market, makes this research of particular interest to other countries in the Middle East. At present tomatoes and melons are the focuses of research.

A great deal is also being done in greenhouse technology, particularly with respect to utilization of new complex polymers with ultraviolet degradation resistance and utilization of geothermal energy for heat. Israeli technical expertise in both controlled environment agriculture and trickle irrigation is well known.

Also of interest is the intensity with which agricultural development and reforestation and afforestation have been accomplished within Israel and the West Bank. Israeli development activities are also well known with respect to the Negev and Kibbitzim. The extent to which the highland and hilly portions of the West Bank are being utilized by the traditional Arab landholders is less well publicized. It would be difficult to imagine a more intensive use of terraced hillsides for dryland production. Jordanian technicians living on the West Bank are now also being provided with additional training by Israeli agriculturists and are the primary technology transfer agents. Credit must be given to the adaptive ability of the "traditional agriculturists" in this region, however. Quick adaptation of the most advanced techniques of farm management have made them able to reach very high yields.

Another aspect of applied research being conducted by the Israeli scientific community worth mention is that of fish production. Their concentration has been upon fish ponds, i.e., fresh-water fish, from an aquaculture perspective.

Evidence of Israeli interest in collaborative projects with their Arab neighbors as expressed by those with whom discussions were held was positive and it was indicated that their opinions reflect a large segment of the Israeli scientific community. Specifically expressed project areas of mutual benefit were in crop ecology, botany and general ecology. As mentioned above, Egyptian and Sudanese technology in gum production is of particular interest as is Egyptian technology in the production of certain produce crops. Desert development is another area in which a particular interest was expressed, particularly in collaboration on appropriate desert architecture and use of locally available materials versus imported cement.

JORDAN

(October 16-19 and 22-25, 1978)

The Jordanian research community was found to be very well organized, trained and equipped as evidenced by visits made to the Royal Scientific Society (RSS) and the University of Jordan, both in Amman and the RSS Solar Energy Station Asaba.

Non-agricultural development research in Jordan is centered at the Royal Scientific Society (RSS). The RSS is overseen by a high degree of interest on the part of His Royal Highness, Crown Prince Hasan, and is staffed by a contingent of professional scientists who have largely received their training and experience in the European technological and scientific community. To a large extent their training is in highly respected German institutions and industry, although a portion of the staff received its training in the U.S., Great Britain and in Jordan.

Well equipped for a newly established institution, the RSS also serves as the national standards agency, testing products for local industry including paints, lubricants, ceramics, metals and non-metallic materials. Close coordination with local industry is being established as the high degree of reliability of their program becomes better known.

Research priorities of the RSS, and hence of Jordan, in the non-agricultural sector are outlined below:

- Protection of the hydroclimatological environment of the Amman-Zarqa strip, particularly as it affects the hydrologic regime of the Zarqa River stream-aquifer system. Current plans are to utilize a portion of the water in the reservoir behind the King Tallal Dam on the Zarqa River for the municipal water supply needs of Amman--a critically water-short community. The concentration of industries, primarily smallscale but including the phosphate mining and processing industry in Amman and Zarqa and within the 35 km strip between these communities, is endangering the quality of the water of the Zarqa stream-aquifer system as it flows by and ends up in the Tallal Reservoir. Industries in this area include plastic formation, paint production, battery production with consequent lead concentrated effluent, and the phosphate processing concentrated in Zarqa. Particulate pollution has already begun to affect the vigor of plant growth in the Zarqa area. Its effects on the stream are as yet unknown. A project to monitor, identify point sources of pollution and develop corrective measures and strategies is of very high priority in the Kingdom. Unfortunately, to date the U.S. has expressed no interest in assisting the RSS with this problem even though the RSS has submitted a

preproposal to the local U.S. Aid Office.

- The development of low-cost, desert-appropriate housing is another applied research priority in the Kingdom as expressed by the RSS. A special research unit at RSS is focusing on this problem with particular emphasis on use of locally available materials and formation and construction techniques which lend themselves to easy and inexpensive fabrication. It was also expressed that research in this area would have one of the highest returns to investment when its applications in rural areas and new community developments are considered. Research at RSS has already developed a new ultra-lightweight scrap-glass-based ceramic material which has very good insulation characteristics. Such research needs to be furthered.

- Solar energy applications are also of high interest in the Kingdom. Particular emphasis is currently being given to desalinization of small water supplies from coastal and brackish sources. Solar energy applications are also being directed at rural and desert development concepts such as home hot water heating and communications-- such as use of solar-cell-powered micro-wave telephonic communications to connect rural settlements with outside facilities. The RSS has a newly installed and well staffed and monitored solar energy station at Aqaba which was also visited during this trip. Current production in the German-produced system is 2 liters/m² with plans for 5-6 liters/m². Plans for expansion include electrical production from solar driven turbine generators in cooperation with the U.S. government and a heating/cooling project in cooperation with Kuwait.

Other RSS facilities include:

- A computer center equipped with a Century 251 computer which serves to introduce computer technology to Jordan as well as train systems specialists.
- Testing labs for strength and deformation characteristics of plastics, cloth and metals.
- A wet lab for analysis of lubricants, foods, water and other liquids.
- Infrared, ultraviolet, gas chromatographic and atomic absorption labs.
- Metal and wood fabrication shops where RSS is currently fabricating a prototype solar panel for production by private industry.

- A glass and ceramics testing lab.
- A non-stress metal testing lab.

Agricultural research is centered at the University of Jordan in Amman. University of Jordan currently has a host country U.S. AID contract with Washington State University.

Other than conventional crop research at the College of Agriculture, the University of Jordan has a particular interest in several projects in the natural resources and environmental sciences sector. Of these, the development and operation of an ecological reserve at Azraq is of special interest. Azraq, a regionally well-known oasis visited during this trip, is the discharge point for a large quantity of artesian water. Situated in the eastern portion of Jordan in the Badiya al-Sham, Araq has historically been a stopping point on the caravan route to the east. Currently, its abundant water supply is being tapped to supply northern Jordanian communities, most notably Irbid. It has been selected as the site of a natural preserve which is jointly administered by the College of Agriculture, University of Jordan, the National Society for the Preservation of Nature, an organization charged with a portion of the environmental protection research in the Kingdom, and the Ministry of Agriculture. At present the al-Azrak preserve is a 5,000-acre fenced area where research is being conducted to restore the natural vegetation community and test introduced varieties, conduct watershed and range management research as well as reintroduce and protect indigenous wildlife species. The goal of the Society for the Preservation of Nature is to enclose 60,000 acres establishing livestock and range management research, drought-resistant forage, and grazing management as priority items. A reinstatement of traditional Arab grazing practices (i.e., the hayma system) will be initiated as a research item. Integrated with this will be a study of desertification and the hydrometeorology of wadis (i.e., the microclimate). These are relevant to the entire Badya al-Sham region and therefore apply to Syria, Iraq, and Saudi Arabia as well as to the rest of Jordan.

Other project interests/priorities of the University of Jordan are outlined below.

- The protection of the marine environment in the Gulf of Aqaba which is being endangered by developmental activities along its shoreline as well as by recreational use, especially skin diving.
- Reforestation of the hill landscape is proceeding much too slowly and should be increased in rate of planting.
- Urban land use planning is required to restrict the encroachment on prime soil/high rainfall land of urban residential use.

