CHAPTER 6
BIRDS

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1. INTRODUCTION

The Afrotropical region receives migrants from the northern hemisphere. Numbers of Palaearctic birds arriving in African sub-Sahara are estimated to be 3750 million, about one million of which are waterbirds (Moreau 1972). Only 20 million km^2 is capable of receiving the migrants, from the 29 million km^2 area of Africa. The rest is occupied by the inhospitable Sahara (Birdlife 2005). The Sahara is extended from the Atlantic coast in the west to the Saudi Arabian peninsula in the east leaving no way to fly around. The Sahara north to south covers about 2000km of extremely inhospitable land with stony, rocky desert, mountain depression and very few oases. Which would takes birds for 30 to 40 h of continuous fly.

One of the main flyways for migration from Palaearctic to Africa is the River Jordan to the Nile Valley flyway, which is considered as the most significant corridor for bird migration in the world, and is the main eastern corridor between Europe/Asia and Africa that is used by over a million birds to pass through a series of migratory bottleneck sites during migration seasons. From this corridor, birds enter Egypt and then fly through Sudan, Uganda, Kenya, Tanzania, and southern Africa (Malawi, Zimbabwe, South Africa). This route takes birds from central Europe, the Middle East and Central Asia (Birdlife 2005).

Avifauna is an important component of the Egyptian biological resources; indeed, it is the most diverse and prominent of all the country's non-aquatic vertebrate fauna (Baha El Din 1999). There are more than 470 bird species recorded in Egypt. The majority are non-breeding seasonal visitors (Fishpool and Evens 2001). Only about 150 species are breeding residents found in Egypt year round (Baha Din 1999). Egypt has international importance for birds with globally significant populations of breeding, wintering and migrating birds, including some 19 globally threatened species (IUCN 2000).

Several hundred thousand water birds winter in the delta, including the world's largest concentrations of little gulls and whiskered terns. Other birds making their homes in the delta include grey herons, Kentish Plovers, Shovelers and cormorants. Also found are egrets and ibises.

This report presents brief description of the of Nile Valley and Delta habitats with specific concern to its ecology, biology especially birds diversity, and threats with special concern to northern and southern lakes as example of important birds habitats connected to the Nile, because it is difficult to distinguish between birds of the lakes and main stream of Nile Valley we will try to compare Northern and southern lakes in term of abundance and diversity of wintering birds in addition to certain breeding species.

2. THREATS ON NILE RIVER

While most of the river's water quality is within acceptable levels, Pollution is the main threat of the Nile River, there are several hot spots mostly found in the irrigation canals and drainages. Sources of pollutants are from agricultural, industrial, and household waste. There are 36 industries that discharge their pollution sources directly into the Nile, and 41 into irrigation canals. These types of industries are: chemical, electrical, engineering, fertilizers, food, metal, mining, oil and soap, pulp and paper, refractory, textile and wood. There are over 90 agricultural drains that discharge into the Nile that also include industrial wastewater.

Agriculture is the largest consumer of water in Egypt using about 85% of available water. Drainage water from the agricultural fields contains pollutants such as pesticide residues, toxic organic and inorganic pollutants, salts and treated and untreated domestic wastewater. In the East - Delta drains - Faraskour, Serw and Hadous, samples of the water contained high levels of hookworms and other intestinal helminthes eggs. In villages where the only available water is from irrigation canals, women use the water for domestic purposes and also dump the used water back into the drainages.

There are twenty-five agencies, under seven ministries that are involved in maintaining water quality, yet their communication and data sharing between agencies is underdeveloped. Water User Associations which are non-governmental associations of farmers, who organize an irrigation process of all agricultural land, maintain diesel pumps and deal with conflicts between farmers and water management. They have been around since 1988, but have lacked structure and the inclusion of women. Women are seen as contributors to pollution of irrigation canals since they wash clothes, dishes and animals in the drainages. The lack of planning and corruption within governmental departments, the neglecting of concerns and disbursement of low-quality land to the poor, and the improper education of safe handling methods and improper irrigation and crop management for men and women, all contribute to poor water quality**.**

3. BIRDS OF NILE VALLEY AND DELTA

Nile Valley and Delta encompasses variable habitats important for birds as coastal plains, coastal lakes, River Nile Branches and other man mad habitats as fish farms and cultivated land. Makes Nile Delta suitable for breeding resting and rich feeding ground for migratory species, thousands of birds are wintering in the northern lakes or crossing the Delta to farther south. *Lake Manzala and Lake Burullus are considered the most important habitats in the Nile Delta in term of Biological, Ecological and socioeconomic aspects we will concentrate on it regarding its values*. Lake Manzala lake Burullus they are probably the most important breeding site in the Western Palearctic, Breeding waterbirds in lake Manzala include Little Grebe, Little Bittern, Water Rail, Moorhen, Purple Gallinule, Collared Pratincole, Kentish Plover, and Spur-winged Plover. Reed beds and salt marshes hold a variety of other breeding birds including Pied Kingfisher, and warbler species.

3.1. Lake Manzala

An important habitat in the Nile Delta, is Manzala lake which located in 31 02 33 N and 47 32 18 E. lake Manzala is the most eastern and largest lake in the Delta situated between Damietta Nile branch and the Swize canal. It is a shallow brackish lake with a depth range between 0.7 and 1.5 m (average about 1m) (Wahabi *et al* 1972). Lake Manzala is connected with the Mediterranean sea by an outlet at El Gamil, about 5km west of Port Said. The lake has a maximum length of 64.5 km. the original area of the lake is 1710 km^2 (1972) had been reached to 1400 km^2 by 1970 (Samman 1974) and to 1200 Km^2 by 1993. (Meininger and Mullei 1981).

3.1.1. Land Use

Fisheries are important human activities in and around Manzala Lake. Many of the islets in the lake are not islands in the real sense, but a kind of fish farm called Hosha, is estimated that there are 35,000 to 40,000 fishermen active on the lake (Meinninger and Mullie1981b). large fish farms are found along eastern shore, west of the Port Said- El Cap road, and in the southeastern part of lake between El Cap and Mattariya.

Birds' hunting is a common activity in the area where it is directly affecting the birds' population. The average annual bag of waterbirds taken in Lake Manzala between 1979 and 1986 was estimated to be 122500- 149000 (Mullie 1989and Mullie and Meinninger 1983). Compared the situation in the early 1980s there is a change in catching methodologies, where 1989/90 mist nets used in several places to catch waders. Also the use of tap recorders and loud speakers to attract ducks to nets is a new innovation.

3.1.2. Threats

The main threats to Manzala Lake are land reclamation and pollution. The area of the lake has changed from 1710 to 1200 Km^2 decreased by 30%. In recent years a number of plans have been considered for reclamation of the greater part of the lake, some of these plans have been carried out. The problem of Lake Manzala is complicated because the lake situated in five governorates. A new high way road connecting the coastal governorate from Port Said to Alexandria (the International coastal road) had been established where the part of the road from Damietta to Port Said is passing through the lake causing more fragmentation of the lake, causing adverse impact on the lake ecology.

Lake Manzala provides good example of recent habitat deterioration due to pollution of untreated sewage. Submerged aquatic vegetation has vanished from large parts of the lake Manzala.

The adverse impact which directly affect the bird population in this hot spot for migratory and breeding birds' communities, large number of waterbirds shot and caught annually which will affect the bird population sizes. Large numbers of fishermen working in the lake cause high rate of disturbance which can be also affect birds population wintering or breed in the lake.

3.1.3. Birds of Lake Manzala

Together with lake Burullus they are probably the most important breeding site in the western palearctic, Breeding waterbirds in lake Manzala include Little Grebe, Little Bittern, Water Rail, Moorhen, Purple Gallinule, Collared Pratincole, Kentish Plover, and

Spur-winged Plover. Reed beds and salt marshes hold a variety of other breeding birds including Pied Kingfisher, and warbler species. In a recent survey conducted in 31st August to 5th September 2007 in North Eastern Delta, almost 9000 individuals were recorded.

- The most abundant species is Slender-billed Gull (about 4000), Black Tern (1905), and Little Tern (1410).
- The least species recorded is Curlew, Little Bitter and Glossy Ibis.
- Four Terns species were counted, where the commonest species was black Tern almost 2000, while the least species was Common Tern was 200 individuals.
- Seven waders species were counted; the commonest species was Little Stint 112, while the least species was Turnstone 18, Black-winged Stilt 15 and Curlew only one individual.

3.2. Lake Burullus

Lake Burullus receives most of the drainage water from the Nile delta land and is considered as an approximate reservoir of the Nile water flowing to the Mediterranean Sea. It plays an important role in the nation's economy, not only because it produces more than 25% of the total fish production of Egypt but also for being a resting area for migratory birds. Lake Burullus has a natural wealth of biodiversity for aquatic and terrestrial plants, invertebrates and vertebrates (fishes, amphibians, reptiles, birds and mammals).

Lake Burullus has suffered and is still suffering from man-made activities and human impacts. The increase of the developmental rate along the coastal belt of the Delta region produces several environmental problems. Agricultural and industrial developments, sewage discharge, land reclamation, illegal fishing and increased pollution are the main impacting activities in the lake. In addition, natural changes are taking place within the lake itself, such as lake periphery erosion, sea water level rise, lake siltation, and sea-lake connection siltation. These may also have considerable impacts. In view of all of these problems and of the wealth in biodiversity, it is deemed necessary to present integrated environmental studies on this lake for conservation and sustainable development.

There are about nine canals that drain the agriculture and industrial and domestic sewage into the lake through openings at the southern part of the lake. This drainage water enriches the lake with nutrients and metals, which in turn increase the eutrophication of the lake. This has led to an increase in the biodiversity of the micro and macro flora of the lake. The lake now comprises about 30 islets covered with dense vegetation, the largest islets being the green hill Elkom- Elakhdar, Kom Dishimi, and Eldakhla.

3.2.1. Ecological Values

Burullus protected area is characterized by a wide range of habitats including marine waters, brackish and fresh lagoon waters, sandy shores, salt marshes, sand dunes rich in flora, islets within the lake mud flats, hyper saline sabkhas, freshwater swamps and reed beds. Several man-made wetlands are also found in the protectorate including fish farms, saltpans, canals and drains. The gradient between the marine and fresh water in salinity levels give the marine and fresh water flora the chance to flourish.

The northern sand bar includes the two threatened habitats in the protectorates: sand dunes and salt marshes. These habitats support highly threatened species in the Mediterranean coastal strip of Egypt. The brackish and fresh waters of the lake are the most important habitat types of the protectorate as they support all fishing activities as well large populations of waterfowl.

Reed swamps habitats form the greatest biomass and are of particular importance as breeding habitats for several water birds, supporting sizeable populations of some 15 breeding species as well as holding one of the largest populations in the western pale-arctic of the Purple Gallinule *Porphyrio porphyrio* and the Little bittern *Ixobrychus minutus*. The ecosystem supports the valuable fish and waterfowl population.

3.2.2. Uses and Threats

Lake Burullus produces about 30% of the total fish production in Egypt. There are about 60,000 fishermen operating legally in the lake, and fishing is the main source of their income. There are also more than 30,000 fishermen operating illegally in the lake. The human population around the lake is about 260,000; most of them depend completely on fishing inside the lake, whilst some depend on the fish farms around the lake. In addition, there are new cultivated lands around the lake that produce vegetables and palm.

The greatest problems facing Lake Burullus are the increase in the rate of water pollution and the decrease of the total fish production from the lake, over fishing of small fish (fry), the drying up of some parts close to the lake, and constrictions of the international road branch. This latter development damages natural habitats around the lake, threatening and endangering most plant species, for example *Limoniastum monopetalum,* which is considered as a threatened species at Lake Burullus. The discharges of the domestic sewages from Baltim City affect lake pollution and increase the rate of heavy metals inside the lake. Many fishermen in Bar Bahry are installing long sets of nets for waterbird catching; there is a large illegal market, despite the national restricted laws relating to the sale of waterbirds.

All these problems are forcing people around Lake Burullus towards land reclamation and cultivation of new reclaimed lands instead of fishing.

3.2.3. Birds of Lake Burullus

During the recent survey conducted from 12th to 15th December 2007, waterbirds were counted in the wetlands of Burullus protected area, represented by the lake and coastal shoreline. Results of the waterbird survey are given in Tables 3 and 4. Highlights of the survey results are given below:

- A total of 14,594 waterbirds of 39 species were counted at Lake Burullus.
- The most common species was Black-headed Gull *Larus ridibundus,* with 3,500 individuals, whilst only 80 Slender-billed Gulls *Larus genei* were recorded.
- The commonest duck species was Northern Shoveler *Anas clypeata*: over 3,000 individuals were recorded.
- Whiskered Tern *Chlidonias hybridus* was the most common tern species with nearly 3,000 individuals, whilst there were also 170 Gull-billed Terns *Sterna nilotica*.

- Little stint was the commonest wader species recorded (over 500 individuals).

In addition to last survey and literatures 232 species have been recorded in the northern part of Nile Valley and Delta (Table 6.1.).

Table (6.1.): Birds' Checklist in northern Nile Valley Delta

No.	English Name	Latin Name	Status in Egypt
1	Little Grebe	*Tachybaptus ruficollis*	RB WV
2	Great Crested Grebe	*Podiceps cristatus*	FB WV
3	Red-necked Grebe	*Podiceps grisegena*	AV
4	Black-necked Grebe	*Podiceps nigricollis*	WV
5	Great Cormorant	*Phalacrocorax carbo*	PV WV
6	Great Bittern	*Botaurus stellaris*	WV
7	Little Bittern	*Ixobrychus minutus*	RB PV WV
8	Black-crowned Night Heron	*Nycticorax nycticorax*	RB? PV WV
9	Striated Heron	*Butorides striata*	RB
10	Squacco Heron	*Ardeola ralloides*	RB PV WV
11	Cattle Egret	*Bubulcus ibis*	RB PV WV
12	Little Egret	*Egretta garzetta*	RB PV WV
13	Great Egret	*Casmerodius albus*	PV WV
14	Grey Heron	*Ardea cinerea*	CB PV WV
15	Purple Heron	*Ardea purpurea*	PV WV RB
16	Goliath Heron	*Ardea goliath*	RB
17	Black Stork	*Ciconia nigra*	PV
18	White Stork	*Ciconia ciconia*	PV WV
19	Mute Swan	*Cygnus olor*	WV
20	Ruddy Shelduck	*Tadorna ferruginea*	PM WV
21	Common Shelduck	*Tadorna tadorna*	WV
22	Eurasian Wigeon	*Anas penelope*	PM WV
23	Gadwall	*Anas strepera*	PM WV
24	Common Teal	*Anas crecca*	PM WV
25	Mallard	*Anas platyrhynchos*	CB? PM WV

26	Northern Pintail	*Anas acuta*	PM WV
27	Garganey	*Anas querquedula*	PM WV
28	Northern Shoveler	*Anas clypeata*	PM WV
29	Marbled Duck	*Marmaronetta angustirostris*	FB WV
30	Red-crested Pochard	*Netta rufina*	WV
31	Common Pochard	*Aythya ferina*	PM WV
32	Ferruginous Duck	*Aythya nyroca*	PM WV
33	Tufted Duck	*Aythya fuligula*	PM WV
34	Common Quail	*Coturnix coturnix*	(RB) PV WV
35	Glossy Ibis	*Plegadis falcinellus*	PV
36	Eurasian Spoonbill	*Platalea leucorodia*	PV WV
37	Greater Flamingo	*Phoenicopterus ruber*	WV
38	Lesser Flamingo	*Phoenicopterus minor*	AV
39	European Honey Buzzard	*Pernis apivorus*	PV
40	Black-shouldered Kite	*Elanus caeruleus*	RB
41	Black Kite	*Milvus migrans*	PV , WV
42	Yellow-billed Kite	*Milvus migrans*	RB
43	Red Kite	*Milvus milvus*	PV
44	Egyptian Vulture	*Neophron percnopterus*	RB, PV (WV)
45	Short-toed Eagle	*Circaetus gallicus*	PV
46	Bateleur	*Terathopius ecaudatus*	CB?
47	Marsh Harrier	*Circus aeruginosus*	#NÉV?
48	Hen Harrier	*Circus cyaneus*	PV WV
49	Pallid Harrier	*Circus macrourus*	PV WV
50	Montagu's Harrier	*Circus pygargus*	PV WV
51	Northern Goshawk	*Accipiter gentilis*	WV
52	Eurasian Sparrowhawk	*Accipiter nisus*	?
53	Levant Sparrowhawk	*Accipiter brevipes*	PV
54	Common Buzzard	*Buteo buteo*	AV?
55	Steppe Buzzard	*Buteo vulpinus*	PV WV SV

56	Long-legged Buzzard	*Buteo rufinus*	CB PV
57	Lesser Spotted Eagle	*Aquila pomarina*	PV (WV)
58	Greater Spotted Eagle	*Aquila clanga*	
59	Tawny Eagle	*Aquila rapax*	AV?
60	Steppe Eagle	*Aquila nipalensis*	PV (WV) (SV)
61	Imperial Eagle	*Aquila heliaca*	PV
62	Booted Eagle	*Hieraaetus pennatus*	
63	Osprey	*Pandion haliaetus*	RB
64	Lesser Kestrel	*Falco naumanni*	CB PV WV
65	Common Kestrel	*Falco tinnunculus*	PV WV
66	Red-footed Falcon	*Falco vespertinus*	
67	Merlin	*Falco columbarius*	WV
68	Eurasian Hobby	*Falco subbuteo*	
69	Sooty Falcon	*Falco concolor*	RB
70	Lanner	*Falco biarmicus*	?
71	Water Rail	*Rallus aquaticus*	RB PV WV
72	Spotted Crake	*Porzana porzana*	PV WV
73	Little Crake	*Porzana parva*	CB? PV WV
74	Common Moorhen	*Gallinula chloropus*	RB PV WV
75	Purple Swamp-Hen	*Porphyrio porphyrio*	RB
76	Eurasian Coot	*Fulica atra*	RB WV
77	Common Crane	*Grus grus*	PV (WV)
78	Greater Painted-Snipe	*Rostratula benghalensis*	RB
79	Black-winged Stilt	*Himantopus himantopus*	RB PV WV
80	Pied Avocet	*Recurvirostra avosetta*	FB PVWV
81	Stone-Curlew	*Burhinus oedicnemus*	RB
82	Senegal Thick-knee	*Burhinus senegalensis*	RB
83	Cream-coloured Courser	*Cursorius cursor*	RB PV WV
84	Collared Pratincole	*Glareola pratincola*	MB PV (WV)
85	Black-winged Pratincole	*Glareola nordmanni*	PV

86	Common Ringed Plover	*Charadrius hiaticula*	PV WV
87	Kentish Plover	*Charadrius alexandrinus*	RB PV WV
88	Grey Plover	*Pluvialis squatarola*	PV WV
89	Spur-winged Lapwing	*Hoplopterus spinosus*	RB
90	Northern Lapwing	*Vanellus vanellus*	PV WV
91	Knot	*Calidris canutus*	(PV)
92	Sanderling	*Calidris alba*	(PV)
93	Little Stint	*Calidris minuta*	PV WV
94	Temminck's Stint	*Calidris temminckii*	PV WV
95	Dunlin	*Calidris alpina*	PV WV
96	Ruff	*Philomachus pugnax*	PV WV
97	Jack Snipe	*Lymnocryptes minimus*	PV WV
98	Common Snipe	*Gallinago gallinago*	PV WV
99	Great Snipe	*Gallinago media*	PV (WV)
100	Black-tailed Godwit	*Limosa limosa*	PV WV
101	Eurasian Curlew	*Numenius arquata*	PV WV
102	Spotted Redshank	*Tringa erythropus*	PV WV
103	Common Redshank	*Tringa totanus*	PV WV
104	Marsh Sandpiper	*Tringa stagnatilis*	PV WV
105	Common Greenshank	*Tringa nebularia*	PV WV
106	Green Sandpiper	*Tringa ochropus*	PV WV
107	Wood Sandpiper	*Tringa glareola*	PV WV
108	Terek Sandpiper	*Xenus cinereus*	PV
109	Common Sandpiper	*Actitis hypoleucos*	PV WV
110	Ruddy Turnstone	*Arenaria interpres*	PV WV
111	Pallas's Gull	*Larus ichthyaetus*	WV PV
112	Mediterranean Gull	*Larus melanocephalus*	WV
113	Black-headed Gull	*Larus ridibundus*	PV WV
114	Grey-headed Gull	*Larus cirrocephalus*	AV?
115	Slender-billed Gull	*Larus genei*	RB PV WV
116	Lesser Black-backed Gull	*Larus fuscus*	WV

117	Yellow-legged Gull	*Larus michahellis*	RB?
118	Armenian Gull	*Larus armenicus*	PV WV
119	Greater Black-backed Gull	*Larus marinus*	AV?
120	Gull-billed Tern	*Sterna nilotica*	PV WV
121	Caspian Tern	*Sterna caspia*	RB PV WV
122	Lesser Crested Tern	*Sterna bengalensis*	Status unknown
123	Sandwich Tern	*Sterna sandvicensis*	PV WV
124	Common Tern	*Sterna hirundo*	PV
125	White-cheeked Tern	*Sterna repressa*	MB
126	Little Tern	*Sterna albifrons*	MB PV
127	Whiskered Tern	*Chlidonias hybrida*	PV WV
128	Black Tern	*Chlidonias niger*	PV WV
129	White-winged Tern	*Chlidonias leucopterus*	PV WV
130	Eurasian Collared Dove	*Streptopelia decaocto*	RB
131	European Turtle Dove	*Streptopelia turtur*	PV
132	Laughing Dove	*Streptopelia senegalensis*	RB
133	Great Spotted Cuckoo	*Clamator glandarius*	MB PV
134	Common Cuckoo	*Cuculus canorus*	PV
135	Senegal Coucal	*Centropus senegalensis*	RB
136	Barn Owl	*Tyto alba*	RB
137	European Scops Owl	*Otus scops*	PV WV
138	Pharaohs Eagle Owl	*Bubo ascalaphus*	RB
139	Little Owl	*Athene noctua*	
140	Tawny Owl	*Strix aluco*	AV
141	Hume's Owl	*Strix butleri*	RB
142	Long-eared Owl	*Asio otus*	RB PV WV
143	Short-eared Owl	*Asio flammeus*	PV WV
144	European Nightjar	*Caprimulgus europaeus*	PV
145	Egyptian Nightjar	*Caprimulgus aegyptius*	RB
146	Common Swift	*Apus apus*	PV
147	Pallid Swift	*Apus pallidus*	RB

148	White-throated Kingfisher	*Halcyon smyrnensis*	RB WV
149	Common Kingfisher	*Alcedo atthis*	RB PV WV
150	Pied Kingfisher	*Ceryle rudis*	RB (WV)
151	Green Bee-eater	*Merops orientalis*	RB
152	Blue-cheeked Bee-eater	*Merops persicus*	MB PV
153	European Bee-eater	*Merops apiaster*	MB PV
154	European Roller	*Coracias garrulus*	PV
155	Eurasian Hoopoe	*Upupa epops*	RB
156	Eurasian Wryneck	*Jynx torquilla*	PV (WV)
S. No.	English Name	*Latin Name*	Status in Egypt
157	Greater Hoopoe Lark	*Alaemon alaudipes*	RB
158	Crested Lark	*Galerida cristata*	RB
159	Temminck's Lark	*Eremophila bilopha*	RB
160	Sand Martin	*Riparia riparia*	MB
161	Barn Swallow	*Hirundo rustica*	PV
162	Red-rumped Swallow	*Hirundo daurica*	PV (WV)
163	Common House Martin	*Delichon urbica*	PV (WV)
163	Tawny Pipit	*Anthus campestris*	PV WV
164	Tree Pipit	*Anthus trivialis*	PV
165	Meadow Pipit	*Anthus pratensis*	PV WV
166	Red-throated Pipit	*Anthus cervinus*	PV WV
167	Water Pipit	*Anthus spinoletta*	PV WV
168	Yellow Wagtail	*Motacilla flava*	RB
169	Citrine Wagtail	*Motacilla citreola*	AV?
170	Grey Wagtail	*Motacilla cinerea*	PV
171	White Wagtail	*Motacilla alba*	PV WV
172	Common Bulbul	*Pycnonotus barbatus*	RB
173	Grey Hypocolius	*Hypocolius ampelinus*	AV (WV)
174	European Robin	*Erithacus rubecula*	WV
175	Thrush Nightingale	*Luscinia luscinia*	PV
176	Common Nightingale	*Luscinia megarhynchos*	PV

177	Bluethroat	*Luscinia svecica*	PV WV
178	Black Redstart	*Phoenicurus ochruros*	PV WV
179	Common Redstart	*Phoenicurus phoenicurus*	PV (WV)
180	Whinchat	*Saxicola rubetra*	PV
181	Common Stonechat	*Saxicola rubicola*	
182	Isabelline Wheatear	*Oenanthe isabellina*	PV WV
183	Northern Wheatear	*Oenanthe oenanthe*	AV
184	Black-eared Wheatear	*Oenanthe hispanica*	PV
185	Desert Wheatear	*Oenanthe deserti*	RB PV WV
186	Mourning Wheatear	*Oenanthe lugens*	RB
187	Red-rumped Wheatear	*Oenanthe moesta*	RB
188	White-crowned Wheatear	*Oenanthe leucopyga*	
189	Blue Rock Thrush	*Monticola solitarius*	CB? PV WV
190	Common Blackbird	*Turdus merula*	RB WV
191	Fieldfare	*Turdus pilaris*	WV
192	Song Thrush	*Turdus philomelos*	WV
193	Graceful Prinia	*Prinia gracilis*	RB
194	Scrub Warbler	*Scotocerca inquieta*	RB
195	Savi's Warbler	*Locustella luscinioides*	PV (WV)
196	Sedge Warbler	*Acrocephalus schoenobaenus*	PV (WV)
197	European Reed Warbler	*Acrocephalus scirpaceus*	PV
198	Marsh Warbler	*Acrocephalus palustris*	PV
199	Blyth's Reed Warbler	*Acrocephalus dumetorum*	(AV?)
200	Great Reed Warbler	*Acrocephalus arundinaceus*	PV
201	Clamorous Reed Warbler	*Acrocephalus stentoreus*	RB
202	Eastern Olivaceous Warbler	*Hippolais pallida*	AV
203	Icterine Warbler	*Hippolais icterina*	PV (WV)
204	Blackcap	*Sylvia atricapilla*	PV
205	Garden Warbler	*Sylvia borin*	PV
206	Lesser Whitethroat	*Sylvia curruca*	PV
207	Common Whitethroat	*Sylvia communis*	PV

208	Subalpine Warbler	*Sylvia cantillans*	PV WV
209	Sardinian Warbler	*Sylvia melanocephala*	FB ?
210	Rüppell's Warbler	*Sylvia rueppelli*	PV (WV)
211	Bonelli's Warbler	*Phylloscopus bonelli*	PV
212	Balkan Warbler	*Phylloscopus orientalis*	PV
213	Wood Warbler	*Phylloscopus sibilatrix*	PV
214	Common Chiffchaff	*Phylloscopus collybita*	PV WV
215	Willow Warbler	*Phylloscopus trochilus*	PV WV
216	Spotted Flycatcher	*Muscicapa striata*	PV (WV)
217	Collared Flycatcher	*Ficedula albicollis*	PV
218	Pied Flycatcher	*Ficedula hypoleuca*	PV
219	Nile Valley Sunbird	*Anthreptes metallicus*	RB
220	Eurasian Golden Oriole	*Oriolus oriolus*	PV
221	Woodchat Shrike	*Lanius senator*	PV
222	Carrion Crow	*Corvus corone*	(WV)
223	Brown-necked Raven	*Corvus ruficollis*	RB
224	Common Starling	*Sturnus vulgaris*	WV
225	House Sparrow	*Passer domesticus*	RB
226	Spanish Sparrow	*Passer hispaniolensis*	PV WV
227	Streaked Weaver	*Ploceus manyar*	IB
228	Common Chaffinch	*Fringilla coelebs*	WV
229	Brambling	*Fringilla montifringilla*	WV
230	European Siskin	*Carduelis spinus*	WV
231	Ortolan Bunting	*Emberiza hortulana*	(PV) WV
232	Common Reed Bunting	*Emberiza schoeniclus*	AV

3.3. Lake Nasser

3.3.1. Human Activities:

Traditional Fishing is the main activities for the local people, where the reservoir is considered as one of the most important source of freshwater fish in Egypt, contributing from 25 to 40% of the total inland fish production (Baha El Din, 1999). After an almost steady increase in fishery from 1964 (with almost 35,000 tons), in mid 1980s there was a significant drop in the yearly yield reached about 15,000 tons which coincided with the

drought in the catchments area. In 1992 the catchments was about 26,000 tons and the number of fishermen was nearly 3,000.

