VEGETATION OF KUWAIT

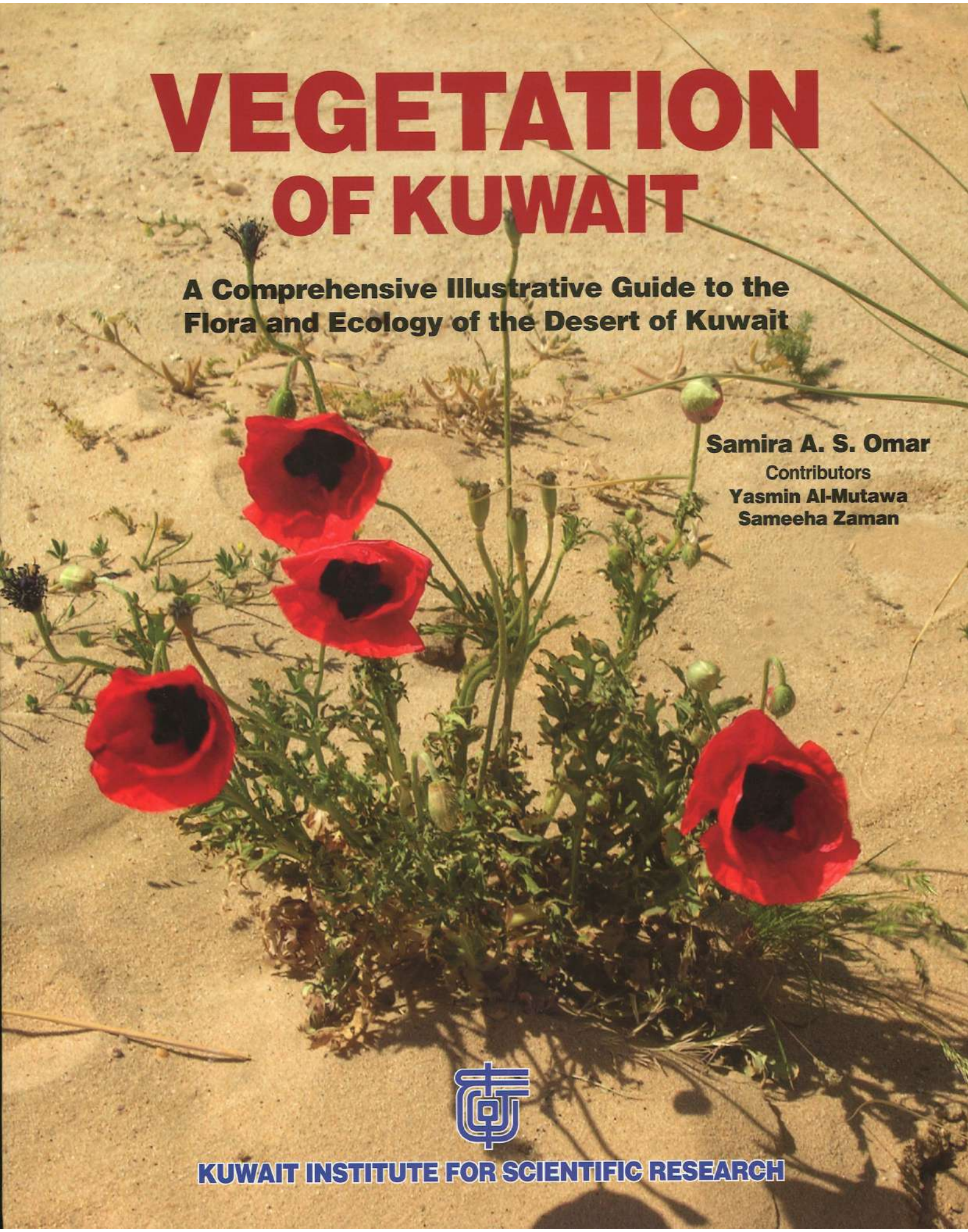
A Comprehensive Illustrative Guide to the Flora and Ecology of the Desert of Kuwait

Samira A. S. Omar

Contributors

Yasmin Al-Mutawa

Sameeha Zaman



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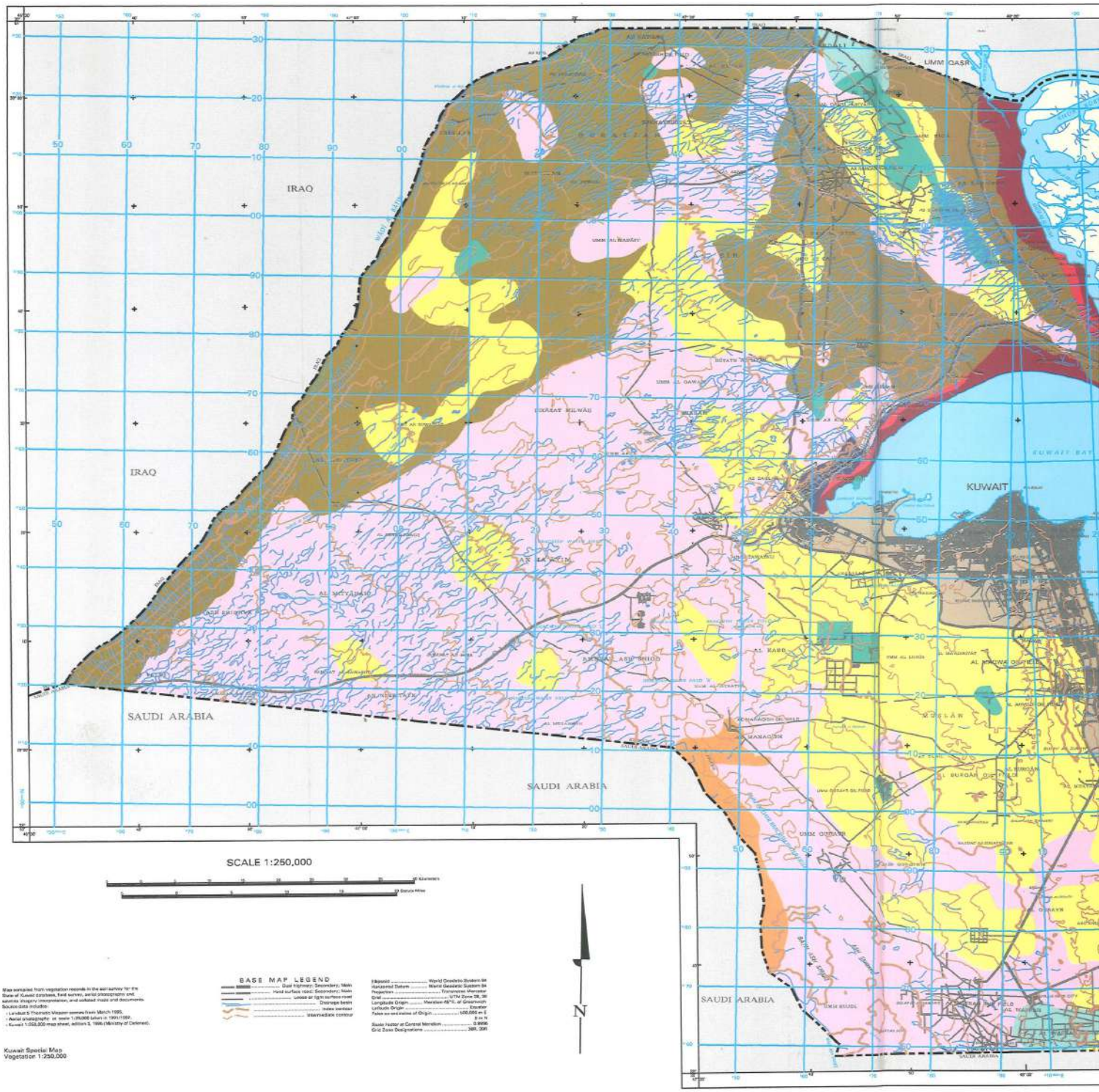
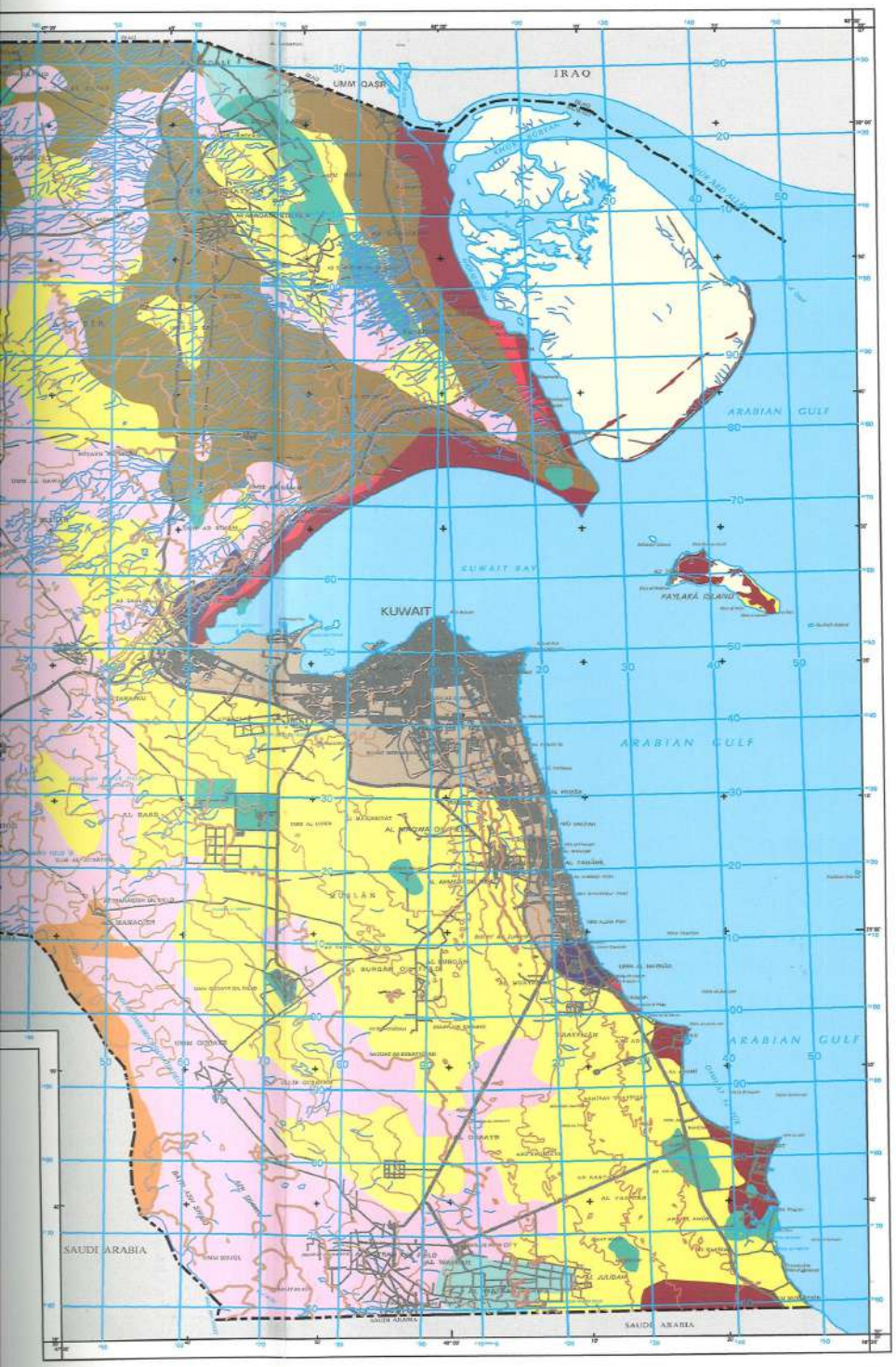


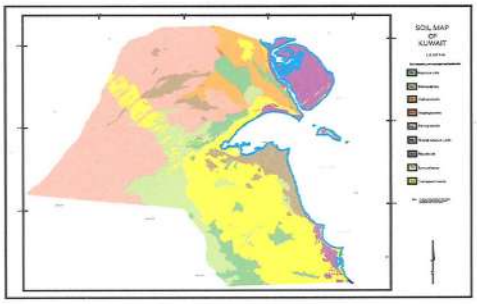
Kuwait Special Map
Vegetation 1:250,000

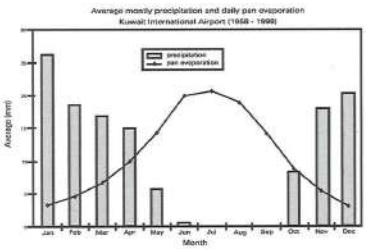


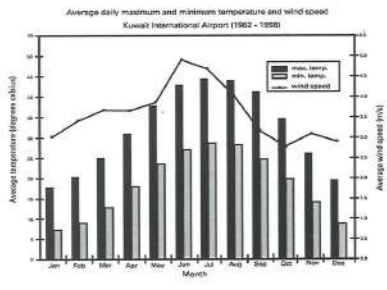
VEGETATION MAP OF KUWAIT

LEGEND

Vegetation Unit	Dominating Community Type
Centropodietum	*Centropodia forskalii*
Cyperetum	*Cyperus conglomeratus*
Halophytetum	*Nitraria retusa, Tamarix aucheriana and others*
Haloxyletum	*Haloxylon salicornicum*
Panicetum	*Panicum turgidum*
Rhanterietum	*Rhanterium epapposum*
Stipagrostietum	*Stipagrostis plumosa*
Zygophyllotum	*Zygophyllum qatarense*
Agricultural area	
Urban area	
Bare	







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VEGETATION OF KUWAIT

A Comprehensive Illustrative Guide to the Flora and Ecology of the Desert of Kuwait

SAMIRA AHMAD SAYED OMAR

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Samira Ahmad Sayed Omar has been a Research Scientist at the Kuwait Institute for Scientific Research in the Aridland Agriculture Department since 1973. She holds a B.Sc. degree in botany and chemistry from Kuwait University, and an M.Sc. in range management and a Ph.D. in wildland resource science, both from the University of California, at Berkeley. She has developed and managed several projects at the Institute related to range management, soil survey, rehabilitation of degraded rangelands and biodiversity conservation. Dr. Omar is active member in many local and international environmental organizations and has several publications in refereed journals and proceedings. Dr. Omar is the team leader who executed the work and prepared the chapters of this book. She also contributed in the photographic presentation.

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FORWARD

In arid regions, where wind erosion and sand encroachment are common problems, vegetation is especially important. Kuwait is an aridland that faces serious problems in land degradation. The natural vegetation, is heavily utilized by different users for essential materials such as feed and fiber. The vegetation also provides a living niche for many wildlife species such as insects, birds, reptiles and mammals. During Spring and heavy rainy seasons the desert is exceptionally beautiful being covered by a colorful mantle. Many authors who tried to identify the plant species have explored the desert and are aware of its solitude and beauty.

For many years the Kuwait Institute for Scientific Research (KISR) has been conducting research projects that assess the status of vegetation and recommend rehabilitation measures for degraded areas. KISR has contributed to conserving and protecting wildlife habitats by setting aside an area (40 km^2) in Sulaybia to the southwest of Kuwait City. Since 1975, this site "Sulaybia Field Station" has been protected from grazing to help preserve the desert ecosystem and its components. The Institute also conducted research projects that resulted in the allocation of the Sabah Al Ahmad Natural Reserve (330km^2) that will promote conservation efforts.

The inspiration of this book came from more than 25 years of field work carried out by the author and others in projects related to range management, soil survey and classification, establishment of protected areas, rehabilitation of degraded rangelands and biodiversity conservation. During the repeated field visits, plant species were identified and closely assessed to record necessary information on their status, attributes, and distribution. The dynamics of vegetation and its response to environmental changes are regularly monitored. Based on these observations, this pictorial book of plant species was developed to provide readers with useful information on species identification and primary plant community characteristics and distribution.

I wish to extend my gratitude to the working team who pursued their goal efficiently. Special thanks are also due to all those who contributed in preparing this document particularly to the staff of the Aridland Agriculture Department of the Food Resources and Biological sciences Division at KISR.

Director General
Kuwait Institute for
Scientific Research

PREFACE

The endless horizon, the sound of silence, the feel of the dry desert wind, the radiant sunlight that makes your eyes eager for cover and the aromatic fragrance of the desert blossoms after the rain. These are the general characteristics of the desert in Kuwait, an Arabian desert located in the far eastern corner of the Arabian Peninsula. Few people are immune to the charm and magnificence of the desert. Those who have experienced the desert know that it can arouse a lifelong desire to learn more and simply be there.

This part of the Arabian Desert witnessed a high pace shifts in social and economic status of the people from simple (Bedouin and pearl divers) to a more wealthy, modern and sophisticated lifestyle. Yet, the love for the desert is deeply embedded in the culture of Kuwaiti public. To date, people camp in the desert during the mild weather and despite changes in the traditional tribal lifestyle, sheep and camel herding are still being practiced. This strong tie between the people and the desert is inherited from one generation to another, and the desert continues on in its own majestic beauty which people find irresistible.

Information on desert plants, particularly those aspects that are unique to the area such as their survival mechanisms, distribution, values, and potential uses, are presented in this book. Useful tips for undertaking desert trips are provided to make desert exploration both safe and more exciting. Procedure for plant specimen collection and photography are described. Conservation measures that are being implemented by the government are highlighted to broaden the reader's understanding of technologies and the need for biological diversity conservation. The author's intent for publishing this book is to heighten curiosity and advance the understanding of the native vegetation of Kuwait and to probe the interaction among plants, animals, and the physical environment.

