PN ABD 085

FIRST DRAFT

THE BIOLOGICAL RESOURCES OF THE ARAB REPUBLIC OF EGYPT

STATUS AND RECOMMENDED CONSERVATION NEEDS

NOVEMBER 4, 1988

Malcolm F. Baldwin
David Ferguson
Kathryn A. Saterson
I. Eugene Wallen

Prepared For

The U.S. Agency for International Development
Office of Science and Technology

Cairo, Egypt

ACKNOWLEDGEMENTS

This assessment, at the request of USAID Cairo, was conducted in Egypt from February 21 to March 13, 1988. The assessment team included the team leader Mr. Malcolm F. Baldwin, an environmental lawyer and independent consultant; Mr. David Ferguson, a wildlife management specialist with the U.S. Fish and Wildlife Service; Dr. Kathryn A. Saterson, a Natural Resource Officer with the Asia/Near East Bureau of A.I.D., who was responsible for the initial scope-of-work and coordinated production of the draft report; and Dr. I. Eugene Wallen, a marine pollution specialist and independent consultant.

The assessment team would like to acknowledge Dr. El-Mohamadi El-Sayed Eid, Chairman of the Egyptian Environmental Affairs Agency, for his assistance in arranging the cooperation of the Egyptian Wildlife Service and the Academy for Scientific Research and Technology. Our thanks to Dr. Mohamed Amer, Director of the Egyptian Wildlife Service (EWS), for making his staff available to us. With the generous and enthusiastic support of the EWS, the team was able to spend almost half of its time visiting sites and individuals outside of Cairo. The success of our field visits were due, in particular, to the gracious assistance of Mr. Gawad El Attar, Mr. Sayed Gamei, and Mr. Nael Abu Zaid. Dr. Samir Ghabbour provided essential background material and assistance in contacting people in Cairo. We are also grateful to Dr. Sharif Arif and Mr. Lawrence Ervin of USAID/Cairo, Office of Science and Technology, for their guidance and advice.

TABLE OF CONTENTS

	PAGE
Acknowledgements	i
Table of Contents	ii
List of Figures and Tables	iii
Executive Summary	1
I. Introduction	7
II. Background: The Biological Resources of Egypt	9
1. Natural Ecosystems	9
2. Flora and Fauna	18
III. Legislative and Institutional Structure	21
1. Government of Egypt	21
2. International Conventions	26
3. Non-Governmental Organizations	30
4. Implementation of Laws	33
IV. Status and Management of Protected Areas	37
V. Conservation Outside of Protected Areas	43
1. Natural and Managed Ecosystems and Development Impacts	
A. Coastal and Wetland Systems	43
B. Inland Systems	46
1. Desert/Oasis Systems	
2. Agricultural Systems	
C. Mechanisms for Anticipating and Preventing Impacts	51
2. Species and Germplasm Conservation	52
A. Endangered Species Status and Protection	52
B. Ex-Situ Conservation	57
C. Economically Important Species	58
VI. Major Conclusions and Issues Related to the Conservation of Biological Resources in Egypt	63
VII. Recommendations for Actions Necessary to Conserve Egypt's Biological Resources	70
V. Literature Cited	79
Appendices	
1. Annotated Literature Search on Egypt's Biological Resources	81
2. List of Persons and Institutions Contacted	82

FIGURES AND TABLES

Page

Figures

1. Natural vegetation of egypt 10
2. General vegetation types of Sinai 11
3. Wetlands of Egypt 14
4. Proposed and Existing Protected Areas 39

Tables

1. Endangered species of Egypt 55

EXECUTIVE SUMMARY

THE BIOLOGICAL RESOURCES OF THE ARAB REPUBLIC OF EGYPT STATUS AND RECOMMENDED CONSERVATION NEEDS

Egypt's biological resources are as important as its cultural monuments. Its deserts and oases contain rare and endangered plants and animals some of which are found nowhere else. Its coral reefs on the Red Sea and Sinai coasts have unsurpassed beauty and complexity. The lakes of the Nile Delta constitute one quarter of all Mediterranean wetlands and offer essential refuge for migratory birds. The Nile islands at Aswan offer an environment to sustain many of the plant species that were prolific in ancient Egypt.

Egypt has recognized these values. In this decade Egypt has passed laws and established institutions to protect its unique plants, animals, and ecosystems:

o the Environmental Affairs Agency (EAA), responsible to the Prime Minister's office and currently administered by the Ministry of State for Cabinet Affairs, now oversees all facets of the environment, including the protection of critical biological resources;

o Egypt has ratified several international conventions that commit it to the conservation of biological resources;

o Law 102, a landmark law adopted in 1983, provides for Natural Protectorates. Seven have been established to preserve areas in the desert, islands in the Nile River, and coastal marine and freshwater systems;

o a 1982 law strives for control of pollution of the Nile and other waterways, decrees protect Egyptian topsoil from depletion, and other environmental laws are being prepared that can help protect biological resources;

o several universities throughout the country have new environmental curricula, and research programs to study biological resources, evaluate problems, and provide technical advice to government agencies;

o the Egyptian Wildlife Service (EWS) has a trained cadre of wildlife experts able to apply scientific management to the natural protectorates, and has proposed the addition of 10 more areas;

o public and mass media concern about environmental conservation has increased strongly within the last five years, and it continues to build;

o new urban parks, gardens, and greenbelts are being created in and around Cairo, Nasr City, Alexandria, and elsewhere, offering new opportunities for public appreciation of the environment and its biological resources.

o foreign tourist interest in Egypt's biological resources is rising, particularly around the spectacular coral reefs and sandy beaches of the Sinai and Red Sea;

o popular and academic interest has focused on links between the conservation of plants and animals with ancient Egyptian culture and the teachings of religion, especially Islam;

These events and changes illustrate the reawakening of Egypt to the close relationship between environmental protection and the health and welfare of the Egyptian people.

Nevertheless Egypt's biological resources are threatened, and the positive forces of environmental concern must focus on immediate actions to protect the nation's natural heritage from severe degradation. Egypt's biological resources suffer from relentless oil and other toxic substance pollution, unplanned development, inadequate application and understanding of the laws, and, in many cases, lack of management. These impacts may soon reduce promising prospects of economic returns from tourism, fishing, agriculture, and other development. They threaten to diminish, if not eliminate, biological resources that are invaluable to Egyptian and world science, culture, and aesthetic appreciation.

The most urgent actions requiring the attention of the Egyptian government and other institutions are discussed below, followed by a summary of the areas needing support over the longer term.

Issues for Immediate Attention

A. Oil pollution of coastal resources

Oil pollution presents a significant threat to Egypt's coral reefs, commercial fisheries, birds, mangroves, and other coastal and marine resources. The Egyptian coast, including the beaches and offshore reefs, from Suez to Hurghada on the Red Sea is coated with tar and petroleum residues from ships, off shore oil facilities, and oil pipelines. The problem is reputed to be as serious farther south. On the shores of the Sinai Peninsula oil pollution from a 1984 pipeline spill, a 1987 ship spill, and other releases has caused signs of stress in the mangroves at Ras Mohamed. Along the Mediterranean coast oil pollution plagues beaches and harms fisheries and birds.

The long-term health of Egypt's coastal resources is endangered by these observable impacts from accidents and apparently routine petroleum operations.

o Oil pollution can be vastly reduced. Application of "best management practices" on offshore oil platforms and pipelines have substantially controlled pollution from drilling muds and routine production operations in other seas.

o Control of shipping pollution is more difficult, but it must be significantly reduced to conserve Egypt's priceless coastal resources. Their protection will require application of technical talent to petroleum operations and vigorous enforcement of pollution controls, such as the actions Egypt took against a Dutch tanker after a September 1987 oil spill off the South Sinai coast.

o To respond to accidents that may still occur, cleanup and protection equipment should be available under contingency plans to reduce oil pollution impacts in sensitive areas.

B. Tourism impacts and opportunities

Tourism in sensitive biological areas can bring great economic benefits over the long term if it is carefully controlled. The desire to see Egypt's magnificent coral reefs and associated marine fish and coastal waters has brought tens of thousands of tourists to the Red Sea and resulted in economic returns to Egypt. Increasing numbers of tourists flock to the Nile Island area at Aswan. The economic benefits can be substantial, but they are sustainable only if the biological resources which people come to see are strongly protected.

The once-rich coral and shell fish region around Hurghada has become a comparative desert, while steady hotel and tourist village development rapidly continues. Tourists must go ever farther away from their hotels to view the coral ecosystem that they came to see. Some local scuba diving schools practice rigorous controls over the taking of corals and shells, but enforcement and public education programs in the region are very weak. At Aswan, where the biota of ancient Egypt is being recreated for the benefit of science and tourism, the placement of new hotels and tourist facilities needs careful control. The natural protectorate requires buffering from development to avoid destruction of the biological resources and the aesthetic opportunity that blends ancient Egypt with its modern environment.

While some coastal degradation can be traced to adverse

impacts of oil pollution, the rapid destruction in local areas can be directly related to unmanaged hotel and tourist development. Physical damage to coastal resources results from construction techniques in and around the reefs and other facilities and the concurrent siltation from runoff of loose material. Piers and jetties can interrupt water currents and change sand movement. Corals are damaged by boats anchoring directly onto the reefs and by collection of coral and shells by and for tourists. Indirect effects, often long-term, come from water quality changes due to untreated sewage or wastes from tourist-related facilities. Plastic and paper trash, along with fishing nets and lines, can become fouled with, coral, and birds, and can be ingested by fish, creating unattractive sights for tourists, who may not wish to return.

What has been happening at Hurghada is likely to happen at Ras Mohamed and other similar areas under development if preventive measures are not taken. Steps should be made to manage tourism in accordance with scientific requirements. Law 102 authorizes control over the location of tourist facilities adjacent to reserves.

o Controls must also be exercised over the location and timing of construction of other facilities planned to bring tourists to the protectorates.

o Tourist promotion should include public education programs and a requirement for a biologically sound management plan to protect fragile marine and terrestrial communities.

C. Germ plasm preservation

Egypt is the cradle of civilization and the birthplace of agriculture that has thrived for millennia along the Nile. The wild grains and animals of the desert and Nile Valley provided the natural basis for this culture. Egypt's ancient poetry and cultural heritage celebrates the value of these species, many of which are now extinct.

o The conservation of commercially valuable plant and animal species, and their landraces and wild relatives, are important to Egypt's economic future. There is a need for field collections and germ plasm storage in order to conserve the genetic variability of crop species that have been cultivated for thousands of years: clover (Birsim), alfalfa, wheat, barley, sorghum, lentils, fava bean, onion, garlic and oil crops.

o There is also a need to conserve seeds or live material from threatened wild plant species for present and potential medical (and economic) use.

o The preservation of Egypt's wild, cultivated, or domesticated germ plasm is insurance against unknown future climate and ecological changes, and development impacts. If funding resources are made available, highly competent Egyptian institutions exist to carry out the surveys, ecological analysis, and preservation work that is necessary

D. Management of existing natural protectorates

Despite some preliminary steps, no master plans or biological management plans have been established for the seven natural protectorates, and there is currently no capability to monitor conditions and protect fragile resources. As a result, hunting threatens wildlife at Gebel Elba, raptors are removed at Lake Bardawil, acacia and other important medicinal plants are being rapidly lost to Bedouins and others at St. Catherine, and small farming settlements have begun inside the Nile Islands. At Ras Mohamed, where trash is omnipresent, tourists drive, walk, or park anywhere, fishermen and shell collectors are unregulated, and the impacts of outside development pose severe additional problems for future management.

o Management plans can be prepared by the EAA that incorporate the biological needs of terrestrial and aquatic life. Such plans could incorporate the experience of the EWS.

o The opportunity exists, and needs to be seized, to facilitate cooperation between EAA, EWS, and each governorate to conserve these natural protectorates.

o Biologically trained rangers, primarily from EWS, can supervise scientific impacts and operations of the protectorates under the governorate administration.

o All government entities should work together to anticipate and control the adverse biological impacts of outside development, promote public education about the area and the law, and engage the support and often employment of local people. Delay in initiating this planning and cooperation is likely to erode the promise of Law 102 to preserve many of Egypt's most significant ecosystems for future generations.

Actions Important for the Long-Term

In addition to these immediate actions to maintain and enhance Egypt's biological diversity many other concurrent and related actions are needed to support Egypt's growing environmental commitment over the long-term. They include:

- improved management of biological resources and development impacts outside existing natural protectorates;
- increased support for public awareness programs for children and adults;
- improved environmental management in the governorates;
- specific needs for applied and basic research.

These needs are discussed in detail in the body of this biological diversity assessment.

I. INTRODUCTION

Conservation of the Earth's biological resources has received increasing attention in the last 15 years. Ever increasing human development and pollution is causing alarming losses of natural habitat and species. The delicate balance of natural ecosystems in regulating air, temperature and water is being irreversibly altered.

Biological resources provide the fish, forests, crops, pharmaceuticals and countless other products that sustain human life. Sustainable use of these resources underlies sound economic development.

The World Conservation Strategy (IUCN, 1980) called for conservation and sustainable use of global living resources at the genetic, species, and ecosystem levels. The term "biological diversity" now articulates concern for "the variety and variablility among living organisms and the ecological complexes in which they occur." (U.S. Congress, 1980)

In response to global concern about integrating sustainable use of natural resources with economic development, the U.S. Congress amended the Foreign Assistance Act in 1983 and 1986 to require the Agency for International Development (A.I.D.) to take specific actions to help other countries conserve plant and animal resources. USAID/Cairo commissioned this assessment in order to identify Egypt's conservation needs and priorities.

This document is intended to help the Government of Egypt, USAID/Cairo, other donor agencies, and non-governmental organizations in identifying opportunities and establishing priorities to support biological resource conservation. The assessment provides an overview of the most urgent issues requiring attention, and it offers suggestions for possible solutions. It recognizes that more work may be needed to analyse all biological resource conservation activities underway in Egypt and to evaluate all of Egypt's conservation needs. Nevertheless, this assessment will be successful if it stimulates the Government of Egypt to develop its own specific action plan to address the needs that have been identified.

The assessment first provides a background summary of the natural ecosystems and the flora and fauna of Egypt (Section II.). An analysis of the legislation and institutions that affect Egypt's biological resources (Section III) is followed by a summary of the status and management of protected areas (Section IV). Conservation and development outside of protected areas,

along with species and germplasm conservation issues are presented in Section V. Major conclusions and issues are outlined in Section VI and the report concludes with recommendations for actions necessary to conserve Egypt's biological resources in Section VII.

II. BACKGROUND: THE BIOLOGICAL RESOURCES OF EGYPT

1. Natural Ecosystems

Biologically, Egypt has more in common with Europe than with the African continent. Egypt is at the southern boundary of the "Palearctic" biogeographic region which ranges from the Atlantic coast of Europe to the Pacific Coast of the Soviet Union . Africa, below the Sahara, is in the "Ethiopian" biogeographic region. Egypt's fauna also reflects the influence of the "Oriental" realm to the east. The borders of these ancient regional divisions have fluctuated with climate changes; during the warmer interglacials the proportion of "Ethiopian" fauna in Egypt was much greater. At various times Egypt has contained species from northern (Palearctic) genera or families that never entered the Ethiopian region - true pigs (Sus), deer (Cervus), cattle (Bos), and sheep (Ovis) (Seton-Williams and Stocks, 1983).

Although Egypt might initially appear to be a uniform desert, it contains a variety of habitats. Oases in the desert and lakes and marshland in the delta provide important habitat for migratory birds. The Nile valley is a rich patchwork of wetlands, trees and cultivated lands. Although natural forests are noticeably absent, the southern tip of the Sinai peninsula supports the northern-most mangrove community in the world. The biological composition of the Nile river is largely Ethiopian, since its source is from the south in Africa (Seton-Williams and Stocks, 1983).

Figure 1 depicts the natural vegetation areas of Egypt. Figure 2 outlines the general vegetation types of the Sinai. The wadis, or dry valleys, originated during pluvial periods of the Pleistocene, when rainfall was much higher. Small erosion gulleys and deep canyons drain water after showers. When soil is soaked to a considerable depth, conditions are favorable for growth of nonhalophytic (Retama, Caligonum) or halophytic plants (Tamarix, Nitraria). Vegetation is confined to the sides of the larger wadis, due to floods (Walter, 1979).

Regs, or gravel deserts, arise from conglomerate parent rock and the gravel can be underlain by a cemented gypsum layer. This type of desert has broad, shallow, sand-filled valleys which offer better growth conditions for typical sandy soil plants and halophytes (Walter, 1979).

The hamada, or rocky desert, is mainly found on plateaus of table mountains and is composed of exposed, eroded rocks cleft by deep erosion valleys. A few xerohalophytic species can take hold in the crevices (Walter, 1979).

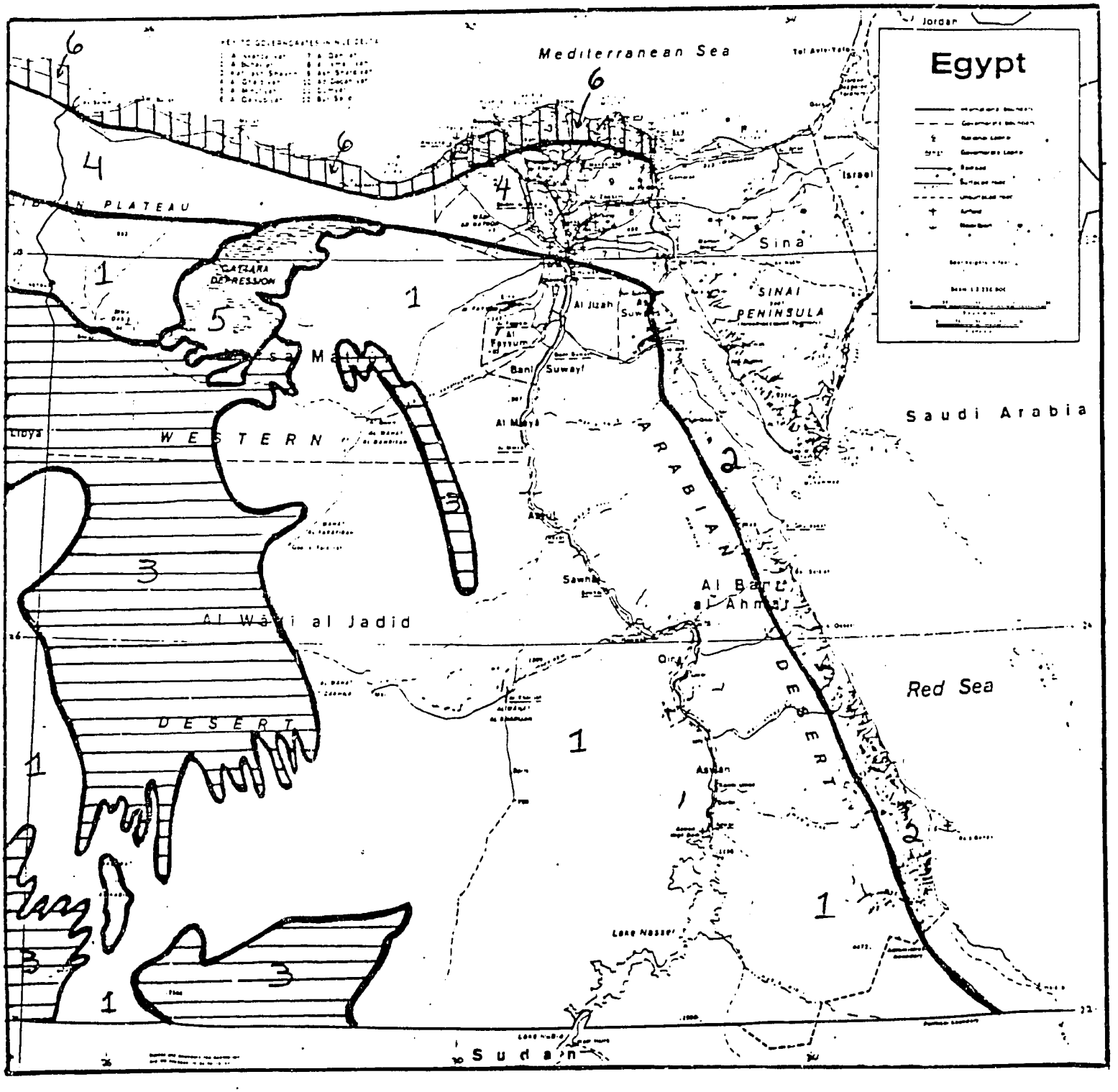


FIGURE 1

NATURAL VEGETATION OF EGYPT

1 - Absolute Desert
2 - Coastal Desert along the Red Sea
3 - Desert Dunes without perennial vegetation
4 - Wadis, Regs, Hamadas
5 - Halophytic Vegetation
6 - Eastern Sub-Mediterranean Vegetation.