A hug and ambitious agriculture development project known as the South Valley or Tushka Project was initiated in 1996 to reclaim and cultivate several hundred thousands feddans of the western desert using Lake Nasser water. The project involves the construction of the world's largest pumps, which will carry water from the lake into 300km long canal to Kharga Oasis.

3.3.2. Threats

In recent time, large-scale human activities have supplemented natural hazards: Nile barrages and irrigation projects in the 19th Century, major modification of Nile flow by 2 dams and large reservoir (Lake Nasser) in the 20th Century, and ongoing diversion of Nile water to the Western Desert and Sinai. Adoption of inappropriate development strategies and techniques in this unique and vital region, Lake Nasser is the main reservoir of fresh water in Egypt, could be ecologically disaster (Baha El Din, 1999). Mismanagement of shoreline agriculture activities where lake Nasser is the only place for disposing any wastes especially sold wastes in addition to drainage water, over use of pesticides can cause severe impact on water quality, lake environment and wild life along the shoreline. Species such as Egyptian Goose, Crested Lark and Dorcas Gazelle are considered pests around Lake Nasser and have persecuted by many means including poisoning, led to killing of other non-targeted wildlife (Baha El Din,1999). Shooting of waterbirds is reported to tack place regularly during winter by visiting European hunters.

There is also intensive tourism activities using the reservoir in cruse tours by ships and motorboats from Aswan to Abu Simbl visiting the archeological site which discharge its treated and untreated wastes directly into the lake not only but also sold and chemical wastes, which can potentially impact the lake water quality in spit of disturbing wildlife particularly breeding and wintering birds.

3.3.3. Birds of Lake Nasser

A recent survey was conducted at the lake from 25th November to 4th December 2007,

Total of about 10,000 birds of 74 species were counted, with 43 species of waterbirds accounting for 7,571 individuals.

- The most common species recorded were Great Cormorant *Phalacrocorax carbo,* with more than 1,500 and Whiskered Tern *Chlidonias hybridus,* with almost 1,300 individuals.
- Black-headed Gull *Larus ridibundus* was also common, with over 700 individuals, whilst Slender-billed Gull *Larus genei* was not observed.
- Grey Heron *Ardea cinerea* was the most common heron species, with almost 800 individuals recorded.
- There were 47 species recorded each with less than 50 individuals in the whole wetland.
- Only 27 species were recorded in numbers between 100 and 1000 individuals.

- The number of birds and species diversity recorded in the western shore of Lake Nasser was more than that of the eastern shore, probably due to the sandy and gentle slope at the western shore, whilst the eastern shore is rocky and steep sloping.
- The most common wader species recorded was Little Stint *Calidris minuta* (over 300 individuals); other wader species were recorded in low numbers, with no more than 20 individuals.

During regular monitoring in Aswan and Lake Nasser since 2003 by different methodologies 146 species were recorded via ringing station and water birds census in Aswan and Lake Nasser 2003 – 2007; about 80% of them are migrants.

Table (6.2.): Checklist of Aswan Birds (Wed Ibrahim & Dirk Mortinus 2007).

No.	English Name	Latin Name
1	Great Crested Grebe	*Podiceps cristatus*
2	Little Grebe	*Tachybaptus ruficollis*
3	White Pelican	*Pelecanus onocrotalus*
4	Pink-backed Pelican	*Pelecanus rufescenus*
5	Cormorant	*Phalacrocorax carbo*
6	Little Bittern	*Ixobrychus minutus*
7	Night Heron	*Nycticorax nycticorax*
8	Mangrove Heron	*Butorides striatus*
9	Cattle Egret	*Bubulcus ibis*
10	Squacco Heron	*Ardeola ralloides*
11	Little Egret	*Egretta garzetta*
12	Great Egret	*Egretta alba*
13	Grey Heron	*Ardea cineria*
14	Purple Heron	*Ardea purpurea*
15	White Stork	*Ciconia ciconia*
16	Black Stork	*Ciconia nigra*
17	Yellow-billed Storks	*Mycteria ibis*
18	Greater Flamingo	*Phoenicopterus ruber*
19	Glossy Ibis	*Plegadis falcinellus*
20	Spoonbill	*Platalea leucorodia*
21	Egyptian Goose	*Alopochen aegyptiacus*
22	Pintail	*Anas acuta*

23	Shoveler	*Anas clypeata*
24	Wigeon	*Anas penelope*
25	Teal	*Anas crecca*
26	Garganey	*Anas querquedula*
27	Ferruginous Duck	*Aythya nyroca*
28	Tufted Duck	*Aythya fuligula*
29	Osprey	*Pandion haliaetus*
30	Step eagle	*Aquila nipalensis*
31	Egyptian Vulture	*Neophron percnopterus*
32	Black Kite	*Milvus migrans*
33	Marsh Harrier	*Circus aeruginosus*
34	Black-winged Kite	*Elanus caeruleus*
35	Honey Buzzard	*Pernis apivorus*
36	Sparrowhawk	*Accipiter nisus*
37	Common Buzzard	*Buteo buteo*
38	Red-footed Falcon	*Falco vespertinus*
39	Kestrel	*Falco tinnunculus*
40	Hobby	*Falco subuteo*
41	Barbary Falcon	*Falco pelegrinoides*
42	Sand Partridge	*Ammoperdix heyi*
43	Moorhen	*Gallinula chloropus*
44	Coot	*Fulica atra*
45	Purple Swamp-hen	*Porphyrio porphyrio*
46	Black-winged Stilt	*Himantopus himantopus*
47	Stone Curlew	*Butorides striatus*
48	Senegal Thick-knee	*Burhinus senegalensis*
49	Black-Winged Pratincol	*Glareola nordmanni*
50	Spur-winged Lapwing	*Vanellus spinosus*
51	Temminck's Stint	*Calidris temminckii*
52	Little Stint	*Calidris minuta*
53	Wood Sandpiper	*Tringa glareola*

54	Green Sandpiper	*Tringa ochropus*
55	Common Sandpiper	*Actitis hypoleucos*
56	Spotted Redshank	*Tringa erythropus*
57	Redshank	*Tringa totanus*
58	Greenshank	*Tringa nebularia*
59	Marsh Sandpiper	*Tringa stagnatilis*
60	Black-tailed Godwit	*Limosa limosa*
61	Snipe	*Gallinago gallinago*
62	Jack Snipe	*Lymnocryptes minimus*
63	Ruff	*Philomachus pugnax*
64	Little Ringed Plover	*Charadrius dubius*
65	Ringed Plover	*Charadrius hiaticula*
66	Three-banded Plover	*Charadrius tricollaris*
67	Painted Snipe	*Rostratula benghalensis*
68	African Skimmers	Rynchops flavirostris
69	Black-headed Gull	*Larus ridibundus*
70	Lesser Black-backed Gull	*Larus fuscus*
71	Gull-billed Tern	*Sterna nilotica*
72	White-winged Tern	*Chlidonias leucopterus*
73	Whiskered Tern	*Chlidonias hybridus*
74	Namaqua Dove	*Oena capensis*
75	Turtle Dove	*Streptopelia turtur*
76	Laughing Dove	*Streptopelia senegalensis*
77	Great Spotted Cuckoo	*Clamator glandarius*
78	Little Owl	*Athene noctua*
79	Humes Tawny Owl	*Strix butleri*
80	Barn Owl	*Tyto alba*
81	Egyptian Nightjar	*Caprimulgus aegyptus*
82	Pallid Swift	*Apus pallidus*
83	Common Swift	*Apus apus*
84	Bee-eater	*Merops apiaster*

85	Blue-cheeked Bee-eater	*Merops persicus*
86	Little Green Bee-eater	*Merops orientalis*
87	Hoopoe	*Upupa epops*
88	Kingfisher	*Alcedo atthis*
89	Pied Kingfisher	*Ceryle rudis*
90	Wryneck	*Jynx torquilla*
91	Crested Lark	*Galerida cristata*
92	Sand Martin	*Riparia riparia*
93	Rock Martin	*Ptynoprogne fuligula*
94	Barn Swallow	*Hirundo rustica rustica*
95	Barn Swallow	*Hirundo rustica savignii*
96	Red-rumped Swallow	*Hirundo daurica*
97	House Martin	*Hirundo rustica*
98	Rock Thrush	*Monticola saxatilis*
99	Tawny Pipit	*Anthus campestris*
100	Tree Pipit	*Anthus trivialis*
101	Red-throated Pipit	*Anthus cervinus*
102	White Wagtail	*Motacilla alba ssp. alba*
103	Yellow Wagtail	*Motacilla flava*
104	African Pied Wagtail	*Motacilla aguimp ssp vidua*
105	Common Bulbul	*Pycnonotus barbatus*
106	Grey Hypocolius	*Hypocolius ampelinus*
107	Thrush Nightingale	*Luscinia luscinia*
108	Common Nightingale	*Luscinia megarhynchos*
109	Bluethroat	*Luscinia svecica*
110	Redstart	*Phoenicurus phoenicurus*
111	Black Redstart	*Phoenicurus ochruros*
112	Rufous Bush Robin	*Cercotrichas galactotus*
113	Wheatear	*Oenanthe oenanthe*
114	Isabelline Wheatear	*Oenanthe isabellina*
115	Black-eared Wheatear	*Oenanthe hispanica melanoleuca*

116	Mourning Wheatear	*Oenenthe lugens*
117	Desert Wheatear	*Oenanthe deserti*
118	White-crowned Wheathear	*Oenanthe leucopyga*
119	Whinchat	*Saxicola rubetra*
120	Stonechat	*Saxicola torquata maura*
121	Rock Thrush	*Monticola saxatilis*
122	Song Thrush	*Turdus philomelos*
123	Lesser Whitethroath	*Sylvia curruca*
124	Sardinian Warbler	*Sylvia melanocephala*
125	Rüppell's Warbler	*Sylvia ruepelli*
126	Graceful Prinia	*Prinia gracilis*
127	Sedge Warbler	*Acrocephalus schoenobaenus*
128	Zitting Cisticola	*Cisticola juncidis*
129	Reed Warbler	*Acrocephalus scirpaceus*
130	Clamourus Reed Warbler	*Acrocephalus stentoreus*
131	Chiffchaff	*Phylloscopus collybita*
132	Olivaceus Warbler	*Hippolais pallida*
133	Spotted Flycatcher	*Muscicapa striata*
134	Red-backed Shrik	*Lanius collurio*
135	Woodchat Shrik	*Lanius senator*
136	Masked Shrike	*Lanius nubicus*
137	Great Grey Shrike	*Lanius excubitor*
138	Nile Valley Sunbird	*Anthreptes metallicus*
139	Hooded Crow	*Corvus corone cornix*
140	Brown-necked Raven	*Corvus ruficollis*
141	Golden Oriole	*Oriolus oriolus*
142	House Sparrow	*Passer domesticus*
143	Goldfinch	*Carduelis carduelis*
144	Trumpeter Finch	*Bucanetes githagineus*
145	Red Avadavat	*Amandava amandava*
146	Spanish Sparrow	*Passer hispaniolensis*

4. RECOMMENDATIONS

1. Raise the capacity building for PA staff working for bird conservation.
2. Design and implement Regular monitoring programs on seasonal and spatial bases.
3. Standardize monitoring methodologies.

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CHAPTER 7
MAMMALS

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1. INTRODUCTION

With most of the land area of Egypt being either arid or hyper arid, the availability of water as the most critical resource, plays a decisive role in determining the habitability of Egypt. Differences in rainfall as well as landform features which control the redistribution and availability of water from local or remote sources, are therefore of extreme importance in determining the nature, distribution and abundance of plant and animal life.

Within any given habitat, animal species richness and diversity are mostly determined by the abundance and diversity of available resources, the extent that species use these resources, and the degree that these resources are shared.

Many species of animals and plants and their habitats depend on wetlands or Nile valley for their continued existence. Some species live permanently in wetlands or Nile valley and others depend on them for key aspects of their life cycles (such as resting points on routes for migratory birds, spawning grounds for fish). Many rare or threatened species depend on wetlands or Nile valley and people value their continued presence in their own right and not as a source of food or other direct use.

Wetlands and Nile valley provide a variety of biological and socioeconomic functions, and are among the most productive ecosystems in the world. They provide diverse wildlife habitats and support complex food chains. Many species of mammals depend on wetland habitats for survival. Some mammals are herbivores, while others are omnivores or carnivores that rely on varying combinations of aquatic invertebrates, amphibians, fish, and other prey. Many wetland and Nile valley mammals consume large numbers of insects, cultivate the soil, or modify habitat used by waterfowl and other wildlife.

Nile Valley and wetlands consider the most diverse and productive Ecosystem in Egypt. It support ideal habitat for 87 weeds species,80 phytoplankton species, 100 Zooplankton species,82 fish species, 31 amphibian & reptiles species, 144 bird species and 39 mammalian species, Small mammals (Rodents and bats) are the most common species and the other mammals (Mongoose, Red fox, Jungle cat and Jackal) are rare species and limited in distribution because it threatened.

Class Mammalia in Egypt is divided to eight Orders

Order 1. Insectivora: Hedgehogs and Shrews (10 Species come from 2 Families)

Order 2. Chiroptera: Bats (22 Species come from 8 Families)

Order 3. Lagomorpha: Hares and Rabbits (1 Species come from 1 Family)

Order 4. Rodentia: Rats, Mice, Gerbils and Jerboas (23 Species come from 6 Family)

Order 5. Carnivora: Dogs, Cats and Foxes (27 Species come from 6 Family)

Order 6. Hyracoidea: Hyraxes (1 Species come from 1 Family)

Order 7. Perissodactyla: Horses and Asses (1 Species come from 1 Family)

Order 8. Artiodactyla: Goats, Sheep and Gazelles (6 Species come from 1 Family)

2. MAMMALS IN NILE VALLEY AND DELTA

Herodotus described Egypt as "the gift if the Nile" and for millennia the Nile Valley and the Delta was Egypt. The harsh deserts that form most of modern Egypt were not considered. Together the river and its delta form a typical river oasis. From Lake Nasser in the south to the apex of the Delta roughly at Cairo in the north, the Nile Valley averages 10km in width. The Delta is 166km from its apex to the Mediterranean coast and is 250 km wide.

Tabel 7.1. Listed Mammals from Nile Valley and Delta in Egypt

Order	Family	Scientific Name	English Name
Insectivora	Erinaceidae	*Hemiechinus auritus aegyptius*	Long-eared Hedgehog
	Soricidae	*Crocidura flavenscens*	Giant Shrew
		Crocidura nana	Dwarf Shrew
Rodentia	Murinae	*Arvicanthis niloticus*	Nile Rat
		Rattus rattus	Black Rat
		Rattus norvegicus	Norway Rat
		Mus masculus	House Mouse
		Acomys cahirinus cahirinus	Cairo Spiny Mouse
	Cricetidae	*Gerbillus gerbillus*	Lesser Egyptian Gerbil
		Gerbillus pyramidum pyramidum	Greater Egyptian Gerbil
		Gerbillus andersoni andersoni	Anderson's Gerbil
Chiroptera	Pteropodidae	*Rousettus eagyptiacus*	Egyptian Fruit-Bat
	Rhinopomatidae	*Rhinopoma hardwickii cystops*	Lesser Rat – tailed Bat
		Rhinopoma microphyllum	Greater Rat – tailed Bat
	Emballonuridae	*Taphozous perforatus*	Tomb - Bat
		Taphozous nudiventris	Naked – Bellied Tomb Bat

	Nycteridae	*Nycteris thebaica*	Egyptian Slit – faced Bat
	Rhinolophidae	*Rhinolophus clivosus brachygnathus*	Horse – shoe Bat
	Vespertilionidae	*Pipistrellus kuhli*	Kohl's pipistrelle
		Plecotus austriacus	North African Long – eared Bat
Carnivora	Canidae	*Canis aureus*	Jackal
		Vulpes vulpes	Red fox
	Herpestidae	*Herpestes ichneumon*	Egyptian Mongoose
	Mustelidae	*Mustela nivalis*	Weasel
	Felidae	*Felis sylvestris libyca*	Wildcat
		Felis chaus	Jungle Cat
4	***14***	***26***	

3. MAMMALS IN WETLANDS

The RAMSAR Convention defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters".

The U.S. Environmental Protection Agency defines wetlands as: “Lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface.” Environment Canada’s official definition is almost the same wording.

Wetlands are lands that hold water at least for part of the time. And while some wetlands may look like small lakes others may appear dry because the water is stored beneath the surface. This ‘in between’ and dynamic character makes the plant and animal communities of wetlands unique and quite different to those of either aquatic or dry habitats.

How much of the earth’s surface is presently composed of wetlands is not known exactly. The World Conservation Monitoring Centre has suggested that roughly 6% of the Earth’s land surface is made up of wetlands. Lakes represent 2% of that while bogs make up 30%, fens 26%, swamps 20%, and floodplains 15%.

Lakes and wetlands of Mediterranean coasts of Egypt and Sinai cover a total area of at least 280,000 hectares, representing more than 25% of all natural and semi-natural wetlands of entire Mediterranean region. The northern delta lakes and wetlands which include Lake Idku - Lake Burullus - Lake Manzala – Lake Maryut and Bur Foad represent, however, the remainder of considerably more extensive wetlands of the recent

past. The Lakes have suffered sever and extensive ecological damage in recent years as a result of chronic pollution and mismanagement. Lake Bardawil of Mediterranean coast of the Sinai will most likely be adversely impacted by a very large agricultural land reclamation project to be implemented in near future. Numerous smaller lakes and wetlands are found in Delta, Fayoum and along the Nile valley.

Most of these are privately owned and many receive considerable numbers of water birds. In addition Lake Qaroun in Fayoum and man- made Lakes El Rayan in Wadi El Rayan Depression are among the major lakes of Egypt.

Tabel 7.2. Listed Mammals from Wetland in Egypt

Order	Family	Scientific Name	English Name
Insectivora	Erinaceidae	*Hemiechinus auritus libycus*	Long-eared Hedgehog
		Paraechinus deserti	Desert Hedgehog
Lagomorpha	Leporidae	*Lepus capensis*	Cape Hare
Rodentia	Murinae	*Arvicanthis niloticus*	Nile Rat
		Rattus rattus	Black Rat
		Rattus norvegicus	Norway Rat
		Mus masculus	House Mouse
		Acomys cahirinus helmyi	Cairo Spiny Mouse
		Nesokia indica	Short – tailed Bandicoot Rat
	Cricetidae	*Gerbillus Andersoni inflatus*	Anderson's Gerbil
		Dipodillus campestris haymani	Large North African Dipodil
		Dipodillus simoni	Lesser short-tailed gerbil.
		Dipodillus ameonus	Charming Dipodil
		Meriones shawi	Shaw's Jird
		Psammomys obesus	Fat Sand Rat
		Gerbillus gerbillus	Lesser Egyptian Gerbil
	Spalacidae	*Spalax ehrenbergi*	Egyptian Mole Rat
	Dipodidae	*Allactaga tetradactyla*	Four-Toed Jerboa
		Jaculus orientalis	Greater Egyptian Jerboa
		jaculus Jaculus	Lesser Egyptian Jerboa
Chiroptera	Rhinopomatidae	*Rhinopoma hardwickei arabium*	Lesser Rat – tailed Bat
	Rhinolophidae	*Rhinolophus clivosus*	Horse – shoe Bat

		brachygnathus	
	Hipposideridae	*Rhinolophus tridens*	Leaf – nosed Trident Bat
	Vespertilionidae	*Otonycteris hemprichi*	Hemprich's Long – eared Bat
		Plecotus austriacus	North African Long – eared Bat
Carnivora	Felidae	*Felis chaus*	Jungle Cat
		Felis silvestris libyca	Wildcat
		Acinonyx jubatus	Cheetah
		Felis margarita	Sand Cat
	Mustelidae	*Mustela nivalis*	Weasel
		Poecilictus libyca	Libyan Striped Weasel
	Herpestidae	*Herpestes ichneumon*	Egyptian Mongoose
	Canidae	*Vulpes vulpes*	Red fox
		Vulpes rueppelli	Sand Fox
		Vulpes zerda	Fennec Fox
		Canis aureus	Jackal
	Hyaenidae	*Hyaena hyaena*	Stripped hyena
Artiodactyla	Bovidae	*Gazella leptoceros*	Slender-horned Gazelle
		Gazella dorcas	Dorcas gazelle
6	***16***	***39***	

4. KEY SPECIES ACCOUNT

ORDER CARNIVORA

FAMILY CANIDAE

1. *Canis aureus* Linnaeus, 1758

Common names: Abu Soliman, Jackal, Deeb, Ibn Awee.

Distribution: *Canis aureus* extends from southeastern Europe through Asia Minor and southern USSR to Iran, India, Burma and Thailand. It also ranges widely in Africa, from Senegal to Egypt, south to Sudan, Ethiopia and Kenya. In Egypt, it is Known in Sinai, northern part of eastern desert, Nile Delta and Valley and bordering Deserts, western Mediterranean coastal desert and oases of western desert.

Description: Dog-like carnivore with broad dorsal mane. Agouti nature of hairs on Hip gives an impression of broken stripes. Side is yellowish with scattering of black and White-tipped hairs. There is black marking on anterior of forelimb. Tail is relatively short with black tip. Pupil of eye is rounded. Frontal region of skull is inflated and cranial ridges are high and prominent.

Comparison: *Canis aureus* is distinguishable from other Egyptian canids in having the dorsum blackish and manned, frontal region of skull elevated, a prominent postorbital swelling, cranium broadest at bases of zygomatic processes and larger dimensions.

Habitats and ecology: Along the rivers and cultivated lands. Frequently seen in isolated cliffs and rocky hillocks in semi-barren desert. Nocturnal scavengers. Their dens are found in tombs, natural caves and crevices.

Status: Vulnerable.

Threats

1. Canis aureus have suffered a great deal of decline in recent years as a result of secondary poisoning with pesticides widely used to control rodent pests.

2. *Canis aureus* hunted to protect livestock, and in some rare cases to protect humans.

3. Habitat Destruction

4. Feral Dogs

2. *Vulpes vulpes* Linnaeus, 1758

Common names: Taalab, Abu Hussein, Red Fox.

Distribution: *V. vulpes* is very widely distributed, with a range that includes Europe and continental Asia, northern India, peninsular Indochina, Japan, Palaearctic Africa and North America. In Egypt, it is found in it is known in Sinai, northern part of eastern desert, Nile Delta and Valley and western Mediterranean coastal desert.

Description: Large reddish fox. The dorsal surface is reddish to reddish brown; side is yellowish gray and Venter is brownish or blackish. Tail is long, bushy and club shaped

with white tip. Ear is relatively large and black posterior. Pupil of eye is elongate vertically. Skull is broadest on sides, narrower at base with frontal region is not inflated.

Comparison: *Vulpes vulpes* differs from other Egyptian foxes by darker color, back of ear being black instead of pale brown in V. *rueppelli*, venter blackish and presence of black mark on foreleg.

Habitats and ecology: Inhabits date and fruit groves, cultivated areas and suburban gardens. Not strictly nocturnal. Commonly seen during daylight hours. Feeds on birds, rodents and insects (Basuony, 1998).

Status: Lower Risk, least concern.

Threats: No Threats

3. *Vulpes rueppelli* Schinz, 1825

Common names: Taalab, Abu Hussein, Sand Fox.

Distribution*: V. rueppelli* is distributed in North Africa and the Middle East, from Morocco to Afghanistan. In Egypt, it is found in Sinai Peninsula, Eastern desert, Western Desert.

Description: smaller than the Red Fox. It is sandy in color and has black patches on the muzzle, as well as a white tipped tail. Rüppell's Fox has fur on the pads on its feet, which possibly helps distribute their weight and move easily on sand. Similar to other desert dwelling foxes, Rüppell's Fox has relatively large ears to cool it off. The tail is long and bushy. These features make Rüppell's Fox look almost like a large Fennec Fox.