- Control of the leaf curl virus on tomatoes.
- Irrigation management.
- Improvement of plastic greenhouse technology by more than 40,000 dunums (dunum = .25 acre +)

During the course of the stay in Jordan, trips were made to the northern highlands at Ajlun and along the Jordan River Valley in addition to those to al-Axraq, Aqaba and Zaroa. In the highland areas similarly intensive terraced agricultural development was noted as was the case on the West Bank. The extensive use of plastic greenhouses was also observed in the Jordan Valley.

Scientists and technologists interviewed in Jordan were as one in their hope that U.S. participation in their research activities would increase. U.S. science and technology is greatly respected among them and expressions of disappointment at the apparent U.S. lack of interest to this point were common. Given the sophistication of the research organizations, staff and facilities encountered in Jordan, such participation could be a wise investment.

GENERAL FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

During the course of this investigation several general observations were made and conclusions reached by the study team.

- Although a positive interest in collaborative research was found among Egyptian scientists, and within the Israeli community, direct joint research is probably not an immediately feasible consideration in many cases. Once a peace treaty is concluded some skepticism encountered may be removed and more willingness engendered. Feelings that the U.S. may be coercing Egyptian scientists into collaboration also exists. A reassessment should be conducted based upon developments as they proceed. At this time Jordanian-Israeli collaborative research is not considered at all feasible. Therefore, an alternative approach is suggested whereby similar projects could be established in separate countries and at some later date perhaps be drawn together. In the meantime, the focal U.S. institution could provide coordination, and information could be disseminated among all participants, perhaps leading to a multinational conference of investigators.
- Among the projects which are of apparent mutual interest in the countries assessed are:
 - The use of saline water for irrigation; and correlatively,
 - The development of salt-tolerant and drought-tolerant crops, particularly as forage, such as Atriplex and the halophytes;
 - The improvement of sheep production as a meat source; and
 - Range, grazing and watershed development and management.
- These projects could easily be integrated as a multidisciplinary activity or components of an integrated program:
 - Desert settlement, including desalination of brackish water, use of low-cost locally available materials in desert-appropriate designed structures;
 - Natural/environmental preserves with research in biology, botany, zoology and associated ecology disciplines, both land and marine; and,
 - Development of fish resources.
- The interest in environmental protection evidenced in Jordan should be encouraged and supported by U.S. participation. U.S. technology and experience is sought after in this area in particular. Support of programs to prevent the degradation of the Amman-Zarqa environment and the al-Azraq preserve

would be well received and greatly appreciated by the Jordanians.

- Participation of Middle East states other than Egypt, Israel and Jordan should not be ignored. Particular reference to ACSAD in Damascus is made here. Work ongoing there could contribute to the overall success of regionally applicable research as attested to by Egyptian scientists.
- The Desert Development Demonstration and Training Program proposed by American University scientists in Cairo appears to provide a foundation for integrated research in several research areas which have regionally collaborative potential. U.S. support of this activity is encouraged as it may well be able to provide a focal point of desert development research enabling Egyptian and Israeli scientists to engage in cooperative research.
- A regional clearinghouse for information and support of information dissemination to the regional scientific community would perhaps be a most appropriate first step toward regional cooperation. Development of a mechanism whereby various scientists can be continually appraised of others' research would prove of great benefit and perhaps be a further stimulus to coordinated research efforts. Integrated with this effort could be state-of-the-art appraisals of selected subjects of mutual interest. This process may stimulate further collaboration.

LIST OF PERSONS AND INSTITUTIONS

Egypt

American University in Cairo

Dr. Ali Bishay, Professor, Department of Physics and
Sciences and Materials Engineering
Dr. Farkanda Hassan, Chairman, Department of Physics and
Sciences and Materials Engineering
Dr. Thomas LaMont, Dean of Faculties
Dr. Carl Schieren, Division of External Relations

Desert Research Institute

Dr. Shattar, Director
Dr. Yousef Ghaneem, Deputy Director and Director of the
Department of Animal Husbandry
Dr. Muhammad Atif Abdul Salaam, Deputy Director and
Director of the Soils Department

Ain Shams University

Dr. Kamal Wassif, Professor of Zoology, Department of
Zoology, Faculty of Science, Abbasia, Cairo

University of Cairo

Dr. Muhammad Kassas

Land Reclamation Authority

Ahmad Abdul Ra'uuf, Chairman, Land Reclamation Authority

U.S. Embassy

Mr. Aimee, Economics, Officer

Israel

Ben Gurion University of the Negev Applied Research Institute

Dr. Joel Schecter, Institute Director
Dr. Dov Pasternak, Professor

U.S. Embassy, Tel Aviv

Ken Stanerman, Economic Officer 03-937-703

Jordan

Royal Scientific Society (Tel: 67111 Telex: 1276 JORAMAH
P.O. Box 6945, Amman Jordan)

Dr. Albert Butrous, Director General
 Dr. Fakhruddin Abdulhadi Daghestani, Deputy Director General
 Dr. Arafat R. Al-Tamemi, Director, Industrial Chemistry
 Department
 Dr. Hami Shakaca, Head, Inorganic Technology Division
 Dr. S. Abdul Jawad, Head, Ceramics Division
 Dr. Yousef Numair, Head, Computer Division

University of Jordan

Dr. Subhi Qasem, Dean, Faculty of Agriculture

National Planning Council (Amman, Tel 44466)

Mr. Nabil Suais

Royal Society for the Preservation of Nature, Amman

Mr. Antoine Bendak, President
 Mr. John Clarke (World Wildlife Fund 41689)

Natural Resources Authority (Amman 44217)

Mr. Yousef al-Numry, Director General

U.S. Embassy (P.O. Box 354, Amman, Jordan)

Mr. Samuel Starrett, Chief, Economic/Commercial Section
 (Tel: 44371)

Mr. Jim Cassanos, U.S. AID

Mr. John Hyslop, U.S. AID

Mr. Tom Pearson, Head, Capital Development Section

Office of the Crown Prince, Royal Palace (Tel: 37341)

Mr. Shehab A. Madi, Deputy Director

APPENDIX B

LITERATURE CITED

LITERATURE CITED

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- . 1976. Science and Technology in the development of the Arab states. CASTARAB Conference, Rabat, 16-25 August 1976. UNESCO SC-76/CASTARAB/3. 202 p.
- . 1976. National and regional planning for scientific and technological information system and services for development in the Arab countries. CASTARAB Conference, Rabat, 16-25 August 1976. UNESCO SC-76/CASTARAB/4. 11 p.
- . 1976. Projects of regional cooperation in the fields of water resources and water management. CASTARAB Conference, Rabat, 16-25 August 1976. UNESCO SC-76/CASTARAB/5. 40 p.
- . 1976. Projects of regional cooperation in research and training in the field of integrated ecology related to the rational management of arid and semi-arid lands. CASTARAB Conference, Rabat, 16-25 August 1976. UNESCO SC-76/CASTARAB/6. 56 p.
- . 1976. Projects of regional cooperation in the fields of geology and geophysics. CASTARAB Conference, Rabat, 16-25 August 1976. UNESCO SC-76/CASTARAB/7. 11 p.
- . 1976. Projects of regional cooperation relating to marine environment and coastal area development. CASTARAB Conference, Rabat, 16-25 August 1976. UNESCO SC-76/CASTARAB/8. 49 p.