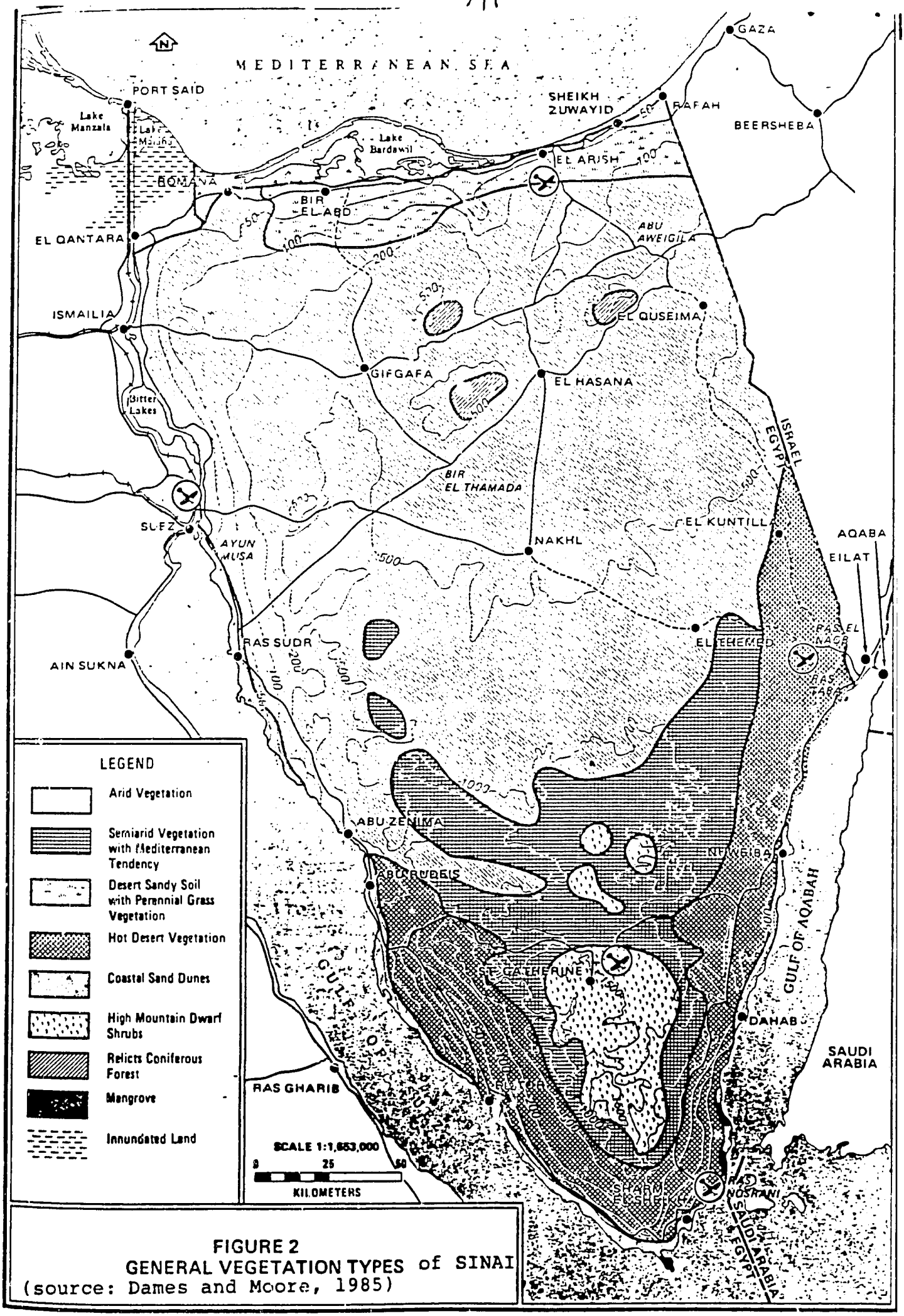


FIGURE 2
GENERAL VEGETATION TYPES of SINAI
(source: Dames and Moore, 1985)

walter's (1979) classificaiton of the earth's ecological climate zones places most of Egypt in a "sub-tropical arid desert climate with episodic rain", with only the Mediterranean coast experiencing winter rain and summer drought.

Desert Ecosystems

Hot desert ecosystems cover all of Egypt. The Nile river divides Egypt into two distinct geomorphological regions; the Eastern Desert and the Western Desert. There are also general differences between the faunas of the two deserts. The Nile acts as a link between the north and south and as a barrier between the east and west. The Sinai desert is usually considered separately (Ayyad and Ghabbour, 1986).

The Eastern Desert is essentially high, rugged igneous mountains running parallel to the Red Sea coast. The wadis along the Red Sea support four vegetation types; ephemeral, shrubs with a woody base, succulant and scrubland (Ayyad and Ghabbour, 1986). The fauna of the northern part of the eastern desert is related to that of Sinai, the Arabian peninsula and western Asia. In the southern part the fauna is more clearly African.

The Western Desert is essentially a flat plateau with numerous closed-in depressions. Oases in the western desert commonly support mobile, sterile sand dunes; sand plains; and salt marshes (Ayyad and Ghabbour, 1986). The fauna of the western desert is generally Mediterranean in the northern part (including Qattara Depression, Wadi Natrun and Faiyum) while farther south the fauna is typically Saharan.

The southern end of the Sinai Peninsula contains the highest peaks in Egypt in its rugged igneous and metamorphic mountains. The northern two-thirds of the peninsula is occupied by a northward-draining limestone plateau. Faunal composition also differs in the two areas. Boulos (1982) estimated that the Sinai contains almost 1000 higher plant species; almost 40% of the Egyptian flora. He noted that the Sinai supports remnants of coniferous forest (*Juniperus phoenicia*) in the northern mountains, dwarf montane vegetation, Mediterranean semi-arid vegetation, arid vegetation, coastal sand dunes, hot deserts and mangroves.

In the Sinai mountains vegetation composition changes with elevation from a community dominated by *Artemesia herba-alba* at 1630-1700 meters to a community dominated by *Phlomis aurea* and *Pyrethrum santolinoides* between 1700 and 2000 m. The highest elevations are dominated by *A. herba-alba* and *P.santolinoides*.

The most common community in the gravel desert (hamada) in the Sinai plains is dominated by Anabasis articulata (Ayyad and Ghabbour, 1986).

Coastal and Wetland Areas

With about half its border along the Mediterranean and Red Seas, Egypt has significant coastal environments of salt and brackish water. Figure 3 shows the wetlands of Egypt. Sea level fluctuations over the centuries, coupled with freshwater runoff from the land carrying soil, eroded rock and other materials, formed and reformed coastal areas giving rise to a variety of different sub-environments; shallow and deep coastal lagoons, barrier beaches, coral reefs, salt marshes, tidal mud flats, and mangrove swamps. The completion of the Suez Canal in 1869 created additional marine environment between the Red Sea and Mediterranean and at Timsah and the Bitter Lakes.

The Mediterranean and Red seas have had a major impact on Egypt's climate, economy, and strategic importance. Ecologically, the two water bodies are different in composition and productivity but have served to provide a significant amount of renewable, as well as non-renewable, resources for the Egyptian people. Fish, sponges, coral, molluscs, crustaceans and other marine species have been the commonly exploited renewable resources while petroleum and minerals are the major non-renewable resources.

The Mediterranean shows affinity to the Atlantic Ocean in terms of water chemistry and composition of flora and fauna, but its overall biological productivity is lower than that of most other seas due to the peculiar hydrology of the basin. Water circulation is poor and hence nutrient supply is restricted.

The Red Sea, along with the Gulf of Aqaba, is a deep, narrow trough of tropical water that follows the extensive Rift Valley for nearly 2000 kms. It connects to the Indian Ocean at its extreme southern end and is characterized by high surface temperatures, narrow coastal shelves, high salinity and subterranean thermal vents. Although no huge stocks of fish fauna occur, there are moderate numbers of a great variety of species which have been exploited by local fishermen for centuries. Most recent fishing activity occurs in the Gulf of Suez because of its shallowness and smooth bottom making it suitable for trawlers and seiners. Some coral fish are caught but the sea is generally thought to be under-exploited from a fisheries standpoint.

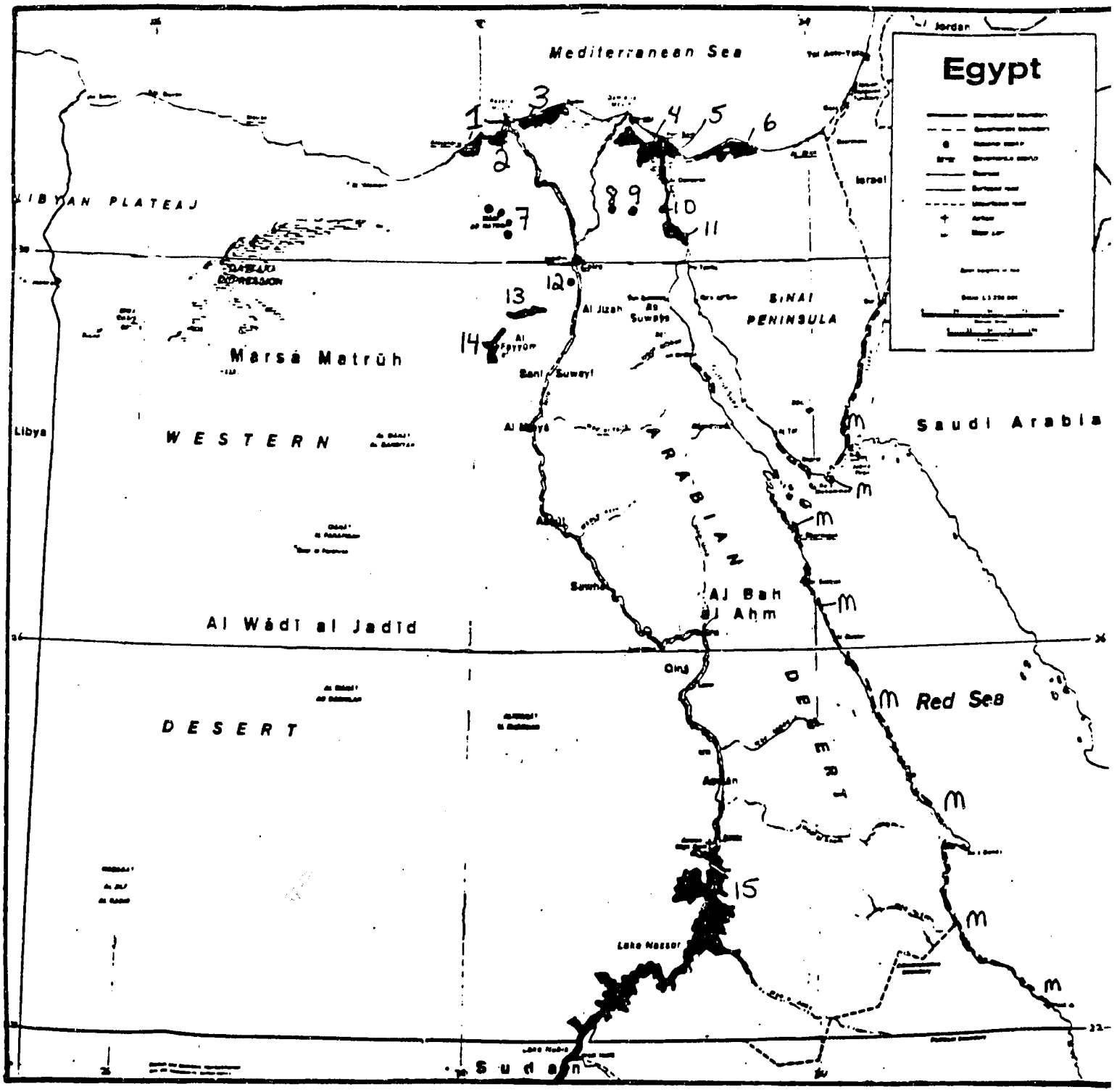


FIGURE 3 WETLANDS OF EGYPT

Wetland Areas

1. Lake Maryut
2. Lake Idku
3. Lake Burullus
4. Lake Manzala
5. El Mahala
6. Lake Bardawil
7. Wadi Natrun
8. Lake Akyad
9. El Abbassa
10. Timsah
11. Bitter Lakes
12. Dahshur
13. Lake Quarun
14. Wadi Ruwayan
15. Lake Nasser

Coral Reefs

M Mangroves

Since the opening of the Suez Canal between the Mediterranean and the Red Sea, there has been considerable movement of plant and animal species, mostly from the Red Sea to the Mediterranean. A few of the fish species have exploited their new environment and have reached the status of commercial species.

The coastal or inland areas referred to as salt marshes, freshwater marshes, wet meadows, tidal flats, or mangrove swamps are known officially as "wetlands" which, according to Cowardin et. al. (1979), are transitional lands occurring between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water.

Freshwater areas are almost entirely related to the flow, both natural and modified, of the Nile River. Water level rises in periods of heavy rainfall and heavy river runoff and recedes during dry periods. In addition, there are areas where land conformations are not conducive to easy drainage and marshes have evolved. These are often associated at the margins of lakes such as Qarun, Maryut, Burullus, and Nasser, but also occur in conjunction with the Nile or its irrigation canal system such as Rishrash, Abbassa, Wadi Natrun and Wadi Ruwayan.

Wetlands are often created and constantly affected by natural catastrophes characteristic of both land and water. Depth, duration, chemistry, temperature of the water, and in coastal marshes, the reach of the tide determine the types of plant life found in a given wetland. These physical and chemical features determine the types of vegetation and the wide variety of fish, molluscs, birds, crustaceans, insects, worms and tiny organisms which find food and shelter in the substrate and within the vegetation. Wetlands, in general, are extraordinary natural systems that are highly productive. They also function as pollution filtration systems, flood protection controls, sources of fodder for domestic animals, materials for baskets, mats, roofing, etc., and as a source of food to humans from birds, eggs, fish. The recording and learning of information was inexorably transformed with the discovery and use of the marsh plant pappyrus from wetlands in Egypt.

Open water areas, both marine and fresh, as well as the wetlands have long been used as resting, feeding and wintering places for migratory birds, especially waterfowl. Egypt is unique along the Mediterranean in providing the Nile River and lakes of the delta as extensive habitat for water birds as well as a migratory route. Approximately 25 percent of the wetlands

in the entire Mediterranean region lie along the Egyptian north coast. These are particularly important in northern Sinai where the existing types of wetlands are the last possible stop before the long flight north across the Mediterranean to Europe in the spring or the first land sighted after a long passage from Europe in the fall. In adverse weather birds such as storks appear to require a safe resting place and these wetlands not only provide that function but permit feeding and energy replenishment for the next stage of the journey. Quail reach land on the Sinai shore apparently exhausted after the Mediterranean crossing.

A detailed summary is given by Petersen and Sorensen (1980), Baha El Din and Saleh (1982), and Meininger and Mullie (1984) as well as others of the use of the Egyptian lakes and wetlands by waterbirds. Those studies indicate that hundreds of thousands of waterbirds overwinter in Egypt's wetlands. It is estimated that millions of birds use these wetlands as resting/refueling stops during migration.

(1) Coastal Coral Reefs and Mangroves.

Coral reefs extend from about mean low tide water mark to depths of about 30 meters in tropical marine waters. Reef abundance and diversity depends primarily on factors which include light, temperature, water clarity and nutrient flow. The Red Sea provides an ideal environment for coral and the reefs at the northern end are the most northerly, fully developed reefs in the world (Bemert and Ormond, 1981). Reefs are made up of innumerable individual living corals attached to the skeletal remains or dead corals. Reefs support a rich variety and abundance of plant and animal life; some biologists estimate that reef diversity may exceed that of tropical rain forests. Besides providing habitats for fish on which many coastal communities depend, reefs protect the coastline and increasingly serve as a recreational amenity.

Mangroves are plants growing in the marine littoral environment of tropical and sub-tropical sheltered coastlines. In the Red Sea, one species of mangrove (Avicennia marina) fringes the shoreline in many areas but only extends as far north as the Bay of Myos Hormos (22 kms. north of Hurghada) (Kassas and Zahran, 1967) on the Red Sea's western shore. However, this species also occurs at the mouth of the Gulfs of Suez and Aqaba on the Sinai side at Surat-El-Manquatah and Ras Mohamed; this location is the northernmost range extension in the world for this species (Rabinovitch et al., 1978). A.marina usually grows in pure stands by may be found mixed with Rhizophora mucronata as a codominant (Kasses and Zahran, 1967). Mangroves often form the basis for communities which

collectively provide products such as construction materials, fuelwood, fodder for domestic animals, and food supplies such as crustaceans, fish, and birds. They also help to reduce coastal erosion, serve as spawning and nursery areas for many marine species of fish, support valuable nearshore fisheries (finfish, shellfish and crustaceans), furnish habitats for many species of birds and mammals and provide valuable opportunities for education, scientific study and tourism.

(2) Lakes.

Egypt's lakes cover an area of nearly 10,000 square kms., yet most lakes appear to be relatively transitory. Over a long time period the lakes formed by shifting dunes became either fresh water lakes or saline estuaries.

Meininger and Mullie (1981) present a description of the major Egyptian lakes in terms of their importance to waterbirds. Lakes Burullus, Manzala, Qarun and El Malaha are designated as of international importance to wintering birds. Lake Maryut forms the southern boundary of Alexandria and is actually a series of shallow, brackish, interconnected basins used extensively as discharge sites for heavy industrial and domestic wastewater. Highly eutrophic as a result, they produce large numbers of a few species of fish which are commercially utilized. One of the lake's basins is used as a fishfarm. Situated just east of Alexandria is Lake Idku which is a shallow marine lagoon connected to Abu Kir Bay in the Mediterranean. Lake Idku supports a commercial fishery and provides a supply of brackish water to Abu Kir Bay that nurtures a valuable shrimp fishery. The lake also supports continuous bird catching activities for the market.

Lake Burullus is a shallow brackish lake connected to the Mediterranean lying about midway between the two branches of the Nile. It supports a commercial fishery and its southern shores are used for enclosing shallow basins to capture or rear fish. Lake Manzala is the largest lake in the Nile delta and the most eastern lying between the Suez Canal and the Dumyat Nile branch. It is very shallow and brackish, connected to the Mediterranean by an outlet near Port Said and traversed by numerous islets creating numerous basins. Many of these islets are artificial and used for fish capture and rearing. The lake supports a large commercial fishery as well as bird catching and hunting activities for the market.