Habitats and ecology: Rüppell's Fox nocturnal. It was pushed to living in the desert biome due to competition with its larger cousin, the Red Fox. It is known as being an extremely good survivor. Rüppell's Fox's only predators are the Steppe Eagle and the Eagle Owl. Rüppell's Fox is a solitary forager. It is an omnivore, and will eat almost anything that crosses its path. Mostly, it is an insectivore, but its di*et al*so consists of tubers and roots, as well as small mammals, reptiles, eggs, and arachnids.

Status: Data Deficient.

Threats:

1**.** Habitat Destruction.

2. Feral Dogs.

3. Hunting & trapping terrestrial animals (fur, pet trade and scientific Researches).

4. Incidental or accidental mortality

4. *Vulpes zerda* Zimmerman, 1780

Common names: Taalab, Fanak, Fennec Fox.

Distribution: *V. zerda* found in the Sahara Desert of North Africa. In Egypt, it is found in Sinai and Western Desert and its oases.

Description: The ears of fennecs are perhaps their most distinctive feature. Massive in proportion to the skull, the large, 15 cm long pinnae are used both to dissipate heat and to locate prey moving under the sand. Enlarged auditory bullae also serve this latter purpose. Fur in adults is thick and silky, buff-colored on the dorsal surface and white along the animal's legs, face, ear-linings and underside. In contrast, juveniles are downy and almost exclusively white. The fur over the violet gland - found in all foxes, and of unknown function - is black or dark brown. This is also the color of the fur on the tip of the tail. The feet are heavily furred, protecting the pads from the hot desert sand. The eyes, rhinal pad, and vibrissae of fennecs are all black.

Habitats and ecology: The Fennec Fox is a nocturnal omnivore. At night, it hunts rodents, insects, birds, and eggs of birds and insects. Much of the diet is desert vegetation, from which the Fennec Fox gets most of its water. This consists of grasses, some roots, and some fruit and berries.

Status: Lower Risk, least concern.

Threats:

1**.** Habitat Destruction.

2. Feral Dogs.

3. Hunting for fur, pet trade and scientific Researches**.**

FAMILY FELIDAE

5. *Felis silvestris* Schreber, 1777

Common names: Wild Cat, Qitt gabali

Distribution: *Felis silvestris* found in the Sahara Desert of North Africa. In Egypt, it is found in cultivated land in coastal desert, Rocky area and around settlement in Fayoum.

Description: Wildcats are generally grey-brown with bushy tails and a well-defined pattern of black stripes over their entire body. Their fur is short and soft. Their coloration is similar to that of a tabby domestic cat and makes them difficult to see in their forested habitats.

Habitats and ecology: Rodents and rabbits are the staple of the wildcat's diet across its range, with birds of secondary importance, although a variety of small prey is taken, and wildcats also scavenge. The African Wildcat is mainly active during the night and twilight. When confronted, the African Wildcat raises its hair to make itself seem larger and intimidate its opponent. In the daytime it usually hides in the bushes, although it is sometimes active on dark, cloudy Days.

Status: Lower Risk, least concern.

Threats:

1. Habitat Destruction.

2. Hunting for fur, pet trade and scientific Researches.

6. *Felis chaus* Guldenstaedt, 1776

Common names: Jungle Cat, Qitt barri nili

Distribution: It ranges from Egypt through to Asia Minor, eastern Transcucasia and north along the west shore of the Caspian Sea to the Volga delta. It is also known from Iran, Afghanistan, Chinese Turkistan, India, Sri Lanka, Burma and Vietnam. In Egypt, it is known in Nile Delta, Nile Valley south to Aswan, El-Fayoum, Farafra and Dakhla oases and western Mediterranean coastal desert.

Description: Large cats. Color is dark, grizzled is buff. Lachrymal stripe is dark brown and prominent. Chick stripe is absent. Ear is reddish brown with black tip and small tuft. Tail is relatively short (one-third head and body length) with several black distal rings and black tip. Skull is large and condyloincisive length over 95 mm.

Habitats and ecology: Low cultivated or marshy ground, reed beds or any similar thick cover (Anderson, 1902; Flower, 1932; Osborn and Helmy, 1980). We saw a specimen in reed swamp, *Phragmites australis*. It is primarily diurnal. Its diet consists principally of birds, small mammals, frogs and snakes of the genus Coluber and Psammophis.

Status: Vulnerable.

Threats:

1. Habitat Destruction.
2. Hunting for fur, pet trade and scientific Researches.
3. Poisoning with pesticides widely used to control rodent pests.

7. *Felis margarita* Loche, 1858

Common names: Sand Cat, Qitt EL Remal

Distribution: found in the Desert of North Africa. In Egypt, it is found in eastern desert and north Sinai

Description: *Felis margarita* is the size of a domestic cat and the smallest of all wild cats. Their most distinctive characteristic is their large ear pinnae, which protect the ears from blowing sand. The most highly developed senses of this species are hearing and smelling. Being nocturnal animals, they rely on sensitive hearing to locate prey moving below the surface of the ground.

Habitats and ecology: Sand cats are not good climbers or jumpers, but they are excellent diggers. They use their digging ability to dig shallow burrows to escape the heat of the desert during the day. They are known to lie on their backs outside their burrows to release internal heat. Their burrows are shared with other individuals, but more than one cat never occupies the same burrow simultaneously. They are generally nocturnal, although members of a subspecies from Pakistan are nocturnal during the summer and active at dawn and dusk (crepuscular) during the winter. Because of their secretive habits, this species is poorly known, and it is suspected that their current population and distribution may be greater than estimated. Sand cats have been described to close their

eyes at night when humans approach making them difficult to see them because they blend in with their environment.

At night it hunts for rodents, lizards and insects. Since the Sand Cat obtains all the water it needs from eating its prey, it mostly stays far away from watering points.

Status: Endangered .

Threats:

1. Habitat Destruction.

2. Hunting for fur, pet trade and scientific Researches.

8. *Acinonyx jubatus* Schreber, 1776

Common names: Fahd siyad, Shita

Distribution: Currently, the cheetah is found in sub-Saharan Africa and Northern Iran. In Egypt, it is found in Western desert around Qattara Depression

Description: The cheetah *(Acinonyx jubatus*) is an atypical member of the cat family Felidae that is unique in its speed, while lacking climbing abilities. As such, it is placed in its own genus, Acinonyx. It is the fastest land animal, reaching speeds between 112 and 120 km/h (70 and 75 mph) in short bursts covering distances up to 460 m (1,500 ft), and has the ability to accelerate from 0 to 110 km/h (68 mph) in three seconds, greater than most. The body resembles that of a greyhound and is slim with very long legs. The base color of the upper parts of an adult is tawny to bale bluff or grayish white, and the underpants are paler, often white. The coat is marked by round or oval black spots

Habitats and ecology: Cheetah favors areas with tall grass and shrubs. They also seek out areas with many elevated points to look for prey from. Young females leave their natal group, but usually occupy the same home range as their mother. Sibling males will often leave their natal group together and form coalitions. They seek out an area a great distance from their mother. It has been suggested that male coalitions help one another in hunting and defending a territory, thus securing access to receptive females.

Status: Vulnerable .

Threats:

1. Habitat Destruction.

2. Hunting for fur, illegal trade.

FAMILY HYAENIDAE

9. *Hyaena hyaena* Linnaeus, 1758

Common names: Striped Hyaena, dab mukhattat

Distribution: It lives in Africa, the Middle East, Pakistan and western India. In Egypt, it is found in Western desert include all major oases and near to Lake Nasser.

Description: It is a medium sized animal with a downward sloping back and a roundish head with a pointed muzzle and pointed ears. It is generally pale grey or beige in color with a black patch on the throat. It sports 5-9 distinct vertical stripes on the flanks, with clearer black transverse and horizontal stripes on the legs.

Habitats and ecology: The striped hyena lives in arid, mountainous regions with scrub woodland. It dens in rocky hills, ravines, and crevices. It also inhabits open savannah areas with dense grassland in some regions. Striped hyenas are more solitary than spotted and brown hyenas. The striped hyena marks its territory through scent marks from secretions from the anal pouch. Grass stalks, stones, tree trunks and other objects are the most commonly marked. The striped hyena has a lower range of vocalizations than the spotted hyena.

Status: Endangered .

Threats:

1. Habitat Destruction.

2. Hunting for fur, illegal trade**.**

FAMILY HERPESTIDAE

10. *Herpestes ichneumon ichneumon* (Linnaeus, 1758)

Common names: Egyptian Mongoose, Nims.

Distribution: *H. ichneumon* ranges widely in Africa, from Morocco and Egypt in the north to Cape Province in the south. It is also known from Spain, Portugal and

Turkey. In Egypt, it is known from Nile Delta, Nile Valley south to Asyut, El-Fayoum and Burg el Arab.

Description: Weasel-like carnivore. Body is elongated. Pelage is long, coarse with blackish brown grizzled. Tail is long and tapering with black tip and flattened base. Palm and sole are naked. Claws are non-contractile. Ear is short, broad and rounded. Skull is elongated and broadest at the base of zygomatic process.

Habitats and ecology: Cultivated areas of Nile Valley and Delta, near water. Terrestrial species, but readily enters water and swims well. Diurnal and crepuscular. Feeds on rodents, bird, poultry, reptiles, frog and various aquatic and terrestrial Invertebrates. It is hunt their prey by speculation and tend to take a variety of species.

Status: Lower Risk, least concern.

Threats:

1. Habitat Destruction.

2. Hunting for illegal trade and scientific research.

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FAMILY BOVIDAE

11. *Gazella leptoceros* F. Cuvier, 1842

Common names: **Sand Gazelle**, slender-horned gazelle and Rim.

Distribution: it found in North Africa, Algeria and Tunisia. In Egypt, it is found in western desert and its oases.

Description: The palest of the gazelles, this animal has adapted to desert life in many ways. Their pale coat reflects the sun's rays instead of absorbing them, and their hooves are slightly enlarged to help them walk on the sand, although occasionally they occupy stony regions. The horns on the male are slender and slightly S-shaped, and the horns donned by the female are even thinner and lighter, and they don't curve as drastically.

Habitats and ecology: The extreme heat of this environment limits their feeding to the early morning and evening and *G. leptoceros* gains most of its water requirements from dew and plant moisture, relying little on open water sources.

Status: Endangered.

Threats:

1. Habitat Destruction.

2. It hunted firstly by motorized hunters for sport, meat or their horns which were sold as ornaments.

12. *Gazella dorcas* Linnaeus, 1758

Common names: Dorcas Gazelle, Ghazal Afri.

Distribution: it found in North Africa South to Senegal. In Egypt, it is found in western desert and its oases, Eastern desert and South Sinai.

Description: *Gazella dorcas* have longer ears and more strongly curved horns, which bow outwards then turn inwards and forwards at the tips. *Gazella dorcas* varies in coloration, depending on the location. They are generally pale colored and have a white underbelly with two brown stripes on either side. In the northern Sahara they are an ochre color with darker flanking stripes. Near the Red Sea, they are reddish-brown with less conspicuous, light flanking stripes. The head is darker than the rest of the body.

Habitats and ecology: The Dorcas Gazelle is highly adapted to the desert. They can go their entire lives without drinking, as they can g*et al*l of the moisture they need from the plants in their diet, though they do drink when water is available. They are able to withstand high temperatures, but when it is very hot they are active mainly at dawn, dusk and during the night. In areas where they face human predation, they tend to be active only at night in order to minimize the risk of falling prey to hunters. These gazelles feed on leaves, flowers and pods of many species of Acacia trees, as well as the leaves, twigs and fruits of various bushes. They occasionally stand on their hind legs to graze on trees, and after rain they have been observed digging out bulbs from the ground. Dorcas Gazelles are able to run at speeds of up to 80 km per hour, and when threatened they tail-twitch and make bouncing leaps with the head held high (stetting) to announce that they have seen a predator.

Status: Vulnerable.

Threats:

The main threat to this species is ever-expanding civilization, which shrinks the gazelle's habitat by converting it to farmland for growing crops, and by introducing new flocks of domestic sheep and goats which compete with the gazelle for vegetation.

5. GENERAL CONCLUSION

Wetlands are among the most productive ecosystems in the biosphere. They provide tremendous economic benefits to mankind through fishery production. They also provide critical habitats for many species of mammals as well as other animals.

Mammals of the area, particularly those that are known to be threatened, require further, more detailed studies. These may include the ecology and biology of these species covering basic aspects such as population size and dynamics, home range, habitat requirements, competition with feral domestic mammals, impact of Human activities

Wild Carnivores in Nile Valley and Wetland Habitat have suffered a great deal of decline in recent years as a result of secondary poisoning with pesticides widely used to control Nile Rat and other rodent pests.

Gazelle Species in Wetland Habitat Showing Decline in population size Due to

1. Habitat fragmentation
2. Hunting
3. Grazing overlap with domestic Bovidae Family

6. RECOMMENDATIONS

- Support wildlife habitat.
- Put wildlife zone in Egypt as main zone away from devolving zone.
- Establishing Nature museum for wildlife in Egypt.
- Establishing captive breeding for endangered species.
- Establishing gene bank for Fauna of Egypt.
- Mammals of Egypt require further, more detailed studies. These may include the ecology and biology of these species covering basic aspects such as population size and dynamics, home range, habitat requirements, competition with feral domestic mammals and impact of human activities
- Establishing regular surveys to estimate the current status for mammals of Egypt.
- Establishing well trained mammalian team able to doing surveys and study the current status of wild mammals of Egypt.

- Involve the local communities in animal conservation.
- The disposal of feral animals within Egypt ecosystem.
- Increase the awareness about the value of wild animals.
- Implement the eco tourism approach, which aim to protect the habitats and nature resources.
- Using the biological control instead of the chemicals poisons to improve the healthy of wild animals

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CHAPTER 8
MICROBIOLOGY

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1. INTRODUCTION

The River Nile is the life artery of Egypt. Throughout the known Egyptian history, the Nile had dominating influences on the Economy, culture, public health, social life and political aspects. The High Dam reservoir has a huge water storage capacity about (164 Km^3) insuring a plentiful freshwater supply all the year round (Abdel-Hamid *et al*., 1992). However, the construction of the High Dam resulted in great modification in the hydrodynamic regime of the River Nile, with significant changes in physico-chemical and Biological characteristics of the downstream water (Saad and Goma, 1994; Fishar & Khalifa, 2003).(Abdel-Shafy and Aly ,2002) reported that the regulation ought to restore the healthy state of the river in terms of physical, chemical, and biological characteristics. The characteristics of the Nile ecosystem clearly reflect the impact of river flow control and can be categorized into three regions: the Aswan High Dam reservoir, the river from Aswan to Cairo and the Delta.

The water quality in the Nile downstream from Aswan has changed dramatically as the Nile water became silt-free, less turbid and with considerably less velocity (Saad and Goma, 1994). According to the National Water Research Center (NWRC, 2000), the River Nile from Aswan to El-Kanater Barrage receives wastewater discharge from 124 point sources, of which 67 are agricultural drains and the remainders are industrial sources. Now, the changes in water quality are primarily due to a combination of land and water use, as well as water management interventions such as; (a) different Hydrodynamic regimes regulated by the Nile barrages, (b) agricultural return flows, and (c) domestic and industrial waste discharges including oil and wastes from passenger and riverboats. These changes are more pronounced as the river flows through the densely populated urban and industrial centers of Cairo and the Delta region (Agricultural Policy Reform Program, 2002).

The water quality released from the Aswan High dam shows little degradation. It remains remarkably clean from chemical pollution until it reaches the Delta (Masoud *et al.,* 2002). The TDS level in the Nile gradually increases from 150 ppm at Aswan to 250 ppm near Cairo. The oxygen concentration recovers as a result of atmospheric re-aeration and increases from 4 ppm at Aswan to 9–10 ppm at 200 km downstream Aswan, in addition the inputs of sewage along the river reduce the oxygen content, especially near big cities (Abdel- Dayem, 1994). Wahaab and Badawy (2004) concluded that the River Nile receives a large quantity of industrial, agriculture and domestic wastewater. Nevertheless, the river is still able to recover in virtually all the locations, with very little exception. According to the final report of Agricultural Policy Reform Program (2002), the water quality of the main part of the River Nile, from Aswan to Delta barrage is good inspite of the high organic and inorganic loads discharged from some drains and industrial activities.

The assessment of environmental quality with respect to heavy metals in aquatic systems involves the measurement of a series of metals in water, sediments and living organisms (Samecka-Cymerman and Kempers, 2001, Sanchez Lopez, 2004). The most important heavy metals from the point of view of water pollution are Zn, Cu, Pb, Cd, Hg, Ni and Cr. Some of these metals (e.g. Cu, Ni, Cr and Zn) are essential trace metals to living organisms, but become toxic at higher concentrations. Others, such as Pb and Cd have no known biological function, but are toxic elements (Dudka and Adriano, 1997). Masoud *et al.,* (1994) concluded that the concentration of trace metals in Nile water has increased from south to north direction. Also, the large part of trace metals is associated with the suspended matter, where it increased from 3.3 mg/l at Esna (south) to 31.2 mg/l at Helwan (north). Issa *et al.,* (1997) reported that distribution pattern of the major elements (Na, K, Ca, Mg) and trace metals (Fe, Mn, Zn and Cu) in River Nile at the greater Cairo area were affected mainly by industrial and sewage effluents inflow to the river.

1.1. Nile pollution sources from Aswan to Delta Barrage

Agricultural Drain Point Source Discharges:

According to the National Water Resources plan for Egypt (NWRP), 2001, the Nile

River from Aswan to Delta Barrage receives wastewater discharge from 124 point

Sources, of which 67 are agricultural drains and the remainder, are industrial sources. Physico-chemical characteristics and fecal coliform counts of 42 major drains at the tail ends, before discharge into the Nile. The data indicates that out of the 43 drains, only 10 are complying with the standards set by Law 48/1982 (Article 65) regulating the quality of drainage water which can be mixed with fresh water. The remainder of the drains exceeds the consent standards in one or more of the parameters. The worst water quality is that of Khour El-Sail Aswan, Kom Ombo, Berba and Etsa drains. In terms of organic load, it was found that the highest organic load is discharged from Kom Ombo drain (218.1 ton COD/d, 59.7 ton BOD/d). This is followed by El-Berba drain (172.7 ton COD/d; 59.7 ton BOD/d). The shaded values highlight the drains that are the worst cases by far. It is worth mentioning that these two drains contribute 76% of the total organic load (calculated as COD) discharged into the Nile by drains from Aswan to Delta Barrage. This is followed by Etsa drain which contributes about 11% of the total COD load (56.8 ton COD/d).

Industrial Point Source Discharges

In general major sources of pollution from industrial activities in the Nile are sugar factories in Kom-ombo, Ques, Armant, Deshna and El-Hawamdia and the oil and Coca-Cola factories in Souhag. It should be mentioned however that it has been reported that these factories have constructed treatment plants.

Fecal Coliforms Counts

Law 48/1982 did not specify a standard for fecal coliform (FC) counts for the ambient water quality of the Nile River. Therefore, the value given by the WHO (1989) as a guideline for use of water for unrestricted irrigation (1000/MPNml) has been taken as a guide for the evaluation of the water quality.

The results of the microbiological examination indicated a great variation in the spatial distribution of the fecal coliforms counts. Great exceedances have been found around the catchment areas of Kom Ombo, El-Berba, Main Ekleet and Fatera drains. It is worth mentioning that the FC counts in the water samples taken from the specific bank side, where the drain water is pumped, are even higher. This indicates the presence of untreated human wastes in these drains.

1.2. Nile pollution sources from the Damietta and Rosetta Branches:

The Damietta branch

Damietta branch begins at the Delta Barrage and ends 220 km downstream at Faraskour dam near Damietta. Major sources of pollution to Damietta branch are Talkha fertilizers factory, High Serw 1 Drain and High Serw Power station.

Assessment of the results of the monitoring trip which was carried out during February 2001 indicates the following:

1. Dissolved oxygen concentration ranged from 7.8 mgO_2/l at its southern part to 6.2 mg O_2/l at the northern part.
2. Nutrients concentrations (nitrogen & phosphorus) were within the permissible limits.
3. The chemical oxygen demand exceeded the standard set by law 48/1982.
4. However, the concentrations were similar to those of the Nile water from Aswan to Delta Barrage.
5. BOD values comply with the consent standard, except at one location at the end of the branch.
6. TDS increased from 240 mg/l up to 372 mg O_2/l, but the values are still within the permissible limits.
7. FC counts exceeded the WHO Guidelines in almost all sampling sites. This is an indication of the discharge of human wastes in Damietta branch.

Rosetta Branch

Rosetta branch, starting from Delta Barrage receives relatively high concentrations of organic compounds, nutrients and oil & grease. Major sources of pollution are Rahawy drain (which receives part of Greater Cairo wastewater), Sabal drain, El- Tahrrer drain, Zawiet El-Bahr drain and Tala drain. At Kafr El-Zayat, Rosetta branch receives wastewater from Maleya and Salt and Soda companies.

Ambient water quality status of Rosetta Branch is Dissolved oxygen concentrations, as indicated by the results of the February 2001 monitoring trip ranged from 5.1 mg O_2/l at the southern part to 6.3 mgO_2/l at the northern part of the branch. Nutrient concentrations are within the permissible limits. COD and BOD values exceeded the standards, but were similar to those recorded for Damietta branch. TDS ranged from 240 at Delta barrage up to 415 mg/l at the end of the branch. With regard to FC, high counts were detected at Kafr El-Zayat, after which the water.

2. MICROBIAL DIVERSITY IN RIVER NILE

2.1.Fungi

Zoosporic and terrestrial fungi in River Nile

The distribution and seasonal fluctuations of aquatic and terrestrial fungi in River Nile have been intensively investigated by many authors, e.g. (El-Hissy, 1979), (El-Hissy& Moubasher, 1982), (El-Hissy& El-Nagdy, 1983), (El-Hissy& Khallil, 1989), (El-Hissy *et al*., 1990), (El-Hissy & Khallil, 1991), (El-Hissy *et al*., 1992), (El-Hissy *et al*., 1997), (El-Hissy *et al*., 2001) and (El-Hissy *et al*., 2002), recorded **151** species from water and submerged mud of River Nile.

Table 8.1. List of terrestrial fungi recovered from water and submerged mud of River Nile.

No	Habitat	Species	Occurrence remark
1	Water	*Acremonium butyri*	M
2	Water	*Acremonium strictum*	R
3	water	*Alternaria alternate*	L
4	Mud	*Aspergillus carneus*	L
5	Water- Mud	*Aspergillus flavus*	M
6	Water- Mud	*Aspergillus fumigatus*	M
7	Water- Mud	*Aspergillus niger*	H
8	Water	*Aspergillus nidulans*	H
9	Mud	*Aspergillus ochraceus*	L
10	Mud	*Aspergillus oryzae*	L
11	Mud	*Aspergillus sydowi*	L
12	Mud	*Aspergillus tamarii*	L
13	Water- Mud	*Aspergillus terreus*	M
14	Water	*Aspergillus ustus*	L
15	Water- Mud	*Aspergillus versicolor*	L
16	Mud	*Aspergillus wentii*	L
17	Water	*Botryotrichum atrogriseum*	L
18	Water	*Curvularia clavata*	L
19	Water	*Curvularia lunata*	R
20	Water	*Curvularia ovoidea*	L
21	Water- Mud	*Emericella nidulans*	L

22	Water- Mud	*Fennelia flavipes*	L
23	Water	*Fusarium equiseti*	H
24	Water	*Fusarium solani*	M
25	Water	*Fusarium semitectum*	R
26	Water	*Fusarium moniliforme*	M
27	Water- Mud	*Fusarium nivale*	L
28	Mud	*Fusarium poae*	L
29	Water	*Fusarium oxysporum*	M
30	Water	*Fusarium tabacinum*	L
31	Water- Mud	*Mucor circinelloides*	M
32	Water	*Mucor hiemalis*	L
33	Water	*Mucor racemosus*	R
34	Water-Mud	*Myrothecium roridum*	L
35	Water	*Myrothecium verruccaria*	R
36	Mud	*Necteria haematococca*	L
37	Water	*Paecilomyces variotii*	R
38	Water- Mud	*Penicillium chrysogenum*	L
39	Water	*Penicillium citrinum*	L
40	Water- Mud	*Penicillium cyaneum*	L
41	Mud	*Penicillium corylophillum*	L
42	Water -Mud	*Penicillium duclauxi*	L
43	Water-Mud	*Penicillium funiculosum*	L
44	Water-Mud	*Penicillium janthinellum*	L
45	Mud	*Penicillium lanosum*	L
46	Mud	*Penicillium verruculosum*	L
47	Water	*Penicillium viridicatum*	R
48	Water- Mud	*Penicillium oxalicum*	L
49	Water - Mud	*Rhizopus stolonifer*	L
50	Water	*Scopulariopsis brevicaulis*	L
51	Water	*Scopulariopsis brumptil*	L
52	Water- Mud	*Syncephlastrum racemosum*	L

53	Water	*Torula herbarum*	L
54	Water	*Trichoderma viride*	M
55	Water	*Trichoderma hamatum*	R

Occurrence remarks:
High (H): More than 46% Moderate (M): Between 23% and 45%
Low (L): Between 13% and 22% Rare (R): Less than 13%.

Table 8.2. List of aquatic fungi recovered from water and submerged mud of River Nile.