- , 1976. Final report. CASTARAB Conference, Rabat, 16-25 August 1976. UNESCO. 108 p.
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- Kiss, A.C. 1976. Survey of current developments in international environmental law. IUCN Environmental Policy and Law Paper No. 10. 141 p.
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APPENDIX C

INSTITUTIONS

EGYPT

ASSOCIATIONS

- Name: ACADEMY OF SCIENTIFIC RESEARCH AND TECHNOLOGY
101 Kasr El Aini Street
Cairo
Director: Abdel Moneim Abu El-Asm
Affiliates: Institute of Oceanography and Fisheries
- Name: AERIAL SURVEY OF EGYPT
308 El-Karam Street
Giza
- Name: AIN SHAMS UNIVERSITY
Kasr-el-El-Caafra
Abbassia
Cairo
Type: Government
Director: Mohamed Nagui El-Mahallawi
Affiliates: Department of Zoology
Subjects: ecology, taxonomy, physiology of
desert animals, parasitology of
desert reptiles, birds, and mammals
Publications: Ain Shams Science Bulletin
- Name: AL-AZHAR UNIVERSITY
Cairo
Director: Badwi Abd El-Latif
- Name: ALEXANDRIA INSTITUTE OF OCEANOGRAPHY AND FISHERIES
Layed Bey
Alexandria
Director: Saad K. El-Wakeel
- Name: AMERICAN RESEARCH CENTER IN EGYPT, INC.
2 Midan Kasr el Loubara
Cairo
Director: Morroe Berger
- Name: AMERICAN UNIVERSITY IN CAIRO
113 Sharia Kasr Al-Aini
Cairo
Director: Thomas Aquinas Lamont
- Name: ASAB ENGINEERING UNION
28 Panses St.
Cairo
Type: regional, World Federation of Engineering
Organizations
- Name: ASAB LEAGUE EDUCATIONAL, CULTURAL, AND SCIENTIFIC
ORGANIZATION (ALESCO)
109 Tahrir St.
Dokki
Cairo
Type: Regional
Subjects: promote intellectual unity of the Arab countries
by means of education, higher cultural standards,
technical development; establish specialized
institutes; train research experts

Name: ASSOCIATION OF ARAB UNIVERSITIES
 Scientific Computation Centre
 Tharwat Street
 Orman P.O.
 Cairo
 Director: M. Mursi Ahmed
 Publications: Bulletin, Directory of Arab Universities, Directory of Teaching Staff of Arab Universities, Proceedings of Seminars

Name: ATOMIC ENERGY ESTABLISHMENT
 Dokki
 Cairo
 Director: I.B. Hazza

Name: BOARD FOR THE UTILIZATION OF THE RIVER JORDAN AND ITS TRIBUTARIES
 Cairo
 Subjects: regulates water activities in the River Jordan basin; activities have been interrupted since Israeli occupation

Name: CAIRO UNIVERSITY
 Giza
 Cairo
 Director: Hassan Ismail
 Affiliates: 1) Department of Botany
 Subjects: taxonomy, surveys of desert vegetation, environmental studies, ecology of coastal and saline deserts, microflora of desert soils
 Publications: Herbarium publications
 2) Department of Natural Resources, Institute of African Research and Studies
 33 Misaha Street
 Dokki, Giza
 Director: Dr. M.E. Jallab
 Subjects: ecology of desert plants and soil fauna, physics and chemistry of desert soils, establishment of national desert parks and nature preserves.
 Publications: African Studies Review

Name: DESERT INSTITUTE
 El. Mafaria
 Cairo
 Type: Government, Ministry of Agriculture
 Director: M.A. El-Mahdy
 Subjects: desert development, water and soil resources, plant and animal production, solar and wind energy
 Publications: Desert Institute Bulletin

- Name: EGYPTIAN ACADEMY OF SCIENTIFIC RESEARCH AND
TECHNOLOGY
131 Kasr El Einy Street, Cairo
Notes: sponsoring a workshop on management of wildlife
in arid ecosystems, 4-8 Nov. 1979
- Name: EGYPTIAN AGRICULTURAL ORGANIZATION
P.O. Box 63
Exhibition Grounds
Gediza, Cairo
Director: Hassan Salem
- Name: EGYPTIAN TECHNICAL SOCIETY
Sharia Kasr El-Aini (Jardin du Ministère de
Irrigation)
P.O. Garden City
Cairo
Director: Soliman A. Hazzayn
- Name: EGYPTIAN HORTICULTURAL SOCIETY
P.O. Box 48
Cairo
Director: Hassan Farid
- Name: ENTOMOLOGICAL SOCIETY OF EGYPT
14 Sharia Ramses
P.O. Box 430
Cairo
Director: Mahmoud Kafez
Publications: Bulletin of the Entomological Society of Egypt
- Name: FAO REGIONAL OFFICE FOR THE NEAR EAST
Box 2223
General Cooperative Society for Agrarian Reform
Building
Dokki, Cairo
Type: Regional
Director: M.A. Hour
Affiliates: FAO Commission on Horticultural Production in
the Near East and North Africa
Chairman: D. Alloum
Subjects: promotion of international collabora-
tion in the study of technical problems
and the establishment of a balanced
program of horticultural research at
an interregional level.
- Name: GENERAL PETROLEUM COMPANY
Dr. Mustafa Abu Zahra Street
Nasr City, Cairo
Director: Ahmend El-Barkowski
- Name: GEOLOGICAL SURVEY AND MINING AUTHORITY
Ministry of Petroleum and Mineral Wealth
Abbassiya P.O.
Cairo

Director: Rushdi Said
 Subjects: regional geologic mapping, mineral prospecting, evaluation of mineral deposits, preparation of techno-economic reports, mine and quarry designs and granting mineral exploration and exploitation rights. 280 research workers.

Name: HYDROLOGICAL RESEARCH STATION
 Kanater-al-Khaiyria Barrages
 Cairo

Director: A.A. El-Darwish

Name: INSTITUT D'EGYPTE
 13 Sharia Sheikh Rihane
 Cairo

Director: Muhammad Reda Madwar

Subjects: literary, artistic and scientific questions relating to Egypt and neighboring countries.

Name: INSTITUTE OF ARAB RESEARCH AND STUDIES
 1 Tolombat St.
 Garden City, Cairo

Director: M.S. Abulezz

Name: INSTITUTE OF FRESHWATER FISHERY BIOLOGY
 10 Hassan Subry St. (Fish Garden)
 P.O. Zamalik
 Cairo

Director: A.R. El Bolock

Name: INSTITUTE OF ASTRONOMY AND GEOPHYSICS: EGYPTIAN
 OBSERVATORIES
 Helwan, Cairo

Director: M. Fahim Mahmoud

Name: INSTITUTE OF NATIONAL PLANNING
 Salah Salem St.
 Nasr City, Cairo

Director: Ismail Sabry Abdallah

Name: INTERNATIONAL METEOROLOGICAL INSTITUTE
 Cairo

Type: Regional, World Meteorological Organization
 Subjects: meteorological research and training for Middle Eastern and African personnel engaged in meteorological work

Name: MANSOURA UNIVERSITY
 Mansoura

Director: M. Abdel Moneim El Badrawi
 Affiliates: Faculty of Science
 Dean: Almed El Baz Younis

Name: MIDDLE EASTERN REGIONAL RADIOISOTOPE CENTRE FOR
 THE ARAB COUNTRIES
 SL. Malaeb El Gamaa
 Dokki, Cairo