Together the delta lakes represent about 15 percent of the total commercial fishing area of Egypt, which includes the Nile River and the contiguous portions of the Mediterranean and Red seas. However, since construction of the Aswan Dam, the delta

lakes now contribute 50 to 60 percent of the country's total fish landings. These lakes, particularly Maryut and Idku, make an important contribution to animal protein production, and to the economy of the country.

Lake Qarun is an isolated, below sea level salt lake in the Western Desert's Faiyum. The lake fluctuates in depth and size because of its use as a reservoir for drainage water from the Nile. The area is a popular tourist site because of its agreeable climate and proximity to Cairo. It also serves as an important agricultural area. The lake itself supports a significant fishery and many of the tourists hunt birds. Regular organized hunts, especially for foreign hunters, result in large numbers of birds for the market.

A series of three lakes in Wadi Ruwayan, southwest of Lake Qarun in the Faiyum began to be created from excess drainage water from Lake Qarun in 1976. It is expected that the new lake area will enlarge to the size of Qarun and provide many of the same use opportunities.

Lake Nasser is one of the world's largest artificial lakes. Created in 1964, this freshwater lake is long and narrow with numerous side projections. It is a multi-purpose project supplying a major portion of the country's electric needs, protecting against floods, and supplying water for irrigation. Major land reclamation projects are underway or being planned along the lake's borders. The lake is subject to large fluctuations in water levels and presently supports a limited commercial fishery and tourism industry.

The Sinai Peninsula contains two major lakes: El Malaha in the northwest bordered by the Suez Canal, and Lake Bardawil in northern Sinai west of El Arish. Both are shallow and hypersaline with several connections to the Mediterranean. Commercial fishing is well established at both lakes. At Bardawil, quail and other forms of bird hunting for market purposes are important seasonal enterprises.

2. Flora and Fauna

The ancient hieroglyphic symbols of Egypt provide a unique historical record of the nation's past flora and fauna. Human use of plant and animal species over thousands of years has made it difficult at times to distinguish between native and introduced species, or wild and cultivated species.

FLORA

Egypt has a large flora, due to its situation at the juncture of three floristic realms. The subtropical climate has permitted introduction of species from both temperate and tropical areas of the world. Two species of water lilies are endemic to the Nile River; these are the lotuses of classical literature and art. The Casuarina tree was introduced to Egypt from Australia and is now abundant in windbreaks and along roadsides throughout the Delta. Acacia nilotica is one of the native acacia trees in the important Leguminosae family; it's timber has been used since ancient times. Only three species of palms (Palmae) are native to Egypt; the date palm (Phoenix dactylifera), the dum palm (Hyphaene thebaica), and argum palm (Medemia argum), which was considered extinct until recently (Seton-Williams and Stocks, 1983).

Many plant species are adapted to extremely dry or saline environments. They include the ice plant family (Aizoaceaeais), the cacti (Cactaceae), and the goosefoots (Chenopodiaceae). The Indian fig (Opuntia ficus-indica) was introduced in the early Ottoman period; it is now found semi-wild throughout the country and produces a rich fruit crop each summer (Seton-Williams and Stocks, 1983).

FAUNA

Mammals: The mammalian fauna of Egypt, which is adapted to desert conditions, is not particularly abundant. The Insectivora are poorly represented with species of only two families; the Erinaceidae (hedgehogs) and Soricidae (shrews). The pygmy white-toothed shrew, cited as the smallest existing mammal, is found in the Delta region. The Chiroptera (bats) are extremely well represented in Egypt. The two Egyptian primates, green monkey and Hamadryas baboon, now only occur in the Sudan. Egypt has about 30 spp. of rodents (Rodentia), which is the largest order of mammals; they include voles, hamsters, gerbils, mice, rats and jerboas (Seton-Williams and Stocks, 1983).

The Carnivora are very well represented in Egypt. The dog family (Canidae) includes four species of fox. The fennec fox is well adapted to desert life; its huge ears and large eyes give it an acute sense of hearing and sight, and it seems to live without water, eating rodents, lizards and insects. Other carnivores include weasels, the snake-eating Egyptian mongoose, and cats (which were probably first domesticated in Egypt). There may be relict leopard populations in remote areas of the Sinai (Seton-Williams and Stocks, 1983).

Birds: The bird life of Egypt is rich but, like the mammalian fauna, has suffered due to human activity. Resident species are joined by an annual influx of winter migrants from the north. Spring and autumn migrants use the Nile valley flyway and oases. Although Egypt has no endemic species, a number of races of more widespread species are unique to the country (Seton-Williams and Stocks, 1983). The herons and storks (Ciconiiformes) and the birds of prey (Falconiformes) were well represented in the hieroglyphic signs of the ancient Egyptians. The songbirds (Passeriformes) include more that half of the bird species in Egypt.

Reptiles: The Nile crocodile once extirpated from Egypt, has made a comeback in Lake Nasser. The country supports a diversity of tortoises, turtles, and lizards, along with 33 species of snakes.

Fish: The Mediterranen (with its similarities to the north Atlantic), the Red Sea (with its tropical Indo-Pacific connection), and the freshwater Nile river support a diversity of fish (Pisces).

Invertebrates: Egypt is too arid to support the diversity of invertebrate species found in tropical Africa, yet it does have an impressive number of species adapted to desert conditions. Spiders and scorpions (Arachnida) are plentiful. The beetles (Coleoptera) are the most successful insects, with over 300,000 species. The sacred scarab beetle was personified as the sun god Khephri by the ancient Egyptians (Seton-Williams and Stocks, 1983).

III. LEGISLATIVE AND INSTITUTIONAL STRUCTURE

Introduction: Since the late 1970's Egypt has established important new environmental policies, laws, and institutions. In 1979 the Ministry of Agriculture established the Egyptian Wildlife Service, and in 1983 the President approved and the People's Assembly passed a landmark law to establish and protect designated preserves (Law 102/1983). That same year the government established an Environmental Affairs Agency (EAA) responsible to the Cabinet Council to oversee and develop environmental programs and passed a new law to control pollution of Egypt's waterways (Law 48/1983). Comprehensive laws and programs concerning air pollution and soil protection are being developed. In addition, Egypt has subscribed to several international conventions and agreements that commit it to protect plant and animal habitat, particularly endangered species, wetlands, and migratory birds and animals.

Egypt consequently has the basic institutional and legal structure for strong programs to conserve its unique ecosystems, species, and other biological resources. Serious problems remain, however, concerning effective management of biological resources, enforcement of conservation laws, and coordination of the government agencies concerned with these resources inside and outside protected areas.

1. Government of Egypt

Basic structure: Under Egypt's Presidential form of government, laws may be established by Presidential decree and ratified by the unicameral legislature (the People's Assembly). Important proposals, such as Law 102/1983, which established a new system of protected areas, are discussed and analyzed by the Shoura Council, an elected and appointed consultative assembly that prepares working papers for the Prime Minister and the President on key issues and needs. Prime Ministerial decrees, such as that establishing the Environmental Affairs Agency in 1983, are promulgated after agreement of the Cabinet Council. Ministerial decrees are important as well, such as those of the Minister of Agriculture that established the Egyptian Wildlife Service.

Many ministries and government entities engage in planning, management, and enforcement activities that affect the important ecosystems and biological resources of Egypt. The Environmental Affairs Agency was established to help coordinate these activities.

Local government serves a critical administrative and coordinative role. It is organized at three levels:

governorates, cities, and villages. There are 25 governorates; of these Cairo, Alexandria, Port Said, and Suez are city governorates that combine functions of a governorate and a city administration. Each governor is appointed by the President. At each level of local government there are two councils -- one to control and plan, and the other to implement and supervise projects. Services at the local level are provided by branches of the Ministries and through the governorates. Governorates obtain few local revenues and are essentially arms of the national government (Nyrop, 1976).

a. Government agencies primarily concerned with the environment and biological resource protection.

Egyptian Environmental Affairs Agency (EAA). The EAA was created in 1983 by Prime Ministerial Decree (No. 631/1982) to link the Cabinet with other governmental environmental matters, prepare a national plan for environmental studies, analyze proposals on environmental affairs, and follow up the implementation of environmental laws, among other similar duties. EAA is part of the Prime Minister's Office, and is administered by the Minister of Cabinet Affairs. The EAA is run by a President who is nominated by ministerial decree. It is advisory and coordinative and has no regulatory authority, except its authority to manage the newly established natural protectorates under P.M. decree #1067 to implement provisions of Law 102/1982. Law No. 101/1985 stipulated that revenue from a 10 percent tax on all airline tickets sold in Egypt in Egyptian currency, must be used to finance tourist promotion, pollution prevention, nature conservation and environmental improvement (Ghabbour, 1986). This provides EAA with important revenue for environmental projects.

EAA has become an increasingly important agency in Egypt. Its staff has grown from 4 to approximately 50, and it is involved in all major aspects of environmental and biological resource conservation. EAA's role has in the past sometimes suffered from uncertainty about its precise authority over environmental staff in each governorate and poor communication between it, the EWS, and the governorates. Effective management of natural protectorates has been one of the casualties of this confusion. Strong interest in improving EAA's capabilities, however, is evident under the EAA Chairman.

Egyptian Wildlife Service (EWS): In 1979 the Ministry of Agriculture established the EWS as a new office to be directed by the head of the Giza Zoological Gardens (MOA Decree No. 349/1979.) EWS duties are: to develop and manage several

protected areas established by law and decrees, draft laws and proposals for wildlife protection, carry out public awareness programs, survey Egyptian flora and fauna, and organize training programs. The EWS staff was recruited from the most recent graduates of the Faculty of Veterinary Medicine at Cairo University. The Ministry of Agriculture provides funds for salaries, and funding for operations comes from the Zoo and from other donors, including the U.S. Fish and Wildlife Service, under the now defunct Public Law 83-480 program.

Under Section 8(a) of the U.S. Endangered Species Act, foreign currencies belonging to the U.S. and available under Public Law 83-480 (The Agricultural Trade Development and Assistance Act) may be used to fund foreign cooperative wildlife conservation programs. In cooperation with the National Park Service, the U.S. Fish and Wildlife Service sent a mission to Egypt in mid-1977 to determine how PL 480 funds might be used to support wildlife conservation. A series of subsequent agreements between these U.S. agencies and the Ministry of Agriculture established wildlife training programs and wildlife surveys in Egypt. The U.S. Fish and Wildlife Service continues to provide technical and financial assistance for these activities.

The EWS currently has a staff of 17 with bachelor degrees in veterinary science, including two officers with Masters degrees in environmental subjects. The operating budget (minus staff salaries) was L.E. 30,000 per year ($13,200 US at .44 US/LE) and was provided by the USFWS.

The EWS is a small, highly motivated entity whose staff has become increasingly well-trained in wildlife management. Its direct authority over the management of Egyptian wildlife is limited, however, by the provisions of Law 102 concerning natural protectorates, and by the authority of the Environmental Affairs Agency. (See discussion below.)

b). <u>EAA's Environmental Plan for Egypt</u>

The EAA's Environmental Plan for Egypt (1986) incorporated into the current Five Year National Development Plan (1987-92) includes:

(1) the <u>development of pollution control activities</u>, including a new law for air pollution control, noise pollution control, protection of agricultural land, protection against coastal erosion, establishment of greenbelts and recreation areas in urban communities, national environmental education, and marine environmental conservation;

(2) management of natural protectorates, including the seven areas already established and any new areas;

(3) establishment of an environmental monitoring network to provide environmental information on pollution control to all concerned ministries;

(4) protection of the Nile and other waterways from hazardous industrial wastes under the 1982 law. Despite a five year moratorium declared on enforcement of the water pollution law (Ghabbour, 1986), effluents from industrial facilities are being reduced; new treatment units are being introduced for 800 Nile vessels; land based collection and treatment plants are being developed, and a national contingency plan for oil spills has been established.

The total cost of the Five Year Environmental Plan is 560 million Egyptian Pounds, of which 45 percent must be in foreign currency. This amount is about 2.2 L.E. per capita per year, or 0.56 percent of the national per capita income (Ghabbour, 1986).

c. Other Ministries and Government Entities Affecting Biological Resources

In addition to the EAA and EWS, other agencies have significant planning, operational or research impacts on Egypt's biological resources. Among the most important are the following:

The Ministry of Defense controls the use and disposition of uninhabited desert lands in Egypt. It also has an important role in establishing regulations for oil and hazardous material controls at ports and for shipping activity in Egypt's territorial waters. The Defense Ministry is responsible for issuing of permits for all desert hunting.

The Ministry of Industry's General Organization for Industrialization (GOFI) is responsible for planning and executing public sector industrial projects (now 350) and licensing private ventures (20,000). GOFI has programs to retrofit public sector industries and to bring polluters into compliance with the water pollution requirements of Law 48/1983.

The Ministry of Irrigation and Water Resources is responsible for issuing permits to commercial, industrial, or tourist establishments for discharge of solid, liquid, or gaseous wastes into Egyptian waterways; including the Nile,

coastal lagoons, canals, lakes, and groundwater reservoirs (Law 48-1982). It is solely responsible for issuing permits for new floating vessels. It may cancel licenses and seek removal or correction of polluting facilities.

The Ministry of Health's Center for Environmental and Occupational Health is responsible, among other duties, for monitoring water quality of licensed discharges into Egyptian waterways (Law 48/1982).

The Ministry of Housing and Public Utilities (MHPU) has primary responsibilities for developing potable water supply and sewage collection projects carried out under its National Organization for Potable Water and Sanitary Drainage, which is also responsible for establishing and enforcing environmental standards.

The Ministry of Tourism, under Law 102/1983, established a "Natural Protectorate Fund" to help implement the law and establish research programs. The Ministry is responsible for tourist development at Ras Mohammed under Law 102.

The Ministry of Higher Education established the National Committee for the Man and the Biosphere (MAB) Program in 1971. The MAB committee gives advice on biological reserves and was instrumental in establishing the Omayed northwest desert site as a Biosphere Reserve.

The Ministry of Petroleum is responsible for developing and operating oil and gas production facilities, which are primarily in offshore fields in the Red Sea. The General Petroleum Company is responsible for oil spill cleanup, in cooperation with the Egyptian Coast Guard, pursuant to the National Oil Spill Contingency Plan.

The National Institute of Planning, under the Ministry of Planning, conducts studies of the economic and environmental effects of industrial, agricultural, urban, and other pollution sources, and has carried out pilot programs for protecting small village parks (Dr. Farkhonda Hassan, oral communication).

The Academy of Scientific Research and Technology (ASRT) was established in 1971 by Presidential decree as the body responsible for science and technology in Egypt. The role of ASRT is to act as a scientific forum to assist the government, to develop policies for linking scientific and technological organizations on behalf of national development objectives, and to encourage and improve research programs. It is funded by the government and has a membership drawn from universities, research centers and ministries in addition to private

individuals. ASRT has a number of scientific and technological agreements with over 40 countries as well as joint research projects with international and foreign organizations. Its 11 councils for scientific subjects include several concerned with environment, which is addressed by 22 research projects under the Academy's current five year plan. The four environmental components of the plan are environmental pollution, occupational health, environmental maps for natural resources, and environmental education. The Egyptian National Commission, affiliated with ASRT and the IUCN, was active in developing a plan for protected areas that resulted in Law 102, in 1983.

Environmental Offices within each of the Governorates are responsible for monitoring environmental problems and activities of the ministries. The offices each have a staff of one or two people who are not necessarily trained in environmental affairs. Each office is currently responsible to the governor, who chairs an interministerial committee that guides the work of the environmental office, under the terms of Law 102. These environmental offices are, or soon will be, the local arms of the EAA. In addition, the environmental officer within a governorate may also be the "manager" of natural protectorates in that governorate (such as Ras Mohamed and Lake Bardawil). However, in the Aswan governorate the responsibility for managing the Nile Island protectorate is assigned to Aswan African University.

Coordination and review of the environmental work of these and other government entitities is largely EAA's responsibility. How this difficult coordination and review work is carried out can have important consequences for biological resource conservation in Egypt. The EAA's interest in environmental impact assessment is tied in part to the need for effective coordination and review capabilities at the highest level.

2. International Conventions to which Egypt is a party.

Egypt has signed several conventions that commit it to wildlife species and habitat protection. Although some of the treaties lack teeth and Egypt apparently has no institution clearly responsible for treaty compliance, they are potentially important opportunities for further government actions. They are summarized here in rough chronological order.

a). The African Convention on the Conservation of Nature and Natural Resources (African Convention).

This convention, considered by one commentator as "the

most comprehensive multilateral treaty for the conservation of nature yet negotiated," (Lyster, 1985) was signed on September 15, 1968 in Algiers; Egypt is a signatory. Although the Convention focuses primarily on wildlife, it also addresses conservation of soil and water, education, research, and the need to integrate conservation into development plans. The Convention requires Parties to establish conservation areas for ecosystem protection and scientific conservation plans for the protection of other important resources.

The African Convention is virtually unknown in Egypt and elsewhere. The Convention allows Parties to bypass its provisions in the "paramount interest of the State," which is an otherwise undefined and large loophole. More importantly, it has no permanent Secretariat to oversee Party actions, receive information, or evaluate progress. Partly for this reason, the list of species in its Annex has not been amended since the Convention was signed. Prohibitions on trade have been largely superseded by CITES (see below).

b). The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

This is a comparatively effective treaty that regulates trade in wild animals and plants that are listed in Convention Appendices. It was concluded in Washington, D.C. in 1973; Egypt is a signatory.

The Convention prohibits trade in species threatened by extinction (listed in CITES Appendix I), and it allows controlled trade in species potentially threatened (CITES Appendix II) if permits are issued pursuant to the Convention. The Convention requires each Party to establish Management and Scientific Authorities to supervise and implement the permit provisions. A Secretariat has been established in Switzerland to oversee compliance, and biennial meetings of the Parties establish, review and amend the Appendix listings.

Nearly 100 states are Parties to the Convention. Responsibilies for ensuring Egypt's compliance lie with the Ministry of Agriculture and the Environmental Affairs Agency.

c). The Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar).

This Convention was the first Convention to be concerned with habitat -- wetlands of international significance. Over 40 countries are Parties, including the US and Egypt. It was signed Feb 2, 1971 in Ramsar, Iran. The treaty seeks to protect wetlands -- broadly defined to include fens, marsh,

peatland, or fresh, brackish or salt water, including riparian and coastal areas -- by requiring parties to practice "wise use" of wetlands and to give special protection for wetlands on the Convention's designated List.

Each Party must designate at least one wetland of international significance to the List upon joining the Convention. The List is maintained by the International Union for the Conservation of Nature and Natural Resources (IUCN), which serves as the Secretariat for the Convention. Criteria for the List include wetlands of international importance for plants or animals if they are "of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna." (Lyster, 1985.)

The Convention requires the Parties to establish nature reserves on listed and nonlisted wetlands, and to encourage research, training, and cooperation on wetlands.

Egypt has recently submitted Lake Bardawil as its first Ramsar wetland listed under the treaty.

d). The Convention on the Conservation of Migratory Species of Wild Animals (The "Bonn Convention").

This Convention to protect migratory species at every stage of their migration, was concluded at Bonn, Germany, in 1979; Egypt is a Party. As under CITES, species are required to receive various degrees of protection depending on their listing in Appendices.