No	Habitat	Species	Occurrence remarks
1	Water	*Pythium* acanthicum	R
2	Water	*Pythium butleri*	R
3	Mud	*Pythium echinulatum*	R
4	Water	*Pythium thalassium*	M
5	Water	*Pythium intermedium*	M
6	Water	*Pythium indicum*	R
7	Water	*Pythium helicoides*	R
8	Water	*Pythium marisipium*	R
9	Mud	*Pythium monospermum*	L
10	Water	*Pythium ostracodes*	R
11	Water	*Pythium papillatum*	L
12	Mud	*Pythium rostratum*	L
13	Water	*Pythium salpingophorum*	R
14	Water	*Pythium torulosum*	R
15	Water	*Pythium ultimum*	R
16	Water-mud	*Pythium undulatum*	M
17	Water	*Pythium oedochilum*	R
18	Water-mud	*Pythiogeton transversum*	R
19	Water-mud	*Phytophthora cinchunae*	R
20	Water- Mud	*Phytophthora hibernalis*	M
21	Water	*Phytophthora omnivora*	R
22	Water- Mud	*Dictyuchus carpophorus*	M
23	Water- Mud	*Dictyuchus magnusii*	H
24	Water- Mud	*Dictyuchus sterile*	H

25	Water	*Dictyuchus monosporus*	L
26	Water	*Dictyuchus polysporus*	L
27	Water	*Dictyuchus pseudoachlyoides*	R
28	Water	*Isoachlya monilifera*	R
29	Water	*Isoachlya eccentrica*	R
30	Water	*Isoachlya toruloides*	R
31	Water	*Isoachlya unispora*	R
32	Water	*Saprolegnia aniospora*	L
33	Water	*Saprolegnia diclina*	L
34	Water	*Saprolegnia ferax*	L
35	Water	*Saprolegnia furcata*	L
36	Water	*Saprolegnia megasperma*	L
37	Water	*Saprolegnia monoica*	L
38	Water	*Saprolegnia terrestris*	L
39	Water	*Saprolegnia turfosa*	L
40	Water	*Saprolegnia littoralis*	R
41	Water	*Saprolegnia luxurians*	R
42	Water- mud	*Saprolegnia hypogyna*	L
43	Water- mud	*Saprolegnia parasitica*	M
44	Water	*Saprolegnia eccentrica*	L
45	Water	*Saprolegnia uliginosa*	R
46	Water- mud	*Olpidiopsis achlyae*	R
47	Water	*Olpidiopsis pythii*	R
48	Water- mud	*Olpidium euglenae*	L
49	Water	*Abodachlya brachynema*	R
50	Water	*Achlya americana*	R
51	Water	*Achlya apiculata*	R
52	Water	*Achlya abortiva*	R
53	Water	*Achlya caroliniana*	R
54	Water	*Achlya cambrica*	R
55	Water	*Achlya colorata*	R

56	Water	*Achlya conspicua*	R
57	Water	*Achlya debaryana*	R
58	Water	*Achlya dubia*	R
59	Water	*Achlya flagellata*	R
60	Water	*Achlya hypogyna*	R
61	Water	*Achlya imperfecta*	R
62	Water	*Achlya klebsiana*	R
63	Water	*Achlya oligacantha*	R
64	Water	*Achlya prolifera*	R
65	Water	*Achlya polyandra*	R
66	Water	*Achlya racemosa*	L
67	Water	*Achlya radiusa*	R
68	Water	*Achlya rodriguazina*	R
69	Water	*Aphanomyces laevis*	L
70	Mud	*Aphanomyces astaci*	L
71	Mud	*Aphanomyces patesnoii*	L
72	Water- mud	*Aqualinderlla fermentans*	M
73	Water	*Allomyces arbuscula*	M
74	Water	*Allomyces macrogynus*	R
75	Water	*Allomyces jaranicus*	R
76	Mud	*Blastocladia pringsheimii*	R
77	Mud	*Blastocladiella simplex*	R
78	Water- mud	*Blastocladiopsis parva*	L
79	Water- mud	*Ceolomomces dodgei*	M
80	Water	*Flagellospora penicillioides*	L
81	Water	*Gonapodya prolifera*	R
82	Mud	*Nowakowskiella elegans*	L
83	Water	*Nowakowskiella elongata*	L
84	Water- mud	*Nowakowskiella macrospora*	L
85	Mud	*Nowakowskiella multispora*	L
86	Water	*Woronina polycystis*	R

87	Water- mud	*Rhizophydium sp*	H
88	Water	*Leptomitus lacteus*	R
89	Water- mud	*Transtotheca clavata*	R
90	Water	*Thranstotheca sp*	R
91	Water- mud	*Pythiopsis cymosa*	R
92	Water- mud	*Pythiopsis humphreyana*	R
93	Mud	*Leptolegnia caudata*	R
94	Mud	*Leptolegnia eccentrica*	R
95	Water	*Calyptralegnia achlyoides*	R
96	Water- mud	*Brevilegnia unisperma*	L

Occurrence remarks:
High (H): More than 46% Moderate (M): Between 23% and 45%
Low (L): Between 13% and 22% Rare (R): Less than 13%.

2.2. Bacteria

One of the most important factors of water pollution is the microbial contamination; especially with pathogenic microorganisms. Enteric pathogens are typically responsible for waterborne sickness (Karaboze *et al*., 2003). Contamination of water is a serious environmental problem as it adversely affects the human health and the biodiversity in the aquatic ecosystem. The distribution and seasonal fluctuations of aquatic and terrestrial bacteria in River Nile have been intensively investigated by many authors, e.g. (Sabae & Rabeh, 2007), (Rifaat HM, 2007) and (Daboor SM, 2008).

Table 8.3. List of aquatic and terrestrial bacteria recovered from water and submerged mud of River Nile.

No	Habitat	species
1	Water- mud	*Escherichia coli*
2	Water	*Alcaligenes eutrophus*
3	Water	*Klebsiella pneumonia*
4	Water	*Salmonella cholerasuis*
5	Water- mud	*Shigella sp.*
6	Water	*Serratia liquefaciens*
7	Water	*Proteus vulgaris*
8	Water	*Acinetobacter sp.*
9	Water	*Brenneria nigrifluens*
10	Water	*Flavimonas oryzihabitans*

11	Water	*Chryseomonas luteola*
12	Water- mud	*Pseudomonas aeruginosa*
13	Water- mud	*Pseudomonas flourcsence*
14	Water	*Aeromonas sp.*
15	Water	*Enterobacter sp.*
16	Water	*Xanthobacter sp.*
17	Water	*Rahnella aquatilis*
18	Water	*Streptomyces rochei*
19	Water	*Rhodococcus sp.*
20	Water	*Arthrobacter sp.*
21	Water-mud	*Bacillus sp.*
22	Water-mud	*Staphylococcus aerus*
23	Water-mud	*Streptococcus faecils*

2.3. Actinomycetes

Actinomycetes in the River Nile are as yet poorly studied the most important study by (Rifaat, 2003). The taxonomic analysis of 114 actinomycete strains isolated from water of the River Nile and its bottom sediments showed that most of the water isolates belonging the genus Streptomyces. As well as, the majoring of the sediment isolates belongs to the genus *Micromonospora.* The overwhelming majority of *Streptomyces* species are ***Str. antibioticus***, ***Str. aunlatus***, ***Str. violaceus*** and ***Str. antimycoticus***. ***M. carbonaceae*** and ***M. purpureochromogenes*** were also identified. Of 68 *Streptomyces* strains obtained, 11-exhibited significant antimycotic activity. Among the test fungi examined, *Aspergillus niger* and *Trichoderma viride* proved to be the most susceptible to the active substance present in the fermentation broths of *Streptmyces* strains. These active substances seem to be polyenes.

No	**Habitat**	**Species**
1	**Water- sediments**	*Micromonospora carbonacae*
2	**Water- sediments**	*Micromonospora purpureochromogenes*
3	**Water- sediments**	*Streptomyces antibioticus*
4	**Water- sediments**	*Streptomyces aunlatus*
5	**Water- sediments**	*Streptomyces violaceus*
6	**Water- sediments**	*Streptomyces antimycoticus*

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CHAPTER 9

AGROBIODIVERSITY

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1. INTRODUCTION

Agro-biodiversity is the result of the interaction between the environment, genetic resources and management systems and practices used by culturally diverse peoples, and therefore land and water resources are used for production in different ways. Thus, agro-biodiversity encompasses the variety and variability of animals, plants and micro-organisms that are necessary for sustaining key functions of the agro-ecosystem, including its structure and processes for, and in support of, food production and food security (FAO, 1999a). Local knowledge and culture can therefore be considered as integral parts of agro-biodiversity, because it is the human activity of agriculture that shapes and conserves this biodiversity.

1.1. Definition of Agro-biodiversity

Biodiversity is the basis of agriculture. It has enabled farming systems to evolve ever since agriculture was first developed some 10,000 years ago. Biodiversity is the origin of all species of crops and domesticated livestock and the variety within them. It is also the foundation of ecosystem services essential to sustain agriculture and human well-being. Today's crop and livestock biodiversity are the result of many thousands years of human intervention. Biodiversity and agriculture are strongly interrelated because while biodiversity is critical for agriculture, agriculture can also contribute to conservation and sustainable use of biodiversity. Indeed, sustainable agriculture both promotes and is enhanced by biodiversity. Maintenance of this biodiversity is essential for the sustainable production of food and other agricultural products and the benefits these provide to humanity, including food security, nutrition and livelihoods.

Agricultural biodiversity is a broad term that includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems, also named agro-ecosystems: the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure and processes. Agricultural biodiversity is the outcome of the interactions among genetic resources, the environment and the management systems and practices used by farmers. This is the result of both natural selection and human inventive developed over millennia.

The following dimensions of agricultural biodiversity can be identified:

1) Genetic resources for food and agriculture: Plant genetic resources, including crops, wild plants harvested and managed for food, trees on farms, pasture and rangeland species, Animal genetic resources, including domesticated animals, wild animals hunted for food, wild and farmed fish and other aquatic organisms, Microbial and fungal genetic resources. These constitute the main units of production in agriculture, and include cultivated and domesticated species, managed wild plants and animals, as well as wild relatives of cultivated and domesticated species.

2) Components of biodiversity that support ecosystem services: upon which agriculture is based. These include a diverse range of organisms that contribute, at various scales to, inter alia, nutrient cycling, pest and disease regulation, pollination, pollution and sediment regulation, maintenance of the hydrological cycle, erosion control, and climate regulation and carbon sequestration.

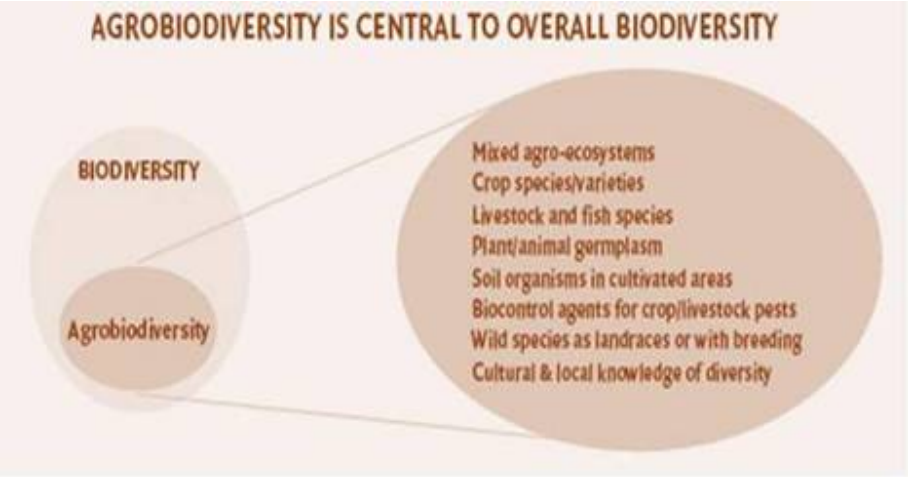
3) Abiotic factors: such as local climatic and chemical factors and the physical structure and functioning of ecosystems, which have a determining effect on agricultural biodiversity.

4) Socio-economic and cultural dimensions: Agricultural biodiversity is largely shaped and maintained by human activities and management practices, and a large number of people depend on agricultural biodiversity for sustainable livelihoods. These dimensions include traditional and local knowledge of agricultural biodiversity, cultural factors and participatory processes, as well as tourism associated with agricultural landscapes.

Biodiversity is essential to:

- Ensure the production of food, fiber, fuel, fodder...
- maintain other ecosystem services
- allow adaptation to changing conditions - including climate change
- and sustain rural peoples' livelihoods

Agricultural biodiversity provides humans with; food and raw materials for goods - such as cotton for clothing; wood for shelter and fuel; plants and roots for medicines; materials for biofuel; incomes and livelihoods, including those derived from subsistence farming. Agricultural biodiversity also performs ecosystem services such as soil and water conservation, maintenance of soil fertility and biota, and pollination, all of which are essential to human survival. In addition, genetic diversity of agricultural biodiversity provides species with the ability to adapt to changing environment and evolve, by increasing their tolerance to frost, high temperature, drought and water-logging, as well as their resistance to particular diseases, pests and parasites for example. This is particularly important regarding climate change. The evolution of biodiversity, and therefore both its and our survival, mainly depends on this genetic diversity. The importance of agricultural biodiversity encompasses socio-cultural, economic and environmental elements. All domesticated crops and animals result from human management of biodiversity, which is constantly responding to new challenges to maintain and increase productivity under constantly varying conditions.



1.2. Historical of Ancient Egyptian Agriculture

While agriculture is important throughout the world, for the people of Egypt it has always been a matter of working closely with the seasons and understanding their change. Throughout history, Egypt has celebrated the relationship between the land they farm and the Nile.

The Nile is the longest river in the world, a majestic body of water that flows with the very life of Egypt in its currents. The shape of the Nile is that of a Lotus flower, the ancient Egyptian symbol for regeneration of life. Rainfall is almost non-existent in Egypt, and the Nile has always been the source of water for crops and animals.

The land of ancient Egypt was divided into sections with varying proximity to the Nile. The lower land on either side of the Nile is known as the floodplain. This is the most fertile land in Egypt and most of the crops were grown here. Farming in ancient times occurred on the highest ground in this zone. The land was rich and fertile, dark black in color.

A little higher, above the floodplains was the low desert. The Nile did not water this area of land. Egyptians used this portion of land to hunt and bury their dead. It was scant with any kind of vegetation, which made it perfect for such activities.

Even higher still, was the high desert area. The area was most likely used for travel of large caravans in search of stones to cultivate. Mineral resources were sought after in this region, but there was little inhabitation. What inhabitation that did exist in the high desert was there for the strict purpose of producing dates and grapes to insure a link to remote areas. These were little pieces of paradise in the desert, often called oases.

The tools used in ancient Egypt agriculture included: plows, sickles, hoes, forks, scoops, baskets, shaduf, skiffs, and sieves. The farmers also used cattle, oxen, donkey, and goats to aid in the cultivation of their fields. The hoe most often used was made of two separate pieces fitted together and bound with rope. The first piece was a handle and the second a blade. Hoes were used to mix water and dirt in brick making, to break up dirt clods, and to manage the growing crops. Sickles were often made of glazed wood that was sharpened to cut. A shaduf is a mechanical irrigation device used to bring water from the

canals to the fields. Skiffs were made of papyrus and were used for travel on the Nile, as well as fishing.

In the cultivation of grain, there were eight steps that the ancient farmer knew as well as he knew his own land. The cultivated land was ploughed with a wooden axe. Ploughing may have been done with the aid of an animal, or exclusively by human strength. Sowing was done by hand, with the help of goats that walked over the newly sown fields to push the seeds out of the reach of bird looking for a quick meal. Once the grain was ready for harvesting, the fields would come to life with the harvesting. The harvesting of the grain was done with sickles. The grain was then bundled and carried, on the back of donkeys, to a safe and dry place to avoid spoilage. The grain was then put through the process known as threshing. It was spread in a contained area and trampled on by the hooves of donkeys. In the Middle Kingdom of Egypt, often cows were used in this process. This process aided in the beginning of separating the grain from the chaff. The next step is often depicted in the tomb paintings of ancient Egyptians.

Often done by women, wooden forks were used to eliminate the light chaff and straw from the grain. Next, they would use sieves made from reeds and palm leaves to separate the longer chaff and weeds from the grain. The final step was to secure the crop of grain in bins until consumption.

The ancient Egyptians were thorough in their cultivation of grain, as it was their main staple. Barley and emmer were used to make bread and beer. Excessive grain was exported to neighboring countries. This exportation of grain allowed the Egyptian treasury to accumulate income.

The main vegetables grown in ancient Egypt were onions, leeks, beans, lentils, garlic, radish, cabbage, cucumbers, and lettuce. The fruit grown consisted of dates, figs, grapes, pomegranates, and melons. Due to the wonderful variety of flowers grown in ancient Egypt, bees were able to pollinate and produce honey. Women cultivated and processed honey to be used in desserts. Flax was grown and processed to make linen. Papyrus was converted into in to sandals, skiffs, paper, and mats.

Animals were raised for; food, hides, milk, and dung (used in cooking fires). Oxen increased agricultural productivity. Others animals were domesticated and used by farmers of ancient Egypt. They raised cattle, goats, sheep, pigs, ducks, goats, and oxen. Around 1600 B.C., horses and donkeys were introduced to Egypt from Asia. Camels were unknown during the time of the pharaohs, as they were introduced at a much later time.

For centuries the Nile flooded the valley, and the Egyptians established a routine in dealing with the seasons. The flooding period was called Aketo. This lasted from July to December, using the current calendar months. During this time the farmlands were under water. The farmers used their irrigation canals to run water to the lands not reached by the Nile. Animals were moved during this time to a safer place, to avoid drowning. The

outflow period was known as Peleto. This was the coolest season, and it ran from December to March. Seeds were sown during this time and crops cultivated. From March to July they experienced a dry season known as the Syumuu. This was a busy time of bringing in and storing the crops. The yearly flooding was known as the "gift of the Nile," for without it the people of ancient Egypt would have perished.

The average rise in the Nile at flood time was twenty-seven feet. The monsoon rains from Ethiopia were predictable, but often the amount of the rise was not so predictable. If the Nile rose lower than the expected twenty-seven feet, there was famine and loss of crops and lives. If the Nile rose higher than the expected twenty-seven feet, there was damage to villages and a loss of livestock and human life. The flooding was predictable in its coming, but often caused chaos when it was too much or too little. The annual flooding of the Nile continued in to modern times. The completion of the high damn in 1988, at Aswan, has made the flooding controllable. The construction of the Aswan dam started in 1902, and has been built taller through the history of Egypt, to its current height.

In ancient Egypt, most people were involved in some fashion in the agricultural process. It was so interwoven in to the very society and economy that no one was spared the work of farming, excluding those noblemen and scribes that were not suited for the work. However, even then, the noblemen were included in the economic part of agriculture, as they often owned the land being farmed and supervised the tending of such.

There were full time farmers. They often worked the land of wealthy landowners and were paid in food, clothes, and shelter. Some families rented land from the landowners, and they gave the owners a portion of their crops as payment. Still, others were forced by the government of Ancient Egypt to dredge canals, survey land, and prepare the ground as a form of taxation. This was called being drafted through corvee. Anyone that tried to avoid the corvee was dealt with harshly, as was his family.

The Egyptians were the first culture to establish gardens of an ornamental nature. The first recorded garden dates around 2200 B.C. The gardens included pools for fish, fig and pomegranate trees, grapevine covered trellises, and beds of flowers. The pharaohs and government officials used them as oases of privacy and cool and shady retreats from the hot desert sun. They were also found at many religious and sacred sites.

Today, agriculture is still an integral part of Egyptian society and culture. They have continued to use traditional methods handed down through the centuries. Many still use the ancient methods of irrigation, organic manure, and crop rotation. Egypt is an

agricultural country with as much beauty as practicality. The wealth derived from agriculture in Egypt can be weighed in more than just coins. The history of agriculture in Egypt has made them rich in knowledge. The courage of past generations has become the courage and wisdom of present and future generations in Egypt. Egypt is a shining example that pride, skill and determination are the foundations of a successful nation.

1.3. The Role of Agro-biodiversity

Experience and research have shown that agro-biodiversity can:

- Increase productivity, food security, and economic returns
- Reduce the pressure of agriculture on fragile areas, forests and endangered species
- Make farming systems more stable, robust, and sustainable
- Contribute to sound pest and disease management
- Conserve soil and increase natural soil fertility and health
- Contribute to sustainable intensification
- Diversify products and income opportunities
- Reduce or spread risks to individuals and nations
- Help maximize effective use of resources and the environment
- Reduce dependency on external inputs
- Improve human nutrition and provide sources of medicines and vitamins, and
- Conserve ecosystem structure and stability of species diversity.

On the banks of the Nile, Egyptians discovered agriculture and invented agricultural and irrigational machines. They cared also about inscribing the agricultural process; ploughing, harvesting, and storage, on the walls of their temples. Moreover, they set the basis of agricultural calendar and so Egypt was the first to set a temporal schedule for agriculture.

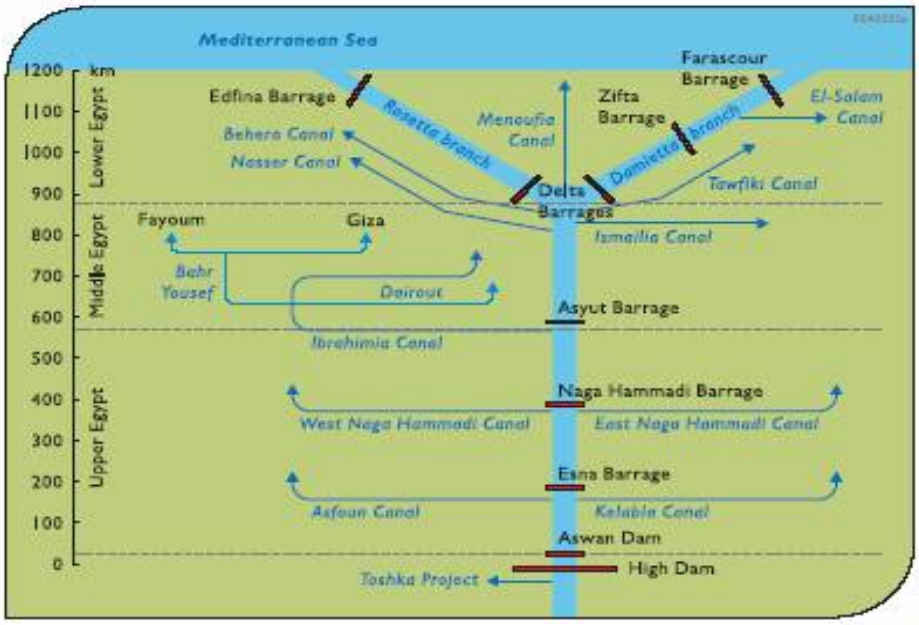
The Nile Valley and the reclaimed desert fringes, this agro- ecological zone represents the greater majority of cultivated lands of the Nile Valley, as well as, most of the reclaimed desert lands, mainly, on the western and eastern fringes of the Delta in addition to relatively limited areas at on fringes of the Valley in Upper Egypt. (total areas over 8.7 million feddans).

The Nile Delta Flooded Savanna ecoregion extends along the River Nile from the Aswan High Dam, 1,100 kilometers downstream to the mouth of the Nile as it enters the Mediterranean Sea. The delta is about 175 km long and 260 km wide. Since the construction of the Aswan High Dam, the riverine floodplains and delta are no longer subject to annual flooding, and *Cyperus papyrus* swamps that used to exist in the wettest areas have largely disappeared. The remaining marshland is associated with lakes and lagoons along the seaward face of the delta. Outer margins of the delta are eroding, and salinity levels of some of the coastal lagoons are rising as their connection to the sea increases.

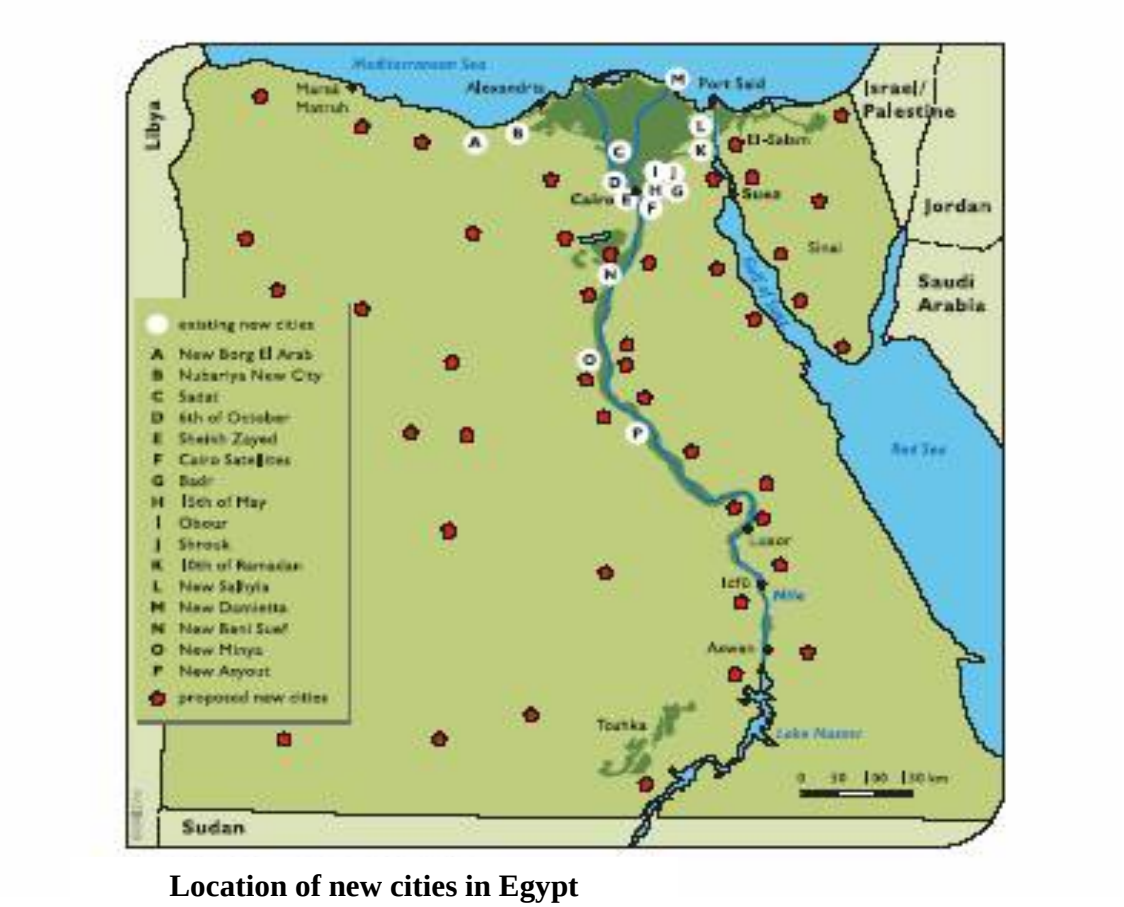
2. ECONOMIC RESOURCES' CONSTRAINTS OF NILE VALLEY AND DELTA

2.1. Land Resources

Land resources constitute a major component of any ginning agricultural development strategy. But soil fertility is deteriorating as a result of over-irrigation and an incomplete drainage infrastructure, despite the on-going efforts to expand tile irrigation so as to improve soil properties. The results of soil survey and classification indicate that only 6.2% of the cultivated lands fall within Grade-A soils. Grade-B soils represent 45.5% of Egypt's agricultural land, while Grade-C soils constitute 38.7% and Grade-D soils account for 9.6%.