- Name: **Arab specialists in the applications of radio-isotopes, particularly in the medical, agricultural, and industrial fields; conduct research in hydrology, tropical and subtropical diseases, fertilizers, and entomology; promote the use of radioisotopes in Arab countries.**
- Name: **MINING AND WATER RESEARCH EXECUTIVE ORGANIZATION**
 Dokki, Cairo
- Name: **NATIONAL INFORMATION AND DOCUMENTATION CENTRE**
 Al-Jazir St.
 Dokki, Cairo
- Director: **Ahmad Abdel-Mawid Kabesh**
- Subjects: **accumulates and disseminates information in all languages and in all branches of science and technology;**
- Name: **NATIONAL RESEARCH CENTRE**
 Al-Jazir St.
 Dokki, Cairo
- Director: **Tokhami Abdel Rahman Yousof**
- Subjects: **research in pure and applied sciences. Staff of 1128 scientists and 183 technicians.**
- Name: **NEAR EAST FORESTRY COMMISSION**
 c/o FAO Regional Office for the Near East
 P.O. Box 2233
 Cairo
- Type: **Regional**
- Director: **Macroud Awad Al-Jabouri**
- Subjects: **forest policy preview and coordination of its implementation on a regional level; information exchange and advice on suitable practices and action on technical problems; make appropriate recommendations to the twenty-one member countries.**
- Name: **NEAR EAST PLANT PROTECTION COMMISSION**
 c/o FAO Regional Office for the Near East
 P.O. Box 2233
 Cairo
- Subjects: **matters relating to the protection of plant resources in the region; fifteen member countries.**
- Name: **RED SEA INSTITUTE OF OCEANOGRAPHY AND FISHERIES**
 Al-Ghardaqa
- Director: **A.A. Al-Kholy**
- Name: **SURVEY DEPARTMENT**
 20 Baghdad Street
 Giza, Cairo
- Director: **Ibrahim Mostafa Ganen**

Name: TANTA UNIVERSITY
 Tanta
 Director: Hasham Nassar
 Affiliates: Faculty of Science
 Dean: M. El Akkad

Name: UNESCO REGIONAL OFFICE FOR SCIENCE AND TECHNOLOGY
 IN THE ARAB STATES
 8 Abdel Rahman Fahmy St.
 Garden City, Cairo
 Director: Chaudhuri Kamal Reheem

Name: U.M. INFORMATION CENTRE
 Sh. Osiris
 Tagher Bldg.
 Garden City, Cairo

Name: UNIVERSITY OF ALEXANDRIA
 22 Al-Gueish Ave.
 Shatby, Alexandria
 Director: Aly Reda El Heneidy
 Affiliates: Department of Botany, Ecology Unit
 Moharram Bey
 Alexandria
 Dean of Faculty of Science: Abdel
 Salam Shalabi
 Subject: ecology of Mediterranean coastal desert
 west of Alexandria
 Publications: Bulletin of the Faculty of Science

Name: UNIVERSITY OF ASSUIT
 Assuit
 Director: Mohamed Hamdy El-Nashar
 Affiliates: Faculty of Science
 Dean: Issa Moustapha Issa

Publications

Name: AL-MUTANSIRIYAH UNIVERSITY
Mutansiriyah, Baghdad
Type: Government
Director: Sultan Abdul-Radir Al-Sayid
Publications: Science College Magazine

Name: INST. OF SCIENTIFIC AND INDUSTRIAL RESEARCH
Directorate - General of Industry
Baghdad
Type: Government
Director: Shesto Na'Amah
Publications: Technical Bulletin, Annual Report

Name: FOUNDATION OF SCIENTIFIC RESEARCH
Baghdad
Director: Hajar M. Al-Kham
Publications: Journal of Science, Journal of Natural
Sciences
No. 1, Box 1104
Baghdad, Baghdad
The foundation is a system of diverse scientific
research. Areas Abdul Radir
The main fields are applied research in
petroleum, natural gas, forest, agricul-
ture, of range soils, soil chemistry,
microbiology, ecology of arid range-
lands, consumptive use, soil micro-
biology, soil fertility, agricultural
meteorology, environmental pollution,
and economic evaluations.
Publications: Technical Bulletins, Reports

- 3) Petroleum Research Institute
- 3) Building Research Centre
- 4) Biological Research Centre
- 5) Agricultural Research Centre
- 6) Dates and Date Palm Research Centre
- 7) Scientific Documentation Centre

Name: FOUNDATION OF TECHNICAL INSTITUTES
Baghdad
Type: Governmental, Ministry of Higher Education
Director: H.M.S. Abdul Wahab

Name: MOSUL UNIVERSITY
Mosul
Type: Government
Director: Hajar M. Y. Al-Mallah
Publications: Faldiran Journal of Science

Name: UNIVERSITY OF BAGHDAD
 Baghdad
 Type: Government
 Director: T.I. Al-Abdullah
 Affiliates: 1) Arid Zone Research Institute
 Abu-Ghraib
 Director: Madheema S. Kaddouri
 Subjects: research and development of natural
 resources; salinity and soil
 chemistry, hydrology, groundwater,
 plant ecology, climate, micro-
 biology, solar energy
 Publications: Annual Bulletins
 2) College of Sciences
 3) Iraq Natural History Research Center
 Waziriyah
 Baghdad
 Director: Anwar D. Niazzi
 Subjects: zoology, botany, geology
 Publications: Iraq Natural History Research
 Center Publications, Bulletin
 of the Iraq Natural History
 Research Center, Annual Report

Name: UNIVERSITY OF BASRAH
 Basrah
 Type: Government
 Director: A.Y. Khashub
 Publications: Bulletin of College of Science
 Affiliates: Centre for Arab Gulf Studies

Name: UNIVERSITY OF SULAIMANIYA
 Sulaimaniya
 Type: Government
 Director: Tariq Hassan Amadi

Name: UNIVERSITY OF TECHNOLOGY
 Baghdad
 Type: Government
 Director: Taha T. Al-Naimi

ISRAEL

Institutions

- Name: ACADEMIC CIRCLE OF TEL-AVIV
P.O. Box 2425
Tel Aviv
- Type: Private
- Director: Moshe T. Hurvitz
- Subjects: encourages all branches of scientific research and promotes cooperation between scientists in Israel and abroad.
-
- Name: AGRICULTURAL RESEARCH ORGANIZATION
The Volcani Centre
P.O. Box 6
Bet-Dagan
- Type: Government, National and University Institute of Agriculture
- Director: Dr. Yoash Maadia
- Affiliates: 1) Forestry Division
Ilanot
Director: R. Karschon
Subjects: afforestation, forestry and problems of tree growth in arid areas.
- 2) Institute of Animal Science
Subjects: management of domestic animals
- 3) Institute of Field and Garden Crops
Affiliates: 3.1) Division of Range Management
Head: N.S. Seligman
3.2) Division of Ornamentals
Head: J. Ben-Jaacov
- 4) Institute of Horticulture
Affiliates: 4.1) Division of Citriculture
Head: A. Bar-Akiva
4.2) Division of Subtropical Horticulture
Head: S. Razit
- 5) Institute of Plant Protection
Affiliates: 5.1) Division of Entomology
Head: E. Swirski
5.2) Pesticide Chemistry and Residue Research Laboratory
- 6) Institute of Soils and Water
Director: Bruno Yaron
Subjects: arid and semiarid soils, agricultural meteorology, soil physics and chemistry, soil reclamation and technology, water quality, stress physiology, crop water requirements, irrigation technology
- 7) Volcani Institute of Agricultural Research
P.O. Box 15
Rehovot

- Affiliates: 7.1) Gilat Regional Experimental
Station
Gilat
Mobile Post Negev 2, Israel
Head: Hadasah Avigdori
Subjects: efficient use of
rainfall and irrigation
water, diversification
of crops, plant protection,
cultivation and fertilization
of loess soils
- 7.2) Soil Physics and Technical
Division
Subjects: water conservation,
soil structure management

Name: ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
IN ISRAEL
P.O. Box 7266
Jerusalem

Director: D. Abir

Name: ATOMIC ENERGY COMMISSION
26 Rh. Hauniversita
Ramat Aviv
P.O. Box 17120
Tel Aviv

Type: Government, Prime Minister's Office

Subjects: advises the Government on long-term policies,
priorities and the advancement of nuclear research
and development; supervises the implementation of
approved policies; represents Israel in relations
with scientific institutions and organizations
abroad.