Strict protection is required for all endangered migratory species (Appendix I). Parties that have jurisdiction over any part of a migratory species' range (Range States) are required to enter into agreements for the conservation and management of species whose conservation would benefit from such international cooperation (Appendix II species). Species requiring protection in Egypt include the sea turtles of the Red Sea, range animals of Gebel Elba, and migratory birds using the Nile delta lakes and Sinai in particular.

e). Marine Pollution Agreements and Laws.

(1) Oil Pollution: Egypt has accepted the provisions of the International Treaty for the Prevention of Marine Polution with Oil, as amended in London in 1962, under Presidential Decree No. 421/1963 (El-Ibyary, 1983). Following a study of oil pollution problems at the port of Alexandria, Law 72/1968 established vessel fines (maximum L.E. 3,000) and

imprisonment penalties for oil pollution in Egypt's territorial waters, oil carrier registration requirements, notification of spill requirements and penalties, and other spill prohibitions for on shore facilities. The Ministry of Transport prescribes rules for vessel disposal of oil in designated ports, and the Ministry of Defense regulates operations of Egyptian ports.

(2) Mediterranean Sea: Egypt has signed three agreements concerning marine pollution of the Mediterranean; 1) the Convention for the Protection of the Mediterranean Sea Against Pollution, 2) the Protocol for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft, and 3) the Protocol concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency.

f). Desertifiction agreement

Along with Tunisia and Libya, Egypt is a party to the "Protocol on cooperation among North African countries in the fight against desertification," which proposes a Transnational Green Belt across northern Africa. (U.N. Conference on Desertification, 1977.) Its purpose is to establish a "greenbelt" that will stabilize soil, conserve moisture, promote afforestation, improve rangelands, husband plants and animals, and develop dryland farming.

g). The World Heritage Convention

Adopted by the General Conference of UNESCO in 1972, this international convention to which over 90 countries belong, aims to preserve the world's heritage in both its cultural and natural aspects, listing sites and monuments which are considered to be of such exceptional interest and of such universal value that protecting them is a concern of all mankind. The convention attempts to promote cooperation among all nations and people in order to contribute effectively to this protection.

A World Heritage Committee administers the World Heritage Fund which is available to member nations for technical cooperation, expert studies, equipment and training. Egypt has been a member of this convention since February 1974 and has five listed sites - all cultural (Abu Mena, Ancient Thebes and its necropolis, Islamic Cairo, Memphis (its necropolis with the pyramids), and nubian monuments from Abu Simbel to Philae). Thus far, no Egyptian natural areas are listed. Since 1980, Egypt has received funds from UNESCO through this Convention to send one or two EWS officers per year to a one year training course at the College of African Wildlife Management, Mweka, Tanzania.

3. Non Governmental Organizations

Universities and research institutions play an important environmental role in Egypt. In addition, private organizations of international, national, and local scope address biological resource issues, and approximately a dozen are particularly active in public awareness and related actions. (Dr. Farkhonda Hasson, oral communication.)

The International Union for the Conservation of Nature and Natural Resources (IUCN), based in Gland, Switzerland, was headed by Dr. Mohammed Kassas, the internationally recognized professor of botany from Egypt, from 1978-84.

The IUCN was formed in 1948 to initiate and promote scientifically based action that will insure preservation of the living world, man's natural environment, and the natural resources on which all living things depend, not only for their intrinsic cultural or scientific values, but also for the long term economic and social welfare of mankind. Composed of soverign states, government agencies and non-governmental organizations, IUCN is the world's only independent scientific organization dealing exclusively with the conservation of nature and natural resources. It is supported by membership dues, donations and grants. Members meet every three years in a General Assembly to adopt a three year umbrella program composed of individual projects addressing specific areas and topics. Program development is carried out in consultation with six commissions of scientists and other specialists.

Egypt is a state member of IUCN through the ASRT which established a National Committee for IUCN. The IUCN has served as an international forum for calling attention to areas of significance such as Ras Mohamed.

The Arab Office for Youth and Environment (AOYE), the first non-governmental organization for youth in the Middle East, was founded in Cairo in 1977 by two medical doctors. It focuses on public awareness and education programs, holding an average of three wildlife and conservation meetings annually, often in cooperation with the Supreme Council of Youth and Sport. AOYE has helped young people plant over six thousand trees, and recently received recognition from UNEP via an invitation to join the Global 500 Role of Honor for its activities. The most recent activity of AOYE is a UNEP supported project to use media and NGO's to create an awareness of the need for rational environmental actions among decision-makers and the public in 16 Arab countries. The AOYE aims to improve media attention to

environmental concerns and activities in Egypt.

The Egyptian Ornithological Society (OSE), based in Cairo, with about 300 Egyptian and foreign members, works to stimulate interest in and protection of the important bird life of Egypt. With help from the U.S. Fish and Wildlife Service, the Holy Land Conservation Fund, and British Petroleum, Ltd. the Society has assisted in producing the book, Common Birds of Egypt, the irregularly published journal Courser, and has conducted bird surveys of Lake Bardawil and other areas.

The International Council for Bird Preservation (ICBP) was organized in 1922 in London as the International Committee for Bird Preservation and its present name was adopted in 1959. This organization seeks to stimulate interest in all countries for better protection of wild bird life. Over 60 countries are members of ICBP, either through national sections or with individual representatives. ICBP is financed by grants and the subscriptions of National Sections and contributing members. Prof. Samir Ghabbour, of Cairo University's Institute of African Research and Studies, was designated Egypt's ICBP Representative in 1987.

In early 1988, ICBP established a project officer in Cairo for a period of one to three years to establish new programs concerned with the conservation of birds and their habitats. The officer will help train EWS staff at the International Center for Conservation Education in the United Kingdom, establish education centers at Cairo and Lake Manzala, produce a newsletter on Egyptian wildlife, and help establish mobile training units for teachers in small villages. The ICBP also has a project to establish bird exhibits for children at the National Museum of Natural History with the Heleopolis Society for the Development of Community Services, for which Mrs. Mubarak serves as chairman.

The Egyptian Association for the Conservation of Natural Resources, started in 1975, has approximately 200 members and is presently chaired by the Director of the EWS and Zoo. It is headquartered at the Giza Zoo, Cairo, and governed by an Executive Committee of 15 members elected annually at a General Assembly. The Executive Committee includes representatives from the ASRT, Cairo university, the zoo and EWS. The Association operates a national library (at the zoo) and since 1981 has published the annual "Egyptian Journal for Wildlife and Natural Resources". It also sponsors symposia such as the one planned for November 1988 on the role of protected areas and tourism in wildlife conservation.

The Conservation Organization for National Wealth, consisting of about 200 members, holds meetings to discuss environmental issues and supports environmental projects. It is headed by Dr. Maher Ali, Professor of Plant Protection at Assiut University.

The Shooting Club is a private recreation club located in Dokki, Cairo with 15-20,000 members and their families. The club has recreation facilities on grounds which cover about 53 acres. Membership costs 3,500 L.E. and dues are about 100 L.E. per year, depending on family size. The club leases about 2,000 acres of lakes in Shakere Governorate for hunting waterfowl, and only club members or guests may participate. It sponsors various shooting contests (for example, a March 1988 contest for pigeons was expected to bring 10,000 applicants from 11 countries).

Zoological Society. Based in Cairo at the Giza Zoo, this organization of about 300 members was started in 1927 to encourage research on wildlife and domestic animals. The Society raises money by conducting a charity drive (under approval of the Ministry of Social Insurance and Social Affairs) for winter aid to the poor. The Society receives half of the funds raised from the charity drive plus a small annual grant (LE 250) from the government to help publish a journal (Zoological Society Bulletin).

Friends of the Zoo. Formed in 1972 to encourage people, especially children, to know about animals, this organization of about 500 members (students) conducts lectures on zoos, taxidermy, and boy scouting skills at the Giza Zoo. Membership is 50 piasters per year.

Cairo Aquatic Association Fans (CAAF), based at the Fish Garden in Zamalik, Cairo, was initiated in 1983/84, but not given official status until February 1986. This society has about 20 active members who are involved in education about fish, assistance to fish breeders for treatment of disease, and breeding aquatic plants for breeders.

National Committee for IUCN. Established in January 1977 by the ASRT as an Eyptian Planning and Advisory group, this organization coordinates its activities with the National Committee for MAB. These activities include information on endangered animal and plant species, formulating proposals for a network of reserves in Egypt, collecting available ecological information about locations of proposed reserves, and organizing and executing actions to increase public awareness of environmental and conservation issues.

National Committee for MAB (Man In the Biosphere). MAB is an integrated, interdisciplinary, problem focused research approach to intergrating human activities with natural ecosystem conservation. It was created after the 1970 General Conference of UNESCO, and has scientific representatives from 30 nations who guide and supervise the program. Over 80 countries participate through national committees which define and organize activities concerning particular national problems. MAB provides a formal mechanism for bringing together and coordinating diffuse national and international research, conservation and training activities. A major emphasis is placed on establishment of reserves. Egypt's national committee for MAB works to nominate sites in Egypt to become part of the international network of biosphere reserves which are protected samples of the world's major ecosystem types. As yet no Egyptian reserves hold this classification.

The Green Association was formed in Cairo in August 1987, partly in response to articles describing import of radioactive milk contaminated by the Chernobyl nuclear plant accident. This group of 1800 members is attempting to became a registered political party. It's aim is to raise the consciousness of the Egyptian people about their role in improving the quality of their lives. Their goal is to create a spokeperson for the link between environment and development in every agency and at every level of the government.

4. Implementation of Laws and Initiatives Concerning Species and Protected areas

Egypt has had protective legislation for wildlife on the books since 1922 with the passage of Act No. 13 regarding the protection of birds. Act No. 134 of 1946 restricted the importation of ornamental birds and Act No. 53 in 1966 (Articles 117-119) attempted to expand the protection of birds and wild fauna. Act No. 61 of 1956 was passed for the protection of flora against exotic pests and diseases while Law No. 144 in 1969 (Section 12) addressed fish, especially preventing the use of explosives. However, most of these laws went largely unheeded. The Ministry of Agriculture, though charged with wildlife management responsibilities, had no organizational capacity to discharge these duties, except through the National Zoological Garden at Giza. Thus, despite issuance of Ministry of Agriculture Decree No. 28 in 1967 (based on Law 53 of 1966) prohibiting hunting of wild birds benifical to agriculture and wild animals, enforcement of the hunting and game regulations was the mandate of another ministry. This was partially rectified in 1979 by Decree No. 349 of the Minister of Agriculture, creating the EWS at the National Zoological Gardens as the functional arm to address

wildlife research and management.

Impetus for creating protected areas in Egypt developed during the Sinai reconciliation between 1979-1982. Prior to 1967 the area had received no wildlife protection. Wildlife losses had become serious, due to increased grazing from goats, explosives used for fishing in coral reefs, and hunting. The Sinai leopard was exterminated, the Dorcas Gazelle became rare found only in remote wadis, the Nubian ibex retreated to a few refuges on mountain tops, and flamingos of the north were disturbed by egg-collecting fishermen. During its occupation of the Sinai, Israel set up a system of nature reserves from Lake Bardawil to Ras Mohamed and hunting and fishing were controlled (Meininger and Mullie, 1981).

After the Camp David Agreement in 1978, President Anwar Sadat, conscious that environmental concerns were a necessary consideration in any overall development program, issued a March 5, 1980 policy statement for the protection of natural resources. He envisaged a network of nature reserves with varying degrees of protection in different parts of Egypt.

Although an interministerial committee met and drew up an implementation plan, the plan was never formally implemented. There were, however, several actions that came as a direct result of the committee's recommendations:

-- In early 1980, the governors of North and South Sinai and the Red Sea Governorate issued decrees for wildlife conservation within their jurisdictions that addressed hunting and fishing activities. The governor of North Sinai subsequently established a wildlife conservation office with an officer responsible for administering the Decree and other pertinent laws and regulations regarding wildlife protection, hunting, air and water pollution and public health):

-- In April 1982 the Minister of Agriculture issued a Decree regulating hunting activities on the Sinai, designating certain areas for more restrictive protection and charging the EWS with responsiblility for enforcing the regulations;

-- In April 1982 the governor of Matrouh Governorate designated an area west of Alexandria as the Omayed Nature Reserve to be considered as part of the UNESCO List of Biosphere Reserves (Decree 701);

-- In May 1982, the governor of North Sinai designated the eastern end of Lake Bardawil as a protective zone against all bird hunting (Decree 472);

-- In June 1982 the Matrouh Governor issued another Decree forbidding hunting in his Governorate;

-- In 1982, the Minister of Agriculture issued Decree No. 701 for the establishment of protected areas in Omayed and Elba (southeast Egypt). It also prohibits hunting of all animal species in these areas;

-- The Academy of Scientific Research and Technology prepared a National Strategy for Nature and Conservation in 1982 which recommended the protection of areas in the Sinai, the Eastern Desert (especially the Red Sea Mountains), the Western Desert (notably the oases), the Mediterranean coast (particularly the wetlands) and the Red Sea coast (notably the coral reefs). It recommended that the Egyptian Wildlife Service be authorized to implement and enforce scientific management of the protected areas and to conduct public awareness and education programs.

-- In 1982 the Ministry of Justice issued Decree No. 2344 authorizing EWS staff members to arrest and question any violators in their field of work;

-- In early 1983, by order of the President, all Governorates were required to hire an environmental officer;

-- Also in 1983 the MOA issued Decree No. 66 prohibiting the hunting of all falcon and eagle species and bustards wherever present in Egypt;

-- Law 102 was passed by the People's Assembly after consideration by the Shoura Council and approval by President Hosny Mubarak in July 1983. Major provisions of the law include:

o prohibition of activities in protected areas such as pollution, the killing or disruption of wildlife, or harm to wildlife habitat;

o prohibition of industrial, commercial, or agricultural activities in the immediately adjacent areas without permits;

o creation of a special fund from admission fees and fines to help support management and enforcement;

o authorization of environmental protection societies to seek counsel with Administrative and Judicial bodies to implement the law;

o authorization of the Prime Minister to establish specific protected areas and the designation of an administrative authority.

Prime Ministerial decrees were issued in 1983 to establish the Environmental Affairs Agency as the Administrative Body to direct and coordinate research and implement programs (Decree No. 1067) and to designate the intended reserves: Ras Mohamed and the islands of Tiran and Sanafir as the first natural protectorate (Decree 1068).

Subsequently, additional Prime Ministerial decrees were issued to create succeeding natural protectorates. Because each of these areas was already subject to the protection decrees of the Minister of Agriculture, one result of Law 102 and the Prime Ministerial decrees was to give both the EAA and the EWS important roles in managing protected areas. Confusion exists, however, concerning the precise role of each, and the process by which planning, management, and enforcement actions should proceed (See earlier discussion in section II, 1,a).

IV. STATUS AND MANAGEMENT OF PROTECTED AREAS

The most significant action concerning the welfare of species and protection of habitat at the national level occured in 1983 with the passage in July of a law on the establishment and management of protected areas. This legislation, known as "Law 102 (1983): concerning Natural Protectorates" was the result of several years' efforts by conservationists and legislators. The law did not disignate any specific area as a Natural Protectorate, but made provision for separate Prime Ministerial Decrees for the designation of respective protectorates and the administrative body responsible for implementaion of the law.

Accompanying the law was a two page explanatory note, signed by the Minister of Cabinet Affairs tenatively designating ten protectorates within Sinai, the Western Desert escarpment and the Easern Desert escarpment. These protectorates, as defined by Law 102, are "any area of land or coastal or inland water characterized by flora, fauna and natural resources of cultural, scientific, touristic or esthetic value, and specified by order of the Prime Minister upon recommendation of the Environmental Affairs Agency."

These potential Natural Protectorates designated by the Ministerial Note included the following:

1. Sinai

    a) Mount St. Catherine area
    b) Ras Mohamed and Tiran Island
    c) Bardawil Lake

2. Eastern Desert and Red Sea Coast

    a) Alaba Mountains
    b) Shayeb-el-Banat Mountains and adjacent mountains
    c) Hamata marine zone south of Marsa Alam (mangrove forests and coral reefs)
    d) Wadi El-Alaqi near its junction with the High Dam Lake

3. Western Desert and Northwestern Coast

    a) Ras El-Hikma peninsula
    b) Hettiat El-Mogharrah Oasis on the eastern tip of the Qattara Depression
    c) Oweinat Mountains and adjacent areas in the Southwest corner of the Republic

1. Existing Protected Areas (See Figure 4)

Following passage of this law, the Prime Minister issued Decree Number 1068 which declared the Ras Mohamed area of South Sinai Governorate as well as the two islands of Tiran and Sanafir in the Gulf of Aqaba as "Natural Protectorates" in conformity with Law 102 of 1983. The Decree prohibits "any action or activities or measures that would destroy or damage or deteriorate the natural environment or harm the fauna or flora or detract from the standard of beauty at the reserves area."

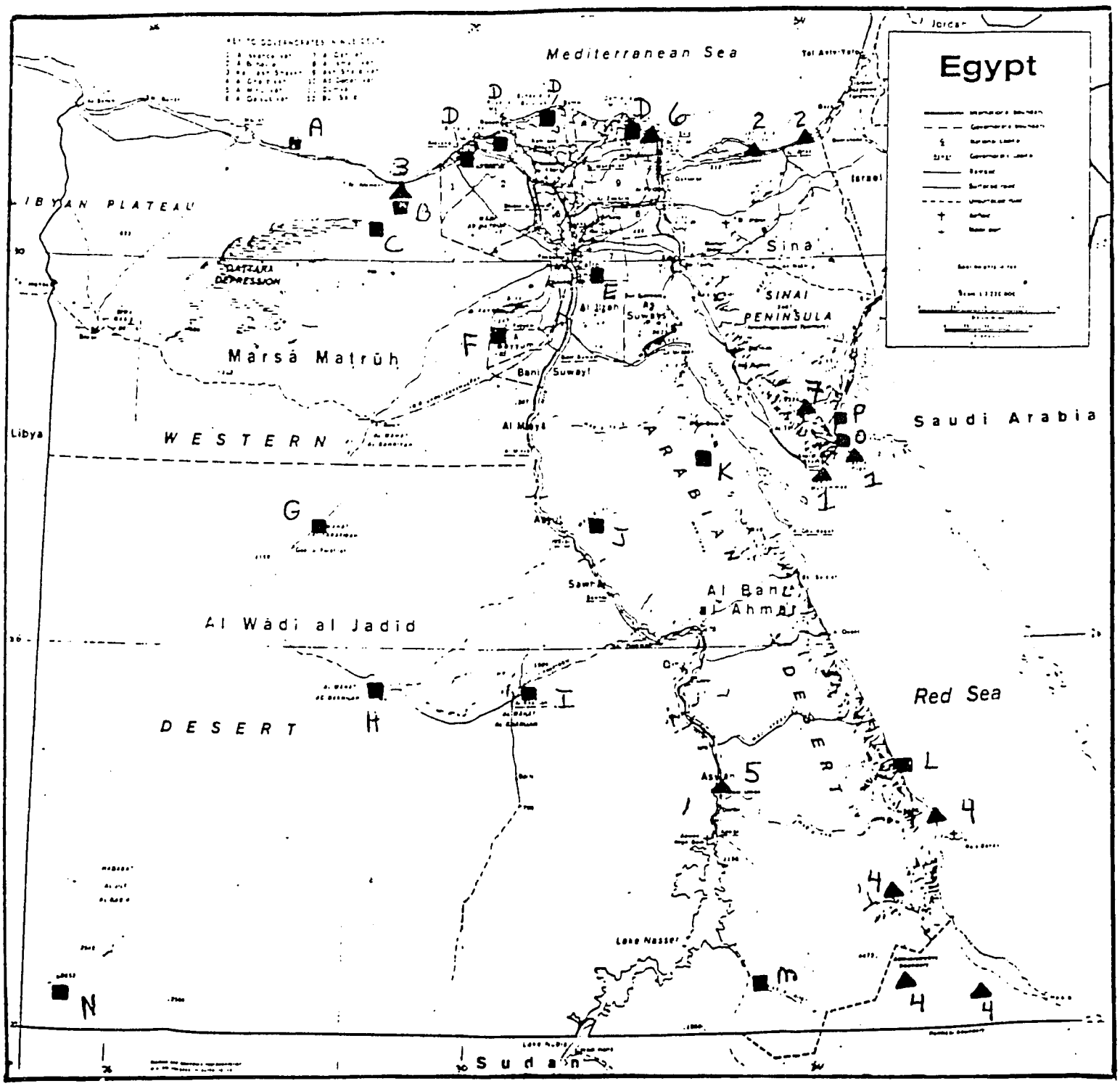
There are currently seven declared natural protectorates:

(1). Ras Mohamed, Tiran and Sanafir Islands (27°40'N, 34°15'E). Established in 1983 (Decree 1068) at the extreme southern extension of South Sinai in the Red Sea. Ras Mohamed is a peninsula of raised petrified coral reef that has cracked and filled with sea water. It features a sea water channel with tropical formation of mangrove trees and shrubs; an inland salt water pool; a series of volcanic cracks filled with sea water and populated by rare and interesting plants and animals, especially crustaceans; a canyon with the ruins of a Roman citadel, surrounded by a multitude of coral reefs and colorful reef fish. Tiran Island is the largest island at the opening of the Gulf of Aqaba. Sandy beaches, which provide nesting grounds for marine turtles, are nearly completely fringed with coral reefs. Ospreys, spoonbills and the rare sooty falcon are among other birds species which breed on the island, which rises up to the 509 meter peak at Gebel Tiran. Sanafir Island lying to the east of Tiran is smaller, lower in elevation and completely surrounded by coral reefs.