Major control structures on the Nile in Egypt



Location of new cities in Egypt

2.2. Human Resources

Unemployment is an important constraint of agricultural development. It leaves negative impacts on the socio-economic aspects of development. The unused human resources create burdens on the societal assets. Over three 5-Year Plans (1982/1987, 1987/1992 and 1992/1997) the workforce has increased from 11092 thousand people in 1982 to 12956 thousand people in 1987. In 1992, it jumped to 15141 thousand people and then to 17358 thousand people in 1997, with average annual rates of 3.16%, 3.17% and 2.77% respectively during the three 5-Year Plans.

The average growth rate in the workforce for the entire period (1982-1997) was estimated at 3%. Subsequently, the workforce/population ratio over the entire period increased from 26.39% in 1982 to 29.05% in 1997. Over the same period (1982-1997), the number of workers increased from 10522 thousand people to 15825 thousand. The percent increased was about 50.4% and the annual growth rate was about 2.8%. In terms of figures, the first 5-Year Plan witnessed an increase in the workforce by 1476 thousand people while the second and the third 5-Year Plan witnessed an upward trend in the workforce by 1744 thousand and 2083 thousand respectively. The annual growth rates for the three plans were 2.66%, 2.75% and 2.86% in order, denoting that the annual job opportunities then available during the three five-year plans amounted to 295.2 thousand jobs, 348.8

thousand jobs and 416.6 thousand jobs respectively. In 1996/1997, about 485 thousand jobs were made available (in addition to replacement jobs made available annually)

It is noteworthy that the national annual growth rate of the total number of workers during the third five-year plan (92/1997) was 2.86%, a little higher than the annual growth rate of the workforce estimated at 2.77%, thus helping to reduce unemployment from 9.2% to 8.8% . Rural development and distribution of reclaimed lands among new graduates help create new productive jobs. Likewise, productive family small enterprises, promoted by the Ministry of Social Affairs, play a major role in job creation. In-kind loans are provided for production and marketing outlets are established for sale of the finished products.

3. AGRO-ECOLOGICAL ZONES IN EGYPT

3.1. Agro-Ecological Zones on Basis of Climate in Combination with the Physiographic

Egypt has been distinguished into four Agro-ecological zones on basis of climate in combination with the physiographic, natural resources, agriculture and other factors affecting the socio-economic activities. This approach would facilitate the investigation and identification of the active factors of desertification, their impacts, capacity building needs, participating stakeholders, required legislations, economic tools and social implications. It would also facilitate the selection of indicators and measures for monitoring ongoing and future desertification processes. These zones are given below

3.1.2. The Nile Valley and Delta

This zone is distinguished into two sectors: **i)** The Nile Delta and its vicinities, with latitude 29° N as southern boundary. Except for the north coastal belt, the area corresponds roughly to the accentuated arid province with 20 to 100 mm annual rainfall.

The Nile Valley and the surrounding reclaimed areas which are almost rainless; roughly belongs to the hyper arid province.

3.1.3. North Coastal Zone

This zone is composed of two major sub zones; northwestern coast and northeastern coast of Sinai. Such zone represents the arid province under the maritime influence of the Mediterranean with shorter dry period.

The northwestern coast (NWC) is characterized by dry Mediterranean climate with an average high and low temperature of 18.1 and 8.1°C in the winter and 29.2°C and 20°C in summer seasons, respectively. Rainfall in the northwestern coast ranges between 105.0 mm/yr at Salloum and 199.6 mm / yr at Alexandria. Data from eight stations situated near the coastline show that most of the rainfall (70 % or more) occurs within the winter months (November to February), mostly during December and January. The NWC area has the highest average wind speed in Egypt in the winter which can reach 18.5 Km/h and drops gradually inland.

The north coastal areas of Sinai are also characterized by the Mediterranean climate with relatively rainy, cool winter and dry hot rainless summer. Air temperature records are similar to those of the NWC. The greatest amount of rainfall in Egypt (300 mm/yr) occurs on the far northeast of North Sinai (at Rafah). Generally about 70 % of rain along the North Coastal Zone, occurs in winter and 30 % falls during the transitional months.

3.1.4. The Inland Sinai and Eastern Desert

This zone is characterized by the hyper arid conditions; with a mild winter and a hot summer. Exceptional being the coastal belt along the Gulf of Suez and highlands of South Sinai which represent the hyper arid province with a cool winter and hot summer.

3.1.5. The Western Desert

This zone is characterized by hyper arid climatic conditions with rare rainfall and extremely high temperature. The northwestern and the northern winds extend from the Mediterranean over the Western Desert with fallen speed south wards. These winds are the major factors of erosion and deposition.

It is mainly located on both the east and west sides of the Delta and is scattered through various areas in he country. Its sand characterizes land, coarse textured, calcareous and non-calcareous soils, except in some areas of this land in the northern part of the Delta are alluvial. The majority of this land uses Nile water as the main source for irrigation, whereas in some desert areas, underground water is the only source for irrigation and new irrigation regimes as sprinkler, and drip irrigation are practiced.

Agriculture areas in Egypt

3.2. Agro-ecological Zones Based on Soil Characteristics and Water Sources:-

The total agricultural land in Egypt is about 8.7 million feddans comprising about 3% of the total area. The total cultivated land is distributed as follows:

- 6,300,000 "Old lands" in the Nile basin and Delta.
- 2,400,000 New reclaimed lands.

Soils in the Nile River and Delta are silt-clay mixtures of good quality, deposited during thousands of years of Nile flooding.

Based on soil characteristics and water sources, four agro-ecological zones can be identified as follows:

3.2.1. Old land:

Nile Valley and Delta Regions, is characterized by its alluvial soils (clay too loamy). Nile water is the main source for irrigation.

3.2.2. New lands

It is mainly located on both the east and west sides of the Delta and is scattered through various areas in he country. Its sand characterizes land, coarse textured, calcareous and non-calcareous soils, except in some areas of this land in the northern part of the Delta are alluvial. The majority of this land uses Nile water as the main source for irrigation, whereas in some desert areas, underground water is the only source for irrigation and new irrigation regimes as sprinkler, and drip irrigation are practiced.

3.2.3. Oases

It is characterized by alluvial, sandy and calcareous soils. Underground water is the main source for irrigation.

3.2.4. Rain-fed

Located in the north coastal areas in Sinai and Matrouh, where rainfall fluctuates between 100-200 mm annually.

4. AGROBIODIVERSITY

4.1. Biodiversity of Crops

In Egypt, above 2000 species and 153 infraspecific epithets (subspecies, variety, forma) of native and naturalized vascular plants are distributed over a vast area compromising a wide ecological variation. Among these species, many useful wild species and wild relatives of several crop plants are found. Several species of the following plant genera are some of the useful plants, which could be considered as important plant genetic resources for possible economic use and sources for genetically useful traits: *Hordeum., Trifolium, Vicia, Gossypium, Allium, Sorghum, Brassica, Vigna,Medicago, Citrulus, Phasuolus, Corchorus, Solanum, Phoenix.*

Many species of the above mentioned genera are still available in the wild. Quite a number of these species have either disappeared or are at the brink of disappearance. Egypt is the home of the wild relatives of some food crops and many pastural and medicinal plants. This rich plant genetic diversity is continuously deteriorating, especially during the last decade, in view of the population explosions, modernization, and innumerable human activities using improper technologies in addition to problems related to over-grazing and the replacement of natural vegetation with other crops. The most

impressive characteristic of Egypt is the presence of several isolated sites (i.e. oases), which represent enclaves for special rare and endemic plants. The coastal area of the country represents a transition from the Mediterranean climate to the Saharan one. This, together with the mountains of Sinai and the desert areas has a remarkable impact on the biodiversity found in Egypt.

There is a great need to put mechanisms for the protection of the important indigenous plants. Many of these plants could be utilized in the development and improvement of many crop varieties. Some of the available indigenous plants contain genes for disease and insect resistance, tolerant to soil salinity, heat and drought or possess other desirable traits, which might be needed in national and international crop improvement programs.

Most of other important agricultural crops cultivated in Egypt, like Egyptian clover, alfalfa, onion, spinach, cabbage, date palm, olives, figs, pomegranates, are planted as old cultivars. The farmers still use old cultivars or landraces for the following reasons:

- Improved varieties are not available.
- Improved varieties are available but the growing of such varieties need special care, high input costs, knowledge and experience.
- Landraces are more adapted to harsh conditions and are resistant to disease and pests.
- The products of landraces and old cultivars of many crops better meet the needs (taste, aroma etc.) of local consumer than of improved varieties.

The government generally encourages the use of landraces and old cultivars, especially of those species that need to be maintained and protected. On the other hand, it discourages the use of the same if these are strategic crops (like improved high yielding varieties of wheat, rice, and maize, among others).

Farmers in Egypt are planting quite a number of crops using traditional varieties and old cultivars. Improved varieties are mainly used for cotton, wheat, barley, maize, sorghum, lentil, faba beans, soya bean, sun flower, onion, peanut, flax, sugar cane, rice, cantaloupe, water melon, green pepper, carrots, egg plants, tomato, cucumber, potato, sweet potato, sugar beat, apples, grapes, mango, bananas, pears, beaches, plum, and olives However, landraces of some crop varieties of barley, maize, sorghum, faba beans, lentil, onion, flax, peanut, carrots, eggplant, tomato, green pepper, citrus, mango, sweet potato and olives are still planted and maintained as old varieties.

The most frequently used genetic resource collections in national programs are wheat, maize, cotton, faba beans, clover, alfalfa, sorghum, barely, sugar beet, sugar cane, sun flowers, garlic, onion, tomato, water melon, grape, peach, apple, pears, banana, citrus, olives, mango, cantaloupe, strawberry, cauliflower, cabbage, egg plant, peas, okra, taro, sweet potato.

The germplasm accessions of different corps are under the control of many germplasm holders in the country.

Germplasm of many Egyptian crop landraces are still in use in commercial agriculture. Clover (*Trifolium alexandrinum* L.), barley maize, faba beans, onion, sorghum, date palm, Guava, and some other medicinal, forage, oil and horticultural crops are the most important ones to be mentioned.

Egypt, particularly during the last few decades, has introduced enormous numbers of germplasm species from abroad and has used them commercially either without or after their involvement in crop improvement programs.

Computerized data on germplasm activities is very limited. Therefore, and because of the lack of co-ordination in germplasm activities, no reliable information on the exchange and frequent utilization of available germplasm collections can be given.

Farmers have access to genetic resources through a different way. Farmers in many cases prefer to maintain their own plant genetic resources for one or more seasons, for later utilization in the field. Egyptian clover, barley, wheat, faba beans, and quite a number of horticultural species are only examples of this way of self-supply.

The nation wide distributed private and governmental nurseries, seed supplying shops, and agricultural co-operatives are another source for crop germplasm of landraces, improved varieties, and hybrids.

People in Egypt, with some exceptions, are generally not completely aware of the value of indigenous plant genetic diversity. The Government however has paid increasing attention to these problems. The Egyptian Environmental

Affairs Agency (EEAA) has been established 1982 as an affiliate of the Council of Ministers. This body is responsible for setting national environmental policies and for their implementation, including conservation of natural heritage. Egypt has established institutions, passed laws and initiated activities to protect a variety of plant and animal species. Public and mass media campaigns for environmental protection including genetic resources conservation, has strongly increased. Egypt has been blessed with numerous places (27 areas under protection) with rare species of living creatures, especially in Sinai, the Red Sea and the North-West coast.

It is clear that more efforts toward the protection of wild and wild relatives of important plant, landraces and old cultivars are very much needed.

Crop production system

Four agricultural production systems are practiced. These systems are complementary and are inter-related. They are as follows:

• Field crops

• Vegetables and Fruits

• Forest trees (lumber wood trees)

• Medicinal, Aromatic and Ornamental plant crops.

Major Crops and Crop Rotations

The major studied crops are: wheat, broad beans, short berseem and long berseem (winter crops), cotton, maize, rice and sorghum (summer crops) and sugarcane – these crops were discussed previously in chapter 2. Crop rotations are defined as the particular sequence of crops planted during the cropping season of the year, as well as during a fixed number of succeeding years, primarily depending on dominant mop of the rotation. There are several crop rotations followed in the Nile Valley and Delta areas depending upon the

soil type and crop choice. Rotations are characterized by the main cash crop in the sequence end. The proportion of area it covers.

The most common rotation is a 3-year cotton rotation where cultivated land is divided into three more or less equal parcels. The first block is planted to a winter fodder crop of short berseem. After taking two cuttings, berseem is followed by cotton as a summer crop. The second parcel is devoted to long berseem and the third block to wheat. In summer, maize, rice or sorghum depending upon the Nile regions follows these crops.

The second most prevalent rotation is a 2-year cotton rotation, in which land is divided into two blocks. The first block is cropped with clover (short berseem) in winter followed by cotton in summer. The second block is divided into two parts.

In winter a legume crop (mostly long berseem) is planted in one pert end the other pert is reserved for wheat. Both these parts are followed by maize, rice or sorghum in summer.

Apart from these two main rotations, there are several variations in each region. In the rice zone in the northern half of the Delta, rice is the predominant summer crop followed by winter cereals and legumes. In the southern part of the Delta and Middle Egypt, maize is the dominant summer crop followed by wheat and legumes in winter. Still further to the south, sorghum is the main summer crop, and even further south sugarcane replaces cotton as the cash crop. Based on this overall set-up of crop sequences, nine crops and their corresponding crop rotations in the three regions are evaluated using the policy analysis matrix approach. Following are the major crop rotations:

Short Berseem + Cotton
Wheat + Maize
Broad Beans + Maize
Long Berseem + Maize

Wheat + Rice
Long Berseem + Rice
Broad Beans + Sorghum
Long Berseem + Sorghum
Sugarcan

The most important agricultural crops cultivated in Egypt

Field crops	Horticultural Crops	Horticultural Crops
Wheat	Orange	Tomato
cotton	Mandarin	Potato
Sugar cane	Lemon	Onion
Egyptian clover (Barseem)	Grape fruit	Broad beans
Faba bean	Banana	Garlic
Rice Maize	Grapes	Lettuce
Barley	Strawberry	Cabbage
Sorghum	Fig	Spinach
Sunflower	Olives	Cauliflower
Peanut	Date palm	Cucumber
Sesame	Mango	Carrot
Flax	Pomegranates	Water melon
Alfalfa	Guava	Eggplant
Egyptian lupin	Apples	Jews mallow
Chickpea	Pears	Common mallow
Cow peas	Apricot	Phaseolus
Millet	Peach	Peas
Fodder beet	Plum	Green peppers
		Okra
		Sweet potato
		Artichoke
		Snake cucumber

Role of Research and Extension

During the last two decades, ARC has undergone several reorganizations and restructuring. Five centers of excellence for research and extension have been initiated and the headquarters is at Giza. This is in addition to four other research and extension centers that are distributed at Sakha (North Delta), Gemmeiza (Southern Delta), Sids (Middle Egypt), and Shandaweel (Upper Egypt). The Genetic Engineering Institute was established through USAID funds and is equipped with excellent facilities. Other institutions such as Food Technology and nine central laboratories were established according to real needs and received donor support.

Therefore, ARC with foreign assistance is growing and gaining the confidence of the agricultural community due to sound increases of yield and production of most commodities as a result of releasing new improved varieties along with their packages.

Participation and inclusion of the private sector in the research operation would definitely add towards stabilizing and sustaining the research system in the country, as some of the local researchers would have the chance to work with the private sector, in various research areas and activities.

The ARC in Egypt is focusing efforts to exploit three high technology systems to enhance agricultural development. The first system uses industry technology for proper

management of national resources. The second system uses computer expert systems as tools to optimize productivity by improving crop management capabilities in an outreach - friendly mode. The third system is genetic engineering to hasten advances in biotechnology to support agriculture.

Research aimed at increasing the productivity of all crops per unit of both land and water will be vital in the future. Much research is already oriented toward producing more products per unit of land. This must be continued and even intensified. Given the likelihood of more limited water supplies in the future, increasing the productivity per unit of water must also be stressed. It should be recognized that research to increase productivity per unit of land would give parallel improvements in productivity per unit of water.

Linkages between research institutions and their stakeholders should be improved by institutionalizing these linkages. The primary improved linkages should be with technology transfer, if technology packages are to be adopted effectively. In addition, linkages should be strengthened with other research institutes in the country (including universities, private sector, and others) and with research institutes outside the country (including national, regional and international development and research institutions) to benefit from donations, material exchange, information, collaborative research, strengthening capacity building and partnership

Uses of the wild plants in Rural areas of Egypt

There in Nile Valley and Delta many wild plants sp. uses by local community in different uses at example:

1- Species with edible parts:

- *Hyphaene thebaica*
- *Malva parviflora*
- *Phoenix dactylifera*
- *Portulaca oleracea*
- *Sisymbrium irio*

- *Sonchus oleraceus*
- *Sorghum bicolar*

2- Fodder species:

- *Alhagi graecorum*
- *Cynodon dactylon*
- *Medicago sativa*
- *Panicum turgidum*
- *Plantago major*

3 - Species can be used for fiber production:

- *Medemia argun*
- *Juncus rigidus*

4 - Species can be used paper production:

- *Cyperus papyrus*
- *Imperata cylindrica l*
- *Juncus arabicus*
- *Juncus rigidus*
- *Phoenix dactylifera*
- *Phragmites australis*
- *Typha elephantina*
- *Typha domingensis*

5 - Some species with medicinal values:

- *Achillea fragrantissima*
- *Adiantum capillus-veneris.*
- *Alhagi graecorum*
- *Ammi majus*
- *Artemisia judaica*
- *Belepharis edulis*
- *Citrullus colocynthis*
- *Cleome amblyocarpa*
- *Eleusine indica*
- *Hyoscyamus muticus*
- *Malva parviflora*

6- Plants can be used for oil production

- *Carthamus tinctorius*
- *Lepidium sativum*
- *Ricinus communis*

7 – Plants can be used for shad and wind breaks

- *Balanites aegyptiaca*
- *Retama raetam*
- *Tamarix nilotica*

8 – Plants can be used for bio-remediation

- *Ceratophyllum demersum*
- *Eichhornia crassipes*
- *Juncus arabicus*
- *Phragmites australis*

The local inhabitants represent the main pressure on species frequency and diversity in the natural habitats as well as in the naturally protected area. This pressure is maxiumum over the economic species especially the monogeneric families of monospecific representatives in Egyptian flora, such as: Balanitaceae, Moringaceae, Salvadoraceae. Some ethnic, folk medicinal and traditional uses comprises a pressure on the sustainability of the wild plant resources especially in remote areas such as S. Sinai, Elba region and Oases where the legislations implementation need governmental support. Bedouins poverty, lack of awareness and shortage in their daily income enforce them to overuse the local plant genetic resources to overcome their life needs.

4.2. Biodiversity of Farm Animal

Genetic resources are generally considered among the most valuable and strategically important assets that a country possesses. Animal genetic resources farm animal genetic resources are important to the subsistence of large number of people in the world's pastoral and crop-livestock systems, particularly in developing countries, where they also

represent an important source of high quality protein and an opportunity for poverty eradication and overall economic development.

The relatively small gene pools of domestic farm animal genetic resources (6,000-7,000 breeds of 40 species) is threatened by extinction, principally through crossbreeding and breed replacement arising from changes in producer preferences, as well as through habitat loss, droughts, famine, civil strives, and epidemic disease. Accordingly, there is need to develop strategies for the sustainable management of these resources, that would include cost effective conservation and utilization approaches to ensure that they are best used to meet the needs of today while also being available for future generations. Unfortunately, the knowledge base on these resources is inadequate. Characterization of these resources is of high priority for better understanding of them. . However, there is also need to prioritize these resources in terms of which would be targeted for conservation and development and how much of the limited resources would be spent on each. This would be done to forestall potential losses even though we do not have complete information on all these resources.

At the outset and before dealing with the strategy of livestock, poultry and fish production in Egypt, common misconceptions have to be cleared. It has always been argued that livestock and poultry compete directly with man by consuming grains such as corn, wheat, etc. There is another claim that livestock compete directly on land use as a large portion of land during winter is cultivated by Berseem major part of this land could otherwise be used for wheat, beans and selected vegetable crops.

These misconceptions which prevailed in previous agricultural strategies and policies were negatively reflected on the development of livestock, poultry and fish production.

The argument of competition between livestock, poultry and man could be valid if those grains consumed by livestock and poultry are being wasted and not being used to synthesize the most vital and irreplaceable essential amino acids needed for the proper physical and mental development of the population. Also the misconception of the expansion of wheat on the expense of berseem area has been proved unpractical as all rotations which include berseem (short or long) come on top of the list of the cash revenue of the farmers; leave alone the value of berseem in building up the soil fertility in all types of soils. Therefore the present strategy will be based on the concept of comparative advantage between all crops, animal and plants.

4.2.1. Distribution of animal species in Egypt

Buffalos.

The buffalo population in Egypt is composed of one breed identified into three local types (Beheiri, Menofi and Saidi), which vary in both phenotypic characteristics and production performances.

The buffalo is the most preferred animal by the farmers due to its great adaptability to local conditions, disease resistance and high production (compared to local cattle). The Beheiri and Menofi breeds spread over most of the country. Saeidi is found in Upper Egypt.

Buffalo is considered the main dairy animal. It contribute more than 65%, of the total milk production (rich in fat, white in color and the most preferred by the Egyptian

consumer) and 35 % of the total meat production (veal meat, culled mature females and fattened males) in Egypt.

There are many buffalo production systems in the country, the dominant one being the mixed farming system where average holding is small (1-2 head), intensive system where farm size range from 200 to500 heads, and the peri-urban system where a producer can have a flying herd of 5-10 female Buffaloes.

Young male calves are often sold for slaughtering around 50-60 kg live body weight as veal meat, a practice represents wasteful for the national animal production.

Most of the holders in the peri-urban system prevent female to be conceived to extend the milking season then sold them for meat. This is another wasteful practice affect negatively the national animal production.

Cattle.

Local and introduced cattle breeds are spread all over the country in places where the production systems fit them. Local Beheiri, Monoufi and Domiati breeds beside exotic Friesian, Holstein and Brown Swiss are found in North of Egypt while Saeidi, and its crosses with Friesian, Abondance and Tarentaise are in Mid Egypt. In newly reclaimed land and desert fringes of the valley and delta, local Mariouti, Simmental, Jersey and Brown Swiss are found. The distribution is related to adaptation to climatic and environmental conditions; local breed and its crosses withstand conditions in Mid and South Egypt while the Friesian and Holstein live better under the moderate weather of the Delta. Small holders own the greatest part of the cattle population, especially of the local breed. These small holders raise their cattle under the mixed farming system. Under this system cattle cover the need of the household to milk and dairy products; surplus milk is sold in local markets either fresh or after processing to butter or cottage cheese. Calves are sold after weaning or after fattening for a period ranging 6-12 months according to the initial body weight where they marketed at live body weight ranging from 350 to 450 kg.

The best material breed (Domiati) is endangered by decreasing interest in its breeding and the decreasing of its population.

Medium and large producers who produce milk under intensive system usually own exotic dairy cattle. Friesian and Holstein are the most common breeds and contribute effectively to national milk production and meat comes in the second place. Friesian and Holstein cows are usually inseminated with imported semen.

Native cattle contributes about 54.5% of the national red meat production and about 15% of Milk.

Sheep.

There are 3 main local sheep breeds; Rahmani, Ossimi and Barki among the 12 local sheep breeds in Egypt. Exotic breeds**,** Finnish Landrace, Romanov, Chios, Suffolk, Karakul and Awassi, are found in Ministry of Agriculture (MOA) experiment stations that often distribute some stocks to breeders.

Sheep are raised mainly for meat. Wool being a secondary product which is coarse type that usually used for rug manufacturing. The great majority of sheep are local breeds.

Local Barki sheep are found in the North West coastal zone, Rahmani and Fallahi in the delta, Ossimi, Saeidi, Sanabawi and Sohagi in mid and North Egypt. Sheep are raised in traditional way with very few commercial farms.

Goats.

Seven local breeds and 5 exotic breeds (Damascus, Alpine, Anglonubian, Boer and Sanean) exist in Egypt**.** Goats are spread allover the country and kept mainly by small holders as scavenging animals. There are only very few commercial farms and most of the large herds are kept at MOA experiment stations. The breeds Barki, Zaraibi and Baladi are found in the delta and north part of the country while Saeidi, Wahati, Aboramad-Halaieb-Shalateen in South Egypt. The Zaraibi goat could be considered at risk where its numberis decreasing. MOA has established a herd of Zaraibi goat at Delta region in the governorate of Domiat in Alserw research station north of Egypt.

Damascus has been imported to Egypt and proved considerable adaptation to the Egyptian prevailing conditions. It has acceptance by the Egyptian farmers and kept either pure or crossbreed with Baladi and Barki goats.

Camels.

Camels are well spread in the desert, oases, and the Nile valley and Delta. Imported camels represent a major component of its population where they pass boarders on foot from Sudan and Libya. Most of these numbers go for slaughtering after rehabilitation. Camels are used for meat and as beast of burden in villages. Breeds of camels are Maghrabi in the North West coast, Fallahi in the delta and valley and Sudani in Aboramad-Halaieb-Shalateen triangle. Camels could play an important role in narrowing the gap of meat production in Egypt.

Horses.

There are two breeds in the country, the Arabian and the Baladi. There exists a great interest in Arabian horses, which are used for leisure. There is one very old horse station, Alzahraa, which breeds pedigreed Arabian horses and holds regular international auctions. There are also some imported breeds, mainly Thoroughbred which has been crossed with the Baladi to produce crossbreds for leisure and sport. The Baladi horse is used to pull carts.