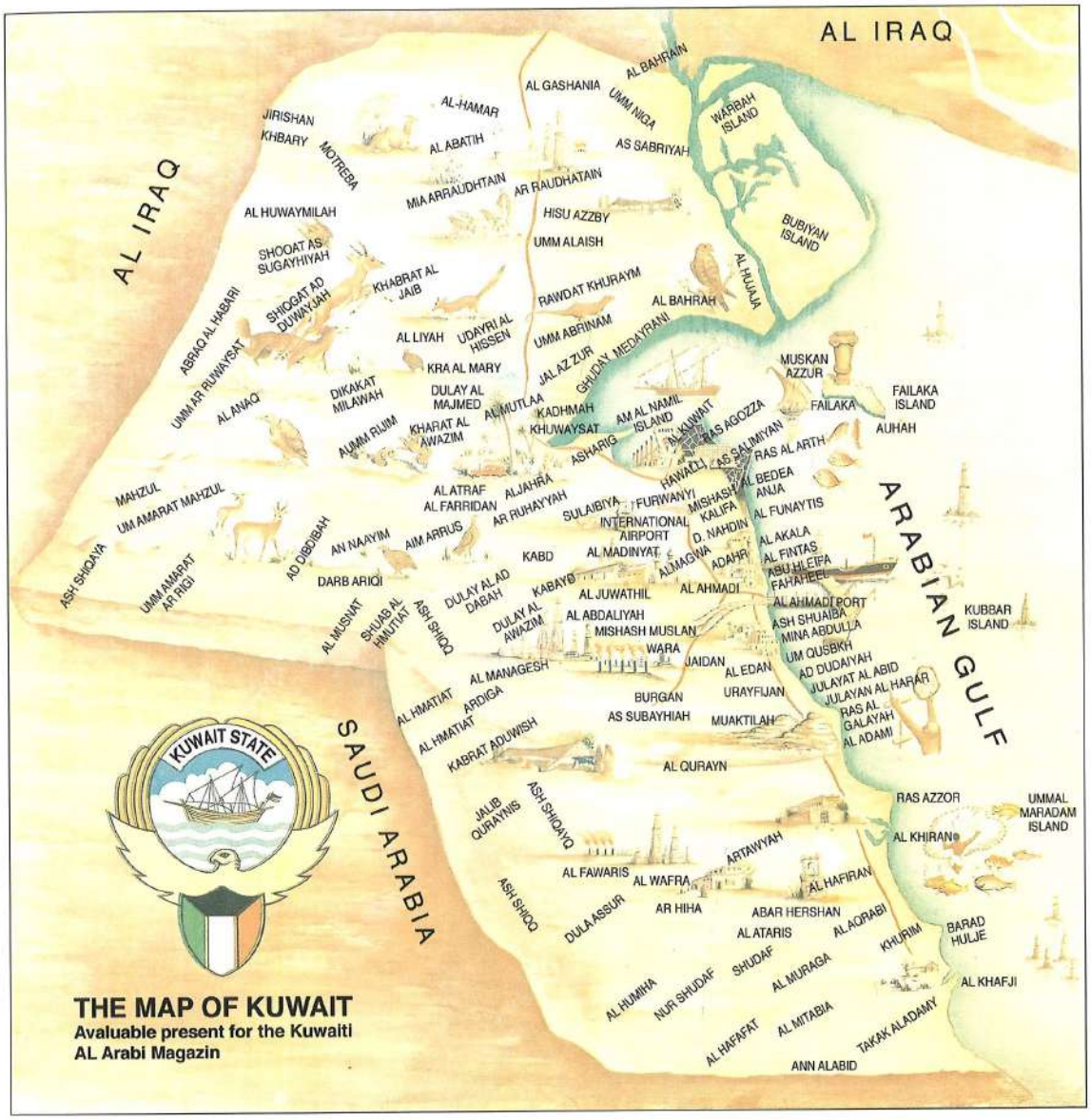
This particular work has involved a lot of time and patience on the part of the staff in the Aridland Agriculture Department at KISR. Special thanks are due to Management of KISR for their support and approval to publish this document.

Thanks are also due to staff members on the Aridland Agriculture Department on the Food Resources and Biological Sciences Division KISR.

The author

Dr. Samira A. S. Omar

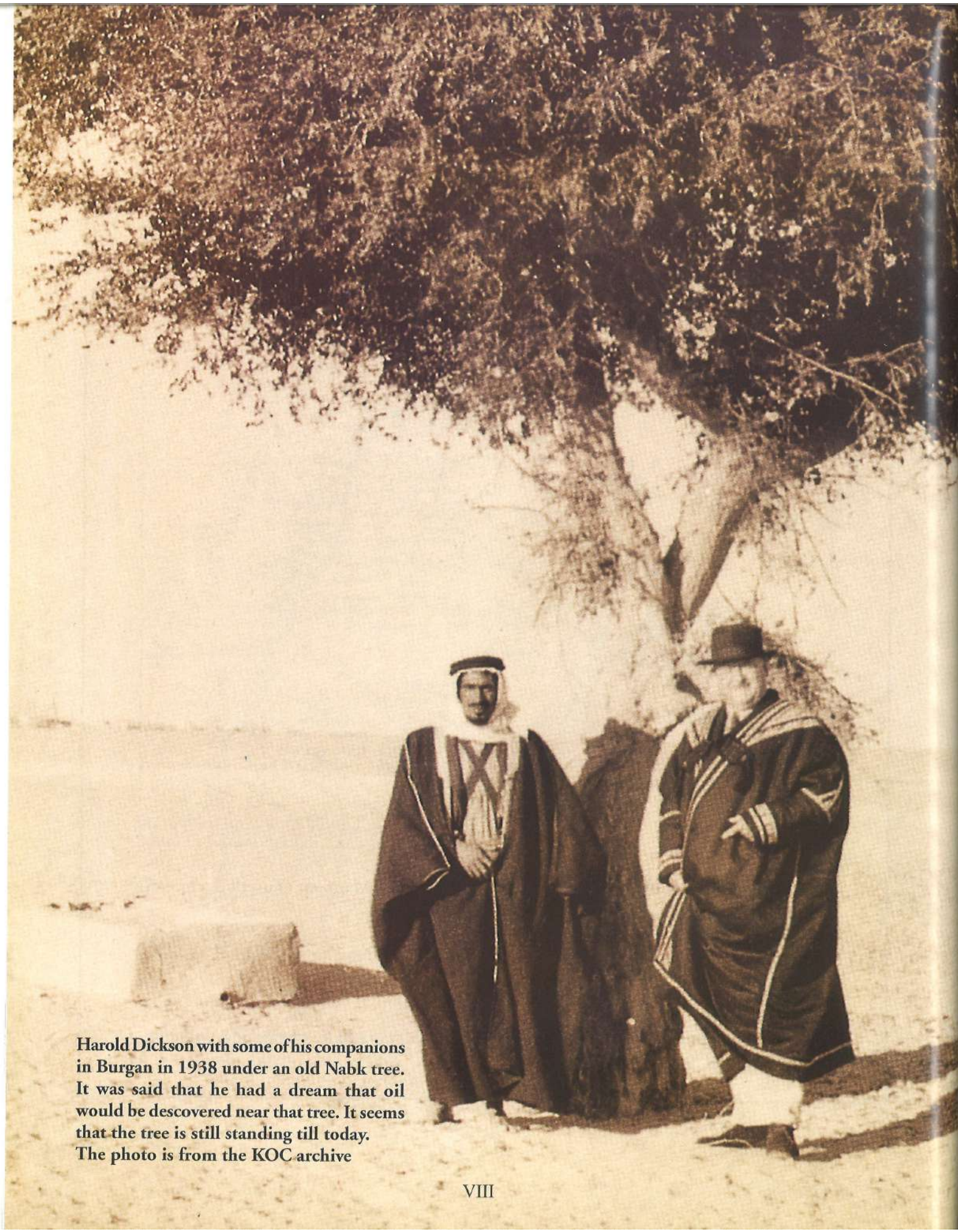
From the past to the present



The Biodiversity Map of Kuwait published by the Al Arabi Magazine (Kuwait in the early sixties). Private collection of Mr. Saleh Khalid Al Misbah.

- Sheep and Camels grazing lands.
- Industrial Establishments.
- Reptiles, birds and marine species.
- Hares, gazelles, foxes, and wolves.

This map shows the desert of Kuwait before it has been devastated by overgrazing, pollution, desertication and urban expansion.



Harold Dickson with some of his companions in Burgan in 1938 under an old Nabk tree. It was said that he had a dream that oil would be descovered near that tree. It seems that the tree is still standing till today. The photo is from the KOC archive

CHAPTER I

THE DESERT ENVIRONMENT AND CONSERVATION

CLIMATE AND LANDSCAPE

The State of Kuwait is situated at the northwestern corner of the Arabian Gulf between latitudes 28° 45' N and 30° 06' N and longitudes 46° 33' E and 48° 35' E. The total land area of the country including the land areas of the offshore islands is approximately 17,818 km^2 (1,781,800 ha).

During the summer, the desert is extremely harsh with mean maximum temperatures of over 44.7°C. Dust and sandstorms, locally known as "Toze" are common during the summer, particularly during July. During this period, most annual plants remain dormant in their seed form and growth of perennials greatly subsides.

During the winter, the air temperature is cool and pleasant dropping to around 8°C. Precipitation is scanty and normally confined to the mild season from October to May. Rainfall is irregular in amount, frequency and distribution. The mean annual rainfall is 113 mm. These conditions are most favorable for annual seeds to germinate, and for perennial plants to revive and generate new shoots. When precipitation drops below the average and drought prevails for several years, annual plants remain dormant in the form of seeds until conditions improve.

Landform and soil characteristics determine distribution, abundance, and survival of plant species. The soil of Kuwait is mostly sandy in texture, has a high infiltration rate and is calcareous in nature. The high salinity in the soil and the presence of a carbonate layer, locally known as "gatch", are the prime constraints to plant establishment. The gatch layer is consolidated, preventing both water and root penetration to deeper layers. The high salinity also prevents most plants from establishing, except for salt-tolerant plants such as the halophytes.

The soil surface and the general landscape of the desert are dynamically influenced by two seasonal factors: water during the winter and wind during the summer. The prevailing high-speed northwesterly winds are hot and dry during the summer. Their speed and dehydrating effect move masses of sand sheets towards the southeast,

1. A dusty day in the desert of Kuwait.

2. Children inspiring by desert blossoms during Spring, 1975, in the Sabah Al Ahmed Natural Reserve near Wadi Umm Ar-Rimam. Notice the thick coverage of the Rhanterium community in the park area.

particularly in areas where the vegetative cover is naturally scanty or has been removed by grazing.

When the vegetative cover is removed, the sand sheet loses its protection and wind starts to impact the sediments on the soil's surface. The organic topsoil, which is an important medium for plant growth, becomes deflated. Wind continues to act on the exposed sediment, where fine material and seeds are situated, and this leads to deflation of granules and coarse material that are concentrated on the surface of the sand sheet. The morphology of the sand sheet changes from domal sand accumulations to rippled sand sheets and granule ripples. This last stage of land degradation is the most severe for plant regeneration and seed germination. Sand sheet movement forms an uneven conveyor belt of sand sheeting 20-50 km wide extending 168 km from the northwest to the southeast (Khalaf et al., 1984). The sand belts are continuously growing and getting wider, being regularly supplied with sand every summer by the process of wind erosion and sand deposition.

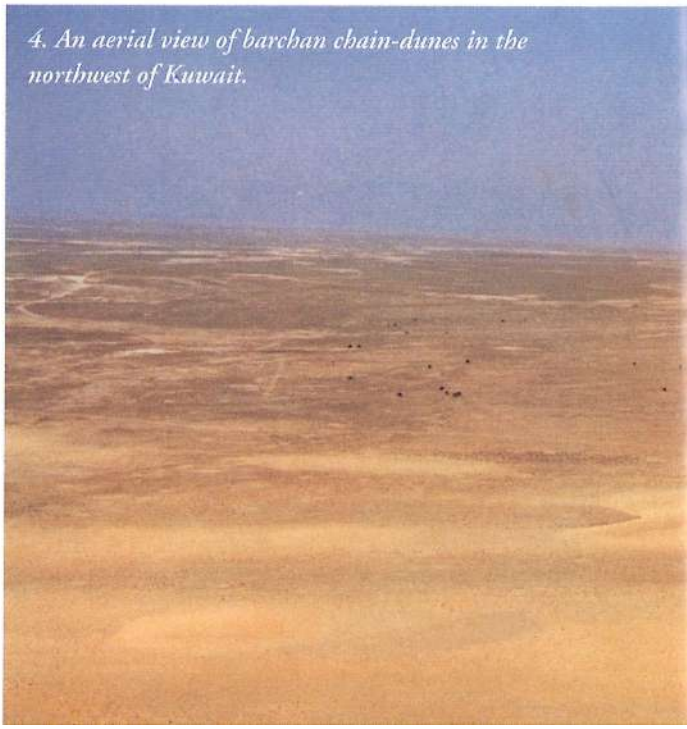
The wind helps to form the classical picture of the desert landscape. It carries and deposits fine soil particles from the bare gravel plain to shape the dunes. This natural phenomenon creates two types of dunes in Kuwait: free barchan dunes and anchored dunes, known as "nebkha."

Free barchan dunes are crescent-shaped and vary in size. They have recently been formed during the last decade, particularly in the northwest at Al-Huwaymiliah and in the northeast at Umm Niga. The formation of the dunes starts with the growth of flat patches of sand, about 80-100 m^2 and not more than 30 cm high. These patches then grow into sand mounds about 2 m high. A slip face is developed, and the sand mounds become small barchan dunes. The crescent shape is due to the blown grains passing over the horns more easily than over the center of the crescent. Over a few years, the height of these dunes can reach 4 m; they often occur in family groups forming the barchan chain-dunes.

Barchan dunes are formed where there is a scarcity of sand and a predominant wind direction. They can reverse their shape if the wind direction changes, and they can move across the desert floor some 50 m or more a year.

Anchored dunes, known locally as "nebkha" (plural nebkhat), are stagnant dunes that accumulate around shrubs and occupy a narrow zone along the coastal area of Kuwait from northeast to southeast.

3. Rippled sand sheet invading a naturally cultivated land.



4. An aerial view of barchan chain-dunes in the northwest of Kuwait.

Nebkha dunes have a convex shape with an average diameter of 2-4 m, and they range in height from 0.76 to 1.8m. They are developed by the accumulation of aeolian sands and muddy pellets around halophytic shrubs (salt loving or salt tolerant shrubs). A nebkha ecosystem is still maintained in the northern area along the eastern coast of Khor As Subiyah and along the southern coast of Bobyan Island. In the southern coastal area, the nebkhat have deteriorated where their vegetative cover has disappeared. Remnants of nebkhat can still be seen in some localities in the southern coastal areas covered with *Nitraria retusa* shrub.

The process of sand transportation and soil erosion is influenced by wind and water erosion. Winter rain flows down the gentle sloping walls of wadis, eroding soil and forming gullies. Seeds are washed away with sediments and are deposited in lowland areas or in the bottom of wadis, where water collects forming playas. Playas, locally called "khobrat" or "thamilat," are small depressions. They range in area from about 1 to 4 km^2. Many playas have been formed in Kuwait. In the northwest, large elongated playas occur in the depressions between residual gravel-capped ridges. In the northeast, two large playas have been recognized, one occupying the central part of the Umm Al-Aish depression and the other in the Umm Ar Rimmam. In the south, playas occupy shallow depressions.

Wet khobrat attract many herdsmen who camp near them and use them as an important source of drinking water for their livestock. When the water evaporates, the soil in the khobrat becomes good ground for many annuals and perennials to grow in, such as the iris (*Gynandriris sisyrinchium*) and the morning glory (*Convolvulus pilosellifolius*)

5. Nebkha dunes are found in the northern and southern coastal areas of Kuwait.

Infrequent heavy rains also collect at the bottom of saline depressions, forming salt marshes known as "sabkhat". Because of the high water table, high soil salinity and the high evaporation rate, the water collected in the soil marshes is very saline. When evaporated, it crystallizes and adds a sparkle to the cracked earth. Only salt-tolerant (halophyte) plants can grow in these grounds. They tolerate the high salinity by developing a special mechanism in their systems. Seeds trapped in the sabkha may never germinate due to the high osmotic pressure of the lake. However, those that are adapted to high salinity can germinate, such as the following species *Tamarix, Nitraria, Bienertia, Cressa, Aizoon, Salsola, Zygophyllum, Halocnemum* and *Seidlitzia.*

6. Dry sabkha with Cressa cretica community type at Al-Nuwaiseeb.

BIODIVERSITY OF THE DESERT

FLORA

There are 374 species belonging to 55 families that have been identified in Kuwait by Boulos and Al-Dosari (1994). The majority are annuals (256 annuals) with 83 herbaceous perennials, 34 shrubs and under-shrub species, and only one native tree species, locally known as "talha" (*Acacia pachyceras*). Dickson (1955) who came to Kuwait in 1929 reported talha. It is suggested that the tree is over 80 years old. The Public Authority for Agriculture and Fish Resources (PAAFR) tried to protect the tree by erecting a fence around it. However, this approach of protection failed as many people camped inside the fence and lit fires. In 1990, the tree collapsed and split into two halves. Fortunately, in 1992, the tree survived and sprouted new branches (Plate 7). There are other naturalized trees to Kuwait such as Al-Sidr (*Zizyphus spina-christi*). The author noted the tree in an old photograph taken with Colonel Dickson standing near it (Al-Rashoud, 1997).