(2). Lake Bardawil and El Ahrash El Shamalia (31°10'N, 33°25'E). Established in 1985 (Decree 1429) Bardawil, on northern Sinai, is a shallow, hypersaline lagoon with salinities much higher than the adjacent Mediterranean Sea due to the lack of fresh water entering the system and the high rate of evaporation. The lake is situated on a very important migration route of waterbirds and serves as an important staging area for other species of migrating birds as well. In addition many birds breed in the area. The El Ahrash area comprises the scrub land and coastal dunes between El Arish and the international border at Rafah.

(3). El-Omayed (30°45'N, 29°15'E). Established in 1986 (Decree 671) at the northern edge of the Western Desert about 80 Kilometers west of Alexandria, this tiny, one kilometer square area is protected solely for its vegetation.

FIGURE 4
LOCATION OF EXISTING AND PROPOSED NATURAL PROTECTORATES



▲ EXISTING NATURAL PROTECTORATES

1. Ras Mohamed, Tiran and Sanafir Islands
2. Lake Bardawil, El Ahrash El Shamalia
3. El Omayed
4. Elba
5. Nile Islands, Saluga and Ghazal
6. Lake Manzala
7. St. Catherines

■ PROPOSED NATURAL PROTECTORATES

A. Ras El Hikma
B. Omayed Extension
C. Hettiat El Mogharrah Oasis
D. Delta Lakes
E. Gebel El Khaseb Petrified Forest
F. Wadi El Rayan
G. El Farfra Oasis
H. El Dakhla Oasis
I. El Kharga Oasis
J. Wadi Habib
K. Shayeb el-Banat Mountains
L. Hamata Marine Zone
M. Wadi El Alaqi
N. Oweinat Mountains
O. Nabo

(4). Elba (22°N, 36°E). (Four areas). Established in 1986 (Decrees 450 and 1186), the Gebel Elba and adjacent area is a remote area in the extreme southeastern part of Egypt and northeast Sudan where the boundary between the two countries has not been mutually agreed upon. Marking the northern limit of many Afrotropical species, this area, although part of the Eastern Desert, receives considerable precipitation and contains a great diversity of plants and animals, marine and terrestrial.

(5). Nile Islands, Saluga and Ghazal (24°05'N, 32°13'E). Established in 1986 (Decree 928), this small group of about nine islands (two large and seven small) in the Nile River at Aswan are an interesting example of island ecosystems. They are protected for their floral values as well as for the habitat they provide to birds, crustaceans, invertebrates and aquatic organisms. Each island is an intricate complex of micro-environments created by the location of the islands and their surrounding climate.

(6). Ashtum El Gamil, Lake Manzala (31°20'N, 32°10'E). Approximately 1200 hectares in the eastern portion of Lake Manzala, in the Port Said Governorate, was declared a Natural Protectorate in June 1988. As the largest of the delta lakes, Lake Manzala provides an abundance of fish and waterfowl. The lake is an internationally important wintering area for waterbirds that include common shellduck (Tadorna tadorna), shoveler (Anas clypeata), and coot (Fulica atra). It is also an important staging area for migratory birds.

(7). Saint Catherines (33°57'E, 28°30'N). Established in June 1988, this area in the South Sinai contains some of the highest mountains in Egypt (over 2500 meters). The rugged granite peaks encompass sites of historic, cultural and religious significance; the 6th century Greek Orthodox monastery dedicated to St. Catherine, Mount Musa where Moses is believed to have received the ten commandments, and numerous monuments. The mountains also provide habitat for rare endemic plants and a variety of animals such as Nubian ibex, rock hyrax, striped hyaena, red fox, and many species of birds.

Little action has been taken to provide the declared natural protecorates with management or protection since their formal declaration. The Egyptian Wildlife Service (EWS) has been deputing wildlife officers to Ras Mohamed, Bardawil, Omayed and Gebel Elba since 1980 on an irregular basis to enforce the Minister of Agriculture's Decree to provide protection to and conduct research on these areas. Draft managment plans were formulated for some of the areas.

Personnel from the Aswan African University have waged a steady battle for several years to conduct research on the Nile Islands, provide protection and convince the Governor and federal government to make the islands into a natural protectorate. In the latter case, an arrangement has been worked out to facilitate research and protection; however the system is yet to function satisfactorily.

In the case of Ras Mohamed, the Environmental Affairs Agency (EAA) has designated a manager and recently devised a construction plan for the area which has not been implemented.

While Omayed and the Nile Islands are rather small and their boundaries obvious, none of the declared areas have been measured and Ras Mohamed, Bardawil and Elba have never had their exact boundaries delineated or accurately measured and marked. Some baseline biological research has been conducted on each of the areas, yet nothing of a systematic nature.

2. Proposed Protected Areas (See Figure 4)

Law 102 proposed ten areas for natural protectorates. Of the seven areas declared, five are from this list. During the course of this study, ten additional areas have been identified by EWS personnel for proposed natural protectorates. Of these ten, only two come from the Law 102 list: Wadi El-Alaqi near its junction with the High Lake, to be an extension of the Gebel Elba area; and El Oweinat Mountains and adjacent areas in the southwest corner of Egypt.

The additional eight areas proposed are as follows:

1. Wadi El Rayan and part of Lake Qarun (El Fayoum Governorate) Eastern Desert.

2. Part of El Farfra, El Dakhla and El Kharga, Oases - New Valley, Western Desert.

3. Gebel El Khasheb Pertified Forest (El Maadi near Cairo).

4. Wadi Habib (Eastern Desert near Assiut).

5. Lake Nasser (Aswan Governorate).

6. Extension of El Omayed to include more land of Western Desert.

7. Nabq - Ras El Tantur mangrove sites (South Sinai).

8. Nile Delta Lakes.

Each of the EWS proposed areas has a uniqueness to qualify it for inclusion in the natural protectorate system. Some areas have been studied in more detail than others, but none has been subjected to the kind of comprehensive baseline surveys that would be required to provide the proper amount of information for decision making. The same can be said for the areas proposed by Law 102.

V. CONSERVATION OUTSIDE OF PROTECTED AREAS

1. Natural and Managed Ecosystems and Development Impacts

A. Coastal and Wetland Systems

The attraction of wetlands and water bodies to waterfowl has seldom gone unnoticed by man and traditionally, hunters have established shooting and trapping stations in the delta and along the shorelines of lakes and the wetlands nourished by the Nile or its canals. Some areas have been used year after year by royalty or the affluent as private reserves. These reserves usually employ guards and thus they are protected against encroachment from those who may use the surrounding area for agriculture or fish ponds. There generally is an awareness of bird identification on the part of hunters, but not always an appreciation for the fundamentals of conservation as a means to assure maintenance of the resource. Personal communications indicate that more than 1000 ducks have been shot at Abbassa by a single hunter in one day.

Wetland management in the United States implies control or alteration of conditions to improve the overall diversity and productivity of an area or to protect specific fauna or flora. Various decrees, legislation and international conventions concerning use and management of wetlands are in existence in Egypt (see Section III), however, except for a few instances, no active management practices are implemented.

(1) Impacts of coastal development on biological resources

A variety of development activities impact on Egypt's natural resources. With approximately 2700 kms. of marine shoreline, coastal development can significantly affect the productivity of marine resources.

(a) Tourism and Recreation. Beach tourism to take advantage of Egypt's great expanses of sandy beaches, is often considered separately from cultural/sightseeing tourism and development focuses on construction of hotels, restaurants, shops and other recreational facilities. Supplemental water and sewerage requirements along with transportation and communication facilities can substantially add to the impacts. Initial construction will physically alter the natural environments on-site and destroy or displace organisms that existed there. Dredging, filling and runoff of soil materials can impact on adjacent areas by causing interference with water and animal movements, siltation and reduction of water clarity and chemistry.

Subsequent activity after construction such as sewerage and trash disposal, hunting and fishing, boating, etc., can continually affect the environment if improperly done. Untreated domestic sewerage kills aquatic organisms and alters the marine environment so that unwanted plant and animal species can become established. Tide changes and water currents can bring unsanitary and odoriferous material back onto beaches creating health hazards or unattractive conditions. Uncontrolled trash disposal can create similar problems. Boating and fishing can harm coral reefs by collisions and anchoring as well as entanglement with fishing nets and lines. Shell collection by tourists can gradually cause a reduction in benefits from the recycling of the shells, loss of habitats for smaller organisms utilizing them for protection and often reduction in live shell animals mistakenly collected. Areas of potential damage from touristic and recreat onal impacts include the Mediterranean around Alexandria, the northern coast of Sinai, especially around El Arish, the Gulf of Aqaba coast, especially near Ras Mohamed, Sharm El Sheikh, Nabq, Dahab and Nuweiba and the Red Sea coast, especially near Hurghada.

(b) Industrial Pollution. A major contributor to marine pollution from industrial wastes is Alexandria, Egypt's second largest city, which discharges materials into the Mediterranean at the western harbor and vicinity, Abu Kir Bay at Tabia as well as into Lake Maryut from textile, paper and canning industries. The cities of Port Said and Suez also contribute industrial wastes to the marine environment. This results in surface oil slicks, turbidity, visual pollution and odors. While industrial pollution is lower off the Egyptian coast than in other Mediterranean countries, the marine ecology is more fragile because of the slower water circulation in the eastern Mediterranean and consequent lower oxygen and nutrient supply. The concern expressed is the steady buildup of pollution and the increasing inability of the marine system to absorb it without severe or permanent damage. Coastal zones are the most threatened.

The Red Sea was transformed into a major commercial waterway with the construction of the Suez Canal. Subsequent programs for deepening and widening the canal to handle supertankers have succeeded in increasing the pollution from dredging and filling operations, oil spills, bilge pumping and other sea dumping of wastes. Movement of ships also results in high turbidity, especially in the shallow Gulf of Suez. Dredge fill from the canal has greatly affected the level and size of El Malaha decreasing its depth and creating turbidity and siltation. Fish production and bird nesting have been greatly affected (Meininger and Mullie, 1981). The higher level of

ship traffic increases the chances of collisions with coral reefs in periods of poor visibility and many rusting hulks along the Gulfs of Suez and Aqaba coastline attest to this fact. The oil port at Eilat, the SUMED pipelines at Ain Sukhna with their docking facilities for supertankers, the Sinai oil fields near Abu Rudeis and El Tur and the offshore Gulf of Suez wells are some of the principal sources of oil pollution in the Red Sea.

The assessment team for this report observed a continuous layer of oil on all the seashore sites visited on the Sinai Peninsula and the Red Sea. This also has been reported as a problem on all islands along the Egyptian coast. It appears that pollution from oil is responsible for a drastically reduced population of mangroves along the Gulf of Aqaba and Ras Mohamed. Personal observations by team members indicate that at some sites, more than half of the mangroves have been destroyed within the last 5 - 8 years. Although slow recovery of similar sites exposed to oil spills has been observed elsewhere, the threat of further exposure to oil is believed to be much more severe in the Red Sea than in any other area of coral and mangrove.

Oil kills zooplankton, phytoplankton, and many fish, birds and mammals in the affected areas, especially at low tides when the tops of coral reefs and the intertidal organisms are exposed. It also fouls beaches and reefs.

(c) Land Reclamation and Agriculture. Land reclamation is a continuing activity of Egypt, particularly to meet the needs of its rapidly increasing human population. As an example, Lake Manzala used to include 1,698, KM^2. Its area now is only 769 KM^2 and existing plans will reduce it to 469 KM^2 (personal communication). Land reclamation in general is a significant problem affecting the Nile delta lakes as this whole area is highly cultivated and irrigated and densely populated. Reclamation activities such as draining and filling destroy habitat for migratory waterfowl, diminish fishery resources and may lower the water table in the area.

The use of the reclaimed land, as well as the use of traditional upland sites for agriculture, contributes to coastal resource destruction primarily because of the use or misuse of pesticides, herbicides and fertilizers. Egypt relies heavily on pesticides to protect cotton, its primary export. Often these pesticides are over-applied and long term residues of heavy metals, hydrocarbons and other toxic materials are washed into surrounding water bodies where they settle in the bottom sediments to be taken up by plants and animals. Mis-applications of chemicals can be lethal to animals and humans

and poses a significant health problem. Likewise, improper application of fertilizers can result in high amounts of phosphates and other substances that adversely affect the natural productivity of receiving waters. Lake Maryut is a prime example of high eutrophication caused by industrial and agricultural runoff which threatens the lake's biological and economic productivity.

B. Inland Systems and Development Impacts

(1) Desert/Oasis Systems

a). Inland energy development: Fossil fuel power generation is increasingly important to Egypt, and development will accelerate if water scarcity limits power production from the High Dam. Nuclear power production is also planned. Egypt exports crude oil and imports liquified natural gas.

Coal mining in the Sinai could have significant potential impacts on wildlife and plant resources of the Sinai.

b). Proposed energy development -- Flooding of the Qattara Depression: A major, long-standing proposal for energy development has involved the concept of bringing Mediterranean water 80 KM into the Qattara Depression, which lies as low as 131 meters below sea level, in the western desert. The resulting lake would approximate the size of Lake Ontario in the U.S. The project has been envisaged as lowering temperatures and inviting productive rainfall and, more importantly, allowing development of a 6,800 megawatt hydroelectric power plant. Equilibrium might be reached when water level reaches 61 meters below sea level and evaporation equals inflow that would permit electric power production. (Audubon, vol 79/No. 2, March 1977.)

A Swedish feasibility study indicated that the proposal is too expensive to be feasible at present. Should the proposal ever be initiated, loss of many plant and animal resources native to the Qattara Depression would be among the significant impacts. Other concerns include salinization of groundwater underlying the adjacent oases and Nile Delta.

c). Wildlife impacts of new roads: New roads have contributed to significant hunting and collection impacts on plants, birds, and land animals by opening up previously inaccessible areas to unregulated hunting and unplanned new development. In early 1988, for example, it was reported that a hunting party had used a new road in central Sinai to kill 380 wild rabbits, 110 bustards, and 8 gazelles, based on a permit received from the Ministry of Defense. Hunting is,

however, prohibited on these lands by the Minister of Agriculture.

While hunting pressure in Egypt is focused primarily on waterfowl, desert birds have been affected by human activity. The ostrich has been deciminated from most parts of Egypt's deserts due to hunting and egg collection. Arabs from the Gulf States have a reputation in Egypt for their interest in hunting bustard. Many members of the Cairo Shooting Club hunt for the desert partridge when the duck season is over. Peregrine falcons are captured alive and yearling females are frequently sold to Gulf Arabs for as much as 5000 Egyptian pounds (Ayyad and Ghabbour, 1986).

Other wildlife, particularly mammals, has been declining in the Egyptian desert. Ayyad and Ghabbour (1986) conclude that this decline is primarily related to use of firearms and mechanized vehicles (cars and helicopters). They relate accounts of wholesale destruction of wildlife (gazelles and ostriches) even in the remote Gebel Elba area.

d). Potable Water Supply: Water supply lines from the Nile to Hurghada on the Red Sea and El Arish on the North Sinai coast have, in addition to their benefits, allowed unplanned and unwelcome development impacts as well. At Hurghada these impacts are primarily focused on marine resources (discussed in part V, A). At El Arish it allowed substantial new coastal development, one effect of which was the massive cutting of the famed date palms that lined the coast. Although requirements for replacement of these trees are now in place, it will be decades before this largely aesthetic impact is corrected.

e). Hotel and Tourist Facilities: Egypt's growing interest in promoting tourism for sand and sea as well as cultural experience (Sultan, 1988) has significant implications for biological resources. The siting of tourist facilities can have significant aesthetic as well as biological impacts on and off natural protectorates. Plans have been considered for locating new hotels on islands directly adjacent to the Nile Island Natural Protectorate, at Aswan. The proposal could add significantly to the impacts on protected resources from tourist use and might substantially reduce tourist attraction to islands that have been remarkably unchanged since ancient times. Positive impacts on biological resource conservation can also occur, however, as a result of tourist education programs and the devotion of some portion of tourist revenues to conservation activities. (Tourist impacts on coastal resources are discussed in Section V.A).

(2) Agricultural Systems

In addition to the impacts of land reclamation mentioned above, the biological resources of Egypt's ancient agricultural systems along the Nile are also being affected by new developments.

a). Aswan Dam: Egypt's legendary dependence on the Nile floods, which ranged from 150 to 45 billion cubic meters (Hefny, 1982), ended in 1964 with completion of the High Aswan Dam. The dam constitutes Egypt's most significant recent impact on its biological resources. The new Lake Nasser can store 162,000 million cubic meters at an elevation of 182 meters. It covers 5,000 square kilometers and extends 500 kilometers (300 miles) into Sudan. It has provided Egypt with up to 40 percent of its electric power. In conjunction with the old Aswan Dam several miles down river (constructed early in the century and raised several times since), water is released for irrigation, power, navigation, and municipal and industrial uses.

After Lake Nasser reached its storage capacity in the early 1980's, dry years in the watershed of the Blue and White Nile Rivers have reduced capacity to potentially critical levels (personal communication, Mustafa Yunedi, General Manager, High Dam Power Station). During this dry period, however, the dam stored and allocated water for agricultural, consumptive, and industrial use on a regular basis.

b). Impacts of the High Dam and rising sea levels on the Nile Delta: Closure of the High Dam in 1964 has essentially eliminated the annual deposit of 73 - 91 million metric tons of sediment in the Nile Valley and the accretion process that has sustained the Nile Delta for tens of thousands of years (Broadus, et al. 1986). As has occurred with the highly managed Mississippi River, one result of this loss and continued subsidence is continued encroachment of delta land by the sea, estimated annually at 1 meter or more, and in some places over 100 m. per year (Broadus, et.al.,1986). The Rosetta estuary promontory and the promontory at Damietta estuary have, in recent times, retreated from 2.5 to 3 kilometers (Hefny, 1982).