Donkeys.

There are four donkey breeds in Egypt used mainly for carrying loads and riding in villages. The donkey plays a significant role in the agricultural system, especially to small holders. However, it does not receive any attention concerning breed characterization or improvement.

Pigs.

There exists one breed in the country. There are no specialized commercial farms in the country but pigs are usually raised around garbage collection sites.

Chickens.

Chickens are considered the main source for white meat and eggs. There are large investors involved in the business of commercial chicken production. The country, now,

is self sufficient in white meat and eggs. Many exotic breeds and hybrids are raised to produce meat and eggs beside the local breeds which produce 25% of the total white meat and eggs in the country. The original local breeds are mainly the Fayoumi and Dandarawi while some of the derived breeds are Montazah Gold, Montazah Silver, Mandara, Gimieizah, Matrouh, Bandara, Hawara and Inshas. Also some of standard breeds have been in the country quite long and become well adapted, like Leghorn and Rode Island.

Ducks.

Duck production is quite common in villages where local breeds are raised like Sudani. Sudani drakes have brooding inclination and are actually used to hatch duck and other species eggs. In cities duck consumption is usually seasonal in certain occasions. Another breed in North Egypt is the Domiati or Shersheer which is smaller than the Sudani and raised in canals and waterways. Usually ducks are force-fed for enhancing growth rate till slaughtering. Beside these local breeds there are some exotic breeds mostly the Peking which is raised at the commercial and village levels and known for its hardiness, disease resistance and good adaptation to local conditions. There are also the Muscovy and Campbell breeds known for their good growth and meat quality. They are bred pure and used also for crossing with local breeds. There is no specific strategy for duck production in Egypt.

Goose.

Goose production is mainly around water surfaces and waterways in the Nile valley and Delta. The birds graze all day long and return to the household in the evening. Only local goose breeds occur in Egypt and no commercial production units occur. As in ducks there is no strategy for goose production.

Rabbits.

In Egypt rabbits are mainly raised for meat production. Fur production requires experience and technology not readily available in the country. The most common breeds in villages and with small producers are the local Baladi, which is small in size but disease resistant, of low nutritional requirement and well adapted to the local conditions. Commercial units are based on exotic breeds, New Zealand, California and Buscat and their crosses with the local breeds.

Two local breeds have already become extinct, Giza White and Baladi White and two more are endangered, Baladi Red and Baladi Black. Sinai Gabali and Matrouh Gabali are raised in desert areas.

There exist many rabbit production systems in the country; the intensive production is limited with the few large farms, semi-intensive system applied in the majority of farms (50-100 does) while the extensive systems is common in most small farms (5-10 does). The latter system depends to a good extent on farm by-products and household leftovers.

Quail.

Quail could be a good and economical source for animal protein because its meat contains 22.8% protein in breast and 19.6% in the fumer. The total edible parts amount to about 71.4% of the carcass in addition it shows low feed consumption compared with

chicken or other poultry species. It rises commercially by few farmers using the Japanese or European breeds.

Turkey

They are raised in very few commercial farms. They are found also in the experimental stations belong to Ministry of Agriculture. The majority is raised.

Pigeon

Local breeds are spread allover the country. They are raised in traditional way.

4.3. Biodiversity of Pollinators

Pollination is a prime example of a supporting service that is being negatively affected by agricultural practices alongside other factors, such as global warming and urbanization. Pollination is essential to most plants for reproduction, including commercial crops. This ecosystem function is provided by many wild pollinator species. There have been worldwide declines in pollinator diversity, with declines identified in at least one region or country on every continent (except Antarctica), including the UK and Netherlands.

The types of pollinators in decline include bees (bumblebees and honeybees), butterflies, bats, hummingbirds and other small mammals. The causes of these declines in pollinator biodiversity are generally related to modification of the land. Pollinators require local floral diversity and nesting sites in order to persist in the unnatural environment of farmed land, but loss of natural habitat, usually related to land use practices, prevents this. Agricultural intensification leads to loss and fragmentation of natural pollinator habitat, while climate change, introduction of alien plants and competition with non-native fauna adds to the pressure placed on pollinator populations. Without the service provided by pollinators, many plant species would go extinct and cultivation of most modern crops would be impossible. Many crops are wholly dependent on cross-pollination (such as melons and squash) by pollinators, while other crops show significant yield increases when cross-pollinated instead of self-pollinated (such as apples, tomatoes and cotton). It has been estimated that pollination is responsible for as much as 30% of agricultural food production, and in some cases pollination services may contribute as much or more to yields than fertilizers. Due to its ability to dramatically improve yields, the economic value of natural pollination worldwide is thought to be between £20bn and £50bn ($37bn and $91bn) each year. Inadequate pollination can not only reduce yields, but may also delay yield and be the reason for inferior fruit production. Without wild pollinator species, current levels of agricultural productivity could only be maintained at a very high cost through artificial pollination.

Egypt's main arable output covers 70 different plant species, which includes both field crops and fruit. These plants differ in their reliance on pollinators for successful fruit and seed setting, from full dependence, to total independence. 9.5 % of the produce are wholly dependent on pollinators, 22.22% are greatly dependent, 19.05% are moderate dependent, 28.57% are little dependent, and 28.57% do not need pollinators to produce seed or fruit at all. This shows that the vast majority of Egyptian agricultural produce would be significantly affected by a reduction in pollinator numbers. Given Egypt's economic status, a loss of agricultural production would not only impact individual farmers but could have negative implications for Egypt's export market, a large contributor to Egypt's economy

Dependency on pollinators to achieve fruit and seed set varies greatly with plant species, and there are many studies that have tried to establish the level of dependence for many of the more common commercial fruit and crop species. The most common measure used is the magnitude of pollen limitation, which gives a value to the reduction in reproductive success of the crop due to inadequate pollen receipt. It is normally based on the fruit/seed set obtained from plants given supplemental pollen compared to the set obtained from control plants. Alternative approaches to pollen supplementation experiments include pollinator exclusion methods and pollinator supplementation experiments.

Exclusion of pollinators, using netting, can give an idea of the potential fruit set reduction in the total absence of pollinators. However, due to logistics of netting plants, this can only be done on a small scale and would be impossible to carry out on a large field crop. This also applies to pollinator supplementation, which can only be carried out in enclosed areas such as greenhouses, to ensure that the supplemented pollinators are contained. All of these approaches will give some idea of the effects that pollinator deficits (and therefore pollination deficits) may have on fruit and crop yields. These studies, however,

will only produce figures specific to the cultivar used within the experiment, and even then can produce greatly differing estimations. Regardless of this fact, the figures that have been published can be used to give maximum and minimum estimates to yield reductions that would occur in the event of pollinator deficits. Where the data are available, it has been possible to calculate percentage reductions in fruit or seed set, depending on the type of crop in question, in the total absence of pollinators.

Commodity	yield decrease (%)	Commodity	yield decrease (%)
Custard apples	90 %	Eggplant	25 %
Cantalope	90 %	Fig	25 %
Kiwi fruit	90 %	Guava	25 %
Melon	90 %	Okra	25 %
Pumpkin, Squash	90 %	Prickly pears (Cactus)	25 %
Watermelon	90 %	Sesame seed	25 %
Almond	65 %	Soybean	25 %
Anise, Fennel	65 %	Strawberry	25 %
Apple	65 %	Sunflower seed	25 %
Apricots	65 %	Beans	5 %
Canola	65 %	Beans, Kidney	5 %
Carrot, Turnip	65 %	Chilli, pepper	5 %
Coriander	65 %	Grapefruit, Pomelo	5 %
Cucumber and Gherkins, snal cucumber	65 %	Lemon, lime	5 %
Cumin	65 %	Linseed, Flax, Straw	5 %
Mangoes	65 %	Orange	5 %
Peach, Nectarine	65 %	Papayas	5 %
Pear, Quinces	65 %	Peanut, Groundnut	5 %
Plum, Sloes	65 %	Persimmon	5 %
Raspberry	65 %	Safflower seed	5 %
Beans, Broad	25 %	Tangerine, Manderine	5 %
Caraway	25 %	Tomato, kawta	5 %
Cottonseed	25 %		

Source: Biomap Project, NCS, EEAA, 2006

4.3.1. Calculating the economic impact of pollinator declines on Egyptian agriculture

Estimating the percentage of a crop's yield attributable to the service provided by pollinators is useful, but it does not consider the variable market values of the crops themselves. Different crops vary greatly in their value per feddan, and this factor needs to be considered when assessing the importance of pollinators to Egyptian agriculture. Using some of the values in Table it has been possible to calculate the monetary loss for the estimated yield reductions

The market values are taken from the 2004 figures published by the Egyptian Ministry of Agriculture. Even though this was possible with just a small number of the total crops produced by Egypt, it does give an indication to the large economic value of the service provided by pollinators to Egyptian agriculture, and highlights the importance of preserving them.

For valuable crops, such as the watermelon, a pollinator decline will have a huge economic impact, because pollinators are essential for watermelon production. Other

pollinator dependent crops, such as other kinds of melons and figs, would also experience a huge monetary loss if pollinators declined dramatically

Commodity	Loss of revenue (million L.E.)
Anise, Fennel	14.19
Dry beans	8.93
Green beans	14.77
Dry broad beans	185.96
Green broad beans	22.28
Caraway	3.83
Chilli, Pepper	123.17
Coriander	32.51
Cottonseeds	1305.44
Cucumber, Gherkins	221.61
Cucumber, Snal	21.90
Cumin	16.06
Eggplant	140.33
Linseed, Flax, Straw	5.60
Peanut, Groundnut	44.93
Pumpkin, Squash	338.19
Sesame seed	39.37
Soybean	20.22
Sunflower seed	21.27
Tomato, kawta	211.58
Watermelons	910.96
Total value of pollinators of these crops to Egypt	3703.1

Source: Biomap Project, NCS, EEAA, 2006

4.4. Biodiversity of Birds and Wild Animals in Agriculture areas

The Nile Delta is part of one of the world's most important migration routes for birds. Every year, millions of birds pass between Europe and Africa along the 'eastern African flyway', and the wetland areas of Egypt are especially key as stopover sites. Species that pass through the Nile Delta Flooded Savanna ecoregion include white stork (*Ciconia ciconia*), black stork (*Ciconia nigra*), European crane (*Grus grus*) and white pelican

(*Pelecanus onocrotalus*), as well as numerous birds of prey, including short-toed eagle (*Circaetus gallicus*), booted eagle (*Hieraaetus pennatus*), steppe eagle (*Aquila nipalensis*), lesser spotted eagle (*Aquila pomarina*), steppe buzzard (*Buteo buteo*), honey buzzard (*Pernis apivorus*) and levant sparrowhawk (*Accipter brevipes*). Large numbers and a wide diversity of waterbirds, passerines and other bird groups also pass through the country during the spring and autumn.

Several hundred thousand waterbirds winter here in the Delta, including the world's largest concentrations of little gull (*Larus minutus*) and whiskered tern (*Chlidonias hybrida*) in Lake Manzala. Other waterbirds include shoveler (*Anas clypeata*), teal (*A. crecca*), wigeon (*A. penelope*), garganey (*A. querquedula*), grey heron (*Ardea cinerea*), pochard (*Aythya ferina*), ferruginous duck (*A. nyroca*), Kentish plover (*Charadrius alexandrinus*), and cormorant (*Phalacrocorax carbo*). This ecoregion contains the largest breeding population of slender-billed gull (*Larus genei*) in the Mediterranean Sea.

The Nile has been connected to the Niger and Chad water systems at various times in the late Pleistocene, through a series of shallow lakes in the Sahara Desert. Therefore, the three river systems share a similar flora and fauna, and endemism in the Nile is low. The delta is rich in wetland plant species that grow in the remaining freshwater wetlands and coastal strip. The Nile River within Egypt has at least 553 plant species associated with it, of which at least 8 species are endemic. Two additional endemics live in the oases close to the Nile. A member of the white-toothed shrew genus, *Crocidura floweri*, is also endemic to the ecoregion. European mammals found here include the otter (*Lutra lutra*) and the red fox (*Vulpes vulpes*). Healthy populations of swamp cat (*Felis chaus*) can be found around Lake Manzala. The hippopotamus (*Hippopotamus amphibius*) became rare in the 18th century, with the last known individual in Egypt killed around 1816.

The ecoregion provides habitat for one endemic frog, *Bufo kassasii*. Aquatic reptiles include *Varanus niloticus* and *Crocodylus niloticus* as well as two marine turtles which breed at Lake Bardawil in the Delta, the endangered loggerhead (*Caretta caretta*) and the endangered green turtle (*Chelonia mydas*). The African softshell turtle (*Trionyx triunguis*) was once found in the Delta but has been eradicated from Egypt. The remaining Mediterranean population is considered to be critically endangered. The endangered Egyptian tortoise, *Testudo kleinmanni*, lives in the dunes and islets of this ecoregion. Marine fish are found in the delta, such as *Anguilla spp.*, *Mugil cephalus* and *Solea vulgaris*. Financially important species in the lakes and lagoons include *Oreochromis niloticus*, *O. aureus*, *O. galilaeus, Tilapia zillii* and *Clarias spp.*

4.5. Value of Agricultural Biodiversity in Egyptian National Economy

The Egyptian economy has traditionally relied heavily on the agricultural sector for food, fiber and other products. The agricultural sector provides the livelihood for about 55% of the inhabitants and employment for about 30% of the total employment and labor force. In addition, agriculture contributes about 14%of the gross domestic product (GDP) and about 20% of the total exports and foreign exchange earnings.

The demand for agricultural products is increasing due to population growth and the need for more export earnings. The country plan is to bring to cultivation a total of 3.4 million acres from the desert area up to the year 2017. This requires more emphasis on agricultural

research to identify agricultural-sector constraints and to develop solutions through appropriate technologies especially in the newly cultivated and reclaimed areas.

The march of agricultural development proceeded so that the annual average of agricultural growth rose from 2.6% in the 1980s to 3.4% in the 1990s to reach 3.6% in 2006/07. Moreover, the area of agricultural lands rose to 2.3 million feddans during this period, thus, Egypt broke through towards projects of huge agricultural expansion that contribute to the addition of 1.4 million feddans, thus increasing the inhabited area from 5.5% to 25% of Egypt's area. Furthermore, this redrew the demographic map after creating new urban communities, in the depths of the Egyptian desert, that represent population-attraction regions due to the new job opportunities they provide.

The agriculture sector contributes to GDP at about 13.4%. In 2006/07, the agricultural product value (at current prices) reached about LE 90.1 billion, the agricultural production value reached about LE 116 billion, while the value of agricultural exports reached about US Dollar 900 million.

Description	2004/05	2005/06
Agricultural Exports Value (LE billion)	6.2	4.9

Ministry of agriculture.2007

The agricultural activity contributes to sustaining about 55% of the Egyptian citizens; about 5.5 million workers work in that sector representing about 27% of the total labor force, and their wages during 2006/07 reached about LE 8.978 million. The agriculture sector is deemed the first responsible body for realizing food security for citizens.

It succeeded in minimizing the food gap, thus realizing complete self-sufficiency at a rate of 75% of meat, 70% of sugar, and 85% of wheat. The sector has a major role in providing needed services for a number of essential industries on top of which are spinning and weaving, and food industries.

Over the period (1981/82-2006/07), efforts of agricultural development succeeded in adding an area of 2.4 million newly reclaimed feddans, so the total area of the cultivated land reached about 8.6 million feddans.

Description	2005/06
Area of agricultural lands (million feddans)	8.6
Crop area (million feddans)	16.04

Ministry of agriculture.2007

The private sector contributes to GDP at about LE 90.06 billion against about LE 14 million; the contribution value of the public sector.

Description	Private sector	Public sector
Share of the agricultural sector's contribution to the GDP (in current prices)	LE 90.06 billion	LE 14 billion

Ministry of agriculture.2007

Share of the agricultural sector's contribution to the GDP (in current prices) LE 90.06 billion against LE 14 billion

5. CROP PRODUCTION

The agricultural sector succeeded in realizing increasing rates in the production of several agricultural crops and occupying lead positions worldwide in the production of a number of strategic crops of which:

- Rice ranked as the highest in productivity worldwide; productivity reached 4.2 tons/feddan.
- Egypt ranked first in producing sugarcane, with average production of 51.4 tons/feddan.
- Egypt ranked second in the production of maize; average productivity reached 25.5 ardeb/feddan.
- Egypt ranked fourth in the production of wheat; average productivity reached 19.25 ardeb/feddan.

Table 9.1. Development in the Agricultural Productivity during the Fifth 5-year-Plan (2002-2007)

Produce	Unit	Feddan Productivity			Realized Percentage %
		2001/02 Base year	2006/07 Targeted	2006/07 Achieved	
Wheat	Ardeb	18.8	20.0	19.25	96.3
Maize	Ardeb	24.75	27.5	25.5	92.7
Rice	Ton	3.9	4.2	4.2	100.0
Beans	Ardeb	8.6	10.5	9.2	87.6
Cotton	Cantar	7.2	8.0	7.6	95.0
Sugar cane	Ton	50.0	51.5	51.4	99.8

Ministry of agriculture.2007

6. ANIMAL PRODUCTION

Animal production activity in Egypt depends on the private sector. Small farmers are mainly responsible for producing a big part of the animal production for the non-existence of natural pastures in Egypt.

Animal quantitative production has achieved a continuous growth which covered the food gap provided a surplus in milk, eggs and poultry meat (this was before the incoming of bird flu). Moreover, about 75% of red meat have been provided.

The year 2006/07 has witnessed the production of about 795,000 tons of red meat and about 800,000 tons of poultry meat, 330,000 tons of eggs and 4.47 million tons of milk.

Egypt, like many countries in the world, was affected by bird flu. The Egyptian government has succeeded in containing this crisis and, limiting its effects.

A national plan was started to eradicate bird flu within a period of 3-5 years. The plan focused on four pivots. The most important of which are developing the current farms,

raising the awareness of breeders, establishing a number of abattoirs to slaughter 2 million hens daily, so as to forbid the circulation of live birds and slaughtering outside the abattoirs. In addition to boosting General Authority for Veterinary Services, developing the diagnosis labs and producing vaccines, providing about 150 million vaccination doses for birds annually and amending the laws relevant to organizing work in farms.

7. FISH WEALTH

Egypt has varied natural sources of fish production. There are natural fisheries including the Red Sea, the Mediterranean Sea, lakes, the Nile course, canals and drains. Internal water areas represent a great opportunity for investment in fish production, as they reach 1,613,000 feddans. The River Nile and its branches provide 178,000 feddans. Over the past two decades, fish production realized a huge leap; it doubled at a rate of 437%, so fish production increased from about 210,000 tons to reach about 1 million tons in 2006/07. Still there is an opportunity to achieve a leap in fish production to cover domestic needs and provide surplus of exports.

Tabel 9.2. The Quantitative Production Development in Poultry, Fish, and Animals over the Fifth 5-year Plan (2002-2007)

Description	2001/02 Base year	2006/07		Percentage of achievements
		Targeted /achieved		
Dairy	3.560	4.2	4.47	106
Cattle meat	0.700	0.812	0.795	98
Poultry meat	0.541	0.600	0.800	133
Eggs	0.223	0.300	0.330	110
Fish	0.750	0.925	1.00	108

Ministry of agriculture.2007

The impressive progress in the agriculture sector presented in the above section is often attributed to, among other factor:

• Developing of high yielding and better varieties and other improved technologies;

• Liberalization of commodity prices;

• Privatization of newly reclaimed government owned land;

• Phasing out of mandatory requirements "Quota" for cereals;

• Implementation of production campaigns– that required research and extension and other agencies to work closely together with a target to provide farmers with better technologies to be adopted.

Egypt has made significant progress towards becoming a more open and efficient economy. Since the mid-1980s, its economic growth, which has taken place due to macro stability and policy reform in agriculture sector has to be sustained over time and agriculture can continue play a dominant role. The export performance of agriculture has

been highly variable, and during the past five years cotton has been Egypt's principal agricultural export.

8. THREATS OF ENVIRONMENT AND BIODIVERSITY IN THE NILE VALLEY AND DELTA.

Egypt faces many environmental challenges that constitute a source of natural resources degradation, and a threat to its future generations. These environmental challenges are due to the inability of available resources to meet people's needs, in addition to the abuse of the available resources. At the forefront of Egypt's environmental problems are pollution of various types, scarcity of water supplies, population increase, resources depletion, relative absence of law enforcement, lack of awareness of the vitality of environmental issues. Awareness is the most effective media for rationalizing the use of resources and dealing with bio-environment. These challenges face the diverse groups and classes of Egyptian society with respect to their responsibility to address such environmental issues in order to achieve sustainable development.

Pollution from industrial sources is generated primarily from heavy engineering; Electroplating and chemical industries, such as pesticides manufacturers, and petroleum refineries. Certain types of significantly polluting industries have a specific geographical distribution, such as the cement, the iron and steel, and the coke and chemical industries in Cairo; textile, food, oil and soap industries in Alexandria and the Delta region; and sugar in Upper Egypt.

During the last few years, significant attention has been given to the protection of the Nile from pollution. The focus is on industrial establishments, since industrial wastewater is the major contributor to Nile pollution. Pollution from agricultural activities: The pollutants from unsound agricultural practices comprise leached salts, nutrients such as nitrogen and phosphorous, and a wide variety of pesticides. In the Delta, salinity of drainage water increases because of intensive agriculture. This salinity can have a negative impact on the quality of fresh irrigation water, and hence on soil properties. Since the beginning of the 1990s, the use of fertilizers and pesticides in agriculture has been declining due to the adoption of technologically advanced cultivation practices, together with the availability of better quality seeds

Practically no areas of delta habitat remain undisturbed. The completion of the first Aswan Dam (between 1912 and 1934) dampened the annual flood pulse in the Nile Delta. The completion of the second Aswan (High) Dam totally stopped flooding and most of the former seasonally or permanently flooded habitats have subsequently been converted to settled agriculture. Before the dams were built, floodplain farming had occurred for over 5,000 years, although flooded areas were only farmed after the flood receded. However, since the closure of Aswan Dam, floodplains are farmed year-round, causing the loss of much of the wetland habitats of the delta and lower Nile River floodplain. Only fragments of the former wetlands remain. The best remaining habitat is found in the Lakes El Mannah, El Qatta, Faraontya, Sinnéra, Sanel Hagar and the coastal lagoons of Manzala and Miheishar.

The ecoregion is largely unprotected. Ashtoun el Gamil-Tanee Island Natural Area and the Lake Burullus Ramsar site are the only two protected areas in the delta and cover a

total area of less than 500 km^2. Lake Burullus is threatened by fishing and pollution although it remains the most unspoiled of the delta wetlands. Ashtoun El Gamil Protected Area was created largely to protect gravid fish and fry as they journey in and out of nearby Manzala Lake, and is not large enough to contain any suitable waterfowl habitat. There are plans to enlarge this protected area, which may give it a greater significance in the conservation of Egypt's resident and transient avifauna.

The main threats to biodiversity in rural areas in Egypt can be categorized into: the dramatic population explosion into the last decades, the accelerated industrial programme started in the second half of the last century, intensive agriculture and land reclamation programme entailed the intensive usage of agricultural fertilizers especially after the construction of Aswan High Dam (1969) due to the decline of soil fertility as a result of lack of silt and clays previously corned by the Nile River's flood, and more recently the flourishing of tourism industry, Other causes of threats to biodiversity in Egypt are illegal hunting, cutting of ligneous plants, overgrazing and over fishing, Invasive species, and genetically modified organisms ,*et al*. The ecosystem-wide impact of agriculture on biological diversity can be mitigated by changes in agricultural practices and technologies and land use patterns. Clearly a balance must be found between maintaining acceptable levels of agricultural production and biological diversity, but this will not be possible unless the broad systemic impacts of agriculture are recognized, the aim protection of nature resources and biodiversity in Egypt is to set the bases of rational use and sustainable development of the national natural biological resources. The objective is that these resources remain fit for use and capable of production in ways that provide for the legitimate requirements of the present and for the basic needs of future generations.

- **Specific problems related to** environment and biodiversity issues in rural are as follows:

- Extensive use of chemical fertilizers and pesticides
- Existing of industrial activities within the agriculture area
- Low percentage of sanitation coverage (sewage water collecting system)
- Absence of solid waste collection mechanisms
- Lack of awareness and community role in pollution control & environment protection
- Weak enforcement of laws and regulation.
- Absence of polluter pay principal
- The population increase in rural areas
- Absence of good agriculture practices
- Loss biodiversity because of Climate change , Invasive species and use of chemical fertilizers and pesticides et, all
- Land and habitat conversion to large-scale agricultural production, including drainage of land and conversion of wetlands and grazing area has also caused significant loss of biodiversity.
- Threats to wild plants as Over collection, Overgrazing, Cutting, Desertification, Soil degradation

9. NATIONAL EFFORTS FOR CONSERVATION OF AGRICULTURE GENETIC RESOURCES

All wild species should be primarily conserved in their natural habitats (*in situ* conservation). Cultivated species and wild species are also conserved outside their natural habitats *ex situ*. This involves their transfer to special collections in gene banks, botanical and zoological gardens, arboretums and aquariums (*ex situ* conservation). Based on the principle that the best way to conserve agrobiodiversity is to sustainably use as many of its components and ecological functions as possible, the on farm management of crops and domestic animals gains importance. Therefore, it is necessary to improve appropriate production and management systems and to develop adequate programs to support engagement. Last but not least the consumers commitment for the issue needs to be won.

The current efforts being made for the conservation of Agro-biodiversity in Egypt are numerous to combat the threatening factors. This is clear in aspects like policies, development plans and programmes, research, human capacity and awareness activities. Regarding policies and plans at the country levels.

9.1. *In Situ* Conservation

The *in situ* conservation is addressed under the protected areas. Protected areas are the backbone of species conservation in its natural habitats. The national program embraces the long-term objectives of development of the present 27 protected areas / reserves and surveys for identifying new sites and expanding some of the existing reserves. Prioritization needs to select short-term targets.