Affiliates: 1) Negev Research Centre
2) Soreq Research Centre

Name: BAR-ILAN UNIVERSITY
Ramat-Gan

Type: Private

Director: E. Rackman

Affiliates: Faculty of Natural Science and Mathematics
Dean: Yigal Cohen

Name: BEN GURION UNIVERSITY OF THE NEGEV
P.O. Box 653
Beersheva 84120

Director: Yosef Tekoah

- Affiliates: 1) Institute for Desert Research
 Sde Boker
 Dean: L. Berkofsky
 Subjects: correlation factors affecting drought-vegetation-rainfall, ecosystems research, seawater greenhouse, algae in brackish water as high-protein food additive.
- 2) Research and Development Authority, Applied Research Institute
 P.O. Box 1025
 Beersheva 84110
 Director: Joel Schechter
 Subjects: exploration of aridity in the Negev, with emphasis on use of raw materials and development of its economic potential, brackish water and waste water desalination, health and environmental problems in the Negev, physiological and agronomic aspects of arid zone crops, industrial electronics, solar energy, industrial chemistry and engineering.
- Name: BETH SORON AGRICULTURE AND NATURE STUDY INSTITUTE
 Deganya A 15120
 Emeq Ha-Yarden
 Director: S. Lulav
 Subjects: Regional Research and Museum of Natural History of the Kinneret (Lake of Galilee) region.
- Name: BIOLOGY MASTERS ASSOCIATION
 4 Hermann Cohen St.
 Tel Aviv
- Name: BOTANICAL SOCIETY OF ISRAEL
 c/o the Hebrew University
 Rehovot
 Director: N. Sharon
- Name: THE CENTER FOR INDUSTRIAL RESEARCH
 Technion City, Haifa
 Type: Private
 Director: Prof. Z. Resnick
 Subjects: industrial development by the application of basic-research results to production, e.g. food technology, plastics, textile and fibres, minerals, and industrial chemistry.

- Name: CENTRAL LABORATORY FOR PREVENTION OF AIR
POLLUTION AND RADIATION HAZARDS
c/o Tel Hashomer Government Hospital,
Building 21
Type: Government, Ministry of Health, Department of
Sanitation
Director: A. Donagi
Subjects: surveys fields of radiation, measures air
pollution and radiation, registers and inspects
radiation producing appliances
- Name: DEPARTMENT OF SURVEYS
Ministry of Labor
P.O. Box 622941, 1 Rechor Lincoln
Tel Aviv
Type: Government
Director: Ron Adler
- Name: ENTOMOLOGICAL LABORATORY
Russian Compound, Jerusalem
Type: Government, Ministry of Health, Department of
Sanitation
Subjects: identification of insects of medical importance,
applied research in the control of harmful
insects, testing of new insecticides.
- Name: ENTOMOLOGICAL SOCIETY OF ISRAEL
c/o Volcani Institute of Agricultural Research
Rehovot, P.O. Box 15
Director: E. Rivnay
Publications: Journal of the Entomological Society of Israel
- Name: ENVIRONMENTAL PROTECTION SERVICE
Prime Minister's Office
3 Hakiryia Bldg.
3 Jerusalem
Publications: Selected papers on the environment in Israel.
- Name: GEOLOGICAL INSTITUTE OF ISRAEL
30 Malkhe Yisrael St.
Jerusalem
Director: E. Zohar
- Name: GEOLOGICAL SURVEY OF ISRAEL
30 Malkhe Yisrael St.
Jerusalem
Type: Government; Ministry of Development
Director: Arnon Arad
Affiliates: maintains seismic stations at Jerusalem and
Haifa and nine research labs specializing on
various aspects of geology.

Name: THE HEBREW UNIVERSITY OF JERUSALEM
 P.O. Box 1172
 Jerusalem

Type: Private

Director: Avraham Harman

Affiliates: 1) Center for Environmental Studies

Director: S. Orshan

Subjects: physical and social aspects of arid environments; mechanics of desert runoff and floods, slope development under arid conditions, groundwater research, desert rainfall, desert ecosystems, physiology of desert plants, pastures under semiarid conditions, afforestation, eutrophication, adaptation of populations to arid environments.

2) Department of Atmospheric Sciences

Head: S. Neumann

Subjects: physics of clouds and precipitation, rainfall enhancement

3) Department of Botany

Director: S. Orshan

Subjects: taxonomy, ecology, geography, physiology and anatomy of plants.

4) Department of Geology

Director: Y.K. Bentor

Subjects: geologic mapping, petrology and paleogeography, desert weathering, hydrogeology, salination of water and soils, geochemistry and sedimentation in the Dead Sea.

5) Department of Geography

Director: Y. Ben-Arieh

Subjects: geomorphology with emphasis on weathering, erosion, wadi transport and hydrography; climatology; planning in arid areas; settlement and sedentarization of nomadic populations; and mutual influences of arid environments and development in arid areas.

6) Hadassah Medical School and Department of Zoology

P.O. Box 1172

Jerusalem

Subjects: ecology, physiology, metabolism, parasitology, and pathology of desert animals, physiological adaptations to arid environments, and selection and breeding of desert rodents.

Name: HYDROLOGICAL SERVICE
Jerusalem
Type: Government

Name: THE INDUSTRIAL RESEARCH ORGANIZATION
13 Ben Yehuda St.
Jerusalem
Type: Government, Ministry of Commerce and Industry
Director: Yitzhak Yaakov

Name: THE INSTITUTE FOR FIBRES AND FOREST PRODUCTS
3 Emck Refaim St.
P.O. Box 8001
Jerusalem
Type: Private
Director: M. Lewin

Name: INSTITUTE FOR PETROLEUM RESEARCH AND GEOPHYSICS
1 Hamashbir St.
Holon
Type: Private
Director: Z. Ben-Ari
Subjects: exploration of petroleum, water and mineral resources; engineering studies in Israel and abroad; documentation unit and data processing centre.

Name: INTERNATIONAL COMMITTEE ON PLANT ANALYSIS AND FERTILIZER PROBLEMS
c/o R.M. Samish
Hebrew University
Rehovot

Name: ISRAEL ACADEMY OF SCIENCES AND HUMANITIES
P.O. Box 4040
Jerusalem
Type: Private
Director: Aryeh Dvoretzky
Chairman of Science: Yigal Talmi
Subjects: promotes work in the sciences and humanities, advises the government on scientific problems, and maintains international contacts.

Name: ISRAEL DESALINATION ENGINEERING (ZARCHIN PROCESS) LTD.
P.O. Box 18041
Tel Aviv
Type: Joint, government and private, Ministry of Development and Colt Industries.
Director: N. Berkman
Subjects: water desalination technology.