Based on estimates of global warming trends due to the greenhouse effect, future impacts of this combined lack of accretion and rising sea level have been examined under two scenarios: a conservative estimate that assumes rising sea levels of 1-m. over the next 100 years (or a 50-cm. rise and 50-cm. subsidence), and a pessimistic high case that assumes a 3-m. rise over 100 years (Hefny, 1982). The low case could

result in inundation of 12 - 15 percent of Egypt's arable land, affecting 8 million people, and the high case could inundate 20 percent of the arable land inhabited by 10 million people. Direct biological resource effects would be substantial loss of the fish catch and bird habitat of the brackish Nile Delta Lakes (Maryut, Idku, Burullus, and Manzala) that are now protected by coastal sand dunes.

c). Other impacts of the High Aswan Dam: Among the impacts of the High Dam:

o It has greatly reduced nutrient supply down river and has caused, or at least contributed significantly to, virtual elimination of the sardine fishery in the Mediterranean off the delta coast (Arid Lands, 1980);

o Continuing irrigation has introduced schistosomiasis in new areas because before irrigation the snail vector was killed during dry seasons, and floods periodically cleared mollusc habitats (Arid Lands, 1980);

o Since the elimination of annual floods many plants have disappeared, including fourteen original species of rice-weed, which have been replaced by other species, some harmful (Arid Lands, 1980).

d). Impacts of irrigated agriculture: use of chemicals for agriculture and channel weed control: The provision of regular irrigation to the 6.4 million feddan of arable land through a system of main, branch, and distribution canals, has allowed significant increases in crop production and use of water. It has also lead to rising groundwater levels, waterlogging, and salinity.

Maintenance requirements for the 48,000 km. of irrigation and drainage channels and 80,000 km. of smaller ditches has shifted from excavation of silt (which no longer passed through the dam) to the removal of weeds that reduce carrying capacity. Weed growth, including Phragmites and water hyacinth, has been stimulated by clearer water and use of fertilizers.

Approximately 4 percent of the government's maintenance program has been devoted to the use of herbicides (Acrolein or Magnacide H) in large canals to eradicate submerged weeds. Ametrine has been sprayed to reduce water hyacinth.

Increased use of fertilizers, herbicides, and pesticides has exposed people to health risks and the environment, including domestic livestock, fishes, plants, and birds, and to

adverse toxic effects. Ghabbour (1987) reports that although many plants and wildlife have long ago disappeared, important ones remain in oases and coastal regions. These are now threatened by agricultural expansion. For example, leguminous weeds useful for nitrogen fixation are disappearing because of herbicides. It has been estimated that every square meter of the Delta has received 30 grams of pesticide since 1952, thus explaining a noticeable lack of earthworms (personal communication).

Submerged aquatic weeds can help control erosion and provide nourishment to buffaloes, frogs and water birds. (Hefny, 1982). Biological control alternatives include introduction of grass carp to eat submerged weeds. However, the spraying of Bayluscide in canals and drains to control the snail problem (Bilharzia) also kills fish.

Dramatic declines in raptor populations have been attributed to use of agricultural pesticides and herbicides to control spreading problems of Cotton Leaf Worm, Grape Moth, and Corn Stalk Borer (Mullie and Meininger, 1985). Of the 17-19 species that breed in Egypt, at least 9 have decreased in numbers, and of the wintering raptors, at least 12 species have decreased, primarily in the Nile delta and Nile valley north of Sohag. The principle cause is apparently use of pesticides, particularly insecticides in cotton fields. However, heavy concentrations of DDT, DDE, and Lindane have been found in Lake Maryut, which has experienced severe fish kills, and declines of scavengers like black kite may be related. Corresponding increases have occurred in bird species, such as the house sparrow and blackbird, normally controlled by raptors, and in some places they have become agricultural pests.

Loss of raptors in some newly irrigated areas may have caused rapid increases in rodent populations. Loss of 20 percent of Egyptian crops to rodent damage (Mullie, Ibid. citing Botje, 1984) has led to use of rodenticides. Use of rodenticides in the Faiyum Oasis may have caused further reductions in raptor populations and substantial reductions in foxes, jungle cat, mongoose, and jackals.

A major component of World Bank lending has been devoted to drainage projects for about 2.6 million feddan (2.7 million acres) of irrigated land. The Dutch government has supported studies of biological weed control and training, USAID has projects to improve irrigation facilities and manpower development (but no projects for use of herbicides).

e). New land development: Urban and industrial development has encroached into the rich old lands of the Nile

delta at the rate of about 20-40,000 fed/year, (one feddan =1.038 acres) (World Bank, 1986) and salinity and waterlogging has reduced these lands' productivity. Until 1985 desert top soil of up to 1 meter in depth was being lost to the production of red bricks, but a new law and vigorous enforcement has largely stopped this practice (Ghabbour, 1986). As a result of population and development pressures, the increasing urbanization of Egypt, and the loss of fertile agricultural land, new land reclamation has occurred in the desert. From 1952 to 1978 approximately 915,000 feddans were reclaimed, of which 770,000 are still considered tillable (Hefny, 1982). A recent project is the New Lands Development Project - West Nubariya, which involves reclamation of 24,000 fed. of desert land and the resettlement of 4,000 small land holders. Among the impacts of new development is loss of wild plants and animals hitherto protected by their remoteness.

C. Mechanisms for anticipating and preventing adverse impacts.

Existing controls: The Minister of Agriculture has authority over Egyptian wildlife and can issue permits for wildlife hunting. Enforcement and monitoring of this authority remains a concern and challenge to the EAA, EWS, and the Environmental Offices in each Governorate. Beyond this, however, Egypt does not now have a mechanism for anticipating and evaluating biological or other impacts of development proposals, before funds or permits are authorized for a new road, water line, mine, hotel, tourist village, or industrial development.

Possible Improvements: The Environmental Affairs Agency is considering requirements for an environmental impact assessment (EIA) process based on studies now under design. Because any requirement for an EIA causes concern about increased costs and delays to development plans, any new process must focus on the most critical potential impacts and maximize simple procedures.

One alternative is to initially only require an EIA for potential development impacts, direct and indirect, on existing and proposed natural protectorates.

Another course would be to require EIAs for potential direct and indirect impacts on specified biological resources (on or off protected areas) that EAA, EWS, the ASRT, or some other body has determined to have significant value to Egypt.

An important element of any EIA should be the need for a project proponent to examine alternative sites and designs that would avoid or substantially reduce direct and indirect impacts on significant biological resources.

Regardless of its scope, even a modest EIA requirement for major development projects offers the possibility for substantial long-term economic savings from development mistakes. It also offers opportunities for effective coordination and management of development activities at the national and local level.

The broad mandate of the EAA makes it highly suited to oversight of any EIA process, but training of government staff in the EAA, the Ministries, and the Governorates is essential. The challenge is to ensure that EIA's are useful to decision makers and that practical preparation and review by experts addresses the most significant impacts of a proposal, and its reasonable alternatives, on important biological resources.

2. Species and Germplasm conservation

A. Endangered Species Status and Protection

Information on endangered species is collected by a number of national and international sources often with varying terms and priorities depending on whether the species is endangered throughout its entire range (which may extend over several countries and continents) or is only endangered locally. Terminology used by the IUCN in their Red Data Book listings includes: Endangered - taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating; Vulnerable - taxa believed likely to move into the endangered category in the near future if the causal factors continue operating; Rare - taxa with small world populations that are not at present endangered or vulnerable, but are at risk; Indeterminate - taxa that are suspected of belonging to one of the first three categories, but for which insufficient information is currently available. The use of the term "endangered" in this paper refers to all four categories used above.

In the U.S., endangered species are given high priority in species conservation efforts. Sometimes these efforts are successful in reversing the downward trend of a rare species, but the economic cost is often staggering and fraught with the potential for failure. Many efforts aim at protecting areas harboring unique communities or a single species recognized as endangered. Unfortunately, no one has yet identified the minimal protected area size required to ensure the survival of any species.

Extinction of species is a worldwide problem. Egypt occupies a key position between the Asiatic and African continents, and its floristic and faunistic composition shows affinities with adjacent lands in all directions. It is also presently a land of sunshine and intense dry heat with over 95% of its area considered desert. However, the land occupied by Egypt was not always so, as indicated by pictures and inscriptions found on the walls of graves 5,000 years old. The climate then was much moister and water more abundant giving rise to a far richer flora and fauna.

Since that time Egypt's climate gradually changed from moist to arid. Savanna and marshlands slowly shrank and disappeared. Animals and plants dependent on these environments "retreated" to similar habitats to the south or became confined to favorable micro-environments within Egypt. Animals left in these environmentally-constricted areas have faced continuous and ever-increasing predation by man which has included direct hunting practices as well as pressure from domestic grazing, tree and vegetation cutting, agriculture development and expansion of settlements. Marabou and shoe-billed storks, camel, fallow deer, auroch and hartebeest disappeared, followed by the lion, hippopotamus, Soemmering's gazelle, ostrich, red-breasted goose, spotted wild dog and sacred ibis. Within the last century the addax, wild boar, leopard, hermit ibis and crocodile were extirpated (the crocodile has since made a comeback in Upper Egypt after the creation of Lake Nasser). It is not known how many other species of birds, plants, insects and invertebrates disappeared with the larger more recognizable species.

Today, though accurate documentation is difficult to come by, Egypt has recorded about 75 species of mammals, about 430 species of birds (150 species resident), 2,081 species of plants, 1,200 species of fish, 100 species of reptiles, and 30 species of amphibians. The majority of these species are not endangered. But the status of Egypt's fauna has not been well studied, with a few exceptions. Best known are some of the larger mammals, birds and reptiles. Those listed as endangered in Egypt are included in Table 1. This account is not definitive for all endangered species in Egypt. Rather, it is an attempt to indicate the status and vulnerability of various groups and species.

Plant species are essential to human life. At present the greater part of man's agriculture is dependent on less than 30 species of plants out of approximately 250,000 known species. Because of the link between plant diversity and that of the dependent fauna, extinction of plants causes an even greater

loss among other organisms. Current indications are that 10% of the world's plants are dangerously rare or coming under severe threat. While Egypt's plants have been fairly well-studied, few conservation measures have been taken to conserve those recognized as endangered.

The following list of endangered plants is not a complete one, but is presented as indicative of the most endangered species identified:

Cyperus papyrus ssp. hadidii -- This endemic subspecies of the once widespread papyrus was believed to have been extinct in Egypt for over 150 years until its rediscovery in 1968. Along with the lotus, this plant was one of the best known from Ancient Egypt, being used as the symbol of the Lower Kingdom. It was used for mats, boats and sandals, funeral garlands or formal bouquets, as motifs on columns, paintings and reliefs, and most important as a writing material. Its present occurrence is restricted to small areas of fresh-water marsh around three saline soda lakes in Wadi Natrun Depression in the Western Desert. This habitat is decreasing in size and is in danger of completely disappearing due to extraction of water from the Nile and changes in irrigation pattern of the country.

Helianthemum sphaerocalyx -- Perhaps the best example of a distinct species found only in Egypt, this species, numbering in the low hundreds, is scattered along a 150-kilometer stretch of the Mediterranean coast between El Amria and Ras El Hekma, west of Alexandria. Tourism development, human settlement and oil extraction have reduced the numbers of this species to less than a dozen small pockets in very rocky areas. Its large fragrant flowers and fleshy leaves are unusual features in the genus and of considerable botanical interest.

Medemia argun -- A palm tree that grows to about 10 meters high and was often depicted in Ancient Egyptian tombs as offerings, it is now only known from a few individual specimens in three widely separated localities within a 200 kilometer radius of Aswan. Although the fruits are barely edible, its leaves are popular construction materials most often used for mats. This exploitation along with change in irrigation systems causing destruction to their Nile habitat has led to its highly endangered status. Its natural habitat is river banks, wadis and oases.

TABLE. 1. Representative List of Endangered Animals in Egypt

Mammals

Barbary Sheep (*Ammotragus lervia ornatus*)
Nubian ibex (*Capra ibex nubiana*)
Wild ass (*Equus asinus africanus*)
Cheetah (*Acinonyx jubatus*)
Slender-horned gazelle (*Gazella leptoceros leptoceros*)
Arabian gazelle (*Gazella gazella arabica*)
Fennec fox (*Vulpes* (*Fennecus*) *zerda*)
Sand cat (*Felis margarita*)
Wild cat (*Felis sylvestris*)
Dugong (*Dugong dugon*)

Birds

White pelecan (*Pelecanus onocrotalus*)
Dalmation pelecan (*Pelecanus crispus*)
Great white egret (*Egretta alba*)
Spoonbill (*Platalea leucorodia*)
Glossy ibis (*Plegadis falcinellus*)
Sacred ibis (*Threskiornis aethiopicus*)
Greater flamingo (*Phoenicopterus ruber*)
Marbled teal (*Anas angustirostris*)
Imperial eagle (*Aquila helinca*)
Peregrine falcon (*Falco peregrinus*)
Sooty falcon (*Falco concolor*)
Houbara bustard (*Chlamydotis undulata*)
Ostrich (*Struthio camelus*)
Egyptian plover (*Pluvianus aegyptius*)

Reptiles

Nile crocodile (*Crocodylus niloticus*)
Green sea turtle (*Chelonia mydas*)
Hawksbill sea turtle (*Eretmochelys imbricata*)
Leatherback sea turtle (*Dermochelys coriacea*)
Dabb lizard (*Uromastix aegyptius*)
Desert monitor lizard (*Varanus griseus*)
Nile monitor (*Varanus niloticus*)

Mangrove (Avicennia marina) fringes the Red Sea shoreline in many areas but reaches its northernmost range extension in the world on Southern Sinai in the Gulf of Aqaba. Serving as shoreline stabilizer, nursery area for young fish and invertebrates and nesting and resting sites for migratory and resident birds, mangroves are heavily impacted by shoreline pollution particularly from oil. In the Sinai, Bedouin use of mangroves for firewood seriously threaten its status.

2. Marine Species: There are some 500 species of fish in the Mediterranean of which 77 are probably endemic (found no where else in the world) plus another 20 which are essentially Mediterranean. There are also some 20 sub-species which are endemic. Over 750 species of fish are represented in the Red Sea of which 10-30% are endemic. The reasons for the high endemism in the Red Sea are different from the situation in the Mediterranean, yet both situations are considered remarkable in terms of the degree of endemism. Most of the endemic species are of the littoral or benthos in the Mediterranean and associated with the coral reefs in the Red Sea and some are limited to particular localities. This makes them especially vulnerable to over-exploitation and to the increasing pollution of the coastal area.

Five species of marine turtles occur in the Mediterranean and Red seas with nesting sites or activity identified on North and South Sinai, the Red Sea coastline and various islands in the Red Sea. All of the marine turtles are listed as endangered throughout their range. Exploitation of turtles in Egyptian waters, mainly for meat and eggs is slight, but oil pollution and marine explosions and other habitat perturbations are intense. Unfortunately, lack of documented information on these sea turtles has prevented an accurate assessment of their status and management.

Dugongs occur in small numbers throughout the Red Sea where they feed on marine algae and seagrasses in sheltered bays and undersea deltas off large wadis. They are occasionally caught in gill nets set for sharks and drowned accidentally.

Manta rays and some whale sharks occur in the Red Sea and have important breeding areas in some of the large bays. Sport shooting of the whale sharks and collisoans with ships is reported to threaten their welfare.

B. Ex-situ Conservation

Ex-situ conservation mechanisms (conserving a species outside its natural habitat) are important for conserving biological resources that are already reduced to threatened population levels in the wild. Some species are extinct in the wild and their only remaining populations are in zoos or botanical gardens. In addition, ex-situ conservation provides opportunities for research and public education.

Botanical gardens: In 1898 the Ministry of Irrigation establish a botanic garden on a 17 Feddan island in the Nile just below Aswan. The garden contained representatives of a variety of north African plants many of which were obtained from gardens in Cairo. Now maintained by the Ministry of Agriculture, the garden appears to be functioning more as a tourist park. The Orman Botanical Garden (Cairo) has a gene bank for horticultural plants and frequently exchanges specimens with other gardens (personal communication).

Zoos: Egypt is reported to have about 12 zoos at Cairo, Alexandria, Faiyum, El Mahalla, Souhag, El Arish, Mansoura, Montazah and Ismailia. Most zoos are small and privately-owned. Some have native species and others contain exotics. The government, through the Ministry of Agriculture, operates the 32 hectare (80 acre) zoological gardens at Giza, the 10.5 hectare (26 acre) zoo at Alexandria, and the small zoo at Faiyum. The Giza Zoo was founded in 1890 and specializes in animals of the Nile valley. About 400 species are currently maintained. The Alexandria Zoo was opened in 1907 and has over 200 species and a good breeding record (Seton-Williams and Stocks, 1983).

Aquaria: There is limited maintenance of aquatic species at the marine research station in Hurghada. The Alexandria marine research station has more extensive facilities for species maintenance, but most ex-situ work is for research purposes. The Giza Zoo supervises the small aquarium/fish garden at Zamalek. Built in 1867 as a private aquarium, but opened to the public in 1902, it was closed in the 1960's because of deterioration. Reopened in 1979, it features fishes of the Nile.

Captive breeding programs: Programs at the Giza Zoo exist for barbary sheep, Dorcas gazelle, baboon, African lion, leopard, chimpanzee, Sudanese oryx, waterfowl and other birds. Many of the smaller zoos keep lions, on loan from the Giza zoo to prevent breeding (personal communication). The Giza Zoo has recently become a member of the International Species Inventory

System (ISIS), a computer based information system for wild animal species in capitivity. The system provides information to cooperators on species and locations and short summaries of the captive status of the 2500-plus registered species. Hopefully, the registry will allow the Giza Zoo to upgrade its stock and to trade species on a more scientific basis.

Gene Banks: There are currently no germplasm storage facilities for wild plant or animal species. Section C, below, discusses gene banks for economically important species.

Herbaria: While dead plant specimens contained in herbaria do not directly assist with conservation of living biological resources, they are necessary in order to determine and verify species identities and as research and education facilities.

Egypt's leading herbarium is at Cairo University in Giza. The Cairo University Herbarium collection was begun in 1926 by Gunnar and Vivi Tackholm and the number of specimens is now approaching 300,000. The library associated with the herbarium is one of the finest in the Middle East. A group of scientists associated with the herbarium are conducting detailed research on the flora of ancient Egypt, using plant remains and materials from excavations. Support for development of the herbarium was provided by the Swedish government until 1980. Current development support is being provided by Cairo University and the ASRT. Egypt currently does not have a computerized list of plant and animal species and locations (conservation data base) but there is interest in such a development at Cairo University.

A herbarium is being developed at Aswan African University, where botanists are collecting information on Bedouin use of wild species.

C. Economically Important Species and Germplasm.

1. Terrestrial Species.

Herodotus called Egypt "the gift of the Nile"; the river's floods and fertile silt deposits led to the birth of agriculture some 12,000 years ago. The Egyptians were among the first peoples to domesticate fowl and beasts of burden. Onions, leeks, radishes, lentils and beans have been grown throughout Egyptian history, and have been transplanted to other parts of the world. Ancient Egyptians extracted sugar from the lotus root and oil from the moringa and balanos trees and from sesame seeds (Background, 1977).