There are many rare plants that thrive during favorable environmental conditions. These plants grow in particular habitats such the islands; Failaka and Bobyan, or in Wadis and depressions such as Wadi Umm Ar-Rimam and Al-Batin. Among the list of rare plants are *Aaronsohnia factorovskyi, Anagallis arvensis, Ducrosia anethifolia, Bellevalia saviczii, Cynomorium coccineum, Typha domingensis, Ixiolirion tataricum, Echium rawolfii, Salvia spinosa, Salvia lanigera, Teucrium oliverianum, Teucrium polium, Onobrychis ptolemaica, Ochradenus baccatus, Astragalus sieberi, Silene arenosa, Pulicaria undulata, Papaver rhoeas, Scorzonera papposa,* and others.

FAUNA

Countries in the Gulf region such as Saudi Arabia, Oman, and Bahrain have designated areas to protect endangered species such as the Houbara Bustard (*Chlamydotis undulatua*), and to reintroduce into the area Arabian mammals that once existed in abundance such as gazelles (e.g., the Reem Gazelle, *Gazella subgutturosa*) and the Arabian oryx (*Oryx leucoryx*).

Records on terrestrial fauna of Kuwait indicate specie's scarcity with close affinity to those of neighboring countries. Such fauna are an integral part of the social and cultural tradition of Kuwaiti people, and, hence, they are as important as the marine coastal fauna. To contibute to the world's

7. Talha tree Acacia pachyceras is a significant-landmark in the National Park of Kuwait. It collapsed during the Iraqi invasion. Top: talha in 1985. Bottom: talha in 1996.

8. Common reptiles in the desert (Blue-throated agamids Agama blandfordi)

efforts in conserving biological diversity, wildlife species should be protected from any further destruction.

There are 28 mammalian species, over 350 birds and 40 reptile species that have been recorded in Kuwait. Out of the 350 birds, there are 18 resident birds that live and breed locally. The rest are migrant. Kuwait is situated at the crossroads of several major bird migration routes; occasionally about one million birds pass through the country each year. Due to the draining of wetlands in Iraq, the intertidal areas in Kuwait currently serve as important feeding and refueling areas for shore birds. The coral islands Kobar, Qaroh, and Umm Al-Maradem are important breeding sites for four species of tern and the *Socotra cormorant*.

Eight of the mammalian species have been eradicated, and 50 species of birds that once bred on the offshore islands are now only visitors. Complete information concerning the status of the reptilian fauna does not exist.

On the endangered or extinct list of Kuwait are eight mammals: the fennec fox (*Fennecus zerda*), the common red fox (*Vulpes vulpes*), the honey badger (*Mellivora capensis*), the Indian gray mongoose (*Herpestes edwardsi*), the wild cat (*Felis silvestris iraki*), the caracal lynx (*Caracal caracal*) and two sand gazelles (*Gazella dorcas saudiya* and *Gazella subgutturosa marica*). Five birds are on the endangered list: the houbara bustard (*Chlamydotis undulata*), the crab plover (*Dramas ardeola*), the cream-colored courser (*Cursorius cursor*), the brown-necked raven (*Corvus ruficollis*), and the pin-tailed sandgrouse (*Peterocles alchata*) and, finally, several reptiles including the spiny-tailed lizard (*Uromastic microlepis*).

ALTERING DESERT BIODIVERSITY

The desert of Kuwait provides an important source of food, particularly for herdsmen or Bedouins who used it in the past and are still using it today. During the winter season, they move their livestock from one location to another in search of water and pasture. In the past, their movement in

9. Traditional Land use in Kuwait. Tribal movement in search of water and pasture in the pre-oil production period.

the desert was regular and followed distinct routes. Migrating flocks of sheep and goats, and herds of camels that belonged to tribes in Arabia moved through Kuwait's desert utilizing available forage, following occurrence of rainfall and the flow of major wadi systems and drainage channels. During hot summers, flocks moved to areas where more drought-resistant and heat-tolerant plants were available.

For generations, Bedouins turned to plants for healing. Scientists who prescribe them as methods of healing recognize the medicinal values of plants. Some plants contain dyes that are useful for cosmetics and material dying. For example, the roots of *Arnebia decumbens* are dark red and can stain the face with red patches or designs.

The desert also has been used for hunting wildlife. Arabian gazelles and houbara bustard were the most commonly hunted animals. They were abundant and grazed on the shrubs locally known as "arfaj" and "rimth" for food and shelter (*Rhanterium epapposum* and *Haloxylon salicornicum,* respectively). Kuwaiti men went to remote areas in the desert in search of prey. They used skilled falcons and guns to hunt wildlife that still migrate seasonally in the north and south of Kuwait. They would travel for days subsisting on what they would catch.

The vegetation of Kuwait is under severe pressure due to multiple interacting factors such as overgrazing,

9 a. Traditional land use in Kuwait. Upper plates: Logging woody shrublets and resting after herding in old Kuwait in the forties. Lower plate: Old water well found in As Subiyah, 1998.

10. Grazing animals cause soil trampling and dust suspension in air.

uprooting of woody shrubs, increased recreation, gravel quarrying, environmental factors, and natural processes. Poor law enforcement to protect the ecosystem is another cause for the noticeable destruction of the desert ecosystem's components. Additionally, the Gulf War increased the constraints and pressures on the desert ecosystem.

Recently, pastures have deteriorated rapidly and can hardly support any living animal. Rather than traditional pastoral grazing practices, the pastures have been grazed excessively due to commercial livestock production. The distribution of subsidized feed and availability of modern transportation have upset the traditional movement of livestock that once allowed the range to rest from grazing and trampling. The regular practice of removing perennial vegetation for fuel and fodder has added more pressure to the land, therefore, reducing the wildlife diversity and population.

Remote areas in the desert are now more accessible for camping and entertainment. Camping is an integral social activity for the people of Kuwait who annually reside in remote areas for six months or more (October-April or until June). Moreover, mining and quarrying of sand and gravel from areas in the north and south of Kuwait have severe impacts on the desert topography. The removal of the topsoil causes erosion, thus, promoting the loss of existing plants and seeds, exacerbating the already fragile desert conditions.

11. Traditional camping during mild seasons in the desert causes soil compaction and littering problems.

12. Desert bloom in the northeast of Kuwait during Spring, 1996.

Added to this situation, is the existence of unpaved roads in the desert that stretch all over the land like a maze. Off-road vehicle use in the desert causes soil erosion and compaction and, hence, accelerates the process of land degradation.

Since the liberation of the country in 1991, the desert of Kuwait has experienced more alteration in its natural characteristics. The oil lakes, military tracks, ditches, bunkers, mines, and ammunitions have collectively altered the general topography, landscape, and soil characteristics. The oil spills and fallout have directly affected plants. This unique experience has preoccupied scientists as they search for and predict long-term consequences of the Gulf War on the desert ecology.

Despite this environmental stress, it is spectacular to see the desert blooming like a colorful carpet during the winter season, particularly when rainfall is abundant. It rains most frequently between November and April, and less in October and May. After it rains, the soil and air temperatures cool drastically, making the desert a more habitable environment. In areas where there is a high amount of rainfall, an increase in species diversity and composition can be observed.

13. A dry oil lake in Burgan, May 1997.

ENVIRONMENTAL CONSIDERATIONS

The Iraqi invasion of Kuwait on August 2, 1990, and the war activities that followed this period have left many scars on the desert ecosystem. Mechanical activities involving military equipment, vehicles, and machinery, as well as heavy bombing and trench digging have resulted in the removal of vegetation and increased soil erosion.

The most severe element in Kuwait's environmental crisis was the burning oil wells. In early March 1991, more than 700 Kuwaiti oil wells were set on fire by the Iraqi forces. More than 80% of the wells blazed while the rest gushed oil to the soil's surface covering wide areas of the desert. Firefighters used millions of gallons of seawater to extinguish the fires.

The oil spill, aerosol deposits, and seawater use have had an adverse effect on the desert ecosystem. The explosion of oil wells in Burgan and Ahmadi produced enormous volumes of soot and unburned oil in the form of oil-mist, which was carried to distant areas. In areas covered by oil-soot, a thin black crust of about 2-5 mm of slightly compact, superficial soil was formed on the surface. Unburnt oil escaping from exploded oil wells accumulated in low-lying areas to form oil-logged soil where oil penetrated up to 15 cm or more in the soil profile.

The thin crust formed in soot-covered sites did not inhibit the emergence of annual plant species. The soot on the perennial species acted as a physical barrier, and, hence, prevented or at least inhibited gaseous exchanges in plants. The rates of photosynthesis, respiration, and transpiration were affected, which led to the death of the existing leaves of some plant species. In oil-mist sites, thick viscous oil residues covered the perennial species and caused their death. However, newly formed leaves and twigs from the affected plants were behaving normally a few months after the oil fires were extinguished. This was observed in *Cyperus conglomeratus* and *Stipagrostis plumosa*, which produced new tillers from the basal buds.

During January 1992, new seedlings of some annual species started to emerge in sites covered by tarmat. Seedlings of the perennial sedge *Cyperus conglomeratus* and grass *Stipagrostis plumosa* also started to emerge during May 1992. The oil-logged soil lost its porosity and was considered to be completely void of natural vegetation.

14. New tillers are produced from Cyperus conglomeratus in areas covered with tarmat in Burgan.

The surviving species in the oil-soot areas were *Rhanterium epapposum, Moltkiopsis ciliata, Haloxylon salicornicum, Cyperus conglomeratus, Stipagrostis plumosa* and *Centropodia forsskalii*. Only *Haloxylon salicornicum* survived in the oil- mist areas, whereas none of the above-listed species survived in the oil-logged areas.

Crude oil pollution in the form of oil spills and/or aerosol deposits have altered plants structures and their chemical composition. Alterations varied considerably among locations. Areas more distant from the oil spills and oil mist were least affected. Livestock grazing forage plants in areas contaminated with oil in the form of aerosol deposits and/or oil spills that contain high concentrations of heavy metals and hydrocarbons, especially in/on

their grazing parts (shoots), should be cautioned against grazing.

CONSERVATION

The need for conser ving biodiversity in the Gulf region has become increasingly apparent. Accelerated development of the desert has subjected the fragile and vulnerable ecosystems to almost non-restorable condition. The value of biological resources, as an integral part of the natural heritage which can yield sustainable benefits, should not be underestimated. Not only can the establishment of protected areas potentially preserve the natural ecological systems of the national ar ea, but it can also contribute positiv ely to the region's ecological balance, scientific r esearch and education, natural history preservation, recreational opportunities, and tourism.

In response to this situation and to give future generations the oppor tunity to enjoy nature, the Arabian Gulf countries safeguarded their natural environment by dedicating areas for the conservation and preservation of biological diversity. By setting aside areas of significant natural ecosystems or impor tant ecological characteristics (in situ conser vation), steps are being taken to conser ve and preserve the natural history of the terr estrial and marine ecosystems. Examples of this in Kuwait are presented as follows:

IN SITU CONSERVATION

The Sabah Al Ahmed Natural Reserve, Jal-Az-Zor

The Kuwait Institute for Scientific Research (KISR) conducted a two phase study on the park area. The first study (1981-1982) designated the location and provided information on the ecological components of the park area (Omar et al., 1992). The second phase (1984-1986) provided a complete plan for the park zonation and establishment (Omar et al., 1996). The Sabah Al Ahmed Natural Reserve is located in the northwest of Kuwait Bay. Salt marshes, ridges, gullies, depressions, wadis, and desert plain ecosystems characterize it. Perhaps it is the largest terrestrial ecosystem designated so far as a protected area in Kuwait. The park extends from Umm Al-Aysh in the north, to Al Bahrah in the east into Kuwait Bay in the south, and Hoban in the west. The purposes of establishing the Sabah Al Ahmed Natural Reserve area are to allocate an area of physical and biological significance, to use recreationally, to promote education and research opportunities, as well as re-introduce lost wildlife species.

The area is generally flat with minor undulations. The significant physical feature in the area is the Jal Az-Zor escarpment, which rises to about 135 m and runs parallel to the seashore. The escarpment forms a natural watershed.

The deepest depression is Wadi Umm Ar-Rimam located in the northwestern corner of the park.

15. The Sabah Al Ahmed Natural Reserve showing the Jal Az-Zor escarpment in 1995.

16. The gate of Sabah Al Ahmed Natural Reserve facing Al Subiyah Road in 2005.

Reptiles, birds, and mammals comprise the vertebrates of the park. The dhub is the most visible reptile. The agamids (lizards) and snakes are also important reptiles. The rodents generally prefer the sandy desert region with shrub cover, where they usually burrow. The jerboas are found on the more open flat areas of stony desert. Foxes have been observed in Umm Ar-Rimam and Jal Az-Zor. Feral dog packs wander along the coastal stretches and are becoming common.

Of the 350 bird species recorded in Kuwait, crested larks, shrikes, bee eaters, wagtails, little owls, kestrels, and steppe eagles are among the most common seen in the park area. Flamingos, herons, cormorants, shelducks, and crab plovers are mostly found in the coastal region. Houbara had not been recorded in the area until 1995 when a group of hunters using falcons captured six Houbara birds in the park area. Invertebrates, especially insects, are an ephemeral component of the community; the majority only appear for a restricted period of each year.

Due to soil erosion and intensive grazing, the status of vegetation in the area is poor. This became a serious problem after the destruction of the park's fence during the Iraqi invasion period (1990-91).

In the park, significant habitats are dominated by the following genera: *Haloxylon, Halocnemum, Seidlitzia, Nitraria,* and *Zygophyllum.* Endangered species in the park include *Rhanterium epapposum, Calligonum polygonoides, Gynandriris sisyrinchium, Ochradenus baccatus, Halothamnus* and *Convolvulus oxyphyllus.*

Different park functions and uses were proposed by KISR. These functions are: protected areas (strict nature zones, managed nature zones and protected landscapes); recreational (park headquarters, visitor's center, camping areas, and hiking trails); and educational and research areas. Wildlife in the area are either reintroduced as endangered indigenous or introduced as new species that are native to the region (e.g., the Arabian gazelle). Creation of an artificial oasis inside the park's boundaries will serve as an attraction for migratory birds and other wildlife. Newly introduced species will be kept in semi-natural conditions until they become adapted to the new environment. Bird monitoring stations will be established within the park to allow scientific research on their management and protection.

In 1988, the Public Authority for Agriculture and Fish Resources (PAAFR) was assigned the responsibility for establishing the park in accordance with recommendations from the Kuwait Municipality and KISR. However, in 1995, due to the Iraqi invasion and difficulties encountered in re-establishing the park, the responsibility for protecting the area was given to the Ministry of Defense (MOD). In December 1995, the MOD commenced with a protection program by fencing both the northern and southern sections of the park.

Both sections are intercepted by As Subiyah road and two gates were established along both sides of the road. After completing all protection measures by the concerned authorities, permits will be required to enter the park area from PAAFR.

Jahra Pond/Reserve

Located at the narrow edge of Kuwait Bay and covering an area of 2.5 km^2 of salt marshes, the reserve consists of a man-made pond covered by secondary treated sewage effluent flowing across sandy sabkha into the sea. It also has a coastal zone with a tidal area, mudflats, shoreline, and reed beds. Jahra pond is a resting site for migratory birds. The reserve serves as a shelter for both indigenous birds and those displaced from Iraqi marshlands. The site has a good potential to be used for field studies at all academic levels.

It was an unfortunate day on October 30, 1997, when the Jahra pond was set on fire due to sabotage. Luckily, the fire department was able to extinguish the fire. Yet, most of the area covered by the reed *Phragmites australis* was destroyed and many birds were killed. Fortunately, one year later, the grass recovered and the pond was restored by providing an underground water supply.

Doha Reserve

Located on the coastal belt at 29° 22' N 47° 49'E, this salt marsh of a reserve covers 4.5 km^2. The sandy sabkha has halophyte vegetation associated with mudflats and coastal plains, and an important reed stand of *Phragmites australis*. The area is regionally significant, for it is used by numerous bird species for breeding and resting.

KISR's Sulaibiya Field Research Station (SFS)

In Kabd, which is located to the southwest of Kuwait City, a green desert plain covers an area of 20 km^2. In 1975, this area was set aside to establish a satellite field station to conduct range management research and to conserve the renewable natural resources of the associated *Rhanterium/Cyperus* community type. A 2 m high chain fence surrounds it and it has a one million gallon capacity reservoir supplied with brackish water of 3,500-4,000 ppm.

The vegetation in the area is dominated by *Rhanterium epapposum* in association with *Cyperus conglomeratus*. Due to its long-term protection, the area has a thick stand of vegetation and litter. Annuals grow vigorously during each rainy season. Among the common annuals are *Plantago boissieri*,

17. Studying migratory birds at Jahra Pond.

Schimpera arabica, Cutandia memphitica, Lotus halophilus, and *Horwoodia dicksoniae,* a plant named after Dame Violet Dickson. Common perennial species are *Farsetia aegyptia, Stipagrostis plumosa,* and *Panicum turgidum.* The dhub is the most common large lizard, foxes and owls are occasionally observed, and bee-eaters and crested larks are common visitors. Permission to enter the site is required by KISR. A site layout is shown in Fig. 1.

EX SITU CONSERVATION

The Kuwait Zoo

The objective of establishing the Kuwait Zoo is two-fold: to breed wildlife in captivity for educational purposes and to preserve indigenous resident or migratory wildlife species to reintroduce them to the wild. The Zoo also conducts baseline studies on mammals.

Kuwait University Insect Collection

The Zoology Department at Kuwait University maintains the insect collection of Kuwait. Before the invasion, the collection comprised 591 species belonging to 414 genera and 21 orders. The collection was a result of 10 years of intensive surveying of the insect fauna of all biotopes. The collection was looted during the Iraqi occupation, and after liberation, a new attempt was made to reestablish the collection. By the end of 1995, 280 species belonging to 223 genera and 14 orders had been recollected.