- Name: ISRAEL EXPLORATION SOCIETY
3 Shemuel Ha-Nagid St.
P.O. Box 7041
Jerusalem
- Type: Private
Director: E. Masar
- Name: ISRAEL GEOGRAPHICAL SOCIETY
23 Dept. of Geography
Hebrew University
Jerusalem
- Director: Prof. D.H.K. Amiran
- Name: ISRAEL GEOLOGICAL SOCIETY
P.O. Box 1133
Jerusalem
- President: M. Goldberg
- Name: ISRAEL INSTITUTE FOR BIOLOGICAL RESEARCH
P.O. Box 19
Nes Ziyona
- Type: Government, Prime Minister's Office
Director: I. Hertman
Subjects: Both basic and applied research in fields dealing with bacterial, rickettsial, viral, and mycotic diseases; oncology, air pollution, polymer science, insecticides, development and screening of new drugs.
- Name: ISRAEL METEOROLOGICAL SERVICE
Ministry of Transport
P.O. Box 25
Bat Dagan
- Type: Government, Ministry of Transport
Director: P.L. Tokatly
Subjects: General and local meteorology and climatology
- Name: ISRAEL MINING INDUSTRIES
Haifa Bay
P.O. Box 303
Haifa 31000
- Type: Private
Director: M. Reis
Subjects: research and development in natural resources, particularly the development of petrochemical industries.
- Name: ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH COMPANY
P.O. Box 1793
Haifa 31000
- Type: Private
Director: Y. Bin Nun

Name: ISRAEL SOCIETY OF SOIL SCIENCE
 c/o National and University Institute of
 Agriculture
 P.O. Box 15
 Rehovot

Name: ISRAEL SOIL CONSERVATION AND DRAINAGE DIVISION
 Soil Erosion Research Station
 P.O. Ruppin Institute of Agriculture
 Emek Hefer

Type: Government, Ministry of Agriculture
 Director: Dan Rosenzweig
 Subjects: hydrology, drainage, infiltration, erosion, and
 land use in arid and semiarid environments.

Affiliates: Soil Erosion Research Station
 Director: N.S. Seligman
 Subjects: soil erosion, hydrological balance
 in catchment basins, consumption of
 water by various vegetation types and
 effects on hydrological balance of
 Carmel region.

Name: LOCUST RESEARCH LABORATORY
 c/o Ministry of Agriculture
 6 Deror St., Yafó

Type: Government, Ministry of Agriculture, Plant
 Protections Department
 Director: R. Gabrielith-Shpan

Name: NATIONAL CENTRE OF SCIENTIFIC AND TECHNOLOGICAL
 INFORMATION

84 Hachashmoniam St.
 P.O. Box 20125
 Tel Aviv

Director: C. Keren
 Subjects: advancement and coordination of scientific and
 technological information activities; training
 professional manpower in information science;
 to provide international contacts in the fields
 of information.

Publications: Guides to Sources of Information, Call lar to
 Forthcoming Scientific and Technological Meetings
 in Israel, Desalination Abstracts, Artificial
 Rain, and Contents Pages in Electricity and
 Electronics.

Name: NATIONAL COUNCIL FOR RESEARCH AND DEVELOPMENT
 3 Hakirya Bldg.
 Jerusalem 91000

Type: Government, Prime Minister's Office
 Subjects: advises on national policy for applied research
 and technological development, evaluates
 research needs, importance and industrial
 applicability.

- Name: THE NATURAL RESOURCES RESEARCH ORGANIZATION
38 Keren Hayesod St.
Jerusalem
Type: Government
Director: A. Hermoni
Subjects: defines research and development needs in natural resources; plans and directs the research institutes under its jurisdiction.
- Name: RODENT RESEARCH LABORATORY
c/o Ministry of Agriculture
6 Deror St., Yafa
Type: Government, Ministry of Agriculture, Plant Protection Department
Director: J. Naghtali
Subjects: biological and ecological research on harmful rodent species, regular surveys on rodent populations and testing of pesticide efficiency and application methods.
- Name: SOCIETY FOR THE PROTECTION OF NATURE IN ISRAEL
c/o University, Tel-Aviv
Director: A. Zahavi
- Name: TAHAL-WATER PLANNING FOR ISRAEL
Tel-Aviv
Director: Aaron Weiner
- Name: TECHNION-ISRAEL INSTITUTE OF TECHNOLOGY
Haifa
Telegraphic Address: Technion, Haifa
Director: Amos Horev
Affiliates: 1) Building Research Station
Technion City 32000
Haifa
Head: Elisha Shklarsky
Subjects: heat and moisture transfer in buildings, human requirements in relation to climate, building design and construction, use of solar radiation as energy source in buildings.
Publications: In the Field of Building
2) Bruner Institute of Transportation
3) Centre for Research in Environmental Engineering
4) Centre for Research in the Economics of Technology
5) Centre for the Study of Man at Work
6) Centre for Urban and Regional Studies
7) Coastal and Ocean Engineering Centre
8) Fertilizer and Soil Laboratory
9) Food Industries Research and Development Station
10) Laboratory for the Technology of Plastic Materials

- 11) Mineral Engineering Research Centre
- 12) Operations Research Centre
- 13) Road Safety Centre
- 14) Solid State Institute
- 15) Stone Technology Center

Name: TEL-AVIV UNIVERSITY
Ramat-Aviv

Director: Prof. H. Ben-Shahar

Affiliates: 1) Department of Botany, Division of Ecology
and Plant Nutrition
Head: J. Galil (Department of Botany)
Subjects: adaptation of plant life to desert
habitats; autecology of halophytes,
nutrition of plants under stress,
mechanisms of ion uptake and trans-
location, water relations of forest
trees and desert conditions

2) Department of Environmental Sciences
Head: J. Otterman
Subjects: overgrazing using satellite
imagery

3) Institute for Nature Preservation Research

4) Institute for Petroleum Research and Geophysics

5) Interdisciplinary Center for Technological
Analysis and Forecasting

6) Israel Institute for Biological Research

7) Kimron Veterinary Institute

8) Medical School, Climatic Research Unit
Tel-Hashmer Hospital
Director: Ezra Sohar
Subjects: physiology of man in hot climates

9) Shiloah Center for Middle Eastern and
African Studies
Tel-Aviv University
Ramat-Aviv
P.O. Box 39012
Head: Haim Skaked

10) University Institute of Petroleum and Energy
Studies

Name: UNITED STATES - ISRAEL BINATIONAL SCIENCE
FOUNDATION
P.O. Box 7677
Jerusalem

Type: Private

Director: Zeev Rotem

Subjects: funds numerous projects in the fields of agri-
culture, biology, physics, energy, oceanography,
limnology, mathematics, health sciences, earth
science, and environmental science

Name: THE WEIZMAN INSTITUTE OF SCIENCE
 P.O. Box 26
 Rehovot
 Type: Private
 Director: Michael Sela
 Affiliates: 1) Isotope Research Department
 Subjects: isotopic methods in geochemical
 and geophysical studies
 2) Plant Genetics Department
 Principal investigators: D. Atsmon, M. Feldman
 Subjects: breeding wheat and barley for drought
 resistance, test in climate chambers,
 measurement of root development,
 stomatal behavior and water relation-
 ships.
 Publications: Annual Report

Name: WORLD ACADEMY OF ART AND SCIENCE
 1 Ruppia St.
 Rehovot

Name: ECOLOGICAL SOCIETY OF ISRAEL
 c/o Dept. of Zoology
 Tel Aviv University
 Tel Aviv
 Director: Y. Loya