Many cultivated plants have an extremely long history in Egypt. Some must have originated there while others were introduced. Lentil (Lens esculenta) is one of the oldest known cultivated leguminous crops. Barley (Hordeum vulgare) was one of the earliest cereals under cultivation; it has been known in Egypt since prehistoric times. Rice (Oryza sativa) may be the single most important food crop in Egypt, where it has been cultivated since the Muslim conquest. Citrus species are comparatively late introductions into Egypt. The grape (Vitis vinifera) has been cultivated in Egypt since 4000 BC.

Agriculture in Egypt was transformed by long staple cotton (Gossypium barbadense) which was introduced from South America in 1820. It was crossed with North American cottons in 1850, producing a cotton that was superior to either parent.

The economic importance of genetic diversity cannot be overestimated. Economically useful crops are developed from wild plants by selecting valuable inheritable characteristics. After years of selection, many wild ancestor plants contain genes that are no longer found in currently cultivated species.

The Egyptian Agricultural Research Center (ARC) has 15 separate institutes and laboratories. The Genetic Resources Section of the Field Crops Research Institute (FCRI) began working on the conservation of field crops six years ago when The International Board for Plant Genetic Resources (IBPGR) offered support for the development of a gene bank for oil crops. USAID is currently supporting development of a germplasm facility at Bahtim for all crop species, but efforts have not yet been initiated to collect germplasm of native, noncultivated species. The new germplasm facility is currently only able to store seeds; a laboratory will need to be added in order to store vegetative material and to undertake tissue culture. The USAID National Agricultural Research Project also provides funds for Ph.D. and post-doctoral training in germplasm conservation.

There is a need to collect and conserve the seed of landraces of Egyptian balady (national, traditional varieties) as well as modern field and horticultural crops. Land-races can evolve for species that have been cultivated for more than 200 years. A number of commercially important species are native to Egypt, including safflower and Egyptian alfalfa (medic). The ARC is interested in conserving genetic variablility of crop species that have been cultivated for thousands of years; clover (Birsim), alfalfa, wheat, barley, sorghum, lentils, fava bean, onion, garlic and oil crops. The survey of birsim races has been started; oases in the desert

have supported some very old races. There a birsim clover and barley races along the Mediterranean that have developed salt tolerance.

The Genetic Resources Section of the FCRI is responsible for:

- o conducting collecting missions to identify and preserve germplasm;
- o preserving collected seeds under controlled conditions and maintaining viability;
- o evaluating and cataloging collected materials to identify traits useful to plant breeders;
- o increase and maintain complete germplasm base of all crops and potentially useful wild/native species;
- o disseminate seed and descriptive data to researchers to enhance production of new cultivars.

There is also a need to conserve seeds or live material from threatened wild plant species for present and potential medical (and economic) use. The ARC has indicated willingness to store germplasm of native species collected by universities or other institutions. Suez Canal University professors are conducting field surveys of the medicinal plants used by the Bedouin on the Sinai, but have not yet initiated plans for germplasm collection (personal communication).

Methods to conserve economically important animal species are also in need of increased attention. Earlier sections described the interest in hunting in Egypt; programs for the sustained production of fish and game species might lessen pressure on wild species.

The Animal Production Research Institute is aware of the need to conserve germplasm of important domesticated livestock species, but programs have been constrained by a lack of resources. The one-humped Camel, such a familiar sight on the Egyptian landscape, is the only domestic animal for which no wild form is known (Seton-Williams and Stocks, 1983).

Marine Species: Egypt has extensive marine ecosystems with the Mediterranean, Red Sea, and Suez Canal and its interconnecting salt lakes. Many marine species are shared with adjacent countries and provide an important source of food and commerce. Included in this grouping are sponges, corals, molluscs, crustaceans, sea urchins, ascidians, fishes, algae and higher plants and animals. Egypt's marine ecosystems,

especially in the coastal zone, are subjected to numerous major pressures by man including industrial and urban waste pollution; urban, industrial, and agricultural development; oil pollution; over fishing; and tourism and mass recreation developments.

The finest and most valuable commercial sponges from the Mediterranean come from Mandruka, between Alexandria and Sallum, where they are collected by hand and by divers using a variety of types of equipment at depths between 15 to 50 meters. Official statistics on take are inadequate in terms of completeness to assess what is happening to the stocks of sponges involved. At least 4 species of Red Sea sponges have been reported to have migrated into the Mediterranean presumably through the Suez Canal.

Corals have been collected "from antiquity" mainly to be worked into jewelry. The thickened skeleton and branches of larger colonies are collected by diving or dredging, then cut and polished. White, dark, red and good pink command the highest prices while black is less expensive. Corals are slow growing and even low-level incidental exploitation can cause significant damage to local populations.

Bivalve molluscs (clams, oysters, mussels, etc.) generally exist in the intertidal or shallow sublittoral zone of marine coasts. Bottom dredging, beam trawling, etc. are collecting methods which cause unjustifiable damage to the habitat and local community as well as the target species. Many of the molluscs, particularly the gastropods are important members of intertidal faunas and because of their easy accessibility, are most vulnerable to various prevalent forms of pollution including oil and sewage discharge. An intensive fishery for Donax trunculus is reported from the littoral sand along the Nile Delta where small dredges are dragged through the shallows by a man or an ox.

Crustaceans such as prawns, shrimp, crabs and lobsters occur through the marine environment from the shallow near-shore area to deep water. Bottom trawling for the deepwater species is destructive to large areas of this fragile biotope which supports a variety of sessile and burrowing benthic animals. However, no quantitative data on damage or on habitat recovery processes and rates is available.

Sea urchins are mobile grazers on algae, encrusting animals and detritus and occur in shallow rocky areas to depths of 100 meters. They are important omnivores whose selective and great grazing powers may play an important part in determining the balance between stands of different sessile

species. Some exploitation of these animals is known in the Mediterranean by collection in shallow water by hand or small trawl and in deeper water by bottom trawl as main target species or as incidental catches in a fishery for prawns, scallops, etc.

Sea squirts are solitary ascidians growing on the bottom in deep water (20 meters and below) sometimes in dense, large groups which feed on algae and other tiny food particles through a filter process. At least one species (Microcosmus salcatus) is exploited in the Mediterranean presumably by bottom dredging. Although catch figures for a 15- year period indicate a decrease in totals taken, no details are available on fishing effort or trends so it is not known whether the reduction is due to a diminishing of the resource.

VI. MAJOR CONCLUSIONS AND ISSUES RELATED TO THE CONSERVATION OF BIOLOGICAL RESOURCES IN EGYPT

Previous sections have reviewed specific and general pressures on the biological resources of Egypt. The following conclusions and findings summarize the issues that require attention in order to improve the conservation of Egypt's unique biological resources and ecosystems. The issues and conclusions presented below are not listed in order of short-term or long-term priority but they provide the basis for specific priority recommendations in Section G.

An important issue requiring attention in all general categories (conservation policies, institution-building, education and training, and research) is the need to integrate the biological resource conservation into all aspects of the economic development process. Although significant attention must be given to the conservation of Egypt's natural protectorates, Egypt has a wealth of other biological resources that are at risk due to unplanned development. Conservation of all these resources can contribute substantially to the long-term economic and social welfare of Egypt.

ENVIRONMENTAL AND CONSERVATION POLICIES

Integration of Biological Resource Conservation into National Five Year Plans:

Discussion: Egypt's biological resources have important economic value to the country and should be carefully conserved as part of Egypt's development activities undertaken by all government agencies and not as an afterthought. Commitments on the part of developmental ministries to conserve the nation's natural resources must be established, monitored, and evaluated regularly.

(1) Need government integration of plans and programs for protecting and managing biological resources into long-term plans and programs for social and economic development.

(2) Need to monitor and evaluate each Ministry's progress in actual accomplishment of planning goals for biological resource protection in each Five Year Plan.

Planning for the Protection and Development of the Coastal Zone:

Discussion: Many of Egypt's vulnerable biological resources are situated in marine and coastal wetlands. Those

areas are also subjects of intense development pressure. Reclamation of extensive areas of Delta Lakes is conducted with little concern for or assessment of environmental consequences. Bedouin villages can have significant impacts on the coastal resources of both protected and unprotected areas (e.g. mangroves in South Sinai). New roads and water supplies can stimulate direct development and indirect tourist and other effects on sensitive biological resources.

(1) Need to develop comprehensive plans for the management of coastal areas of the Mediterranean and the Red Sea.

(2) Need to develop management and impact assessment plans focused on special areas of significan biological value that are under intense development pressure.

Planning to Assess and Mitigate Impacts of New Development:

Discussion: Egypt's most important biological resources are vulnerable to development activities, including roads, canals for irrigation and drainage, pipelines, industrial plants, new communities, and hotels and recreational facilities. No practical mechanism now exists for reviewing potential environmental effects of proposed activities nor for anticipating and coordinating mitigation actions for development activities likely to cause significant adverse impacts on biological resources. Confusion exists as to the role of each Governorate in approval of permits for new developments. (Some environmental protection officers believe the governorate issues permits for new development projects and other officers said permits were not required.) No effective procedure appears to exist to facilitate high-level coordination and assessment of government development plans affecting biological resources.

(1) Need governmental mechanisms and procedures for anticipating and evaluating the impacts of proposed development actions on significant biological resources before detailed plans are completed and while decisions are being made.

(2) Need both local and national planning and environmental review capability within the governmental units to review and coordinate plans and programs for proposed actions.

Management of protected areas:

Discussion: Management plans for protected areas must be based on biological resource and impact data. The EAA does not have wildlife management capabilities within its staff. The

EWS lacks adequate resources to exercise the staff capabilities it does have. The lack of appropriate management of protected areas includes widespread lack of enforcement within and outside protected areas. (Examples: young sea turtles from Hurgada were killed by local people, coral and shells sold outside MarineMuseum at Hurgada, birds poached at Gebal Elba, and Hawksbill turtle killed at Ras Mohamed.)

The lack of management plans for protected areas is contributing to serious resource degredation. For example, in Ras Mohamed visitors drive over dunes and harm plant and animal habitat, coral reefs are damaged by boat anchors, mangroves suffer from oil and plastic pollution, and every wadi near the coast is filled with human waste and garbage. The EAA proposed development and construction plan for Ras Mohamed is not a biological resource management plan and appeared to include mininal scientific input.

The present administrative status for areas protected under Prime Ministerial and Ministry of Agriculture decrees is frought with uncertainty concerning which agency has specific responsibilities. There is a lack of precise procedures for establishing and implementing comprehensive management plans for each protected area. Many protected areas appear to exist only "on paper" and lack management regulations and enforcement programs.

Development pressures (due to intense population pressures) make it difficult to protect biological resources in areas usable for agriculture, or other development. Acacia woodland in the protected area north of El Arish is on fertile land that could be used for agriculture. Trees are continually being cut from within the protected area.

New protected areas are only considered for areas with no development potential (for example, only the shores of Lake Nasser that lack minerals), which may result in inadequate protection of the important biological resources elsewhere. Addition of proposed protected areas would contribute substantially to Egypt's conservation of representative species and ecosystems. Their approval with implementation of scientific management plans should be encouraged.

Consideration should be given to whether existing protected areas are large enough to protect their biological resources. (For example, the small natural channel of mangroves at Ras Mohamed is under severe stress and may not survive.)

(1) Need biological resource management plans for protected areas. Such plans should recommend ways to protect the

reserves from external impacts such as pollution, land modification, fish farming, industrial expansion, and tourism.

(2) Need clear and practical guidelines for the responsibilities of EAA, EWS, and the Governorates for plans, management, and enforcement in protected areas.

(3) Need adequate staff and financial support for effective plant and wildlife management in each area.

(4) Need stronger enforcement and penalties for illegal hunting, sport fishing, coral and shell collection, etc.

Management of biological resources outside protected areas:

Discussion: Violations of existing decrees regulating hunting appear to be frequent. Examples: North Sinai hunting by Gulf Arab shieks, Gabel Elba hunting, taking of coral in Red Sea. Wetland and other habitat protection conventions are also violated by unplanned development. The Lake Nasser Development Authority is planning major development projects for the Lake's perimeter, yet ecological factors and impacts play no role in the Development Authority's planning process.

(1) Need establishment of clear authority over, and responsibilities under, Egypt's obligations under international conventions, including Ramsar and CITES, concerning hunting, fishing, and habitat conservation.

(2) Need clarification of the control of issuing permits for hunting and in managing desert lands of biological importance.

(3) The Lake Nasser Development Authority needs to consider ecological factors in development plans.

Environmental Management within the Governorates:

Discussion: The establishment of environmental offices in each governorate was a significant step toward improved management of Egypt's environment. Responsibilities and lines of authority are unclear, however. Opportunities need to be seized to use these offices as effective arms of the EAA . The role of EWS relative to EAA and governorate environmental officers is unclear, particularly in governorates with protected areas. Protected area advisory committees appear not to meet regularly or effectively.

(1) Need clear goals and lines of responsbibility for environmental protection staff.

(2) Need training programs for existing staff in environmental education, participation in enforcement actions, and monitoring of government activities.

(3) Need more staff where biological resources are unique and/or vulnerable, as, for example, in the Red Sea Governorate, which has important and extensive jurisdiction over resources south to the Sudan border.

(4) Need regular meetings, and communication between the environmental officers of all governorates.

Regulation of Pollution:

Discussion: Law 48 on water pollution has not been enforced systematically and vigorously to control pollution damaging the Delta lakes. The law does not apply to oil pollution actions causing significant problems in the Red Sea and the Gulf of Suez. The EAA should become more involved in pollution control throughout Egypt. The pollution control activities of the Ministry of Petroleum should be reviewed and coordinated by the EAA. Oil pollution appears to have caused significant damage to coral reefs around Hurgada and to mangroves off Sinai. Pollution from solid wastes and garbage is also damaging to protected and unprotected biological resources. The fish processing plant at Lake Nasser dumps directly into the lake and affects water quality.

(1) Need regulation, monitoring, and enforcement concerning oil and chemical discharges from offshore rigs, pipelines, loading docks and shipping in the Gulfs of Suez and Aqaba and the Red Sea.

(2) Need improved enforcement of pollution requirements in all Egyptian waterways, including the Gulf of Suez and the Red Sea.

INSTITUTIONAL DEVELOPMENT

Egyptian Wildlife Service

Discussion: The EAA has rapidly increased is staff size and exercises a critical role in Egypt's balanced environmental management capability. Its needs for further training and

technical assistance will require regular as economic development activities increase. Its capacity to carry out and oversee comprehensive environmental impact assessments may require particular attention.

Although staff of the EWS are enthusiastic and dedicated to conservation of Egypt's biological resources, the staff levels and budget are inadequate to meet the protection and enforcement challenges they face. There is a need for monitoring equipment such as radios and jeeps, or even an airplane to monitor fish and net use on Lake Burullus. Only 3 staff are presently availablefor field monitoring, and the total EWS staff is only 17 people. Additional training is also needed for EWS staff.

(1) Need regular review of EAA staff and technical needs to keep up with development pressures on biological resources.

(2) EWS needs adequate budget and staff to execute assigned wildlife and plant conservation activities.

EDUCATION AND TRAINING

Government Agencies

Discussion: All levels of staff of the agencies involved in biological resource management would benefit from both degree and non-degree training. The importance of biological resources to Egypt's people and economy, and the mechanisms for protecting those resources, must be understood by all natural resource managers. This knowledge can then be passed along to others involved in activities that affect resources.

(1) Need University degree training in plant and wildlife conservation for EWS and EAA staff.

(2) Need training for decision makers on the importance of biological resources and environmental assessment.

(3) Need to train airport and seaport personnel on enforcement of Conventions on International Trade in Endangered Species (CITES).

Universities

Public Awareness

Discussion: The citizens of Egypt could contribute to

protection of biological resources with increased knowledge; e.g. of the importance of 1) coral reefs to fishery production and 2) mangroves and other vegetation to erosion and water quality control. There is a need to increase public understanding of the scientific, cultural, ethical and economic basis for the need to conserve biological resources.

(1) Need increased public awareness of the importance of biological resources to human welfare.

RESEARCH

Discussion: The Egyptian University system has many excellent research facilities and field stations that could expand their research programs in biological resources. The research stations at St. Katherine's and Sharm El Sheick are carrying out important work but appear to be underutilized.

The intensive managment of Egypt's natural resources provides numerous unique opportunities for basic and applied research that is of interest worldwide. The Aswan dam's effects on biological resources could receive much more research attention; the number of aquatic species just below the dam has decreased from 14 to 7 since the dam was built and Ceratophyllus domatica has become abundant where it was absent previously (I. Springer, personal communication).

(1) Need to increase university research in plant and wildlife conservation.

(2) Need to establish programs and capabilities to conserve germplasm of wild plants.

(3) Need to encourage EAA, EWS and other institutions to do more applied research related to critical biological resource conservation needs.

(4) Need more research on the effects of development on water quality throughout Egypt (lake Nasser...)

(5) Need basic taxonomic studies.

(6) Need field station for breeding endangered animal species and reintroducing them into the wild.

VII. RECOMMENDATIONS FOR ACTIONS NECESSARY TO CONSERVE EGYPT'S BIOLOGICAL RESOURCES

The recommendations below address actions that might be taken by Egyptian governmental, non governmental, and university institutions to improve the protection of valuable biological resources. An underlying goal was to build, whenever possible, on existing Egyptian laws or institutions concerned with biological diversity. Recommendations emphasize specific areas where there is a need to ensure that government plans to protect biological resources are actually implemented, and they address needs to promote understanding and concern about these resources among all citizens of Egypt. The recommendations are divided into sections reflecting the major conclusions and findings of the report concerning institutions, conservation policy and management, education and training, and research. Recommendations are ranked as short-term (ST), requiring initiation within 1 year, or long-term (LT), requiring initiation within 2 years.

I. INSTITUTION-BUILDING

A. Government of Egypt

1. Environmental Affairs Agency (EAA): Clarify and strengthen the capacity of the EAA to monitor, report, and reduce adverse impacts of development activities on natural protectorates and other biological resources. Specific actions might include:

- o guidance from EAA to environmental offices in each Governorate on monitoring, reporting, and enforcement duties concerning impacts on significant biological resources from oil pollution, improper construction activities, dumping, illegal hunting, and other harmful human activities;

- o require reporting from appropriate ministries to EAA on incidents of pollution, pollution control actions, issuance of hunting and fishing permits, private sector development permits, and other actions that might adversely affect significant biological resources.

- o improved EAA, Egyptian Wildlife Service (EWS) and Governorate cooperation: Intensify the planning, scientific management, and enforcement responsibilities of the EAA, the EWS, other conerned Ministries, and the local Governorate concerning natural protectorates in

particular. The EAA should:

- ensure secure funding that will provide scientific management assistance in natural protectorates, possibly with the EWS;

- ensure that EWS participates in the development and implementation of construction and management plans of the EAA for natural protectorates;

- establish procedures for the local Governorates responsible for enforcement of the management plans and regulations concerning natural protectorates;

- establish procedures for EWS to provide technical management for established natural protectorates in accordance with management plans approved by the EAA.