Kuwait University Herbarium

The number of native and naturalized vascular plant species in Kuwait as reported in the checklist developed by Boulos and Al-Dosari (1994) is 374. The number of plant specimens in the Kuwait University Herbarium during the pre-war period was 22,000. Some 4225 species have been recollected since1991.

KISR Herbarium

The KISR herbarium contains specimens collected by the author and other research scientists of the Aridland Agriculture Department. It contains 5000 plant specimens and large quantities of seeds were collected from about 80 native plant species during the period 1992-99.

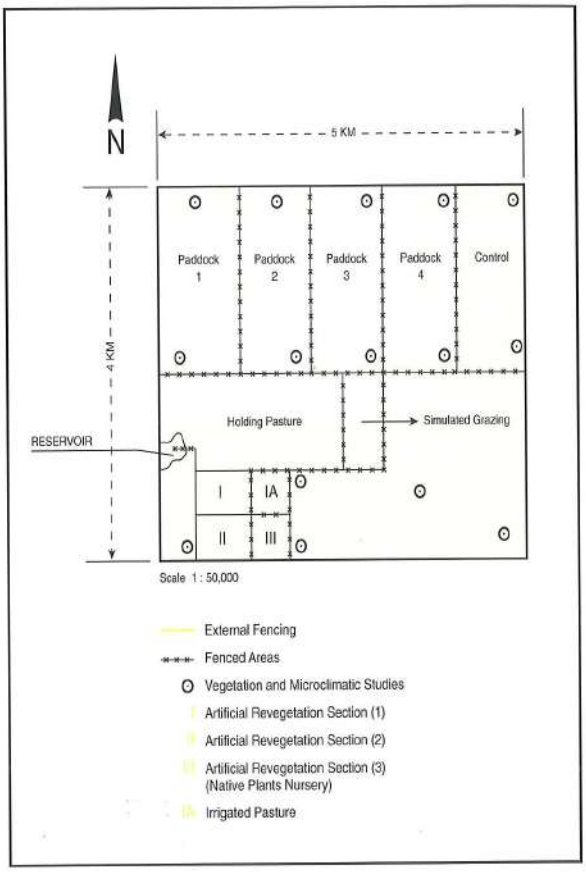


Fig.1 Sulaibiya Field Station with zones of research units.

Science Museum

The Science Museum contains the following numbers of specimens from Kuwait's desert and marine ecosystem: 130 plants, 10 reptiles, 200 insects, 110 fish and marine specimens, 2 birds, and 4 mammals.

Botanical Garden of Kuwait

The Botanical Garden of Kuwait has been proposed and will be established by the Al-Waqf Fund for the Advancement of the Environment. An area of about 176 ha has been designated for the establishment of the garden. The main objectives are to conserve the local flora, demonstrate their potential landscaping use and economic value, and to provide educational and public awareness programs.

Scientific Centre

The Scientific Center was established in the year 2000 by Kuwait Foundation for the Advancement of Sciences (KFAS) in Ras Al-Salmiya, which overlooks Kuwait's bay for educational and public awareness purposes. The Centre consists of an aquarium and desert animal unit with facilities for research and exploration. The Centre includes a group of land and marine species collected from local native habitats and neighbouring countries. It also receives sick animals which are treated by the Scientific Centre specialists and later released back to the wild.

STRATEGIES FOR THE FUTURE

Kuwait signed the International Convention on Biological Diversity which was launched at the Earth Summit in Reo de Janerio, 1992. Though it has yet to ratify the Convention, Kuwait has embarked on the preparation of a National Biodiversity Strategy, the central activity called for by the Convention. The strategy is based on a thorough analysis of the best information available; this is particularly true with regard to an understanding of the status and trends of Kuwait's biological resources, the socioeconomic dynamics that contribute to biodiversity loss, and the prevailing policy and legislative environment.

The overall objective of the National Strategy is to conserve Kuwait's biological diversity, ecological systems and processes. The strategy formulates an integrated approach to biodiversity issues in all sectors and at all levels of governance in Kuwait. The intention is to develop a concise, non-technical, multi-sectoral planning document, which can be readily understood at all levels. The National Strategy presents the primary goals and objectives of biodiversity conservation. It sets out the justifications, and attempts to indicate the value of biodiversity and identify the most important priority conservation issues. The National Strategy also includes an action plan, with appropriate measurable targets that will redress the current situation. The National Strategy contains a series of guidelines for policy makers and decision takers to try and ensure that biodiversity considerations are fully integrated into the national planning and development process.

In 1993, the Environment Public Authority (EPA) established the National Biodiversity Committee. The committee organized many workshops, seminars and programs to develop and embark on the strategy. It also set forward the first legislation for protected areas in Kuwait. Potential and existing protected areas proposed by the Committee are shown in Fig. 2.

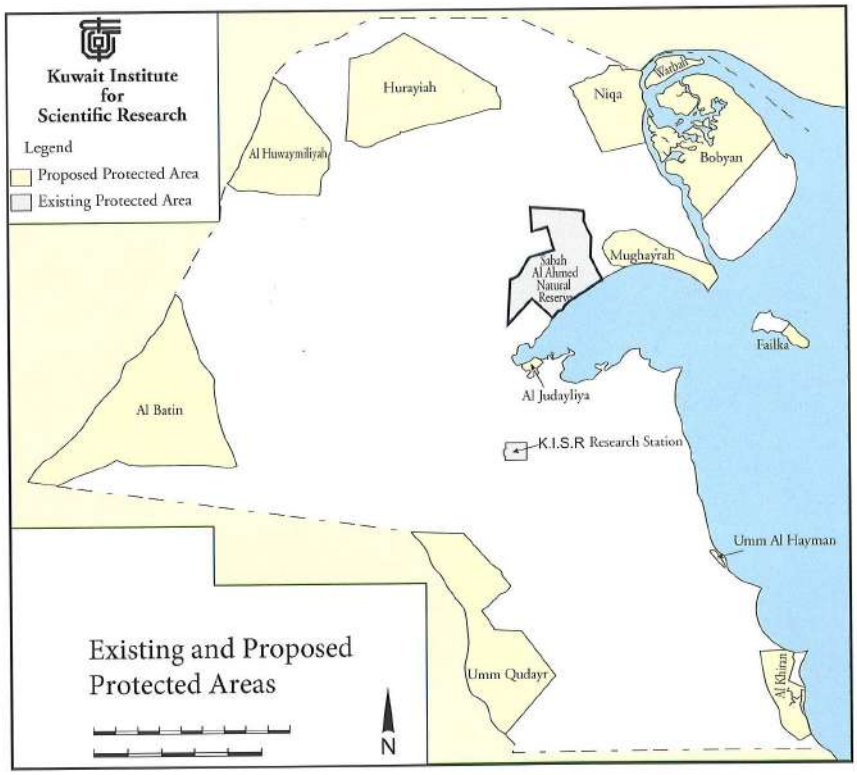


Fig. 2. Locaion of proposed and existing protected areas in Kuwait (1998)

CHAPTER II

PLANT ECOLOGY

HISTORY OF PLANT CLASSIFICATION AND DISTRIBUTION

Plant classification and distribution have received attention from many authors. In 1955, Dame V. Dickson published her book, The Wild Flowers of Kuwait and Bahrain (Dickson, 1955). In the book, a sketched map of Kuwait's vegetation was presented showing the distribution of four plant communities: *Haloxylon salicornicum, Rhanterium epapposum, Panicum turgidum,* and *Cyperus conglomeratus* (Fig. 3).

Kernick (1963) recognized the plant communities identified by Dickson (1955) and added the *Zygophyllum qatarense.* Kernick (1966) modified his earlier map and inserted an *Anabasis* steppe in the *Haloxylon* steppe in the western part of the State (Fig.4).

In 1969, Ergun developed a vegetation map similar to his previous one (Ergun, 1966) identifying the five steppes: *Rhanterium, Haloxylon, Cyperus, Panicum* and *Zygophyllum* (Fig. 5).

Macksad (1969) revealed the vegetation of the neutral zone and showed the communities of *Anabasis setifera* and *Anabasis articulata* in the *Haloxylon* steppe in the west (Fig. 6).

Halwagy and Halwagy (1974) also produced a vegetation map defining the five steppes: *Haloxylon, Rhanterium, Zygophyllum, Panicum,* and *Cyperus.* The map shows that *Panicum* distribution had decreased while *Zygophyllum* seemed to diminish along the coastal zone (Fig. 7).

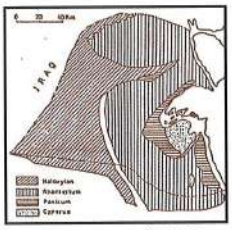


Fig. 3. Vegetation map of Dickson (1955).

Fig. 4. Vegetation map of Kernick (1966).

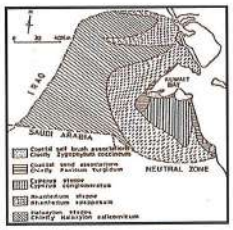


Fig. 5. Vegetation map of Ergun (1969).

Fig. 6. Vegetation map of Macksad (1969).

Fig. 7. Vegetation map of Halwagy and Halwagy (1974).

In 1983, the author surveyed Kuwait's vegetation; the map was presented in 1995 and showed major changes in plant distribution, particularly *Rhanterium epapposum* and *Haloxylon salicornicum* (Omar, 1995) (Fig. 8).

Dieb and Salim (1974) published a book that provided information on the native and exotic plants of Kuwait with drawings and colored illustrations.

Daoud and Al-Rawi (1978) and Al-Rawi (1987) published two volumes on the Flora of Kuwait. A general key to the classification of the flora was provided with some colored illustrations. In 1982, the author developed baseline information on the flora of Kuwait. Information about the plant values, life forms, growth forms, and the methods of propagation was included. The book provided the first database on the flora of Kuwait (Omar, 1982).

Boulos and Al-Dosari (1994) produced a checklist on the flora of Kuwait. Boulos in 1988 also prepared the weed flora of Kuwait. The checklist and the book helped researchers identify local and weed species.

Shuaib (1995) published a book entitled Wildflowers of Kuwait. The book contained a pictorial record of some selected flowering plant species.

In 1999, KISR prepared the vegetation map of Kuwait, which incorporated data generated from the Soil Survey Project (KISR, 1999). The vegetation map is presented in the following section.

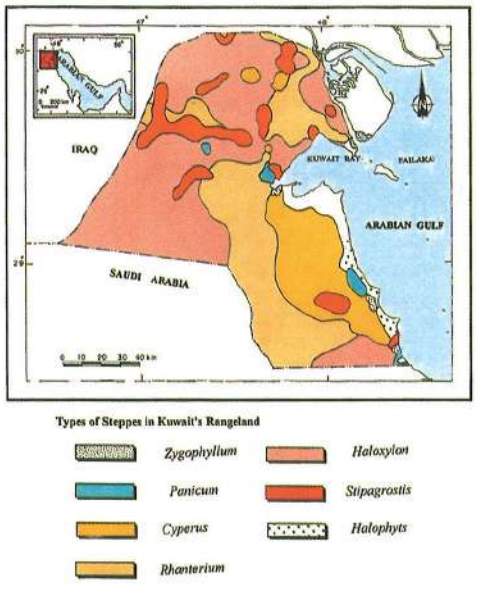


Fig. 8. The Vegetation map of Kuwait after Omar (1995).

CURRENT VEGETATION MAP

In comparison to the standard vegetation map of Kuwait (Halwagy and Halwagy, 1974), the proposed vegetation map (Fig.9) comprises eight vegetation units described as follows:

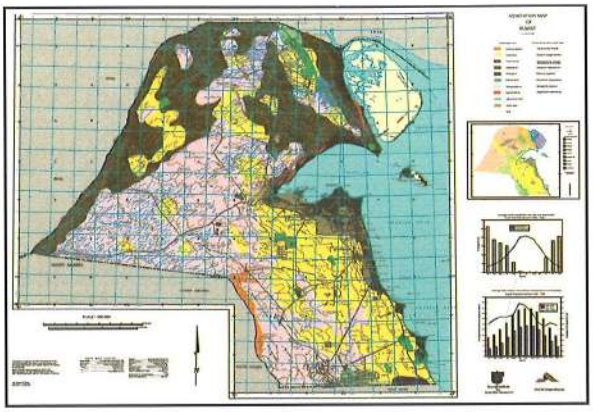


Fig. 9. Current vegetation map of Kuwait.

HALOXYLETUM

This map unit covers about 23% of the total surveyed area of Kuwait. It is dominated by the species *Haloxylon salicornicum*, a low shrub that grows up to 60 cm in height (Plate 18). The community is associated with other community types of less spatial distribution such as *Astragalus spinosus* and *Chrozophora* sp. When heavily grazed or uprooted, the *Haloxylon salicornicum* community is replaced by the annual grass species *Stipa capensis*.

The community type covers large areas in the northern and western parts of Kuwait. The soils in such areas are mostly petrogypsid*. Landform is leveled to gently undulating plain. The *Haloxylon salicornicum* community is under severe pressure from grazing, uprooting, gravel quarrying and military activities. Degraded areas, particularly in the northwest and west of Kuwait, require intensive rehabilitation measures.

* *Petrogypsid: Soils with pytrogypsic horizon at the upper layer within 100 cm from soil surface. Petrogypsic horizon is alluvial with gypsum accumulation. The horizon is cemented or indurated.*

18. Haloxylon salicornicum community.

RHANTERIETUM

The vegetation unit Rhanterietum is dominated by the species *Rhanterium epapposum* in association with *Convolvulus oxyphyllus, Moltkiopsis ciliata, Helianthemum lippi, Centropodia forsskalii* and *Stipagrostis plumosa.* It occurs in small patches in the northern, central and southern parts of Kuwait. The dominant plant species *Rhanterium epapposum* is highly palatable and susceptible to overgrazing. When mature, it can reach 80 cm in height, forming fibrous stems and roots that are often used as fuel by Bedouins. Since the vegetation map of Halwagy and Halwagy (1974), the community has significantly receded in its geographic distribution. In the past, the community was abundant and dominated in the southwestern and western parts of Kuwait. Plant species that are associated with this community and that favor its preferred site characteristics such as soil type, topography and micro-climate are *Gynandriris sisyrinchium* in shallow depressions; *Horwoodia dicksoniae* and *Cornulaca aucheri* in mobile sandy areas; and *Anthemis deserti, Schimpera arabica, Arnebia decumbens, Arnebia tinctoria, Cutandia memphitica* and *Plantago boissierri* in stable soils (Plate 19).

The total area covered by the community is about 2% of Kuwait. Soils associated with this community type are calcigypsids* in the north, and torripsamments** and petrocalcids*** in the south. Landform in the north is typically filled with undulating plains with gentle slopes and flats that have many shallow drainage depressions. In the south, the landform has levels or gently undulating plains.

19. Rhanterium epapposum community.

* *Calcigypsids: Soils with calcic and gypsic horizons within 100 cm from soil surface. Calcic and gypsic horizons are alluvial, with accumulated calcium carbonate and gypsic.*

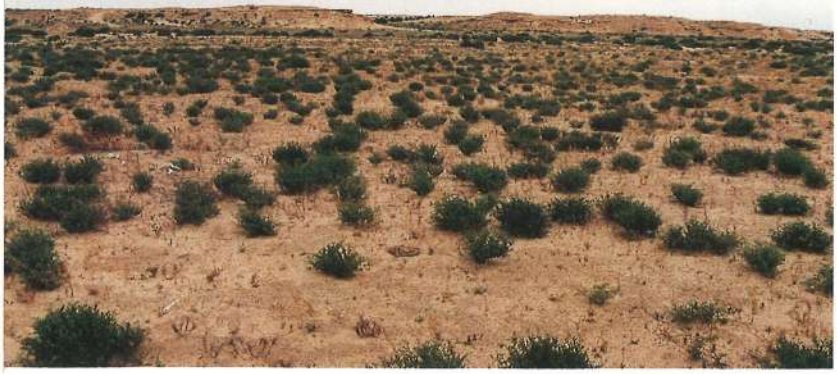
** *Torripsamments: Soil with loamy fine sand or coarse texture in all layers.*

*** *Petrocalcids: Soils with petrocalcic horizons within 100 cm from soil surface. Petrocalcic horizon is an illuvial horizon with calcium carbonates accumulation.*

20. Cyperus conglomeratus.

21. Stipagrostis plumosa community.

22. Zygophyllum qatarense community.



CYPERETUM

This is one of the most extensive vegetation units in Kuwait, covering approximately 26% of the country. The sedge *Cyperus conglomeratus*, which colonizes mainly on sandy areas with Torripsamment soil types (Plate 20), dominates it. It is about 60 cm tall, forming a dense cluster at the base. It is an excellent sand stabilizer, as hummocks of fine sand are formed on the leeward side of the plant. Generally, hummocks' maximum height can reach 120 cm and stretch in a northwest to southeast direction. The plant is usually associated with annual species such as *Astragulas annularis, Brassica tournefortii* and *Plantago boissieri.* When heavily grazed, a temporary community type of annual shrub, *Cornulaca aucheri,* can replace it.

STIPAGROSTIETUM

This is dominated by *Stipagrostis plumosa.* The community is expanding in areas that were previously dominated by the community type *Rhanterium epapposum* (Plate 21). It extends in the west and southwest of Kuwait with a few clusters in the north and northwest, indicating its potential for future expansion. The associated species are *Moltkiopsis ciliata,* and *Centropodia forsskalii.* The Stipagrostietum map unit covers 39% of Kuwait. It traverses a range of soil types (undulating petrocalcids, haplocalcids , and petrogypsids) on surface level to gently undulating plains. It is possible that this community type replaced Rhanterietum and Haloxyletum communities (see Fig. 12).