JORDAN

Institutions

- Name: AGRICULTURAL INSTITUTE
Tulkarm
West Bank, via Israel
Director: S.A. Nashef
- Name: BETHLEHEM UNIVERSITY
P.O. Box 9
Bethlehem
West Bank, via Israel
Director: Joseph P. Lowenstein
- Name: BIRZEIT UNIVERSITY
P.O. Box 14
Birzeit, via Israel
Director: Hanna Nasir
- Name: DEPARTMENT OF AGRICULTURE AND SCIENTIFIC
RESEARCH AND EXTENSION
P.O. Box 226 and P.O. Box 2177
Aminan
Director: Said Ghezawi
- Name: DEPARTMENT OF LANDS AND SURVEYS
P.O. Box 70
Aminan
Director: Badri Al-Mulgi
Subjects: cartography
- Name: JORDAN NATIONAL GEOGRAPHIC CENTRE
P.O. Box 20214
Amman
Director: R. Majali
Subjects: cartography
- Name: JORDAN METEOROLOGICAL DEPARTMENT
Amman Civil Airport
Amman
Type: Government, Ministry of Transport
Director: Ghazi M. El-Rifai
Subjects: climatology and agrometeorology
Publications: Climatological Atlas of Jordan, Handbook of
Climatological Data
- Name: JORDAN RESEARCH COUNCIL
P.O. Box 6070
Amman
Director: Issam Khairy
- Name: MINES AND GEOLOGICAL SURVEY DEPARTMENT
P.O. Box 39
Ministry of National Economy
Amman
Type: Government, Ministry of National Economy
Director: Kassem El Umari
Subjects: geology

Name: MINISTRY OF AGRICULTURE, DEPARTMENT OF SCIENTIFIC RESEARCH
 Amman
 Type: Government
 Subjects: saline land reclamation, range improvement, flora and fauna preservation, soil classification, ecology, agroclimatology
 Publications: Yearly Reports, Quarterly Reports
 Affiliates: Experiment Station at Jafer

Name: NATIONAL RESOURCES AUTHORITY
 Box 7
 Amman
 Type: Government
 Director: Imar Abdullak
 Subjects: cartography, geology, hydrology, minerals, petroleum regulation
 Affiliates: Water Resources Division
 Chairman: Usara Khalil
 Subjects: exploring and developing groundwater and surface water resources, coordinating hydrological and meteorological activities, water resources research
 Publications: Annual Report, Annual and Technical Reports on Rainfall and Evaporation

Name: KING ABDULLAH'S COLLEGE
 P.O. Box 4445
 Amman
 Director: Albert Butros

Name: UNIVERSITY OF JORDAN
 P.O. Box 1682
 Amman
 Director: Ishak Farhan
 Affiliates: Faculty of Agriculture
 Dean: Subhi Qasem
 Subjects: crop production, irrigation, waste management

Name: YARMOUK UNIVERSITY
 P.O. Box 566
 Irbid
 Director: Adnan Badran

KUWAIT

Institutions

- Name: AGRICULTURAL EXPERIMENT STATION
c/o Agricultural Department
Ministry of Public Works
Kuwait
- Type: Government, Ministry of Public Works
- Director: S.I. Al-Mannai
- Subjects: arid zone studies, soil conservation, plant protection, agriculture, fisheries
- Publications: Reports, Bulletins
- Name: KUWAIT INSTITUTE FOR SCIENTIFIC RESEARCH
P.O. Box 12009
Kuwait
- Type: Government, Council of Ministers
- Director: Adnan Shihab-Eldin
- Subjects: revegetation of desert areas, greenhouse technology, forage improvement, animal nutrition development of new food sources, marine biology, petroleum, arid zone agriculture
- Affiliates: Scientific and Technical Information Center
- Name: SCIENCE AND NATURAL HISTORY MUSEUM
Ministry of Education
Kuwait
- Type: Government, Ministry of Education
- Director: Hammad M. Al-Ateeqi
- Publications: Museum Notes
- Name: UNIVERSITY OF KUWAIT
P.O. Box 5969
Kuwait
- Type: Government
- Director: Hassan Al-Ebraheem
- Affiliates: Department of Botany
Chairman: K. Al-Kaisi
- Subjects: botanical studies, marine algae and phytoplankton, soil and air bacteria and fungi, cytogenetics, plant breeding, physiology, medical microbiology.
- Publications: Journal of the Univ. of Kuwait (Science)

LEBANON

Institutions

- Name: AMERICAN UNIVERSITY OF BEIRUT
Beirut
Type: Private
Director: C.S. Lichtenwalner
Affiliates: Department of Geography
Subjects: use of water resources, especially irrigation, in Syria, Lebanon, and Jordan.
- Name: BEIRUT ARAB UNIVERSITY
Tarik El-Jadide
P.O. Box 5020
Beirut
Type: Private
Director: M.H. El-Khouly
- Name: BEIRUT UNIVERSITY COLLEGE
P.O. Box 11-4080
Beirut
Type: Private
Director: Albert Badre
- Name: CONSEIL NATIONAL DE LA RECHERCHE SCIENTIFIQUE
Beirut
Director: M. Le Lannou
Subjects: coordinating a national effort to check environmental deterioration.
- Name: HAIGAZIAN COLLEGE
P.O. Box 1748
Beirut
Type: Private
Director: John J. Markarian
- Name: INSTITUTE OF AGRICULTURAL RESEARCH
Tel-Amara
Riyāq
Type: Government
Director: Joseph Haraoui
Subjects: irrigation, soil science, ground cover regeneration, studies on evapotranspiration and water requirements of different crops.
- Name: UNIVERSITE LIBANAISE
Bir Hassan
Beirut
Type: Government
Director: Butros Deeb
Affiliates: Institute of Information

SAUDI ARABIA

Institutions

- Name: DIRECTORATE GENERAL FOR MINERAL RESOURCES
Jiddah
Type: Government
- Name: HOFUF AGRICULTURAL RESEARCH CENTRE
Ministry of Agriculture and Water
Type: Government
Publications: Publications of Univ. College North Wales and
Ministry of Agriculture and Water, Saudi Arabia,
Joint Agricultural Research and Development
Project, nos. 1-
- Name: KING FAISAL UNIVERSITY
P.O. Box 1982
Dammam
- Name: KING ABDULAZIZ UNIVERSITY
P.O. Box 1540
Jeddah
Type: Government, Ministry of Higher Education
Affiliates: 1) Department of Botany
Chairman: Hassan H. Hajara
Subjects: desert ecology, flora, fauna,
parasitology, microbiology,
taxonomy.
- 2) Institute of Meteorology and Arid Lands
Studies
Chairman: Abdulbar A. al-Gain
Subjects: development of programs in meteor-
ology, hydrology, water resources,
and grazing.
- Name: PETROLEUM AND MINERALS UNIVERSITY
Dhahran
Type: Government, Ministry of Petroleum and Mineral
Resources
- Name: TECHNICAL INSTITUTE
Riyadh
- Name: UNIVERSITY OF RIYADH
Riyadh
Type: Government, Ministry of Higher Education

SUDAN

Agencies

- Name: AGRICULTURAL RESEARCH CORPORATION
 Ministry of Agriculture
 P.O. Box 136
 Wad Medani
 Director: Osman Muhammad Salih
- Name: AGRICULTURAL RESEARCH DIVISION
 Gezira Research Station
 Wad Medani
 Type: Government, Ministry of Agriculture
 Director: H. Idris
 Subjects: irrigated and rainland agriculture, soil and cotton studies, agronomy of various dryland crops.
- Name: ASSOCIATION OF AFRICAN UNIVERSITIES
 O's University
 P.O. Box 331
 Khartoum
- Name: JAIBO UNIVERSITY, KHARTOUM BRANCH
 P.O. Box 1055
 Khartoum
- Name: DEPARTMENT OF ANIMAL PRODUCTION RESEARCH DIVISION
 P.O. Box 293
 Khartoum
 Type: Government, Ministry of Animal Resources
 Director: A.A. El Karib
 Affiliates: Southern Darfur Range and Livestock Centre
 P.O. Box 64
 Nyala - Darfur
- Name: FOREST RANGERS COLLEGE
 P.O. Box 6164
 Khartoum
 Director: E. Satti
- Name: FORESTRY RESEARCH AND EDUCATION CENTER
 P.O. Box 658
 Khartoum
 Type: Government, Ministry of Agriculture, Forest Dept.
 Director: D.A. Lane

Subjects: forest reconnaissance and survey; hormone trials, artificial regeneration, rate of tree growth, gum fields, factors injurious to Acacia senegal, chemistry of gum Arabic.