2. Egyptian Wildlife Service (EWS): Support efforts to improve the institutional capability of the EWS in training, monitoring, and enforcement. Specific actions include:

o provision of monitoring equipment to carry out effective on-site monitoring of biological resource conditions and impacts;

o financial support for additional staff for monitoring and enforcement;

o provision of uniforms for EWS personnel;

3. Offices in each major ministry concerned with biological resource conservation. Establish a Biological Resource Conservation Office in each Ministry that may have significant impacts on, or responsibilities for, biological resources. Each office could:

o assist EAA by providing information on new development projects likely to affect significant biological resources; this could be done with the assistance of EWS.

o serve as liason to the EAA (using EWS if possible) regarding ministerial actions affecting natural protectorates and other significant biological resources;

o assist EAA and appropriate agents in training ministerial staff in the values and protection needs of natural protectorates and biological resources.

B. Non-governmental Organizations [See EDUCATION AND TRAINING below]

II. CONSERVATION POLICY, PLANNING AND MANAGEMENT

A. Policy and Planning

1. Biological resource conservation in Egyptian Five-Year Plans: All ministries having significant responsibilities for, or impacts on, significant biological resources should incorporate a conservation component into their five-year plans. EAA could be responsible for:

- o ensuring that protection and management of biological resources are integrated into other long-term plans and programs for social and economic development;
- o monitoring and evaluating ministerial progress in meeting planned goals for biological resource protection.

2. Environmental assessment of proposed new development projects which may affect significant biological resources: Establishment of procedures to ensure that, before permits or funding decisions are made, EAA reviews major new development projects to avoid potential adverse impacts on significant biological resources. Development projects would include tourist villages, hotels, roads, or major water supply lines serving areas near a protected area or proposed protected area. To facilitate efficient and effective reviews EAA could:

- o cooperate with the EWS to develop basic criteria for the kinds of data that proposing ministries should submit on impacts and location of significant biological resources;
- o develop guidance for the ministries, in cooperation with EWS, concerning the designs, best management practices, and alternatives that can help reduce potential impacts on protected reserves or proposed protectorates.

B. Management

1. Management plans for natural protectorates: Establish management plans for each existing natural protectorate. Each management plan should:

- o be based on initial surveys of biological resources and anticipate regular assessments of the conditions of ecosystems;

o reflect EWS analyses of the vulnerability of these resources to impacts from pollution, tourism, hunting, fishing, and other human uses;

o describe programs and on-site management needs for effective monitoring and enforcement;

o consider actions to avoid or reduce biological resource losses from oil pollution and other external impacts through contingency plans and other actions;

o incorporate programs for the education of tourists, operators of businesses, and local residents concerning the cultural, economic, scientific, and other values of the resources and their vulnerability to loss;

o establish procedures for changing buffer areas and protected area boundaries based on biological impact and other data;

o develop programs to enhance local support for, and benefits from, protection of the resources (such as the provision of employment opportunities, provision of alternative fuels to Bedouins in order to conserve protected mangroves).

o consider needs for a tourist management plan including licensing of guides, limits on publicity, and other actions related to carrying capacity of natural protectorates.

2. Additions to natural protectorates: Establish a system of natural protectorates with scientific and enforcement management plans. The expanded system could be based on recommendations of the Environmental Council of the Academy of Scientific Research and Technology, decrees of the Ministry of Agriculture, and recommendations of the EWS. (For example, new reserves might include an expanded Ras Mohammed, additional Nile Islands at Aswan, the Petrified Forest, Wadi Rayan, and the Bahireha Oasis.) These protected reserves could:

o assure adequate protection of representative examples of each of Egypt's major ecosystems and communities;

o protect the best and largest example of each valuable and vulnerable ecosystem (for example, all mangroves along the Gulf of Aqaba);

5. Coastal zone management program: Establish a coastal zone management program under the supervision of the EAA. The

program could:

- o establish criteria for the sustainable use of Egypt's coast line (Mediterranean, Gulf of Suez, Gulf of Aqaba, Red Sea), including important coastal development and conservation areas;

- o establish a procedure for identifying areas most suitable for development and for protected status;

- o establish a mechanism for planning, assessing, and coordinating government actions affecting local development programs adjacent to, or significantly affecting, important biological resources (such as those at Hurghada, Sharm El Sheik, El Arish, and the Nile delta lakes);

- o identify regulatory or other needs necessary to protect coastal resources, including improved controls of oil pollution from ships and best management practices for oil production and transport.

6. Germplasm Resource Management Programs: Establish a germplasm storage facility and collection program for conservation of:

- o cultivated plants, their landraces, and wild relatives;

- o endangered or threatened wild plants;

- o wild relatives of domesticated animal species.

III. EDUCATION AND TRAINING

A. Public awareness

1. Science education: Support education programs in biological science, develop a science education center, produce brochures and field guides for natural protectorates, and print other materials that illustrate the scientific, cultural, and socioeconomic concepts and values underlying biological diversity conservation.

2. Mass media education programs: Support non governmental organization programs (NGO) and government programs to increase public awareness of the nature and value of biological diversity. Programs would include:

- o materials for school children and secondary level

students suitable for use by teachers in curricula (literature, science, history) and outside classrooms for special interest activities;

o guides, brochures and other materials for adults and children on conservation of natural protectorates and their biological values;

3. Status and trends report on Egypt's environment and biological diversity: Prepare a report on the status and trends of the environment and biological resources in Egypt, based on the best available information. The report would:

o provide a comprehensive report on the condition of Egypt's air, water, soil, and ecosystem and genetic resources;

o analyze the trends and activities affecting these resources;

o recommend the kinds of research, policy changes, and educational activities necessary to improve the protection and sustainable use of these resources;

o be broadly available to the public, government agencies, law-makers, academics, and businessmen as an accurate source book on the environmental and biological resources of Egypt;

o be updated as changes occur.

B. Professional training

1. Environmental assessment training: Support a technical assistance program on environmental impact assessments.

o Support a team to work in-country with EAA and all Ministries designing development projects (agriculture, tourism, etc). The team could provide information on impact assessment experiences elsewhere and on alternative means available to reduce costs and increase decision-making values of assessment processes;

o Support technical training in environmental impact assessment through training programs abroad.

2. Training for government officials: Support a variety of biological resource education programs for government officials and staff. Programs could include:

o seminars and study tours to natural protectorates in Egypt, the United States, and elsewhere, for administrators and civil servants;

o seminars, study-tours, scholarships, and other programs for Egyptian law-makers, lawyers, and law-enforcement professionals on environmental legislation generally and biological diversity in particular.

o technical training of EAA and EWS personnel in appropriate wildlife management institutions;

o training of EAA, EWS, Governorate Environmental Office Directors, and other government personnel in basic wildlife management requirements.

o an in-country position to facilitate exchange of information between Egyptian organizations and personnel, and provide technical expertise in ecological concepts and practices;

o professional training programs for customs inspectors in CITES enforcement (airports and ports) and managers of all natural protectorates.

o training for environmental officers in each governorate in the values and threats to biological resources, enforcement procedures, and techniques for conducting public awareness programs.

o support for training of B.S. graduates in U.S. museums of natural history through scholarships;

4. University support: Support development of Egyptian expertise within universities (Alexandria, Cairo University, Ain Sahs University, etc.) and the Academy of Scientific Research and Technology, to teach ecological courses and curricula leading to degrees, to prepare specialists for new jobs, and to innovate and excel in biological diversity fields. Additional elements of support could include:

o encouragement of the Supreme Council of Universities to nominate people for AID Peace Fellowships in conservation and natural resource management;

o MS and Ph.D. support to governmental biologists;

o support of university programs in Library development. (Subscriptions to environmental journals etc.)

5. Museums and Aquaria: Support creation of a major natural history museum as well as development of an aquarium in Cairo. Elements of this program would include:

- o support for museum and aquarium staff development;
- o support the aquisition and maintenance of taxonomic collections and the development of biological diversity exhibits for public education.

IV. RESEARCH

A. Applied Research

1. Impact evaluation studies: Support applied research to benefit biological diversity resource protection programs concerning such topics as:

- o assessment of migratory bird impacts on fish resources of Lake Bardawil;
- o effects of Aswan Dam on biological resources;
- o development of evaluation techniques for assessing the functions and values the Nile Delta Lakes and the of impacts of development activities;
- o support studies of the cumulative impact of oil pollution from ships and off shore oil platforms on marine ecosystems;

2. Social, economic, and sustainable development studies: Support research on:

- o the economic value of species and natural protectorates for tourism, medical advances, genetic engineering;
- o Bedouin folklore knowledge of the taxonomy and ecology of flora and fauna, including medicinal plants;
- o support for the UNEP project on biological diversity and sustainable development at Wadi Alecki on Lake Nasser.

B. Basic Research

1. Taxonomic studies: Support taxonomic studies of the planned museum of natural history in basic fields of study related to biological resources.

2. Survey support. Support surveys, monitoring and evaluation of biological resources for intensive taxonomic and ecological studies.

3. Germplasm banks: Support establishment of germplasm banks for Egyptian plants, such as wild barley, wild cotton, wild rice, and other species.

4. Breeding station for endangered plants and animals: Support establishment of a field site for breeding endangered plants and animals and reintroducing them into natural protectorates or other areas.

VIII. LITERATURE CITED

Ahmed I. El-Ibyary. 1983. "A Study of Local Legislation for the Protection of the Aquatic Environment," Bulletin, Institute of Oceans and Fish, Vol 9.

Arid Lands Information Center. 1980. Draft Environmental Report on Arab Republic of Egypt. Prepared by the Office of Arid Lands Studies, University of Arizona, May 1980. Contract No. CX-0001-0-0003 with the US National Park Service and the Man and the Biosphere Program.

Ayyad, M.A. and S.I. Ghabbour. 1986. Hot Deserts of Egypt and the Sudan. Chapter 5 in Hot Deserts and Arid Shrublands, M. Evenari et al., editors. Elsevier Science Publishers. pp.149-202.

Baha El Din, S.M., and M.A. Saleh. 1982. Report on the Ornithological Results of the Egyptian Red Sea Pollution Expedition. Ornith. Soc. Egypt Cairo.

Bemert, G. and R. Ormond. 1981. Red Sea Coral Reefs. Kegan Paul International. London.

Boulos, L. 1982. Flora of Sinai. In: Environment in Sinai. Arab office of Youth and Environment. Al-Ahram, Cairo. p. 45-58 (in Arabic).

Broadus, J., J. Milliman, S. Edwards, D. Aubrey, F. Bable. 1986 Rising Sea Level and Damming of Rivers: Possible Effects in Egypt and Bangladesh. Effects of Changes in Stratospheric Ozone and Global Climate, Vol. 4: Sea Level Rise, UNEP, EPA, October.

Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Fish and Wildlife Service. OBS - 79/31. Washington, D. C.

Dames and Moore. 1985. Sinai Development Study Phase I Final Report. Volume IV. The Land and the Environment of Sinai. Submitted to the Ministry of Development Arab Republic of Egypt. USAID grant no. 263-0113.

Ghabbour, S.I. 1986. Good conservation news from Egypt. Environmental Conservation. 13: 79.

Ghabbour, S.I. 1987. "Evaluation of Measures for the Protection of the Environment in Egypt," Symposium on Environmental Crimes, Cairo, Egypt, 12-13 April, 1987.

Hefny, K. 1982. Land-use and management problems in the Nile Delta. Nature and Resources, Vol 18, No. 2, April-June.

Kassas, M. and M. A. Zahran. 1967. On the Ecology of the Red Sea Littoral Salt Marsh, Egypt. Ecol Mono. 37:297-316.

Lyster, 1985. (Malcolm Baldwin reference)

Meininger, P.L. and W.C. Mullie. 1981. The significance of Egyptian wetlands for wintering waterbirds. Holy Land Conservation Fund. New York.

Meininger, P.L. & W.C. Mullie. 1984. (Dave Fog)

Mullie, W.C. and P. L. Meininger, 1985. The Decline of Bird of Prey Populations in Egypt, ICBP Technical Publication No. 5.

Nyrop, 1976. Area Handbook for Egypt.

Peterson, I. and U.G. Sorenson. 1981; Migration studies from the Eastern part of the Lagoon. Sabket El Bardawi on the North-Coast of the Sinai Penisula. Cyclostyled Rpt. Copenhagan.

Rabinovitch, A.G. Ilani and S. Suaretz, 1978. Goals of Nature Conservation in Sinai. Appendix to Memorandum, Israel . Nature Reserves Authority Report. on Cooperation with the Egyptian Authorities on Subjects pertaining to Nature Conservation and Tourism in the Sinai Area.

Seton-Williams, V. and P. Stocks. 1983. Egypt Blue Guide. Ernest Benn Limited. London. 694 pp.

Sultan,F. 1988. The Challenge of Egypt's New Tourism. Horus. Spring issue.

United Nations Conference on Desertification.

Walter, H. 1979. Vegetation of the Earth and Ecological Systems of the Geo-biosphere. Second Edition. Translated by Joy Wieser. Springer-Verlag, New York. 274pp.

World Bank. 1986. Arab Republic of Egypt Channel Maintenance Report. Staff report. May.

APPENDIX 1

Annotated Literature Search on Egypt's Biological Resources

Appendix 2
List of Persons and Institutions Contacted

February 23:
Agency for International Development
Mr. Lawrence Ervin, Director Office of Science and Technology
Dr. Sharif Arif,

University of Cairo
Dr. Samir I. Ghabbour, Department of Natural Resources

Egyptian Wildlife Service
Mr. Gawad El Attar

United States Embassy
Mr. Francis Cunningham, Science Attache
Ms. Suzanne Raphael, Program Coordinator, Science Office
Dr. Omar El Arini, Science Office

International Council for Bird Preservation (ICBP)
Dr. W.J.M.(Wim) Verheugt, Migratory Bird Programme Coordinator
Ms. Mindy Rosenzweig, Egypt Science Education Center, Project Coordinator, Migratory Bird Program (ICBP)

February 24:
Egyptian Wildlife Service and Giza Zoological Park
Dr. Mohammed Hussein Amer, Director of EWS and Director General of Zoo
Dr. Mervat Morcos, Director of Zoological Museum
Mr. Gamil Atta, Bird Migration Division
Mr. El-Sayed Gamei, Wildlife Programs
Dr. Mohamed Abdel Rahim

Egyptian Environmental Affairs Agency (EEAA)
Dr. El-Mohamadi El-Sayed Eid, Chairman

February 25:
Academy of Scientific Research and Technology
Dr. Abou el Fotouh Abd El Latif, President
Dr. Ahmed I. Naguib, Vice-President

USAID
Mr. John Starnes, Mission Environmental Officer

February 27:
Governorate of North Sinai, El Arish

Mr. Waheed Salama Hameid, Environmental Protection Office
Mr. Fouar

February 28:
Suez Canal University, Ismailia
Dr. Ahmed Khodei, President
Dr. Ahmed Dewedar, Vice-President
Dr. Usama, Gelogist
Dr. A.F.A. Ghobashy, Marine Biologist
Dr. Sayada, Botany Department
Dr. Alzaid, Dean of Science

February 29:
Governorate of the Red Sea, Hurghada
Mr. Gamal Karawia, General Secretary, Red Sea Governorate
Mrs. Nawal Nashid Iskander, Head of Environmental Protection Office, Red Sea Governorate

Museum of Marine Biology
Mr. Chalim Mattai, Taxonomist

March 2:
The American University in Cairo
Dr. Farkhonda Hassan, Professor, Chemistry Department

USAID
Ms. Vivika Moldrem and Mr. Dan Leaty, Program Office
Mr. John Foti, Agriculture Office

Mr. Ayman Taher, Photographer
Mr. Omar Bayazid, President Spectrum Aerospace S.A.

March 3:
USAID
Mr. Adel Gohar, Education office
Mr. Joe Williams, Training Office

The American University in Cairo Press
Mr. Arnold Tovell, Director
Ms. Cassandra Vivian, Marketing Director

Giza Zoological Gardens
Mr. Taher Issa, Head Section of Fish Management and Diseases, Dept of Fish Garden

March 4:
Ministry of Construction and New Communities
Mr. Sayed Morsy, Public Relations Officer, High Dam Lake Development Authority

Assiut University Faculty of Science at Aswan African Unversity
Dr. Irina Springuel, Botany Dept.
Dr. Ahmed Esmat Delal, Dean of Faculty of Science

Aswan Governorate
Mr. Adel Moghazy Ahmed, Director of Nile Islands Protectorate

March 5:
Ministry of Reconstruction and New Communities
Aswan Dam Lake Development Authority
Dr. Hamdy Tolba, Engineer and Vice Chairman

High and Aswan Dam Authority
Eng. Ahmed Hassanein, Chaiman of the Board
Eng. Mustafa Yunedi, General Manager High Dam Power Station
Eng. Selman, Chief Engineer

Aswan Regional Planning Unit
Dr. Mohamed M. Rashid, General Director

Aswan African University
Dr. R.M. Awadallah, Vice Dean, Faculty of Science
Dr. Mohamed Abdel Rahman, Physics Department
Dr. Abdel Salam Abdel Ghany Arifien, Chemistry Dept.
Dr. M.M. Mustafa, Faculty of Science

March 6:
Egyptian Wildlife Service
Mr. Mohamed Nael Abu Zied, Division of Wildlife Programs

March 7:
Environmental Affairs Agency, Sharm El Sheikh
General Omar Hassan, Manager of Ras Mohamed Protectorate
Other
Mr. Ahmed, Bedouin Herbalist, St. Catherine's

March 8:
Suez Canal University, Marine Science Station, Sharm El Sheikh
Dr. Saad Zakaria, Zoology Department

National Institute of Oceanography, Alexandria
Dr. A.H. Nawar, Associate Professor, Marine Geology

March 9:
University of Cairo
Dr. Mohamed Kassas, Emeritus Professor, Faculty of Science, Botany
Dr. Aly Aly El Moursy, Faculty of Science, Entomology

March 10:
Agricultural Research Center
- Dr. Ahmed Moumtaz, Director Agricultural Research Center
- Dr. Rashad Ahmed Abo-Elemin, Deputy Director, Field Crops Research Institute
- Mr. Jan Konopka, Genetic Resources Officer, IBPGR and FAO
- Dr. Nabil Khalaf Mahmoud, Field Crop Research Institute
- Dr. Sami Mohamed Soliman, Head Genetic Resources Section

Consortium for International Development
- Dr. Bob Witters, National Agricultural Research Project

Egyptian Wildlife Service
- Dr. Hassan Hafez,

March 12:
Academy of Scientific Research and Technology

- Dr. Ahmed I. Naguib, Deputy President, ASRT
- Dr. Moustofa M. Fouda, Al Azhar University (Marine Biology)
- Dr. Mohamed H. Amer, EWS and Zoo Director
- Dr. Aly Aly El-Moursy, Department of Entomology, Faculty of Science, Cairo University
- Dr. Samir I. Ghabbour, Department of Natural Resources, Institute of African Research and Studies, Cairo U.
- Dr. A. Maher Ali, Faculty of Agriculture, Assuit University
- Dr. Mohsen Tawfik, Dean, Institute of Environmental Stud es and Research, Ain-Shams University
- Dr. Abdulla M. Ibrahim, Zoology Department, Faculty of Science, Ain Shams University
- Dr. Mohamad Kassas, Faculty of Science, Cairo University

March 13:

Egyptian Environmental Affairs Agency (EEAA)
- Dr. El-Mohamadi El-Sayed Eid, Chairman

USAID
- Mr. George Laudato, Deputy Mission Director
- Mrs. Joana Laudato, Evaluation Officer
- Ms. Mona El Shaffei, Program Specialist
- Mr. Dan Leaty, Dr. Sharif Arif, Mr. Lawrence Ervin.

KASaterson.1001e.11/4/88.