ZYGOPHYLLETUM

This type is dominated by *Zygophyllum qatarense,* which is a medium-sized shrub commonly found in coastal areas and depressions (Plate 22). The community is associated with salt-tolerant annuals and perennials such as *Salsola imbricata, Cressa critica,* and *Aizoon hispanicum.* The total distribution of the community is 1% of total vegetation. The aquisalid soils are characterized by

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* *Haplocalcids: Soils similar to calcids, but do not have a petrocalcic horizon.*

***Petrogypsids: Soils that have petrogypsic horizon within 100 cm from soil surface.*

****Aquisalids: Soils in wet areas where capillary rise and evaporation of water concentrate the salts near the surface.*

high salinity. They occur on supratidal flats and associated drainage channels. These areas have a shallow water table (50-200 cm) and are often inundated during the rainy season.

CENTROPODIETUM

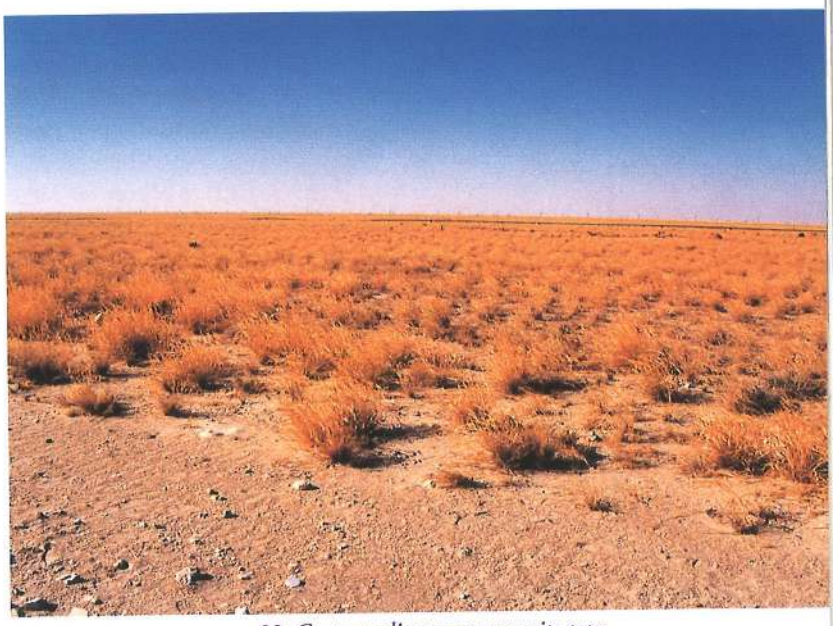
This map unit is dominated by the species *Centropodia forsskalii,* a perennial grass that has recently become abundant in the southwest of Kuwait. The community is usually associated with *Stipagrostis plumosa* (Plate 23). The soil type in this area is petrocalcid on a gently undulating plain. The Centropodietum map unit covers approximately 1% of Kuwait.

PANICETUM

This type is dominated by *Panicum turgidum* (Plate 24), a perennial desert grass forming tangled bushes up to 1 m tall. Sandy hillocks grow up to 1.2 m in height and usually accumulate around this plant. The community is intensively grazed by sheep and goats, allowing it only to survive in the northwest of Kuwait Bay and along the southeastern coast near Umm Al-Hayman. The soil types in these areas are torripsamments and aquisalids, located on level coastal plains covered by uneven sand sheets or isolated hummocks. The distribution of the plant is very limited, estimated at <1%. Associated species are *Aeluropus lagopoides* and *Pennisetum divisum.*

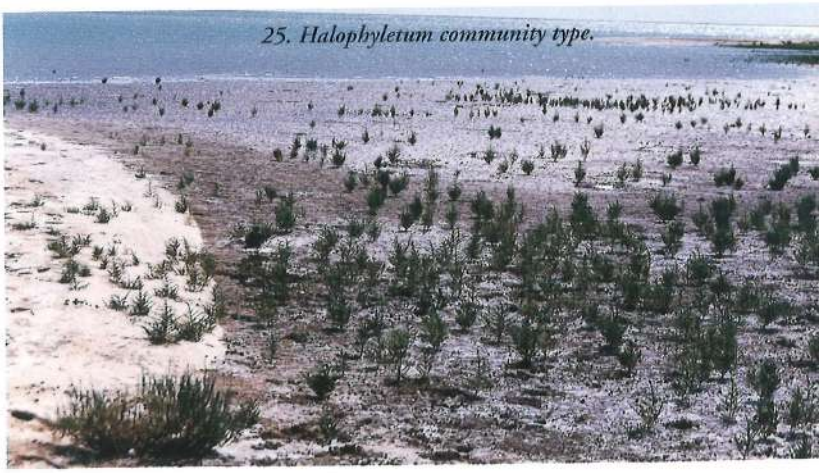
HALOPHYLETUM

This map unit is dominated by many halophytic plant communities such as *Tamarix aucheriana, Nitraria Retusa, Halocnemum strobilaceum,* and *Siedlitzia rosmarinus.* A high water table and occasional flooding from surface runoff characterize the map unit. *Tamarix aucheriana* favors saline flats such as those found along the coast in Sulaibikhat/ Doha area (west of Kuwait City). It is a large shrub, about 3 m high, with scale-like leaves. *Nitraria retusa* is also associated with *Tamarix aucheriana*, the plant is a stiff-branched shrub and 1-2 m high. It forms hummocks, with added gray woody twigs. The habitat where *Nitraria* grows best is sabkha (salt marsh), which is near the coastal areas in the south. The plant forms the basis for a typical example of



23. Centropodietum community type.

24. Panicetum community type near Umm Al-Hayman.



25. Halophyletum community type.

nebkha, which are anchored dunes accumulated around shrubs (see Plate 5). Other community types in this map unit include *Halocnemum strobilaceum*, which is found in the northern and southern coastal areas of Kuwait. The plant is usually submerged by seawater at high tides (Plate 25) and may grow on large areas on sandy saline soils. Soils in this map unit are aquisalids. The total area is about 1.5% of Kuwait.

SOIL KINDS

In general, Kuwait's soil is arid, poor in organic material and in moisture. A soil map of Kuwait was prepared by GIS application, and by using aerial photography and Kuwait's Topographic map (provided by M.O.D.) in addition to field assessment. Eight great soil groups were identified on the map as result of detailed soil information, which were collected during the soil survey of Kuwait project at KISR in 1999. The soil map units are associations and complexes, and therefore contain other soil types in minor quantities. The general characteristics of the map units are described as follows:

1- Petrogypsids
Shallow soil or moderately deep, sandy to loamy overlaying a gypsic hardpan. Hardpan may be exposed at surface when the upper layer is removed. This group constitutes 33% out of soil's map unit areas.

2- Torripsamments
Sandy soil coarse to fine, deep to very deep, excessively drained. It constitutes 27% of total map unit areas.

3- Petrocalcids
Shallow or moderately deep soil , well drained to moderate sandy to loamy soils overlaying a calcic hardpan, which may be exposed at the surface when the surface soil is removed. It constitutes 11%.

4- Haplocalcids
Deep to very deep soil, good penetration, consists of sandy and loamy soil, it has a layer of carbonates and nodules in the profile. It constitutes 8%.

5- Aguisalids
Deep to very deep, sandy clayey soils very poor drained, with an accumulated saline layer. It forms 7%.

6- Calcigypsids
Deep to very deep, sandy to loamy soils

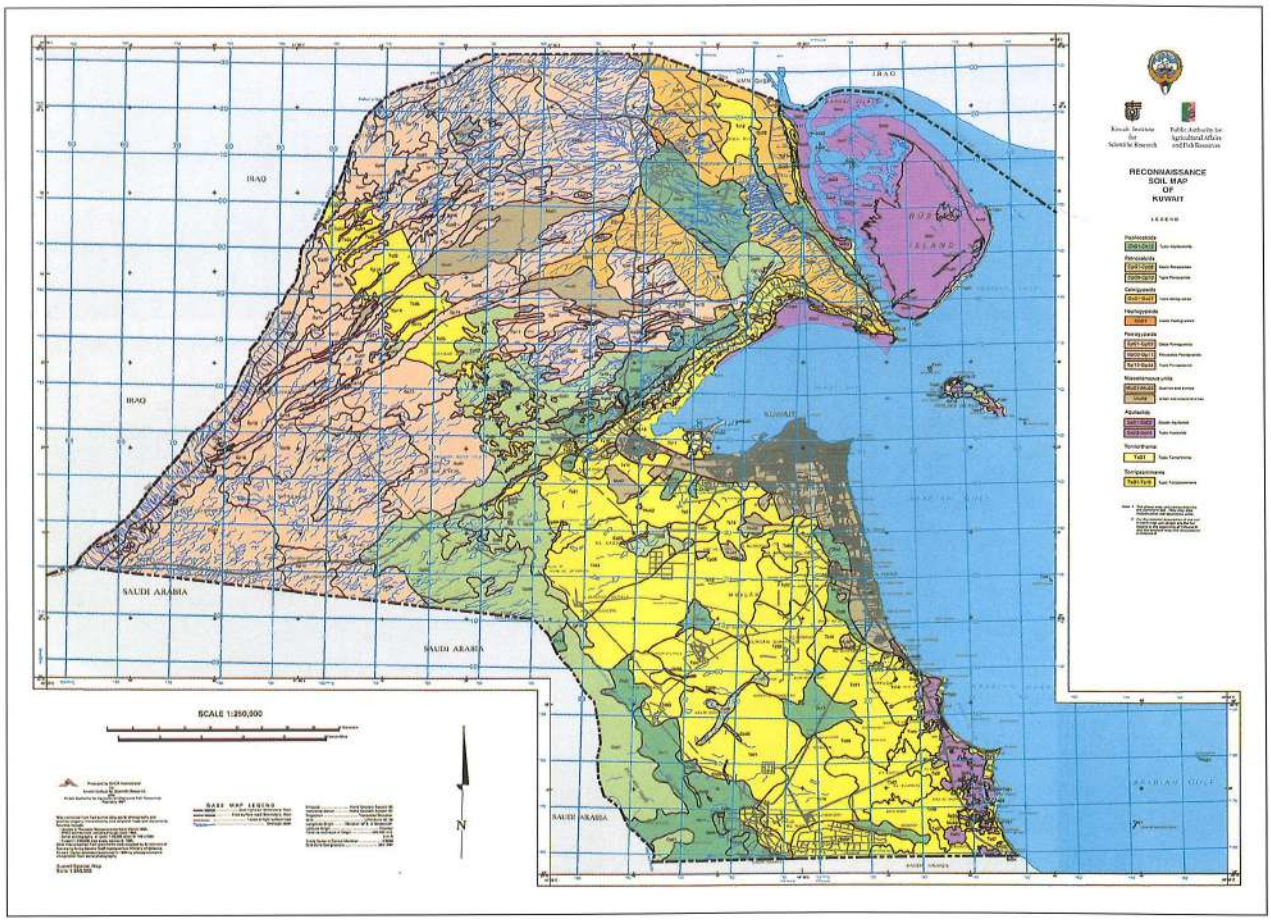


Fig. 10. Map of Soil in Kuwait - 1999 Omar et al 2000.

containing a layer of carbonates and a layer of crystallized gypsum. It forms 6%.

7- **Haplogypsids**
Deep, well drained, sandy to loamy soils with a layer of gypsum crystals, not widely common.

8- **Torriorthents**
Moderately deep, excessively drained to well drained, sandy rich in fragments shells with accumulations of some gypsum, not widely common.

Results

Eight great soil groups are identified and grouped into eight map units; they characterize the soils of Kuwait (Fig. 10). The map units are associations and complexes, and therefore, contain other soil types in minor quantities. Results show that the dominating soil types of Kuwait are Petrogypsids and Torripsamments. Petrogypsids soils generally occur on level to gently undulating plain formed on the sand and gravel deposits of the Dibdibah Formation. The Torripsamments soils generally occur on an extensive sand sheet in central and southeast direction. They also occur at the base of escarpments where fall dunes have formed, along the coast on dunes and in the north-west on isolated barchan dunes and sand ridges. Calcigypsids and Haplogypsids occur in the northern part of Kuwait, Haplocalcids occur in the north, south and central part of Kuwait; while Aquisalids are confined to Bubyan and Failaka Islands and the coastal areas. Torriorthents are the least occurring soils.

COMPARISON OF THE CURRENT VEGETATION MAP WITH PREVIOUS STUDIES

Eight vegetation map units were recognized compared to five plant communities as reported by Halwagy & Halwagy (1974). The percentage distribution of area constituted by urban development and plant communities in the vegetation map of Halwagy & Halwagy (1974) was 10.1, 52.2, 30.6, 4.2% and 3.0% for urban areas, *C. conglomeratus*, *H. salicornicum*, *R. epapposum*, and *Z. qatarense* respectively (Table 1). These were compared to the percentage distribution of the new map units, which scored 26.9, 22.7, 2.1, 0.3% and 4.2% for urban areas, Cyperetum, Haloxyletum, Rhanterietum, and Zygophylletum respectively (Table 1). The comparison showed that some plant communities retreated in distribution whereas others expanded. For example, *C. conglomeratus* community in the previous vegetation map covered 10.1% of the total area compared to 26.9% in the current map indicating its potential to expand in time. This map unit extended over areas that were previously dominated by *R. epapposum*, *H. salicornicum* and *Z. qatarense* communities by 9.9%, 7.8% and 1.0% of areas respectively, 7.8% of the area remained unchanged (Table 1).

On the other hand, the percentage distribution of the *R. epapposum* community was considerably altered from 30.6% in the previous vegetation map to 2.1% in the current vegetation map. Only 0.6% of the area remained unchanged (Table 1). This indicates that this community has considerably retreated from the rangelands of Kuwait and that the community is more susceptible to grazing than *C. conglomeratus*. Presently, it is confined to protected areas such as the Sulaybiya Field Station, military air bases, military camps and some restricted oil fields.

Haloxylon salicornicum and *Z. qatarense* also decreased in percentage distribution from 52.2 and 4.2% in the previous vegetation map to 22.7 and 0.3% in the new vegetation map respectively. Only 0.4% of the *H. salicronicum* area and 0.2% of the *Z. qatarense* area remained unchanged (Table 1). The *H. salicornicum* community in the south of Kuwait reported by Halwagy & Halwagy (1974), is presently non-existent due to changes in the borderline with Saudi Arabia and Kuwait. The Haloxyletum map unit showed that the *H. salicornicum* has retreated from the west and north-west of Kuwait. Both communities are under pressure from overgrazing.

The *St. plumose* map unit was not recorded in the previous vegetation map. Presently, it is occurring in the south and in the south-western areas. The unit has spread over areas previously dominated by *R. epapposum* and *H. salicornicum* communities by 16.6% and 22.3% of areas respectively (Table 1).

Halwagy & Halwagy (1974) indicated that *Panicum turgidum* has retreated considerably and may soon disappear. In this study, Panicetum map unit percentage distribution was 0.7%. It was found dominating in the south-eastern coastal strip between Shuaiba and Umm Al-Hayman. The community in this area, however, is under severe pressure from grazing and urban expansion.

Both Centropodietum and Halophyletum map units were not reported in Halwagy and Halwagy (1974). Both map units showed low percentage distribution and expanding in areas which were dominated by *R. epapposum* and *H. salicornicum*. Halophyletum also expanded in areas that were dominated by *Z. qatarense*. The new map showed expansion in urban

area distribution from 3.0% to 4.2% and agricultural area showed1.0% distribution.

The species *Cornulaca aucheri* may form a temporary community type during favorable conditions, particularly when late spring rainfall is abundant and thick sand accumulation exist (> 30 cm thick). The community started to dominate in the Cyperetum map unit between 1993 and 1996 in the south. Currently, many new seedlings have been established in the central and northern parts of Kuwait while the recently established community in the south has receded. A new community type of *Convolvulus oxyphyllus* was found near Um Al-Jethatheel playa in the central part of Kuwait and in the north-west of Kuwait along with *Ziziphus nummularia*. The later species was first recorded in this study. Also, a community type of *Astragalus spinosus* was found in the northwestern portion of Kuwait near Umm Al-Madafae. These communities form clusters of less than 5 km2. Due tot map scale limitations, these two community types were not delineated.

The vegetation map accuracy was calculated as 70%, which is high for a reconnaissance scale map such as this. The value is high because the three dominant map units had high individual map unit purities (Cyperetum 77%, Haloxyletum 84%, Stipagrostietum 72%), and they contributed 68% to the map purity.

CONCLUSIONS

The current study adopted a new approach for mapping the vegetation of Kuwait by using the Geographic Information System (GIS). The application of GIS technology helped in mapping and evaluating soil and vegetation. It is a primary tool for range managers who wish to manage and monitor rangeland status and use. New information from field studies can be entered into the GIS database and then compared with existing data sets for monitoring and to determine what change has occurred.

The vegetation of Kuwait has been altered due to intensive deterioration of rangeland productivity. Past attempts to classify vegetation showed dominance of five communities, most of which were shrubby species. The current status of vegetation, however, has shown intensive land degradation and retrogression of shrubby species, in particular *Rhanterium epapposum*. Perennial shrubs constitute about 27% of the surveyed area while perennial grass and sedge constitute 67.9%. Weedy shrubs such as *Cornulaca aucheri* are invading the rangelands, forming temporary communities.

Improvement of deteriorated vegetation units is vital to the future stability of Kuwait rangelands. Natural revegetation is the most economically sound approach for regeneration of depleted rangelands. Natural revegetation is based on eliminating the factors that have caused retrogression, and allowing autogenic succession to take place.