Name: GEOLOGICAL AND MINERAL RESOURCES DEPARTMENT
P.O. Box 410
Khartoum

Type: Government, Ministry of Industry and Mining

Director: Yousif Suleiman

Subjects: geological mapping, mineral exploration and development, groundwater investigating oil exploration.

Publications: Bulletins, Memoirs

Name: GEOLOGICAL SURVEY DEPARTMENT
P.O. Box 410
Khartoum

Type: Government, Ministry of Mineral Resources

Director: M.A. Abdulla

Subjects: soil cartography, geological survey, groundwater investigations.

Name: GENERAL ADMINISTRATION FOR NATURAL RESOURCES
Khartoum

Type: Government, Ministry of Agriculture, Food and Natural Resources

Name: INSTITUTE OF CIVIL ENGINEERING AND ARCHITECTURAL
TECHNICIANS
Khartoum

Director: M. Amin Zeidun

Name: INSTITUTE OF LABORATORY TECHNOLOGY
Khartoum

Director: A.A. Akoor

Name: INSTITUTE OF MECHANICAL AND ELECTRICAL ENGINEERING
Khartoum

Director: S.B. Gar El Nabi

Name: INSTITUTE OF MECHANICAL ENGINEERING
Atbara

Director: F. Adan

Name: INSTITUTE OF SURVEY TECHNICIANS
Khartoum

Director: M.O. Adam

Name: NATIONAL COUNCIL FOR RESEARCH
P.O. Box 2404
Khartoum

Director: H.E. Wadie Habushi

- Affiliates: 1) Agricultural Research Council
 2) Scientific and Technological Research Council
 3) National Computer Centre
 4) Scientific and Technological Potentials Survey Unit

Name: SUDAN INLAND FISHERIES RESEARCH INSTITUTE
 2 - Game and Fisheries Department of the Ministry of
 Animal Resources
 P.O. Box 336
 Khartoum

Type: Government, Ministry of Animal Resources

Director: F.T. Madani

Subjects: fish farming

Name: SUDAN NATURAL HISTORY MUSEUM
 P.O. Box 301
 University of Khartoum
 Khartoum

Director: Sayal T. Abushama

Name: UNIVERSITY OF KHARTOUM
 P.O. Box 301
 Khartoum

Type: Government

Director: H. Karim Dafalla

Affiliates: 1) Arid Zone Research Unit

Chairman: M.A. Kassas

Subjects: improvement of land use, improvement and
 diversification of crop and animal pro-
 duction, groundwater geology, geomorphol-
 ogy, climate, adaptation of animals to
 aridity, zoogeography, soil studies.

Publications: Guide to the Natural History of
 Khartoum Province, Annual Report.

Note: as of September, 1978, this unit is under
 the Department of Botany

2) Faculty of Agriculture

P.O. Box 21

Khartoum North

Dean: M.A. Nour

Affiliates: 2.1) Department of Agricultural Botany
 Senior Lecturer: A. Gadir Ali

2.2) Department of Agricultural Chem-
 istry and Pedology

Head: D.R. Drover

2.3) Department of Agriculture

Head: M. Said Bayoumi

2.4) Department of Agricultural
 Engineering

Head: F. Coleman

2.5) Department of Crop Protection

Head: M.A. Nour

- 2.6) Department of Horticulture
Head: J.P. Hudson
Subjects: water relations and
other aspects of plant
growth in hot arid
conditions.
- 3) Faculty of Medicine
P.O. Box 102
Khartoum
Dean: H. Butler
Affiliates: 3.1) Department of Bacteriology and
Parasitology
Head: J.M. Dunbar
3.2) Department of Physiology
Head: J.B. Lynch
3.3) Department of Public Health
Acting Head: A.M.A. El Shami
- 4) Faculty of Science
Dean: Mustapha Hassan Ishag
Affiliates: 4.1) Department of Botany
Head: K.N.G. MacLeay
4.2) Department of Geology
Head: A.J. Whiteman
4.3) Department of Zoology
Head: J.L. Cloudsley-Thompson
- 5) Faculty of Veterinary Science
P.O. Box 32
Khartoum North
Dean: A.A. El Karib
Affiliates: 5.1) Department of Animal Health
Head: C. Perumal Pillai
5.2) Department of Animal Husbandry
Head: A.I. Gillespie
- 6) Hydrobiological Research Unit
c/o University of Khartoum
P.O. Box 321
Khartoum
Director:
Subjects: hydrobiology and sedimentology

INSTITUTIONS

- Name: ACADEMY OF DAMASCUS
Damascus
- Name: ARAB ACADEMY
Damascus
- Name: ARAB CENTER FOR THE STUDIES OF ARID ZONES AND
DRY LANDS
P.O. BOX 2447
Damascus
- Type: regional, controlled by a Board of Directors
representing the member states
- Director: Mohamed El-Khashk
- Subjects: regional studies among Arab countries including
water resources, soil classification, soil-water
relationships, field crops, pastures, sheep
improvement, range management, crop rotation,
soil conservation.
- Publications: Papers in several series, Reports, Annual
Technical Reports
- Name: MINISTRY OF AGRICULTURE, STEPPE DEPARTMENT
Damascus
- Type: Government
- Director: F. Ladkany
- Subjects: range improvement
- Publications: Reports
- Affiliates: Wadi Al Alazib Range and Sheep Experiment Station
- Name: NEAR EAST FOUNDATION
B.P. 427
Damascus
- Name: TISHREEN UNIVERSITY
Lazikiah
- Director: S. Yassin
- Name: UNIVERSITY OF ALEPPO
Aleppo
- Type: Government
- Director: A.Y. Hassan
- Affiliates: 1) Agricultural Research Centre
2) Technical Institute for Agriculture
- Name: UNIVERSITY OF DAMASCUS
Damascus
- Type: Government
- Director: Abdul-Razzak Kaddoura
- Affiliates: Department of Botany
Chairman: B. Hazzi
Subjects: systematic study of Flora of Syria

APPENDIX D

SUBJECT BIBLIOGRAPHIES

Note: the references included in these bibliographies were extracted from a variety of sources, as explained in the note to Table 2 contained in the Survey of Existing Conditions. We feel that these references represent a significant percentage of the literature available on these subjects which reports on studies or assessments done within each country during the last two decades.

Subjects: Biology
Dead Sea
Desertification
Environmental Considerations and Policies in
Development and Resource Management
Forestry
Geology
Mineral Development
Pollution
Range Management
Sand Dune Stabilization
Soils
Water Harvesting
Weather

BIOLOGY

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- . 1966. Microclimatic conditions in Wadi Hoff. Bull. Soc. Geographie d'Egypte 39:137-153.
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APPENDIX E

REFERENCES CONCERNING HALOPHYTES

Note: Included here are studies dealing with the ecology, potential for use as forage plants, and cultivation techniques of various species of salt-tolerant plants.

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