Important protected areas which include some of agriculture genetic resources:

1. St. Katherine Protectorate

It was declared a protectorate by the Prime Minister's decree no. 613 of 1988. From the biological point of view, the area is characterized by a remarkably high concentration of endemic species of plants and animals, as well as 318 plant species of medicinal and poisonous uses. It represents in bio-geographic terms the most western limit of the Irano-Turanian biota. Among the common plant species are: *Alkanna orientalis, Anchusa milleri, Boerhaavia diffusa, Commicarpus sinuatus, Eragrostis cilianensis, Heliotropium bacciferum, Oligomeris linifolia, Salvia lanigera Telephium sphaeospermum* and *Echium rauwolfii.*

2. Wadi Allaqi Biosphere Reserve

This is a dry river system traversing the southern part of the Eastern Desert of Egypt and joining the Nile valley at a point some 180 km to the south of Aswan. The protectorate covers an area of ca 30,000 km^2. Wadi Allaqi has been the site of extensive research programs in fields of ecology, sociology, economics of natural resources, etc. under the leadership of the Aswan Faculty of Science. Among the species recorded in the eastern desert 127 species belong to 38 families are protected in Wadi Alaqi (Belal & Springuel, 1996).

3. The Elba Protectorate:

This is by far the largest reserve in Egypt, covering anarea of 35,600 km^2 and including 4 distinct types of ecosystem: the mangrove forests of the Red Sea coast and its numerous islands, the Doaib region, the Gebel Elba region and the Abraq region. The Gebel Elha

region has large mangrove communities along the Red Sea coast which are the most important breeding sites for marine birds. Plant diversity in Elba is also remarkable; records include 396 species of flowering plants and ferns and the vegetation is particularly lush after incidents of rainfall. Among the interesting species are: The endemic species *Biscutella elbensis. Dracaena ombet* and *Anogramma leptophylla* restricted to this site only.

4. The Omayed Biosphere Reserve

This protectorate was declared by Prime Minister's decree no. 3216 of 1996; it covers an area of about 700 km^2 and is located some 83 km to the west of Alexandria (or 200 km east of Matrouh) and nearly 15 km south of the Mediterranean shore. It incorporates a variety of habitat types, animal and plant communities, traditional bedouin settlements, and patterns of land use. The plant species protected in this area is about 288 species representing 49 families. Among the economic plant species are: *Achillea santolina, Alhagi graecorum, Arisarum vulgare, Artemisia herba-alba, Foeniculum vulgare* and *Lycium shawii.*

9.2.*Ex Situ* Conservation

Agricultural plants genetic resources especially the threatened and economic species would benefit from condensed efforts at *ex-situ* conservation in botanical and ornamental gardens, zoos as well as gene banks, and herbaria, it deserves more consideration. The strengthening and coordinating of existing gene banks for crop genetic resources is a major problem. The renewal of genetic material, in small available units in the country, especially in case of endangered wild species is a major task. *Ex-situ* conservation efforts must be joined with new data on germination, storage conditions, and necessary replenishment cycles of gene bank material.

9.2.1. Herbaria

There are 27 botanical herbaria recorded here according their establishment date and there are about 6 small herbaria we have no information about their specimen number. The following table based on the report of the 1st International Conference on Strategy of Egyptian Herbaria, Botany, Dept. Faculty of Science, Ain Shams University, Cairo.

9.2.2. Gene banks

In the past a number of institutions and individuals collected plant germplasm all over the country according to their need and in the absence of a national program. Recently, a national program for *ex-situ* conservation in Egypt has been developed. A new National Plant Genetic Resources Unit (The Gene bank of Egypt) is being established.

Table 9.3. List of herbariums and their locations in Egypt

Herbarium location	City	Established since	No. of specimens
Flora and Taxonomy Research Dept., Horticulture Institute, Agricultural Research Center	Giza	1898	260000
Botany Dept. Faculty of Science, Cairo University	Giza	1929	250000
Botany Dept. Faculty of Science, Alexandria University	Alexandria	1944	6200
Botany Dept. Faculty of Science, Ain Shams University	Cairo	1953	5076
Orman Garden	Giza	1960	5879
Botany Dept. Faculty of Science, Assiyut University	Assiyut	1961	7000
Desert Research Center, Mattaria- Cairo	Mattaria-Cairo	1962	1130
Botany Dept. Faculty of Science, Tanta University	Tanta	1969	9000
Botany Dept. Faculty of Science, Shebeen El-Koam- Minufia University	Shiebeen El-Koam	1977	6000
Botany Dept. Faculty of Science, Mansoura University	Mansoura	1976	5000
National Research Center	Dokki, Giza	1979	6004
Botany Dept. Faculty of Science (Aswan), South Valley University	Aswan	1980	14000
Botany Dept. Faculty of Science, Suez Canal University	Ismahelia	1983	3500
Botany Dept. Faculty of Agriculture, Cairo University	Giza	1990	912
Botanical Garden in Aswan	Aswan	1993	600
Horticulture Research Station at Sakha	Sakha- Kafr El-Shiekh	1993	649
Biology and Geology Dept. Faculty of Education, Ain Shams University	Cairo	1994	2000
Horticulture Research Station at Sedes, El-Minya	Sedes, El-Minya	1996	413
Botany Dept. Faculty of Science, Helwan University	Helwan, Cairo	1997	8000
Weed Research Dept., Field crops Institute, Giza	Giza	1998	819
Saint-Catherine protectorate, S. Sinai	S. Sinai	1999	233
Wadi El Assyuti protectorate	Assyut	2001	600
Faculty of Girls , Ain Shams University	Cairo	2002	300
Elba Protectorate, Sudano-Egyptian border	Sudano-Egyptian border	2002	270
Ismahelia Horticulture Research Station	Ismahelia	2003	132
Regional Center for development of Sinai	N. Sinai	2003	150
El Sheikh Zuwayed Gene bank	N. Sinai	2003	2000

a. National Gene bank

The NGB (Agricultural Research Center, Ministry of Agriculture) undertakes the process of collecting, conserving, describing, evaluating, regenerating and documenting flora and fauna genetic resources and origins and beneficial and disease-causing micro living organisms in the agricultural field. The NGB also reproduces plant genetic origins with vitality less than the limits identified by competent international organizations, as well as repatriating Egyptian genetic origins stored in foreign Genetic Origins Programs. The NGB also regulates Egyptian genetic origins aiming at generating new derived items and reserving the right of the Sate therein. NGB capacity encompasses 200,000 genetic origin samples.

Plant genetic origins of field and horticulture crops existing in NGB conservation chamber is estimated at more than 35,000 genetic origins, 500 of which are vegetables collected from breeding programs and international gene banks. Classes and species follow the genetic origins shown in table.

Table 9.4. Classes and species genetic origins

Crops	Class No.	Species No.
Field crops	**48**	**111**
Vegetables	**45**	**56**
Medicinal & aromatic plants	**133**	**173**
Wild plants	**141**	**227**
Trees & bushes	**45**	**63**
Total	**412**	**630**

Sources: - National Gene bank, 2005

b. El Sheikh Zuwayed bank

A Plant Genetic Resources Station, under the Desert Research Center, has been established in 1997 at El Sheikh Zuwayed at the North Sinai. Field collections of fruit species are maintained at this station (18 acres). The bank contains two cold stores one running at -20°C and the other 50 m^3- running at -4°C. Among the wild plants stored in the gene bank are: *Moringa peregrina, Capparis sinaica* and *C. spinosa.* Species grown and distributed among the bedouins as small plants planted in their fields are: *Thymus vulgaris, Balanites aegyptiaca, Urginea maritima, Salvia officinalis* and *Origanum syriacum.*

9.2.3. El-Hammam breeding center

It is a newly established center Near El-Omayed protected area it is a breeding center used for growing the wild desert economic species under conditions similar to its natural habitats. This project granted from the Egyptian Academy of Scientific Research and Technology, and supervised by Dr. K. H. Batanowny, from the botany Dept. Faculty of Science, Cairo University. Some species were succeeding to grow as: *Thymus vulgaris, Balanites aegyptiaca, Urginea maritime, Capparis sinaica,* and *Ziziphus spina-christi.*

9.2.4. Botanical gardens

Aswan botanical and Orman botanical gardens are among the notable botanical gardens in Egypt with a good management and staff facilities. The later garden containing some wild species cultivated for its ornamental values such as: *Nymphaea lotus, Solanum nigrum, Phoenix dactylifera, Acacia nilotica* and *Cyperus papyrus.*

9.3. Other Efforts and Achievements of Egypt to conservation & sustainable use of agriculture genetic resources in Egypt.

a. Medicinal Plants Conservation Project (Egyptian Environmental Affairs Agency)

The Medicinal Plants Conservation Project (MPCP) is a national project that aims to eliminate the root causes of the loss in biodiversity and the threats to the conservation and sustainable use of Wild Medicinal Plants in Egypt especially in St. Katherine Protectorate. The project was launched in January 2003 and it is jointly undertaken by the United Nations Development Program (UNDP), the Global Environment Facility (GEF) and the Egyptian Environmental Affairs Agency (EEAA).

Achievements of the project:-

- An improvement in the distribution and growth of the different species of plants through enacting methods of grazing control and 'fenced enclosures'.
- Creation of a diversity of community occupations that do not impact on the environment, i.e. bee keeping.
- The publications of informative books (monographs) on the different Medicinal Plants.
- The creation of an Ex-Situ conservation site in the grounds of the Botanical Gardens in Sharm El- Sheikh to raise public awareness.
- The launch of a website and database on the Medicinal Plants of Egypt.
- Creation of a diversity of community occupations that do not impact on the environment i.e. bee keeping.
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- The creation of an *Ex-situ* conservation site in the grounds of the Botanical Gardens in Sharm El- Sheikh to raise public awareness.
- The launch of a website and database on the Medicinal Plants of Egypt
- Record of Bedouins traditional knowledge of medicinal plants in Saint Katharine protected area.
- Foreclose the use of critically endangered medicinal plant species in hotspots.
- Introduce small-scale community-based cultivation, processing and medicinal plant marketing to relieve pressure from wild sources in orchards gardens
- Introduce best practices for sustainable collection of wild medicinal plants throughout the protectorate
- Promote alternative energy sources in demonstration areas
- Disperse grazing pressure throughout the protectorate
- Protect community intellectual property rights and replicate project successes in Egypt.

b. The present time in Egypt there many agriculture projects it include Environmental Impact Assessment (EIA) studies aiming to protect the environment, conservation of biodiversity and sustainable use of nature resources:

The Toshka Project, Egypt: With the increase of Egyptian population living in just 4% of the country surface along the Nile shores, the government realized the necessity of accelerating its horizontal expansion plans into the deserted uninhabited regions of Egypt. As part of this plan, the agricultural land is forecasted to spread out by an area of 1.42 million hectares in several regions of Egypt by year 2017, of which 0.23 would be irrigated by the Southern Egypt Development Project (Toshka Project).

According to the guidelines of the Egyptian Environmental Affairs Agency (EEAA), the decision whether to undertake or not the Toshka Project had to be based on an Environmental Impact Assessment (EIA) to protection of environment and to conservation of biodiversity. The EIA was undertaken using the Environmental Impact Assessment Decision Support System (EIADSS) for irrigation projects, developed by Centre for Environment & Development for Arab Region & Europe (CEDARE). EIADSS is a computerized checklist - based on a set of multiple-choice questions that describes the project impacts on selected criteria - supported by an Expert System that evaluates all potential environmental impacts of irrigation projects.

Based on the systematic approach of the EIADSS evaluation, the expected performance of the project alternatives were assessed, including the implementation of mitigation measures. The EIADSS recommended to implement the project, mainly due to its positive impacts on socio-economics, and on the overall economical welfare of the country.

c. Organic farms in Egypt to production of organic food with protection of environment conservation of biodiversity.

Sustainable Plant Nutrition to Increase Food Production to reduce the amount of chemical fertilizers applied to crops, biofertilizers have been produced and applied to legume crops and cereals. This practice will enhance the quality of the crops and reduce the amounts and costs of mineral fertilizers.

Compost production is promoted among farmers to reduce the amount of chemical fertilizers and to re-add the nutrients uptakes by plants compost to improve the soil characteristics conditions.

Ministry of Agriculture (MOA) has realized the importance of organic farming of vegetables, fruits and some crops. Organic farming ensures:

- Suitable and healthy food for human consumption.
- Environmentally friendly practice.
- Conservation of soil fertility.
- Enhance exports to external markets.
- Absence of using pesticides, which has an adverse effects on environment and human and animal health.
- High price than conventionally produced products.

MOA is taking necessary steps to issue a decree outlining the rules and procedures of organic farming. A number of certifying agents are starting now to register, inspect and certify organic products. Total area producing organic products is about 130,000 feddans.

Organic agriculture in Egypt dates back to the mid-1970s, though astute observers would point out that until the 1940s, Egyptian farmers used no fertilizers or pesticides on their crops. Prior to the construction of the Aswan High Dam, the Nile's annual flood inundated farmland and left behind a thick layer of fertile soil, obviating the need for chemical fertilizers. Pesticides, including DDT, first arrived in Egypt after World War II. Farmers welcomed science's cure for the insect pests that had ravaged their crops since time immemorial, but the bugs soon became resistant, and stronger chemicals were needed.

By the time Sekem founder Ibrahim Abouleish launched Egypt's first biodynamic farm in 1977, farmers were caking their fields in chemicals. Abouleish recognized that fertilizers and pesticides were degrading the soil and seeping into the food chain. His small farm on virgin desert land 60 kilometers north of Cairo sought to revive traditional methods of agriculture in Egypt .

In three decades, Sekem has grown into a nationwide network of biodynamic farms cultivating about 14,000 feddans to produce its own line of organic food products, pharmaceuticals and cotton-based textiles. As Sekem grew, so did its business. A decade ago, the company's sales were LE 35 million; last year they surpassed LE 200 million .

Altogether, approximately 130,000 feddans of farmland in Egypt have been converted to organic farming. But despite soaring export sales, organic farmers say they are struggling to get a foothold in the domestic market. Sales are improving, but price and perceptions continue to hamper sales growth.

Table 9.5. Main organic products in Egypt

Main organic products	**Certification Bodies** 3 foreign; 2 local
Cereals Fresh vegetables Medicinal herbs, aromatic plants Fruits Grapes Citrus Olives and olive oil	**National legislation** draft
	Market Export developed **Local** growing
	Farms Operators 500

Source: Organic farming in the Mediterranean: towards further development, Lina Al -Bitar Mediterranean Agronomic Instituteof BarI (CIHEAM- IAMB), March 2008

e. Activities of the Plant Protection Research Institute, ARC:

- Minimizing the side effects of insecticide applications on beneficial insects including natural enemies, honey bees and silkworm.
- Using sex pheromones and light traps for monitoring the population density of most pest insect species, hence, the infestation levels including the cotton leaf worm, pink bollworm and black cutworm.
- Using plant extracts, mineral & natural oils, bacterium formulations and other conventional methods for controlling different species of mites.

Mass breeding & production for the most famous parasite Trichograma sp. for controlling sugar-cane pest and citrus leaf miner in addition to using spider mite predators for controlling different species of mites (pest mites).

f. Rural Energy Transition to conservation of agro biodiversity in rural areas:

Egypt has many activities to Energy Transition in rural areas at example:-

- Solar energy collection, storage and utilization in grain drying.
- Thermal control in greenhouses.
- Evaluation of irrigation pumping by solar energy.
- A study on the operation of an ultra–low–volume spray by solar photo voltaic cells.
- Environmental control in hydroponic culture.
- Designing an instrument for measuring the power requirements to operate different agricultural equipment.
- Utilization of solar energy in drying agricultural crops.

- Designing and testing of a solar cooling system.
- Using solar energy for cooling agricultural products.
- Rationalization of energy consumed in dairy industries.
- A study on biogas production technology and design for municipal solid biowaste.
- Improving the utilization of wind energy for water lifting at n. w coast of Egypt.

Applications:

- Energy utilization in operating farm tractors using gear-up, throttle-down principles for light loads that saved energy and fuel consumption as well as helped in environment protection.
- Utilization of plastic houses as field solar dryers for paddy before delivered to milling factories and for drying corn and maize crop.
- Use of pull meter dynamometer and 3-point hitch dynamometers to measure draft for trailled 8or mounted form machinery.
- Use of cotton stalks to produce biomass that are used as nontraditional energy sources. Brickets are produced by using choppers to cut and chop from residues (especially cotton stalks) to be used to produce energy, helping in getting rid of cotton worms and minimizing the use of pesticides to environment protection and conservation.

g. Activities of the National Biosafety Committee

Egypt leads the Middle East and North Africa region in the development and acceptance of agricultural biotechnology. The Ministry of Agriculture is a strong supporter of biotechnology. Egypt is a large consumer of agricultural products (such as corn, soybeans, and soy meal) derived through modern biotechnolgy and imported from the United States and Argentina. The government continues to maintain a general import policy that allows imports so long as the product imported is also consumed in the countries of origin.

Egypt has not produced any commercial biotechnology crops.

Egypt has a fairly well-advanced biosafety system, and it has ratified the Cartagena Protocol. In 1995, the Ministry of Agriculture formally instituted Egypt's national biosafety system. A National Biosafety Committee (NBC) was established and included representatives from the ministries of agriculture, education, industry, health, environmental affairs, private sector, policy makers, and consultants knowledgeable in polices and applicable laws, and nontechnical members. The initial committee consisted of 10 members. Subsequent appointments expanded membership to 30. Current members include seven representatives from the ministries of Agriculture, Health, Environment, Industry, and Commerce; one representative from the Egyptian Academy of Science and Technology; 12 members from academic institutions; one attorney, eight people from government research institutes, and one seed expert. Based on area of expertise, members are appointed to one of three subcommittees that specialize in agriculture (crops), environment (biopesticides, biofertilzers, agents for bioremediation), and health

(pharmaceuticals, human, and veterinary vaccines. The committee is responsible for ensuring the safe use of biotechnology products and facilitating access to modern biotechnolgy generated abroad. The system involves several ministries, organizations, and government agencies involved with the importation, exportation, and local production of natural products. The committee establishes policies and procedures to govern the use of modern biotechnology. This includes publishing the National Biosafety Committee guidelines (NBC guidelines) to be followed at the national level. The committee also provides technical advice to the regulatory authorities and institutions responsible for the development of biotechnology in Egypt. The guidelines describe the modalities of use, handling, transfer, and testing of GMOs. They address laboratory practices, greenhouse containment, and small-scale field-testing. Duties of the committee include formulating, implementing and updating biosafety guidelines, conducting risk assessment, issuing permits, coordinating with national and international organizations. The biosafety guidelines are not legally binding. They have only advisory status. There are no details regarding review, decision making, and reporting processes, and they have not been well publicized within the country. Nevertheless, the guidelines have functioned since 1995, with 23 permits for field trials issued and four GM crops moving toward commercial release. The activities covered by the biosafety guidelines include risk assessment, determination of the level of safety concern (LSC) for parental organisms, and determining the effect of genetic modification on level of safety concern.

There is also an Institutional Biosafety Committee (IBC). The NBC requires that all institutions conducting R-DNA research assemble an IBC. The IBC is responsible for insuring that the R-DNA is carried out in full conformity with the provision of the NBC guidelines. The IBC may establish additional procedures as deemed necessary to govern its institution's.

h. Rehabilitation of Lands to maintenance of agriculture ecosystem.

- The study of salinization using different thematic data and satellite's images shows that the highly saline area located in the North of Nile Delta, has increased. However, areas where tile drainage system was introduced have been improved.
- A number of projects can be given to show the Egyptian efforts such as Toshki project to cultivate 540.000 feddan in Upper Egypt, Salam Canal that will add six hundred thousands newly reclaimed feddan in Sinai.
- Overgrazing in the North Western Coastal zone of Egypt is controlled and cultivation of 1.5 million of seedlings in the area suffering from the desertification will minimize its effect.
- Treated sewage water has been channelled into desert and has been planted with trees for production of wood. These forests were established in 19 locations throughout the country, with a total area of about 3500 feddan. The establishment of these forests will have positive impact on environment and agriculture resources.
- The national action programme to combat desertification for achievement of sustainable development in effected areas. This programme highlights the necessary national mechanisms to manage the irrigated lands, rainfed lands and range lands. In all cases, it is important to define the measurements to prevent degradation of fertile

lands, rehabilitate lands that have been exposed to slight degradation and reclaim lands that are extensively degraded.

- Plans of the Egyptian Government aim to reclaim 150.000 acre annually.
- More than 20 nurseries for cultivating different species of trees were established.
- Many of the desertification processes menace the arable land that represent only 4 % of the Egyptian land. Remote sensing was used as the main tool in this study to monitor and evaluate different desertification processes. Convention of farmland to non-agricultural uses considerable losses: multi-temporal aerial photographs and satellite images made it possible to find out the annual rate of urban encroachment that ranges from 5 to 30 %.>

I. Publication of reports about agro biodiversity in Egypt

There some reports it was Prepared by nature conservation sector within ministry of environment on Agro-biodiversity, Egypt as following

1- Abdelwahab A. A., Harhash K. A., (2008). Report on Agro-biodiversity in Egypt, Fouda M. M., Nature Conservation Sector in second conference on Policy towards Dynamic Rural Area in Egypt "Conditional incentive based rural development programme by EU funded, 16 June 2008.

2- Report on Agro-biodiversity in Egypt (NCS).2007.

10. NATIONAL LEGISLATION ON BIODIVERSITY CONSERVATION

Egypt prepared its Biodiversity Strategy and Action Plan in 1998, which was sent to the Ministries of Planning and Financing to be included in the national plan for funding from the government and donor countries and organizations. In 2002, the EEAA approved a National Environmental Action Plan (NEAP), also approved by the Prime Minister. NEAP dealt with many environmental issues including water, air, soil, waste, biodiversity conservation and biosafety, protection of marine environments, desertification, global environmental problems such as climate change, economic issues such as environmental accounting, natural resources accounting and economic incentive tools, and social issues including minorities, youth, women and old people.

During the last decades the Government of Arab Republic of Egypt has paid special attention, to issues of natural resources protection. It has also established a system and legislation for conservation of natural heritage under directives and support of the political leadership, emphasizing integration of development sectors with environmental protection and natural resource conservation for the benefit of the present generation and the generations to come. This legislation can be summarized as follow;

- The agriculture law, Law No. 53/1966: This is the main legislation protecting the wildlife, especially, birds useful to agriculture and certain endangered mammals and reptiles (chapter 3).
- The fisheries law, Law No. 124/1983: Especially in the parts concerning sustainable fisheries. The General Authority for Fisheries Resources Development (GAFRD) is the responsible body to implement this law.

- Law 102/1983 for Establishment of Protected Areas*:* This is the most valuable law for conserving the nature in Egypt. This law provides the legal framework for the creation and management of protected areas. Egyptian Environmental Affairs Agency (EEAA) is the competent authority responsible for implementing this law.
- Law no. 4/1994 for Environment: It is supportive to Law No. 102/1983 especially in the areas out side the declared protected areas. Although law No. 4/1994 is focused mainly on pollution issues, yet it contains many provisions having implications for nature conservation and hunting management in Egypt. Article 26 forbids hunting, shooting and catching of species stated in the Agriculture Law No. 53/1966 and or by Egypt participated international conventions such as CITES and IUCN.
- The quarantine laws in Egypt are strict. Importation and exportation of plant genetic resources are possible if the given regulations are followed.
- This applies also to the passage of in vitro materials through the quarantine, planting out of imported vegetatively propagated material is only possible if the germplasm has been inspected and tested in isolated greenhouses according to given rules and regulations.
- The legislation Nr. 53 from 1966 governs the production, certification, import distribution and registration of seeds. The government controls these activities in order to make sure that farmers are getting a good quality of seeds.
- The government is subsidizing the seed prices to encourage farmers to use high quality of seeds. Farmers' varieties can be traded legally as seed if they are registered and recommended by the government.
- A legislation for Intellectual Property Rights doesn't exist. The government is planing to issue such a legislation in the near future. Assistants for preparing the legislation will be needed and a request will be made accordingly.
- The general policy of the government is the free exchange of plant genetic resources. In some cases, like with cotton germplasm, special regulations with the exchange of cotton germplasm have to be followed. The president of the Egyptian government in consultation with the Minister of Agriculture can decide whether or not to export particular plant genetic resources. Factors that influence these decisions are mostly related to market competition.

11. PROPOSED APPLIED TECHNOLOGIES OF ECO-FARMING IN EGYPT

The proposed applied technologies of eco- Farming in Egypt includes:

11.1. Eco- engineering technology

Eco- engineering technology refers to the comprehensive application of the principles of the biology, ecology, economics, environmental science, agro- science, systems engineering and principles regarding to the co-existence of populations of the ecosystem and the circulation, re-birth of materials in combination with multi- stage techniques of systems engineering. It mainly includes the following aspects:

a) The agro-technology of three dimensional breeding and farming, that is, engineering technology dealing with optimum space combinations. Three dimensional farming is a simulation of the ecosystem's multi-tier use of solar energy, like the three dimensional technology for cultivating of trees, bushes and grass in hilly areas; the three dimensional technology for inter-cropping and inter-planting crops; as well as the three–dimensional technology for cultivation of rice, duckweed and fish.

b) Engineering technology for food chain structure. A simulation of the ecosystem's food chain structure, this engineering technology is designed to establish a workable circle for the multi stage utilization of materials. The output of one system is the input of another system. Thus, waste materials are used two or more times in production and a stable system for the circulation of materials is formed. By so doing, not only the natural resources fully used, but remarkable economic returns obtained. In some eco-farms, for example, fertilizer for crops, and crops as feed for chicken. This is what is called an enclosed circle of materials.

c) eco-engineering for the integration of agriculture, sideline production and fishery while the combination crop planting, livestock breeding and farm produce processing. Eco-engineering refers to a comprehensive eco-engineering technology which ensures an overall, well- projected development of agriculture, livestock breeding and sideline production by readjusting the structure of crop planting, livestock breeding and farm produce processing. This eco-engineering technology requires that each locality give full play to its advantages in resources, use one economic sector to boost the development of others and conduct a comprehensive harnessing of its rural environment so as to balance the improvement of its eco-environment with its socio-economic development and the growth of its population.

11.2. Technology for energy development:

Along with the steady development of modern science and technology, some applied technologies for developing new energies have been popularized in the countryside. These technologies mainly include:-

a) Technology for building firewood- saving stoves.

b) Technology for solar energy. For example, some rural areas should built solar-energy stoves, others should built sheet canopies and solar-energy green houses to breed seedlings or grow vegetables in early spring.

c) Technology for using wind and water energy. Using wind energy is Egypt new energy technology. In areas abundant of wind resources but short of electricity, wind energy is used for irrigation and power generation.