Table. 1
A comparison matrix showing changes in percentage distribution of community types and urban area from previous to new vegetation maps.

Community Types from Previous Vegetation Map* and Percent Distribution

		Cyperus conglomeratus	*Haloxylon salicornicum*	*Rhanterium epapposum*	*Zygophyllum qatarense*	*Urban areas*
	% total	10.1	52.2	30.6	4.2	3.0
Haloxyletum	22.7	0.0	0.4	0.1	1.0	0.4
Rhanterietum	2.1	0.3	0.7	0.6	0.3	0.1
Cyperetum	26.9	7.8	7.8	9.9	1.0	0.4
Stipagrostietum	39.3	0.3	22.3	16.6	0.1	0.0
Zygophylietum	0.3	0.0	0.0	0.1	0.2	0.0
Centropodietum	1.0	0.0	0.7	0.3	0.0	0.0
Panicetum	0.7	0.3	0.0	0.1	0.2	0.1
Halophyletum	1.9	0.0	0.4	0.1	1.0	0.4
Agricultural areas	1.0	0.0	0.2	0.8	0.0	0.0
Urban areas	4.2	1.3	0.0	0.0	1.9	1.0

* Halwagy & Halwagy 1974 & Omar et al 2000

ECOSYSTEM CLASSIFICATION

Several interacting factors such as landform, climate (primarily precipitation) and soil characteristics control the type of vegetation. Biotic factors are also important such as human-induced factors, microbial activities in soil, and wildlife activities.

Halwagy and Halwagy (1974) described the ecological classification of the vegetation in Kuwait. They distinguished four ecosystems on the basis of variations in the habitat, chiefly landform and soil characteristics, as well as in florestic composition, particularly of the dominant species. The following ecosystem of classification is suggested here by the author based on previous findings by Halwagy and Halwagy (1974) and information gathered from the Soil Survey Project (KISR, 1999). The suggested ecosystems are: (1) the coastal plain and lowland ecosystem; (2) the desert plain and lowland ecosystem; (3) the alluvial fan ecosystem; (4) the escarpment, ridges and hilly ecosystems; (5) the wadi and depressions ecosystem; and (6) the barchan sand dune ecosystem (Fig. 10).

THE COASTAL PLAIN AND LOWLAND ECOSYSTEM

Two ecological zones distinguish this: the salt marsh and saline depression, and the sand dune, ridges and terraces. It covers the areas along the coastline from the north to the south and the islands of Kuwait. Urban areas are exlcuded.

Salt Marsh and Saline Depressions

The salt marshes (sabkha deposits) extend from the north coast of the Khor As Subiyah, Doha, Ad-Dhubaiyah and Al-Khiran. They also occur in the islands Bobyan, Warbah, and part of Faylaka. The soil is saline, poorly developed and influenced directly by tidal action and indirectly by a shallow saline water table. The soil is classified as gypsic aquisalids loamy mixed hyperthermic and typic aquisalid loamy mixed hyperthermic. In general, the dominating plant communities are the halophytic species such as *Halocnemum strobilaceum*

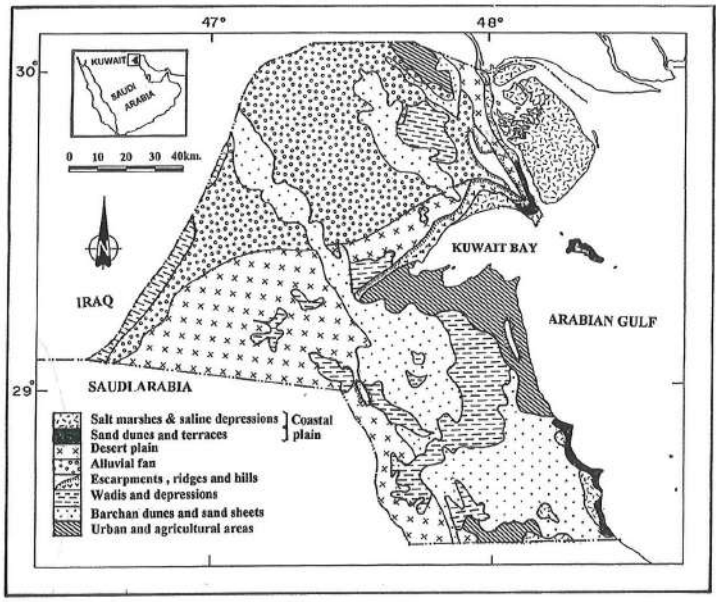
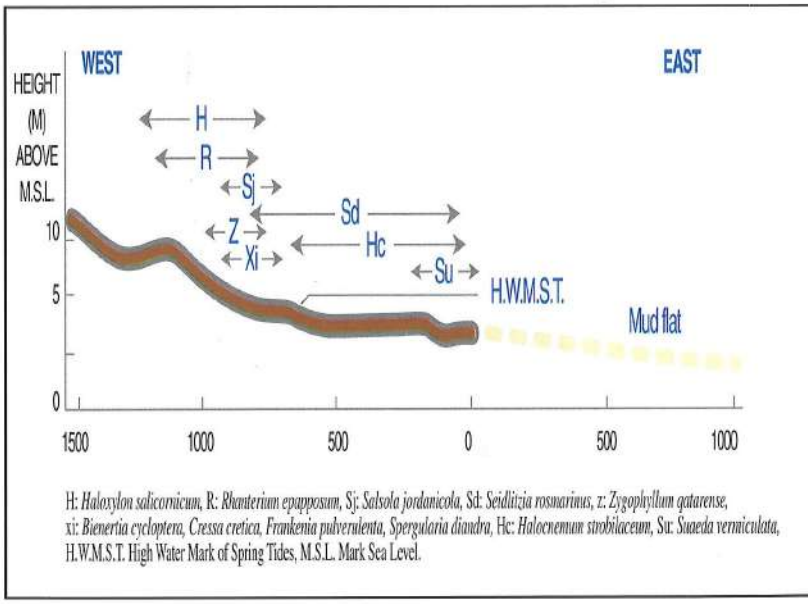


Fig.11. Ecological ecosystem classification map.*

near the shallow shores followed by *Nitraria retusa* growing on nebkha (anchored or fixed dunes). Associated species are *Aeluropus littoralis, Aeluropus lagopoides, Bienertia cycloptera, Seidlitzia rosmarinus, Suaeda vermiculata, Salicornia europaea, Cressa cretica* and *Juncus rigidus.* An example of a coastal transect at Haswan is presented in Fig. 11. The plant communities from the zero point (shoreline) are: *Suaeda vermiculata, Halocnemum strobilaceum, Seidlitzia rosmarinus; Rhanterium epapposum,* and *Haloxylon salicornicum.* Annuals are mainly present between 500-1000 m distance from the zero point near Haswan (modified after Halwagy, 1973).



H: *Haloxylon salicornicum*, R: *Rhanterium epapposum*, Sj: *Salsola jordanicola*, Sd: *Seidlitzia rosmarinus*, z: *Zygophyllum qatarense*, xi: *Bienertia cycloptera, Cressa cretica, Frankenia pulverulenta, Spergularia diandra*, Hc: *Halocnemum strobilaceum*, Su: *Suaeda vermiculata*, H.W.M.S.T. High Water Mark of Spring Tides, M.S.L. Mark Sea Level.

Fig. 12. Example of coastal communities in Haswan

* *Contributer Dr. Rafat Misak, Research Scientist, KISR.*

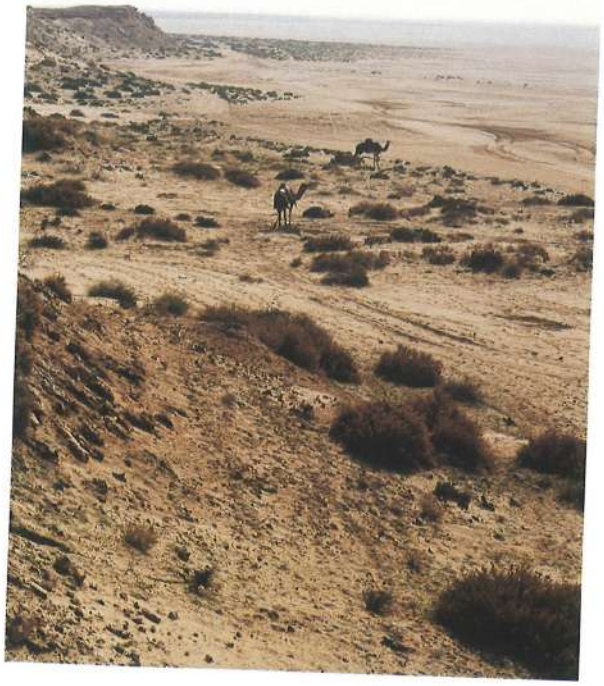
26. Salt marsh community near Kazma showing Juncus rijidus in the background.

The saline depressions occur in the southern coastal areas west of the sand dune ecosystem (Al-Khiran and Az Zor). They are affected by the shallow saline water table, and are dominated by *Halocnemum strobilaceum, Bienertia cycloptera, Cressa cretica,* and *Zygophyllum qatarense.* Common annuals include *Aizoon canariense, Aizoon hispanicum, Frankenia pulverulenta* and *Mesembryanthemum nodiflorum. Tamarix aucheriana* is associated and may form a localized distinct zone, particularly in Doha and Ad-Dhubaiyah.

Sand Dune, Ridge and Terrace

Sand dune ecosystems comprise a series of low coastal sand drifts and dunes along the southern and northern coastal strips. Large stablized sand dunes also occur in Ad-Dhubaiyah. The soil is identified as loose coarse sand, predominantly oolitic, and occasionally lime-cemented. The ecosystem is usually dominated by *Zygophyllum qatarense* and/or *Seidlitzia rosmarinus* and occasionally by *Atriplex leucoclada* and *Halothamus iraqensis. Lycium shawii* is localized. *Pennisetum divisum* is a common associate. *Cistanche tubulosa* occurs as a common root parasite on the dominating plants *Zygophyllum* and *Seidlitzia.* In the southern sand dune ecosystem, *Cornulaca aucheri* dominates. The terraces, which extend along the northern coastal line of Kuwait Bay, were formed by the action of wind and water erosion, comprising mixed stands of vegetation. Of particular importance are *Pennisetum divisum, Calligonum polygonoides* and *Cornulaca monocantha.*

27. Terraces in As Subiyah during spring 1998.



DESERT PLAIN ECOSYSTEM

This ecosystem is located west of the coastal plain and extends to the southwestern borders and into the northeastern part of Kuwait. The soil type is classified into torripsamment, haplocalcid and calciargid. The ecosystem is characterized by aeolian deposits, which are further divided into four main forms of aeolian sand accumulation: (1) sand sheets, (2) wadi fill, (3) sand dunes, and (4) sand drifts. Three types of sand sheets are also recognized: smooth sand sheets, rugged vegetated sand sheets and active sand sheets. The smooth sand sheets are flat to slightly rippled and are usually covered with a thin veneer of very coarse sand or granules. Smooth sand sheets cover extensive areas in southern Kuwait. Rugged vegetated sand sheets are mostly covered with dense vegetation. The dominating community types in this ecosystem are: Cyperetum, Rhanterietum, Haloxyletum and Panicetum.

ALLUVIAL FAN ECOSYSTEM

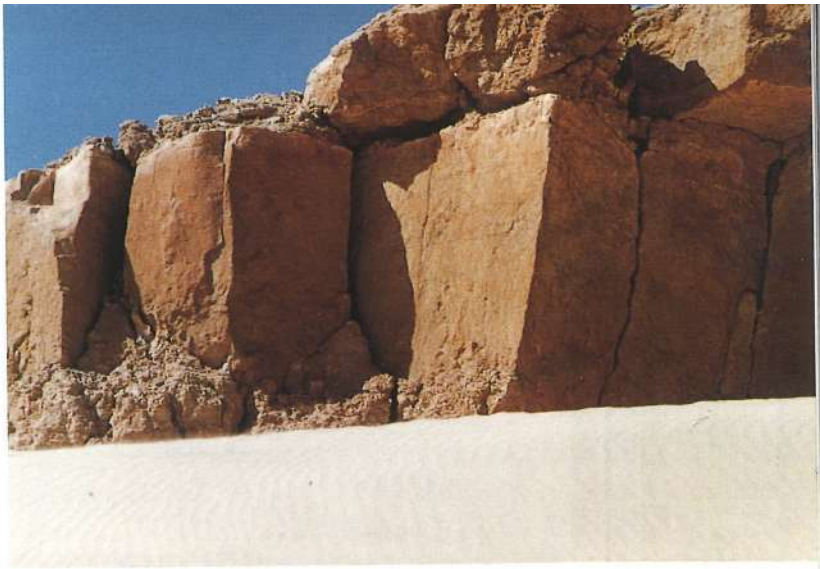
This ecosystem occurs in the western, central and northern parts of the country. The soils vary greatly as they are gypsic cemented hardpans,

shallow petrocalcic petrogypsid sand mixed with a hyperthermic shallow; petrocalcic petrogypsid coarse-loamy mixed; typic petrogypsid sandy mixed hyperthermic; typic petrogypsid coarse-loamy gypsic hyperthermic; or calcic petrogypsid sand mixed with hyperthermic. They have a hardpan that occurs within 100 cm of the soil's surface. The hardpan restricts root growth and impedes drainage (locally, this layer is known as "gatch"). The high gypsum content in the soil is a chemical limitation to plant growth. Clumps of *Haloxylon salicornicum* occur on sand accumulations. Other species such as *Citrullus colocynthis, Cistanche tubulosa, Helianthemum* species, *Astragalus* species and *Schismus barbatus* are common.

ESCARPMENTS, RIDGES & HILLY ECOSYSTEMS

This ecosystem is distinguished by the presence of the Jal Az-Zor escarpment, which is one of the most prominent geomorphological feature in Kuwait. It extends parallel to the northern shores of Kuwait Bay and rises 135 m in elevation (Al-Sulaimi and El-Rabaa, 1994). Other features are the Ahmadi ridge and the Al Bahrah-As Sabriyah ridge.

The Ahmadi ridge is a north-south-tending broad ridge that runs from south of Ahmadi, a 50 km distance. The altitude of the ridge reaches 100 m in the south and 55 m in the north. The Al Bahra-As Sabriyah ridge is a 45 km long ridge trending northsouth to northwest-southeast running over As Subiyah.



28. Jal Az-Zor ridge.

The ridges are dominated by mixed stands of vegetation and contain relatively high varieties of species such as *Astragalus spinosus, Anthemis deserti, Reseda arabica, Scabiosa olivieri, Gymnarrhena micrantha, Carduus pycnocephalus, Asphodelus viscidulus, Neurada procumbens, Savignya parviflora, Halothamus iraqensis* and *Anabasis setifera. Lycium shawi* is also common in drainage areas.

29. Jal Az-Zor escarpment.

WADIS AND DEPRESSIONS

Mud playas known as "khubrat" are shallow depressions scattered within the drainage system. They have a limited aerial distribution between 50 and 80 ha, however, some cover more than 300 ha. The soil of the playa is impervious, rich in silt and clay, except the soil underneath is very compact, and is classified as petrocalcic. Playas support pure stands of the colorful bulb *Gynandriris sisyricnchium* in association with *Convolvulus pilosellifolius* and *Malva parviflora*. Known playas are Al Rawdatayn, Umm Al-Aish, Ad-Dibdibah, and Al-Awjah. The latter has a naturally growing lonely tree known as talha (*Acacia pachyceras*)(Plate7). In Ad-Dibdibah, *Echium rauwolfii, Helianthemum lippii, Lappula spinocarpos, Silene arabica,* and *Malcolmia grandiflora* were viewed. *Helianthemum lippii* supports the truffle (*Termania* and *Terfezia*), locally known as "Fuga". The Dibdibah area was once abundant with Fuga, However, it is almost impossible to find it now due to human disturbance.

There are two major wadis in this ecosystem: Wadi Al-Batin and Wadi Umm Ar-Rimam. The first extends along the western boundary with Iraq. The second is located along the northern region of Kuwait Bay.

Wadi Al-Batin is 7-10 km wide, with a relief amplitude of 75 m. It extends over 75 km along the western borders of Kuwait. The drainage system in Wadi Al- Batin occupies a narrow zone about 6 km in width and extends for about 70 km along the eastern slopes of the Wadi. The drainage lines flow from the A Dibdibah plain in the westerly and northwesterly direction perpendicular to the main course of Wadi Al-Batin.

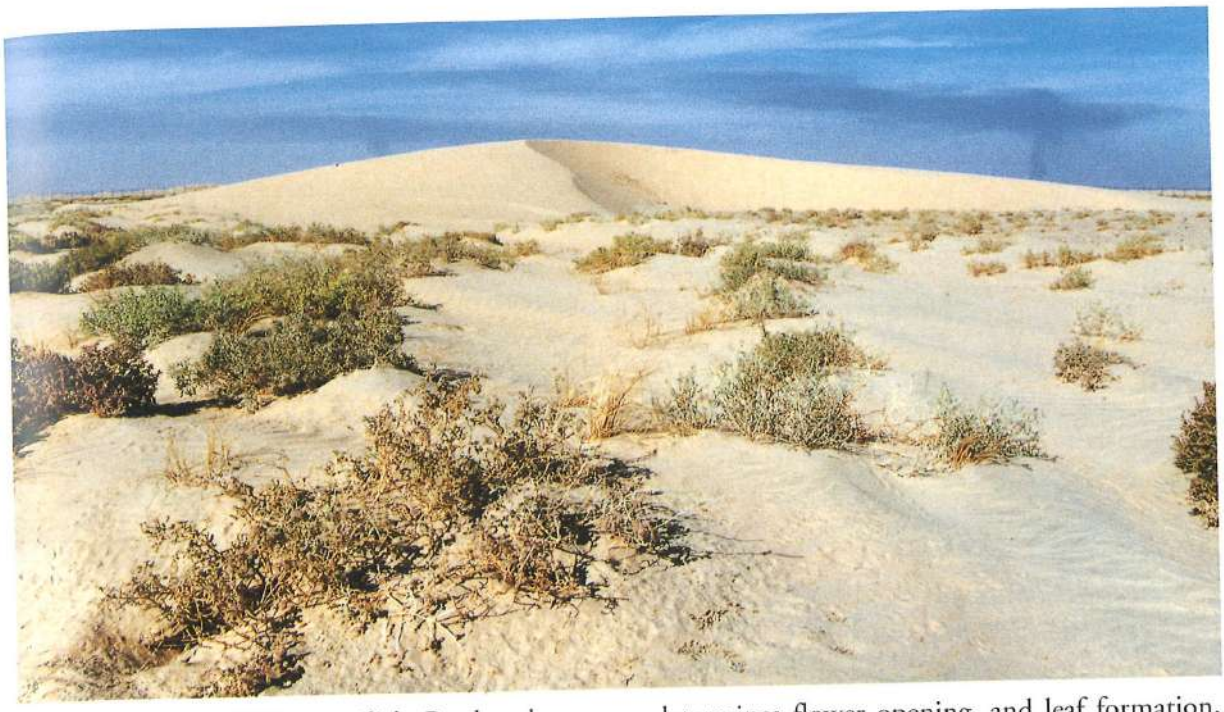
Umm Ar-Rimam depression has a maximum length of about 6.8 km, with a maximum width of about 3.6 km, and has an average total area of 16.5 km^2.

Specific species that grow in Wadi Umm Ar-Rimam are *Ochradenus baccatus, Calligonum polygonoides, Chrozophora* sp., *Savignia parviflora, Trigonella anguina,* and *Gynandriris sisyrinchium.* Near Wadi Al-Batin, *Astragalus sieberi* associated with *Haloxylon salicornicum* has been recorded. *Zilla spinosa* and *Astragalus spinosus* have been indicated in Wadi Al-Batin.

BARCHAN SAND DUNE ECOSYSTEMS

In the northern part of Kuwait, two belts of barchan sand dunes extending in a northwest-southeast direction are recognized. One occurs at Umm Niqa in the northeast while the other extends

30. Wadi Umm Ar-Rimam.



31. Barchan sand dune ecosystem.

in the northwest at Al-Huwaymiliah. Barchan dunes have also been indicated near Umm Al Aysh and As Subiyah. In Umm Niqa, the sand dunes constitute a few scattered, relatively large barchan dunes (170 m in width and 8 m in height on average). Barchan dunes in the Al-Huwaymiliah belt are scattered in several successive zones perpendicular to the prevailing northwesterly winds.

The barchan sand dunes are usually void of vegetation. However, they occur in areas that are dominated by the *Haloxylon salicornicum* community type. Associated species are *Stipa capensis, Arnebia decumbes, Moltkiopsis ciliata, Silene villosa, Schimpera arabica, Polycarpaea repens*, and *Asphodelus tenuifolius*.

SUCCESSION

Plant survival and existence are influenced by conditions in the ecosystem in which they exist. The ecosystem is dynamic and changes in overlapping scales of time and space. The time scale can be short or long. Short time scales are often those of physiological processes within an individual or within a life cycle. Long time scales occur within an evolutionary or geological cycle.

There are four types of ecosystem change cycles. The first and shortest cycle is 24 hours; this cycle determines flower opening, and leaf formation, seed dissemination, and the plant's general physical and morphological changes. The role of animals is important in this cycle. They graze plants, disperse seeds, digest fruits, and recycle nutrients.

The second type of cycle consists of random change that correlates with wet/dry and hot/cold annual seasons. The third type of ecosystem changes results from uncontrollable influences like weather and events, such as alternating periods of drought, and above-average precipitation that extends over several years. Organisms in these cycles respond with differences in phenology (stage of growth) during their life cycle. The fourth cycle consists of succession, by which certain species dominate immediately after a disturbance such as overgrazing, gravel quarrying, or fire pollution. Here, the original dominating plant is replaced by a secondary dominating plant that is normally associated with it.

Early dominants are likely to be small in size, mature quickly, and have short life spans. Year by year, a successive series of developmental communities, or "series", lead to a more stable plant community, which is called the "climax". An example of this type of change, a succession model (Tables 1 and 2) for the Haloxyletum and Rhanterietum map units in Kuwait, was

developed by Omar (1990) and shown in Fig. 12. The major factors that contribute to vegetation changes are natural (precipitation, drought, and soil erosion and/or accumulation) and human-induced (logging of woody shrubs, off-route vehicle use, and grazing).

The model comprises seven stages. At the top climax stage, either the Rhanterietum or Haloxyletum community dominates, depending on the soil type. In this stage, human-induced factors such as grazing and shrub logging are hardly present. In lower stages of development, plant development comprises annuals that are small in size, mature quickly, and have a short life span.

State I is dominated by the shrublet *Haloxylon salicornicum*, which occurs on clumps of shallow hard gatchy soil with bare grounds in the open spaces. State II is dominated by *Rhanterium epapposum*, which occurs in moderately deep sandy soil with bare ground, possibly occupied by its roots. The two communities form clear boundaries in distribution; however, when the upper soil is changed as a result of long-term erosion or sand accumulation, each community may replace the other. Halwagy and Halwagy (1974) suggested that *Haloxylon* replaces *Rhanterium* as a result of overgrazing, logging, or soil erosion. Therefore, transition 13 or transition 14 could occur due to changes in the soil's physical characteristics or competition in mixed stands of the two communities. Provided that good rainfall occurs, States I and II could be reached by resting a range site in State V. However, when the two communities are disturbed by partial logging and moderate grazing (transitions 2 and 4), middle stages of succession are developed (States III and IV).

States III and IV are states that convert to upper or middle states. For example, State III converts to State I by over-resting (transition 1), State IV also converts to State II by over-resting (transition 3). Both states convert to State V by logging and/or heavy grazing (transitions 6 and 8). The time required for the transient states to convert to upper states is 7-10 years. The presence of drought may delay the successional progress or regress of change to lower states. In the two transient states, sedge (*Cyperus conglomeratus*) dominates in association with *Panicum turgidum*. Seedlings of *Haloxylon salicornicum* and *Rhanterium epapposum* are present with old shrubs being dead or intensively grazed. The soil is moderately stable, but is vulnerable to wind erosion. The percent of ground cover occupied by the plant is less than 20%. Among the common species in State III are *Stipa capensis* and *Stipagrostis* while those in State IV are *Plantago boissierri* and *Cutandia memphitica*.

State V is characterized by the absence of shrulets and is dominated by sedge and other associated perennial grasses. Increasers (plants that increase with heavy use) such as *Plantago boissierri* and *Arnebia decumbens* and invaders (plants that were not present in the first place) such as *Moltkiopsis ciliata* and *Cornulaca aucheri* become abundant. Under good precipitation and restoration of the rangelands (transitions 5 and 7), State V could be converted to States III or IV, depending on soil characteristics. If pressure from grazing and drought continue to occur (transition 10), State V will be converted to State VI. The period required for State VI to progress to upper successional states (State V) is 5-8 years, and can be achieved by relaxation from grazing pressure and human- induced factors (transition 9).

States VI and VII are the lower states of the Range State Transition Succession (RSTS) model. The former state is dominated by increasers, mainly *Plantago boissierri*, and invaders such as *Cornulaca aucheri*. Drought, overgrazing, intensive human activities, removal of top soil by wind erosion and burial of vegetation by mobile sand (transition 12) are the main causes of transference of the state of the range from State VI to State VII, in which mainly bare ground exists and the topsoil becomes extremely vulnerable to wind erosion, especially during the summer. In State VI, animals become less selective in grazing, which results in a low productivity potential.

Therefore, State VI is highly undesirable relative to State V. The period required to convert State VI to State V is 5-7 years, and from State VII to VI is 3-5 years. The transition could be achieved by a reduction in overgrazing in conjunction with proper amount of precipitation (transitions 9 and 11) or by applying rangeland improvement techniques. Transition 9 is to be chosen to avoid Transition 12.

By identifying the successional states that the rangelands transfer to under certain conditions (e.g., climatic circumstances in conjunction with grazing), it is possible to define the necessary management approach. For example, if the vegetation is in State VI and needs to be transferred to State V, reduction of stocking rate and restoration may be the best management technique. It should be noted, however, that rangelands could be most productive during the transient States III for the *Haloxylon* steppe and IV for the *Rhanterium* steppe because of the diversity in species and presence of palatable species. States I and II, however, have conservation value for wildlife and habitats.

Khalaf (1989) reported that desertification in Kuwait is recognized by the deterioration of the natural vegetation cover, increase in mobile sand activity, and change of immobile to mobile sand sheets. It is, therefore, suggested that any site described by those characteristics could be classified as States VI or VII. In this case, transitions 9 and 11 (halt human-induced factors and apply range restoration techniques and rangeland improvement) could be implemented to improve range condition. Succession with water in the arid rangelands is very rapid, and the changes in State from VI to III or IV may be attained in less than 15 years.

Since the establishment of the city, dominance of the sedge *Cyperus conglomeratus* in the southwest of Kuwait City could have resulted from long-term grazing or logging in the area. Perhaps the *Rhanterium epapposum* community (State II) originally dominated in the area. However, due to its close proximity to the city and the fact that long-term grazing and uprooting must have been practiced there, particularly in the past when vehicles were not available, causing the regression of the *Rhanterium* community to State V, in which sedge and increasers dominated.

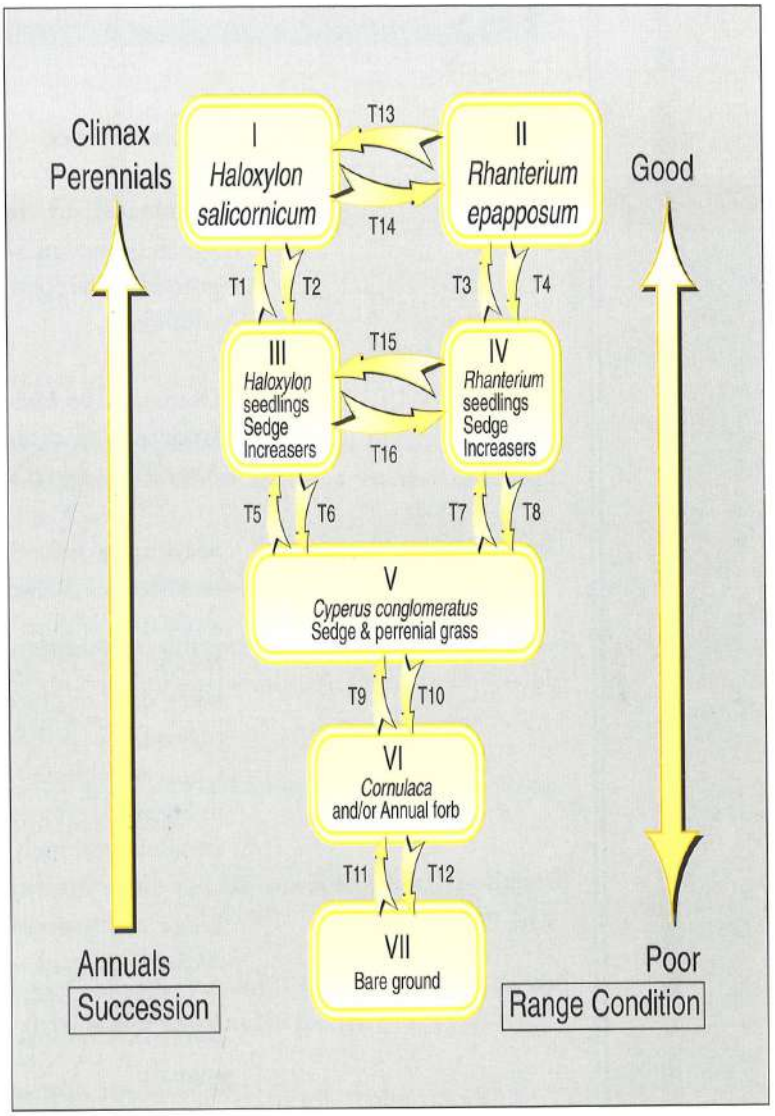


Fig.13. The succession model for Haloxylon and Rhanterium community types.

The model is a practical approach for organizing information relevant to management, and follows theoretical assumptions about the dynamics of the two communities. However, many of the transitional factors need to be studied to establish the validity of the hypothesis represented in this model. The impact of the Gulf War, in particular the oil pollution due to the explosion of more than 750 oil wells, on the successional stages of the two plant communities has left an obligation to investigate.

Table 2. Catalogue of States in Range Succession and State/Transition Model

State No.	Characteristics
State I	Dominated by the shrublet *Haloxylon salicornicum,* which occurs in shallow and consolidated soil, with bare ground in the open spaces occupied by its roots. Active in wildlife.
State II	Dominated by *Rhanterium epapposum,* which occurs in deep sandy soils, with bare ground occupied by its roots. Abundant desert wildlife species.
State III	Sedge and grassland with many shrub seedlings of *Haloxylon salicornicum*. Sedge (*Cyperus conglomeratus*) is dominant in association with palatable grasses such as *Panicum turgidum.* Seedlings of *H. salicornicum* are present, with old shrubs being dead or grazed. Increasers are annual grasses (*Stipa capensis*) and perennial grasses (*Stipagrostis plumosa*). Converts to State I or V in a few years. It may also convert to State IV if the topsoil layer is changed. Desert animals are abundant, such as lizards, jerboas, etc.
State IV	Sedge and grasses are similar to State III; seedlings of *Rhanterium epapposum* are present, with annual grasses (*Cutandia memphitica*) and annual forbs (*Plantago boissieri*). Converts to State II or V in a few years. Few animals.
State V	Absence of shrublets and dominance of sedge and associated grasses. Increasers are *Plantago boissieri* and *Arnebia decumbens*; invaders are *Moltkiopsis ciliata* and *Cornulaca ausheri*. Mostly lizards and insects.
State VI	Dominated by increasers, mainly *P. boissieri,* and invaders like *Cornulaca aucheri.* Bare ground with a few small and palatable annuals. Vulnerable to wind and water erosion. Poor in animal life.
State VII	Mainly bare ground covered with mobile sand sheet or hard eroded soil. Complete absence of perennial shrubs, sedge, and grasses. Annuals are rare. Extremely vulnerable to wind and water erosion.

Table 3. Catalogue of Transitions in Range Succession and State/Transition Model

Transition No	Cause/Characteristics
Transition 1	Due to resting.
Transition 2	Due to uprooting of shrubs and overgrazing.
Transition 3	Due to over-resting.
Transition 4	Due to uprooting of shrubs and overgrazing.
Transition 5	Due to relaxation from grazing pressure and human-induced factors. Normal precipitation is needed to prolong survival of new seedlings. Presence of drought may convert State III to VI in 5 years.
Transition 6	Due to moderate to heavy grazing pressure and uprooting of shrubs.
Transition 7	Due to relaxation from grazing pressure with good seasonal precipitation (above normal or normal to prolong survival of new seedlings). Presence of drought may convert State IV to VI in 5 years.
Transition 8	Due to moderate to heavy grazing pressure and uprooting of shrubs. Drought causes dormancy and death of perennials.
Transition 9	Due to relaxation from grazing pressure and human-induced factors. Rainfall is normal or slightly below normal.
Transition 10	Due to drought (<35 mm per year precipitation), overgrazing, and human activities. Animals graze palatable and unpalatable species.
Transition 11	Due to moderate relaxation with low moisture.
Transition 12	Due to drought, overgrazing, intensive human action, removal of topsoil by wind erosion, and or burial by mobile sand. Animals are less selective in grazing, with low productivity potentials.
Transition 13	May not occur, but could be due to changes in soil's physical characteristics or competition in mixed stands of the two communities
Transition 14	May not occur, but could be due to sand accumulation and changes in the micro-climatic conditions that promote *Rhanterium epapposum.*
Transition 15	May not occur, or may occur on a long time scale as a result of competition or changes in the plant's phenological stages (*Rhanterium epapposum* matures in summer, whereas *Haloxylon salicornicum* matures in autumn).
Transition 16	Same as transition 15.

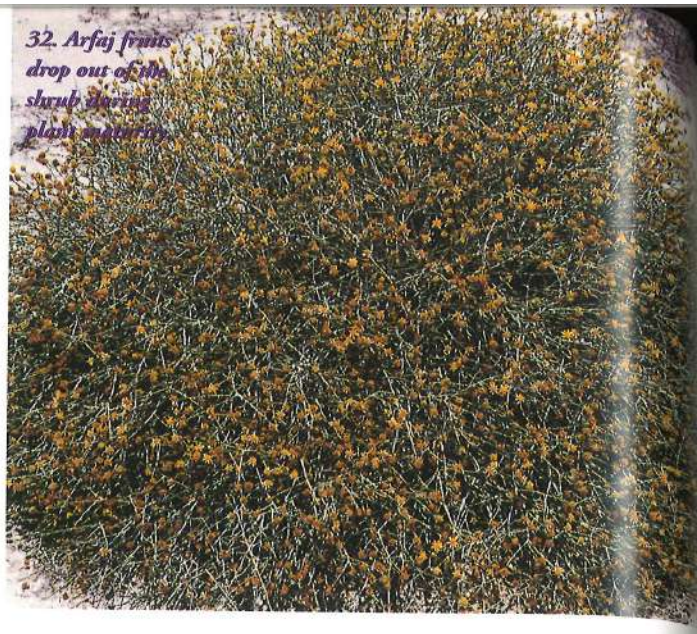
PLANT ADAPTATION

It is a natural phenomenon the way plants have specialized to develop a way to protect, spread and ensure the success of their seeds. When the soil's surface becomes stable, the seed has a better chance of germinating, particularly when rainfall is frequent and abundant. Water performs its power as an eternal source of life.