11.3. Technology for harnessing the nature environment:

In combating nature disasters, man has created many technologies for harnessing the natural environment in light of local conditions.

a) Technology for harnessing soil erosion: At present, tow categories of technology are used for putting a halt to soil erosion in Egypt countryside. One is planting technology, that is, the planting of trees, grasses, and various locally tree species to build shelterbelts and protect the headwaters of rivers.

There has also been inter-planting of crops with trees, crops with grass, or tree with grass. In sparsely inhabited area, grass belts may be interspersed among belts of crop. The other category is engineering technology. This mainly refers to constructing terraced fields where trees and crops are planted. This technology is widely used on the loess plateau to harness soil erosion. It also includes the construction of level terraces, level terraced ditches and fish-scale pits.

b) Technology to control desertification. The technology for harnessing the desert is similar with that of harnessing soil erosion. The most widely used technology is planting trees and grasses.

11.4. Comprehensive prevention and control technology:

Comprehensive prevention and control technology is meant the comprehensive application of physical, chemical, biological and agricultural technologies to prevent and eliminate diseases, insect pests and weeds. It mainly includes:

a) Agricultural prevention and control technology: This refers to using agricultural technology to prevent and eliminate crop diseases, insect pests, and weed. Technical measures now in use include cultivating disease and pest resistant seedlings and livestock strains, rotating crops and improving farming methods to reduce the population of insect pests and weed, changing the sowing, nourishing and harvesting periods of crops so as to interrupt the time a plant can be harmed by diseases, insect pests and weed, cleaning up farmland by weeding so as eliminate intermediate parasitic medium of diseases and insect pests, and rational irrigation and fertilization so as to increase crop resistance.

b) Biological prevention and control technology: This refers to the use of the natural enemies of insect to prevent and eliminate in sect pests and weeds.

c) Chemical prevention and control technology: That is to use nature or synthetic chemicals to control hazardous organisms. The characteristics of this technology are quick results, high efficiency and being less restricted by the size of areas. It can rapidly bring under control acute insect pests and weeds. The currently applied measures chiefly include applying high efficient, low toxic and high selective agricultural chemicals with low left- overs, researching new chemicals, improving the methods of application, rationally applying chemicals and using small doses of chemicals.

d) Physical prevention and control technology: As the name suggests, this refers to using physical measures to prevent and eliminate diseases and insect pests by, for example, eradicating weeds with machines and luring insect pests with lamp lights. In addition, there is a modern prevention and control technology by the combined application of physical, chemical and biological means. For example, there is the sterilization and elimination of insect by applying a synthetic hormone and extra –sex hormone.

12. RECOMMENDATION

1. Prepare of strategy to conservation and sustainable use of agro-biodiversity components in Egypt especially in rural areas out site protected areas.
2. Surveys and inventories and develop databases on agro-biodiversity and indigenous knowledge
3. Importance study agro-biodiversity in wetlands and rural areas by evaluation of socio- economic benefits of biodiversity to local communities.
4. importance of systematic eco-geographical surveys in order to determine the location, distribution and diversity of agro-biodiversity
5. Strengthen agricultural extension services and research support systems
6. Determine and analyze the causes of genetic erosion and take necessary remedial measures
7. Develop and adopt complementary conservation methods and strategies.
8. Promote utilization of agro-biodiversity by adding value to germplasm through research and development
9. Promote the production, utilization and marketing of high value/industrial crops for income generation and economic development
10. Strengthen national capacity for biodiversity conservation and use through co-ordination efforts, human resources development and information networks
11. Develop institutional/legal frameworks and policies for the conservation and utilization of agro-biodiversity, access to germplasm and the fair and equitable sharing of benefits arising from its use.
12. Importance of Public awareness about agro-biodiversity and conservation it through media, newsletters, schools, meeting to help in creating and promoting education and awareness at all levels of society, especially among government departments, policy and decision-makers, developers, land owners and local communities.

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CHAPTER 10
INVASIVE AND ALIEN ALIEN SPECIES IN EGYPT

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1. INTRODUCTION

1.1. The Irrigation and Drainage Canal System of the River Nile in Egypt

Various water ways, namely, drainage canals, irrigation canals, northern lakes (Manzala, Borollus and Idku), Damietta branch, Rosetta branch and main stream of the River Nile (Mashaly and El-Ameir Ameir, 2007).

1.2. The Aswan High Dam impact on the Nile river ecosystem

The constructing of the Aswan High Dam (AHD) across the Nile River caused alterations of the aquatic ecosystem specially the aquatic weed community structures. The high aquatic weed infestations caused a lot of problems by creating losses of water, retardation of flow, interference with navigation, health hazards and alteration in the physicochemical characteristics of both water and hydro soil.

The (AHD) provided routes for some aquatic weed species to the Nile system where they had been previously absent, or they caused permanent elimination for some of them within the Lake Nasser, Aswan Reservoir, Nile River, and waterways (canals and drains).

In the Lake Nasser, two aquatic macrophyte species were eliminated and six species were introduced. In addition, the phytoplankton primary productions have become high throughout the year. The mean density and prevalence of the submerged aquatic weeds are greatly influenced by the high water level fluctuation, hydro soil texture and nutrients.

In the Aswan Reservoir, the submerged aquatic weed, *Ceratophyllum demersum* has become dominant because it has an ability to tolerate severe water fluctuation near the littoral zone.

In the Nile River and waterways, the water level regime has been regulated. This regulation has created a favorable habitat for many aquatic weeds to establish than before and the aquatic weed infestations have been increased.

2. AQUATIC INVASION TO THE NILE RIVER

Researchers noted that some alien species appear in the Nile River and its banks and affect its ecosystem; these species include both fauna and flora invasive species.

Aquatic weeds create serious problems in irrigation canals and open drains as well as lakes in Egypt, these weeds may be placed into three groups: floating weeds, emerged weeds (foliage above water), and submersed weeds (majority of foliage below water).

Floating weeds float in or on the surface of the water and obtain their nutrients from water rather than soil, water hyacinth is an example of common floating weeds. Emerged weeds are rooted to the bottom, but have stems, leaves and flowers which extend above the water surface. They primarily occur on the shoreline and in shallow water up to 10

feet deep. Common emerged weeds are water lily (*Nymphaea* spp.). Submersed aquatic weeds grow under and up to the water surface. Most submersed weeds have flowers and seed heads that extend above the surface of the water. Examples of common submersed weeds include *Hydrilla verticillata, Ceratophylum demersum* and *Potamogeton pectinatus.*

Field studies were carried out by Channel Maintenance Research Institute (CMRI, NWRC) for the last two decades. Classification of the problem was as follows:

2.1. Total weed problem.

The total ratio of infested canals with all types of weeds was 86.9% and drains had a ratio of 73.6%,

Floating weeds.

Ratio of infested canals and drains with floating weeds was about 7.5% related to the total length of both. The most common types of floating weeds are *Eichhornia crassipes, Limna gibba*, and *Nymphaea coerulea.*

Submerged weeds.

The total ratio of infested canals and drains reached 41.77% of the total length of both networks. The common types of submerged weeds are *Potamogeton* spp., *Ceratophlum demersum*, *Najas armata* Linb, and *Zannichellia palustris.*

Emergent and ditch-bank weeds.

The total length infested by both emergent and ditch-bank weeds had a ratio of 15.9% of the total length of canals and drains, fig. (3). The common types prevailing are *Typha domingensis, Phragmites australis, Cyperus alpecuroids*,..etc.

The freshwater crayfish *Procambarus clarkii* as example for fauna invasion; had been introduced, accidentally, to the Egyptian Nile water during the last three years. It has been collected during fishing from many locations at the northern parts of the River Nile.

2.2. Lake Nasser - Aquatic weed infestation

In 1962-1964 (before constructing Aswan High Dam, AHD), the area of the Nile valley (Nubia) which was became Lake Nasser, 57 species of aquatic weeds were detected. Those aquatic weeds were submerged and emergent flora. Sixth from them were euhydrophytes (*Alisma gramineum, Damosonium alisma, Potamageton cripus, Potamageton pectinatus, Potamogeton perfoliatus* and *Zannichellia palustris*).

In 1966-1968 (subsequent to the construction of AHD), two euhydrophyte species have been lost from the region (*Alisma gramineum, Damosonium alisma*). But the other four species have colonized the lake with varying degrees of success. Furthermore, six new species were recorded for the first time within the Lake (*Vallisneria spralis, Potamogeton schweinfurthii, Najas horrida, Najas marina*, Subsp. *Armata and Nitella hyalina*).

In Lake Nasser there is an annual cycle of water level changes according to the seasonal flood pattern of the River Nile. The flood occurs in late summer-early autumn. Alteration of the hydrology of the River Nile system caused dramatic changes in macrophyte

community structure. The water body regulation selects submerged weeds tolerating the fluctuating water level.

Fluctuations in Lake Level have led, during recess, to temporal exposure of large areas, so that a wetland ecosystem prevails. In particular, large wetlands have been formed in the deltaic mouths of the dry wadis where they join the Lake. The pioneer plants that colonized the exposed land *are Tamarix nilotica, Glinus lotoides,* and *Heliotropium supinum*. Among the submerged euhydrophytes in shallow water the most common are *Najas marina, Ceratophyllum demersum, Vallisnaria spiralis* (a new invasive species first discovered in a water channel in Aswan in 1966), and *Potamogeton crispus*.

The invasion of *Myriophyllum spicatum* into Lake Nasser, and its impact on submerged macrophyte communities are quantitatively documented. Samples of macrophytes, water and hydrosoil were collected from 17 sites, in October and November 2002. *Myriophyllum spicatum* has replaced the originally dominant submerged macrophyte *Najas marina* subsp. *armata*. The study indicated that the invasion of *M. spicatum* depends not only on its attributes, but also on the physico-chemical characteristics of Lake Nasser.

2.3. Aswan Reservoir - Aquatic weed infestation

Before constructing AHD, Aswan Reservoir showed a pronounced annual change in the water level. However, after the construction, the High Dam regulated the Nile floods. In the Aswan Reservoir, the water level regime followed a fixed pattern in which each day a certain amount of water is released to produce the hydroelectric power. Usually, water is stored overnight and released during the day with about three meters water level fluctuation. As a result of this fluctuation, the submerged aquatic weed, *Ceratophyllum demersum* became dominant because it has an ability to tolerate severe water level fluctuation near the littoral zone. Also, the abundant growth of this type of weed was confined to clay loamy hydrosoil. Such fine texture was trapped within Aswan Reservoir after building the two dams.

2.4. Aquatic weed infestation within River Nile

After constructing AHD, the water level regime in the River Nile has been regulated to meet Egyptian demands for cultivation, industrial, navigation, hydroelectric power and domestic water supply. This regulation allows a gradual increasing and decreasing the water level creating a favorable habitat for many aquatic weeds to establish than before. Many submerged weeds have established in the River Nile such as *Ceratophyllum demersum, Myriophyllum spicatum. Potamogeton pectinatus, Najas horrida, Vallisneria spiralis* and *Chara globularis.*

In the River Nile, the dominant species is *Ceratophyllum demersum* (59-78% of the total standing crop) and *Potamogeton crispus* (15-28% of the total standing crop). However, about (25% of the total standing crop) is made up of *Potamogeton perfoliatus* and *Myriophyllum spicatum*.

Furthermore, the abundance in species richness can shift from *C. demersum* during the autumn and winter, through *Potamogeton crispus* in early summer, to *P. perfoliatus* in late summer and early autumn.

Though the water hyacinth has been introduced in Egypt since 1890,s, it did not reach the plague proportion exhibited in the Nile until recent times. Since the construction of AHD, the Nile system has been subjected to several ecological changes: silt free water running downstream and the consequent excessive use of fertilization, permanent presence of water through out the year, low current velocity in the Nile and stopping the water flow to the Mediterranean. These factors have encouraged fast growth of *Eichhornia crassipes* within the Egyptian Nile River even at the end of the growing season, which extends from the end of March to October. This is truly alarming.

2.5. Aquatic weed infestation within the irrigated system

For many reasons, aquatic weeds with their various types (floating, submerged, ditch-bank and emergent) were flowered and spread all over water courses since the spring season of 1975. The sudden invasion of aquatic weeds to the irrigation system in Egypt was related to the construction of the AHD as follows:

1. The construction of AHD has decreased the peak discharges that used to smash out any kind of aquatic weeds in the main course of Nile River and its main two branches.
2. Daily discharges were reduced to 235 million cubic meters instead of 900 million cubic meters before the construction of the AHD. As a sequence, water became clear and free from solid suspensions. This good condition encouraged the growth of weeds due to the better and deep penetration of sunlight in water.
3. Decrease of water level fluctuations in main canals due to the construction of the AHD has created permanent presence of water in the waterways through out the year.
4. Increased fertilization of farmlands to compensate the lack of silt and to increase the horizontal expansion of agricultural lands caused changes of the chemical characteristic of the water quality within the drains and canals.

Hydrophytic Vegetation in the Irrigation and Drainage Canal System of the River Nile in Egypt

70 plant species recorded in 80 sampled stands.

Six vegetation groups dominated by: *Phragmites australis*, *Eichhornia crassipes*, *Typha domingensis*, *Arthrocnemum macrostachyum* and *Echinochloa stagnina.*

3. CASE STUDIES

3.1. Lake Edku – Weed infestation

Edku is a large lake in the Nile Delta linked to the Mediterranean Sea. Its area is being rapidly reduced by land reclamation (Ramdani *et al*., 2001a).

Three types of invasive weeds present a problem on Lake Edku:

- Submersed aquatics, mostly *Potamogeton*, which cover large areas of the open water in the NE, SE and SW quarters of the lake;
- Floating plants, mostly the water hyacinth, *Eichhornia*,

– Rooted reeds, mostly *Phragmites*.

This vegetation has two main impacts on the lake and its fishery. There is a tendency to block water flows and to present an obstacle to movements of the fishermen. In addition to the physical problem of passage through the weeds, they may have an effect on water quality by stagnating water volumes and leading to extremely anoxic and foul conditions.

After the closure of the Aswan High Dam in 1964, Water weeds increased, including indicators of eutrophication such as *Ceratophyllum* (hornwort), *Lemna* (duckweed), *Eichhornia* (water hyacinth), and reed swamps grew up dominated *Typha* (cattail). *Azolla nilotica* thrived in the brackish and saline conditions early in the century, but became extinct after 1920 when nutrient levels began to increase. *Azolla filiculoides* was introduced to the delta as a fertilizer and it spread across the lake in the 1990s.

Any control of the weeds on the lake should be considered from the separate aspects of the biological effect on the fishery and the improvement in the work and life of the fishermen.

3.2. Water Hyacinth Infestations In Egypt

The water hyacinth, *Eichhornia crassipes*, is native to South America and was first introduced to Egypt during the rule of Khedive Tawfiq (1879-1892) for its decorative inflorescence of blue flowers. Since its introduction, water hyacinth was found in several areas at the northern part (Lower Egypt) and no problems were resulted from its existence.

In 1958, this weed started to spread in many drains and canals from middle Egypt to the Mediterranean. By the end of 1965, this weed flourished over about 40 million square meter of water surface area of water courses in Egypt. As a result, Egyptian authorities launched a national program to remove this weed from water courses. By February of the year 1967, Ministry of Irrigation was able to eliminate aquatic weeds from 65 million square meter of water surfaces. Between 1967 and 1975 many other types of aquatic weeds were created due to non-existence of *Eichhornia crassipes* that used to prevent sunlight required for their growth. By the spring of 1975, more than 80% of the whole canals and drains were infested with different types of aquatic weeds. Accordingly, national programs for channel maintenance and weeds control were adopted in a regular basis**.**

Fact

Field monitoring showed that more than 40% of the canals are infested with submerged weeds (*Potamogeton pectinatus, P.nodosus and P.crispus*). A numerical procedure for design of canal with submerged weeds has been worked out. The procedure is based on the Manning's formula considering factors such as vegetation density and different types of distribution of submerged weeds along the canal cross section.

The numerical solution is an iteration process within the capabilities of scientific pocket calculator (Bakery, 1992).

Distribution of water hyacinth in Egypt

Simpson (1932) reported that during the period 1926-1931 he had seen water hyacinth near Cairo, Alexandria, Damanhour (Beheira Governorate), Demiat, the area extended

from Belbees (Sharkia Governorate) to El-Manzala Lake (Dakahlia Governorate) where it was causing a serious problem in Baher El Bakar drainage system.

Fayad (1982) first surveyed water hyacinth in Egypt in the early 1980's. The results of the study showed that water hyacinth was widely distributed in all governorates of the Nile Delta including the governorates of the Mediterranean coast and in the governorates of Giza, Fayoum, Beni-Suef, Minya and Assiut. At that period the most southern governorates of Sohag, Qena and Aswan were free of water hyacinth.

Another survey was conducted in 1997. The results indicated that the High Dam was free of water hyacinth. Few scattered infestations were found in the "Khoors" 12 km north of the High Dam and the infestation increases further north. After the construction of the High Dam the flooding seasons ended and flushing of water hyacinth plants through the river to the Mediterranean Sea has been stopped. As a result, water hyacinth plants started to spread upstream through the southern governorates. The clearance of El Sud Lake (Nasser's Lake) of water hyacinth proves the fact that Sudan was not the source of water hyacinth infestation to Egypt.

Weed Control In Egypt

Egypt has 38000 km of canals and drains which are heavily infested with aquatic weeds. The River Nile and main canal irrigation and drainage systems are under the care of the Ministry of Public Work and Water Resources.

About 6000 km of channels are treated with herbicides mainly acrolein, ametryn, dalapon and glyphosate (Khattab and Gharably, 1988). In a case study results showed that velocity distribution through the water of a channel being injected by acrolein might affect seriously the performance of the herbicide. In kafr-Hakim a canal with uniform velocity, 100% of the submerged weeds were killed while this percentage was reduced to 60% in Abu Talab canal where 30% of the water cross-section was nearly a dead zone.

Temperature is also very important factor for both chemical injected for submerged weeds and for those applied to control ditch bank weeds. Results reveal that in Egypt (Khattab and El-Gharably, 1988) submerged weed *Potamogeton spp*. And *Ceratophyllum demersum* can be controlled at 5-12 ppm when water temperature is more than 150C, while these doses should be increased up to 50% if temperature is less than 150C.

Research and extensive field use during a period of 10 years with acrolein showed that this chemical is not toxic to irrigated crops at concentrations required to control submerged aquatic weeds (Timmons et.al., 1969, USDA 1963).

In Egypt, doses of 5-15 ppm of acrolein are used for control of submerged weeds and algae, and, no injury to crops has been reported by farmers. Acrolein has a very positive effect on *Potamogeton crispus*; *P. pectinatus; Ceratophyllum demersum*; *Najas armata* and algae. It has unsatisfactorily control of *P. nodosus* because of partly floated leaves in the Egyptian channels. The Ministry of Irrigation prohibits the use of water for human, livestock and irrigation for 48 hours after the acrolein injection in the channel.

Poor mixing of the herbicide may affect seriously its performance. Results show that the herbicide should be injected down stream of regulators, weirs or bridges. In canals with bed width of 15-30 m chemical should be injected in two points, while 3 points are needed for canals having bed width of 30-40m. It is not economic to treat canals of bed

width more than 40m. In channels having larger discharge, mechanical or biocontrol system are recommended.

It is worth stating here that it is not economic and not advisable to inject channels having discharge more than 2 million in m3/day (23.1 m3 /sec.) except in very special cases. In channels having large discharge mechanical or biological control is recommended (Khattab and Gharably, 1990)

Khattab and Gharably (1990) have developed a herbicide gravity feeder. During the operation of the new system, the herbicide drum is laid down on a variable height stand of maximum height one meter. The stand is made of steel and its height can be adjusted for the total head (H) from 1m to 6 m (Table 3).

The total head is the distance between the water level in channel and the center line of the drum (Fig. 26).

In Egypt, the (Ministry of Public Works and Water Resources - MPWWR) started to use glyphosate for controlling ditch banks and emergent weeds. Results showed that concentration of 2% is enough to kill all types of common ditchbank and emergent weeds. The herbicide should be applied between June to August when temperature is more than 30oC.

The Control Of Water Hyacinth In Egypt

A successful mechanical control program is ongoing. Water hyacinth causes a serious problem in the northern lakes of Mariout, Edko, Manzala and Borolos. The four lakes reported to be heavily infested with water hyacinth and mechanical control is not an efficient method. Furthermore, serious water hyacinth problems occur in the small canals of the farm irrigation and drainage systems. Both systems are the responsibility of the farmers and manual control is the only applied method.

At present and since 1990, the Egyptian authorities have banned the use of herbicides in all water surfaces in Egypt due to environmental concerns. Therefore, alternative methods for the control of water hyacinth should be developed in a long-term approach. These methods should be ecologically friendly and economically viable leading to significant reduction of water hyacinth infestation. As a result, integration of biological, mechanical and manual control should be applied.

Biological control agents (the weevils *Neochetina bruchi* and *Neochetina eichhorniae*) were released in Egypt in 2000 to control water hyacinth (Fayad *et al*. 2001, in Julien 2001). The status of *N. bruchi* following release is under evaluation (Fayad *et al*. 2001, in Julien 2001). The status of *N. eichhorniae* following release is under evaluation (Fayad *et al*. 2001, in Julien 2001).

3.3 The Freshwater Crayfish, *Procambarus clarkia*

The freshwater crayfish, *Procambarus clarkii* (Girard, 1852) is known to receive a great environmental and economic importance. It was introduced into the Egyptian freshwater bodies in early 1980s. Through the last decade, the invader has become a substantial member of the Egyptian aquatic fauna in considerable areas of Egypt. It is considered as one of the largest crustacean animal in the most freshwater systems. Two species were recorded in Egypt; the red swamp crayfish *Procambarus clarkii* and the white river

crayfish *p. zonangulus* (Ibrahim *et al*. 1995 and 1997). These authors found that both species coexist in mixed population, though *Procambarus clarkii* showed a remarkable predominance over *p. zonangulus*.

In Egypt p. clarkia had invaded most of the governorates of upper and Lower Egypt. Its distribution has extended from Northern Delta to Assuit (Saad and Emam, 1998).

The presence of this animal in Egypt in large numbers without any control or natural enemies caused several troubles for both farers and fishermen. Its burrowing behaviour caused considerable agricultural damage to irrigation systems and crops. They burrow in the barriers or dams between the fields causing the water to flod the fields; and they feed on the shoots of some crops (Huner and Barr, 1991). Also, they cause damage to the fishing nets and may attack the fishes inside them.

On the other hand, this crustacean animal can be infected with several microbial, protozoan and helminthic diseases. Such diseases are harmful for the crayfish itself and to human. One of them is the crayfish plague which is caused by the fungus *Aphanomyces astaci* and causing a great loss of the animals affecting their cultivation (Huner and lindqvist, 1991). Some diseases can be transmitted to human by eating the uncooked infected animals; *p. clarkii* was naturally acting as a paratenic as well as intermediate host for the rat-lung nematode by harbouring its third larval stage causing meningoencephalitis to human (Soliman,1998).

Although the crayfish is widely distributed in the Egyptian freshwater systems, there is a little information about this species (IAA Newsletter, 1995).

3.4. Invasion Of A Snail Vector Of Schistosoma

Invasion of the Nile Valley in Egypt by a hybrid of *Biomphalaria glabrata and Biomphalaria alexandrina,* snail vectors of *Schistosoma mansoni*

Survey showed that a hybrid of *Biomphalaria glabrata* and *Biomphalaria alexandrina* has invaded the irrigation and drainage systems in the Nile Delta and the Valley nor the El-Menya. However, the infestation of water courses by and the population density of this snail were variable in various localities. The infestation rate ranged between 7.1% in El-Fayoum Governorate and 52.6% in El-Dakahliya Governorate and the snail density from 2 snails/site to 69.7 snails/site in the same governorates, respectively. Comparing the survey results of the two study years in the sampling sites indicated that the hybrid snail has relatively increased in population density than *B. alexandrina*. The hybrid snail of *B. glabrata* and *B. alexandrina* was found alone in some sites, but was mostly associated with *B. alexandrina*. The results showed also that both *Biomphalaria* have almost the same major physicochemical requirements. However, the hybrid snails and *B. alexandrina* were found differently associated with aquatic snails and plants. The hybrid snail was found naturally infected with *S. mansoni* thus giving indication that it is presently participating in *schistosomiasis mansoni* transmission in Egypt.

Selected photos

Phoenix dactylifera

Casuarina stricta

Calotropis procera

Olea europaea

Cynanchum acutum

Amaranthus lividus

Adiantum capillus veneris

Najas marina

Ceratophyllum demersum

Myriophyllum spicatum

Phragmites australis

Typha domingensis

Potamogeton pectinatus

Juncus acutus

Juncus rigidus

Spergularia marina

Asparagus stipularis

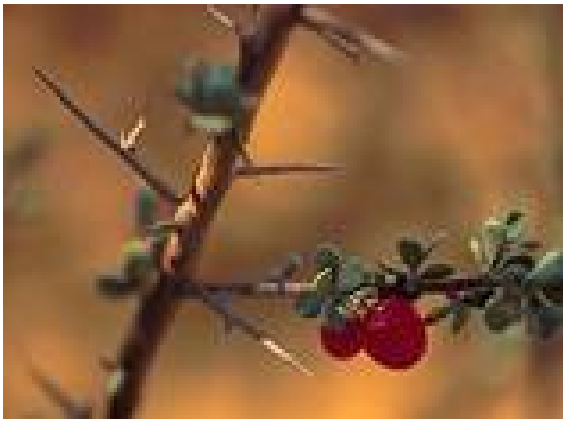
Malva parviflora

Limoniastrum monopetalum

Hyoscyamus muticus

Cressa cretica

Calligonum polygonoides subsp comosum



Nitraria retusa

Alhagi graecorum

Agama spinosa

Uromastyx aegyptia

Acanthodactylus pardalis

Chalcides ocellatus

Psammophis aegyptius

Walterinnesia aegyptia

Naja naja

Naja nubiae

Crocodylus niloticus

Trionyx triunguis