In the wet years, the desert changes from a pale sandy color to a blanket of bright blossoms. In some marvelous way, plants escape the effects of drought as their seeds have developed mechanisms that work to hold back the onset of germination until certain conditions, such as the proper amount of moisture and the right temperature, have been met.

Seed adaptation to desert environments allow plants to thrive in deserts. They adapt themselves either through physical changes (morphological) in their branches, leaves, roots, or seeds, or by modifying their organic functions (physiological) changing their osmotic pressure, absorption rate of elements, or preservation of carbohydrates to allow them to exist within their surroundings.

An example of adaptation in shrubs is the presence of living fibers and lignin* in plant parts, such as in the case of local shrub "arfaj" *Rhanterium epapposum*. When cold temperature prevails, this perennial shrub produces leaves quickly after rainfall. In a few months, the branches and newly formed leaves become vigorous, and the brownish yellow flower buds become enormous, attracting insects and birds. In the summer, when the earth has dried out, the leaves fall and the branches become naked and lignified with living fibers. In times of stress, these alterations may be important in increasing the chance of survival, water and reserve material stored in the stems to remain alive by allowing it to have a few dormant buds. When conditions improve, the reserves are transported into buds allowing new growth. Arfaj fruit is numerous; it forms in late spring and falls off the branches after maturity. It accumulates under the shrub and remains dormant until favorable conditions for germination prevail. Each fruit contains about 6-8 seeds that are transported by wind or water.



32. Arfaj fruits drop out of the shrub during plant maturity.

Adaptation to drought in shrubs is also accomplished by seasonal leaf shedding, branch shedding, and whole-shoot shedding, thereby reducing transpirational water loss. Drought-resistant plants (xeromorphic), such as *Zygophyllum qatarense*, have leaves that are composed of a succulent leaflet located on top of the compound leaf. At the beginning of the summer, the leaflets and, later, part of the petioles, are gradually shed.

A cross section of a leaflet in *Zygophyllum* (Fig. 13a) shows the epidermis that covers the entire surface of the leaf and is continuous throughout the stem where the leaf is attached. It is made of a single layer of cells containing ordinary epidermal cells. The ordinary epidermal cells look like irregular pavement blocks with depth that is usually less than their length. The epidermis is covered with a thick cuticle that is usually thicker on the upper side of the leaf than on the underside. Most plants of arid and semi-arid climates have a thick cuticle. The thick cuticle is a modification in the leaf structure in order to reduce cuticular transpiration. In some species such as *Nitraria retusa*, hair is grown on the surface layer of the leaflet (Fig. 13b). The cuticle has sunken stomata at both ends, but more on the lower side. There are large, thin-walled, colorless water-storage cells arranged in 6-10 layers to form water-storage tissue, which is a prevalent chamber of typical drought-resistant leaves. This helps the plant reduce its transpiration rate, and, hence, water loss during dry seasons.

* *lignin : a complex carbohydrate polymer making up 25% of wood of trees.*

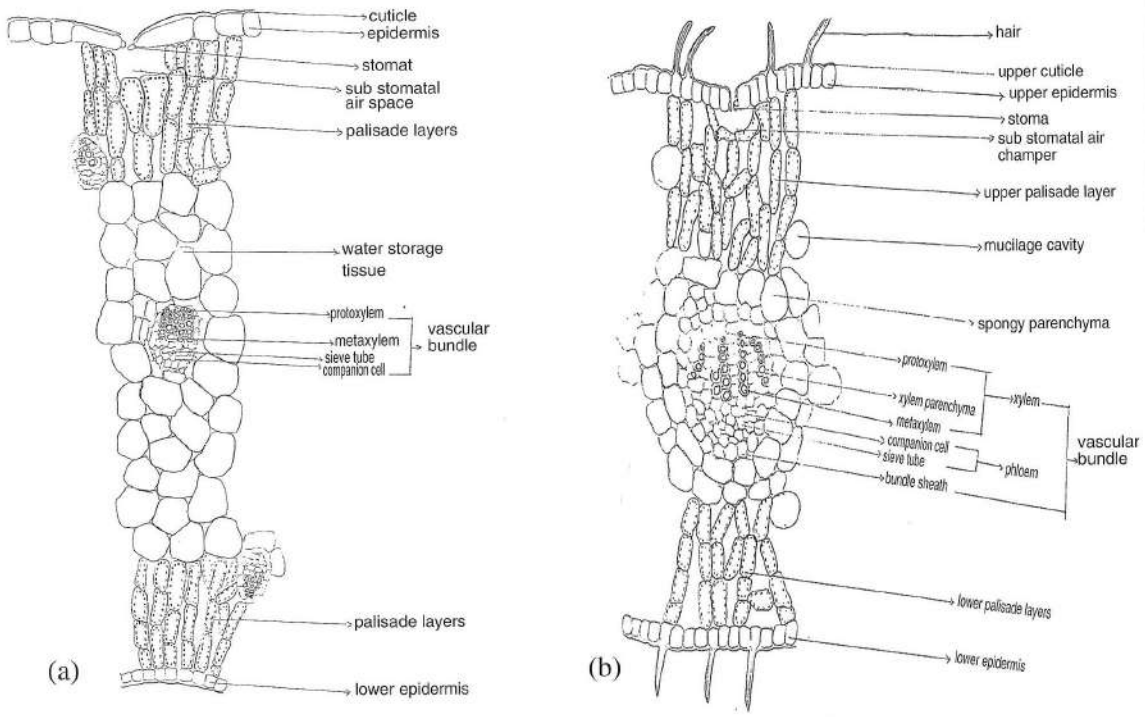


Fig. 14. Cross section in leaves of (a) Zygophyllum qatarense and (b) Nitraria retusa. (drawing by Sameeha Zaman)

To reduce water loss, the leaf of *Nitraria* is covered with a thick cuticle, particularly on the upper surface of the leaf. There are dense hairs on the epidermis; they are unicellular and have a thick wall and narrow lumen. The hairs are denser on the upper epidermis than on the lower epidermis. The hairs have a role in insulating the leaf against excessive heat and reducing water loss.

Examples of plant adaptation to drought by whole-shoot shedding, in which plants seasonally shed their above-ground parts, are: *Helianthemeum salicifolium* (sun rose) and *Moltkiopsis ciliata;* the aerial parts completely dry out and shed during the summer.

Root system adaptation is another mechanism by which plants survive during drought periods or hot and dry summers. Such plants develop numerous annual horizontal roots (laterals) that are thin and shallow (generally not deeper than 10-15 cm). These roots develop immediately after the first rain and enable the plant to efficiently utilize any water penetrating the uppermost soil layer before it is lost by evaporation.

33. Exposed roots of Calligonum polygonoides shrub.

Root adaptation can also be accomplished by developing a few perennial laterals that are thicker, shallower and longer. They run a certain distance horizontally from the taproot before turning downward. They cover a wider surface area than the annual thin laterals, and join them through soil moisture available in the upper layer.

Some plants develop deeper emerging laterals, first descending obliquely and then turning vertically downward. These roots insure survival of the plant during the summer when moisture in the upper soil layer has already been used up. Occasionall in years with high rainfall, the roots penetrate soil deeper into lower layers that are saturated with water that has been stored as a reserve.

34. Exposed roots of Cyperus conglomeratus on eroded dunes.

Psammophytes are plants that grow on sand and help stabilize its mobile behavior. They are morphologically adapted to act as a sand barrier. When the sand over them becomes slightly moistened, numerous adventitious roots start developing on the branches. Lateral roots grow along the slopes of the dune and extend very deep to reach the capillary water available at the bottom of the dune. Sedge plants such as *Cyperus conglomeratus* can develop new tillers and deep adventitious roots when buried by sand to tap the soil moisture present in the dune.

As the wind blows the soil out from under the roots, the plant becomes exposed and lies on the surface of the dune. In some cases, the whole nebkha is blown away, and the plant roots such as *Nitraria retusa* become totally exposed. The roots in both cases, however, are protected against the burning sun rays by a thick crust or a coating layer of cemented soil particles.

Other shrubs grow over the desert plains and plateaus. These habitats are the most severe because of the extreme dryness and soil salinity caused by high levels of sulfates and carbonates. The plants,

35. Saline tolerant plants (Salicornia europaea and Phragmites australis)submerged by seawater in Doha Bay, 1999.

which grow in such places, are low growing shrubs that are drought-resistant. An example is *Haloxylon salicornicum*, which is a dominant shrub in such areas. It is highly drought-resistant and can grow vigorously during hot summers.

Saline-resistant plants are essential to the functioning of the ecosystem. They are capable of recycling salts through the soil-plant system and provide nutrients for livestock. High concentrations of soluble salts such as sodium and calcium in the root medium affect plant growth in several ways. The water potential at root surface may be lowered, thus, inhibiting water absorption by the roots, affecting ion uptake from the soil.

Plant and seed adaptation to the environment is a factor promoting localized variability in vegetation and reflects both the physiological status of the individual plant species and their competitive relationship with each other.

Halophyte plants such as *Tamarix aucheriana, Salicornia europaea, Bienertia cycloptera,* or *Cressa cretica* can complete their life cycle and produce biomes despite the presence of large amount of salts in the root zone. Halophytes are widespread in low-lying lands that have been waterlogged and salt-affected by surface and sub-surface flooding. Their cells maintain a higher osmotic potential to prevent water loss. The roots can withstand low oxygen levels without losing control over ion uptake. Some halophytes develop root air channels and adventitious roots, which can assist them in surviving under sabkha conditions. Some absorb salts while others lose salts via leaf tissues.

SEED DISPERSAL AND GERMINATION

Wind and water are important elements for seed dispersal; seeds modify their features to make use of these two powerful forces and to maximize their chances for germination. Some fruits and seeds use the force of the wind to spread as far as possible. They develop different types of devices that aid in their dissemination. The most common structural modifications of seeds are wings and plumes (e.g., *Picris, Launaea, Tamarix, Erodium, Stipagrostis, Horwoodia, Mathiola* and *Schimpera*).

Seeds of sedges *Cyperus conglomeratus* and fruits of *Citrullus colocynthis* are well adapted for water dispersal. The seeds and fruits are readily transported long distances by moving water in the form of surface runoff and drainage channels.

36. Citrullus fruits can be transported by surface water.

Animals, both wild and domesticated carry many seeds and fruits. Those seeds with beards (*Koelpinia linearis*), spines (*Neurada procumbens*), hooks (*Medicago laciniata*), or barbs adhere to the hair of animals. Animals actively transport seeds to their nests. They pass seeds through their digestive system unharmed, and they passively carry seeds that adhere to fur, feathers and feet. The fact that a plant grows on a spot of soil indicates that somehow a seed or fruit arrived there and became established.

37. Ant mound surrounded by piles of seeds.

Birds and rodents are the most active transporters of seeds. Accumulation of seeds and chaff from consumed seeds around an ant mound indicate that harvester ants occupy the burrow. They do not transport seeds for great distances, but they do have an impact on the overall vegetation distribution. Animals spread plants by ingesting seeds at one location and digesting them at another. Passage through the digestive tract often increases the chances of germination.

Seeds of spring annuals only germinate when watered by cool rains during times of low temperature. They wait in the dormant stage during the summer when the seed coat is scarified by the cumulative action of the wind and heat. The seeds germinate or stay dormant until the right conditions have been met as if they knew how much was required to see them through their short lives.

Some seeds develop a hard seed coat to protect the embryo and endosperm from dehydration; others form water-soluble inhibitors in the material surrounding the seed. These inhibitors prevent seed germination until an adequate amount of rainfall washes off the inhibitors. Over thousands of years, this natural "birth control" mechanism has been the survival source of many desert plants.

Seed germination is a process of unusual activity. Cells in the seed, having been dormant, begin to divide vigorously. Roots, stems and leaves take form, forming a young seedling. The root is the first tissue to emerge from the seed, and the young plant is temporarily dependent upon food stored within the cotyledons or within the endosperm. Once the shoot and root tissues are developed, the plant becomes self- supporting, and is no longer dependent on stored food.

PHENOLOGICAL PROGRESSION

To live in a given location, the plant must be able to make full use of the favorable environmental conditions and tolerate the unfavorable ones. Phenology is the morphological and physiological expression of a plant's adaptation to seasonal changes in its physical environment. Each plant has its own phenophase in which it grows during favorable conditions and matures at its own pace in order to secure its existence and continuity. The phenological progression of the primary species in Kuwait such as *Rhanterium epapposum*, *Cyperus conglomeratus*, *Stipagrostis plumosa*, *Moltkiopsis ciliata*, and *Cutandia memphitica* were recorded throughout the year. Phenological development was recorded for individual species at two-week intervals throughout the season. The stages for grasses and shrubs are described in Tables 3 and 4, respectively. Results of the study are presented in Fig. 14.

The occurrence and amount of rainfall influence the stages of plant growth in each season. In general, annual species grow rapidly as soon as the favorable conditions prevail and complete their life cycle by seed setting, whereas perennial shrubs and forbs extend their growth for a longer period. Major phenological dates for shrubs and forbs (in this study, presented by *Rhanterium epapposum* and *Moltkiopsis ciliata)* were as follows: vegetative growth varied from February 10 to February 24, full bloom from March 9 to March 23, and seed dissemination from April 6 to May 12. As for grasses (*Cutandia memphitica* and *Stipagrostis plumosa*), the sequence was as follows: full vegetative growth varied from January 13 to February 24, full bloom was from March 23 to April 20, and seed dissemination started on April 5 to the end of the growing season (June).

Table 4. Phenological Stages and Numerical Scores for Grasses

No	Description
1	first leaf stage
2	second leaf stage
3	third leaf stage
4	fourth leaf stage
5	boot stage (the seed stalk is elongated with noticeable swelling of the seed head)
6	seed head emergence
7	early anthesis
8	mid-anthesis
9	full anthesis
10	mild stage (seed is soft and immature)
11	dough stage (seed is well-formed yet soft)
12	ripe seed
13	past ripe

Table 4. Cont'd

No	Description
14	vegetative parts browning
15	reproductive parts curing while stems, leaves and seeds cast.

Table 5. Phenological Stages and Numerical Scores for Shrubs and Forbs.

No	Description
1	early vegetative growth
2	immature vegetative growth
3	full vegetative growth
4	floral bud stage
5	early bloom
6	mid-bloom
7	late bloom
8	milk stage (soft seeds)
9	dough stage (well-formed seed yet soft)
10	ripe seed
11	past ripe (seeds not shattered)
12	mature vegetative growth
13	reproductive stage

LONELY TREES

There are only a few trees that can be considered native to Kuwait. Boulos and Al-Dosari (1994) indicated that there is only one native tree in Kuwait, namely, *Acacia pachyceras*. However, by investigating the history of the flora of Kuwait and by field observation, it can be concluded that there are five native trees to Kuwait: *Acacia pachyceras, Prosopis juliflora, Zizyphus spina-christi, Tamarix aphylla,* and *Phoenix dactylifera.* A photographic image of *Zizyphus spina-christi* (sidr) was shown in Al-Rashoud (1997). It is an old sidr tree named "dream tree" because it appeared in a very detailed dream to Colonel Dickson. The tree is believed to have led Colonel Dickson to the discovery of the Burgan oil fields in 1938 (Al-Rashoud, 1997). In 1997, the author spotted a tree standing alone near the Burgan oil fields (28° 48' 88" N, 47° 53' 62" E), which resembled the one shown in Al-Rashoud (1997) (Plate 38).

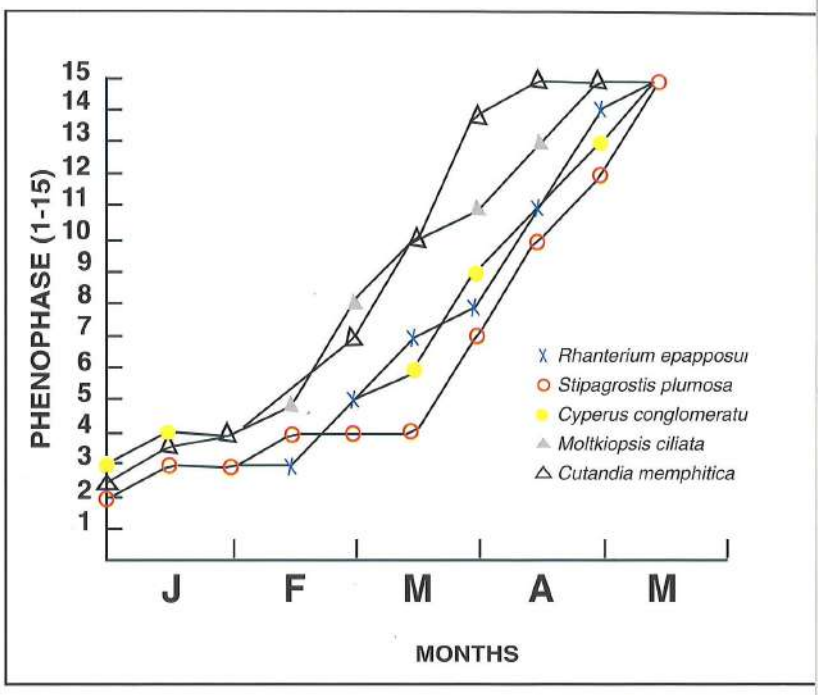
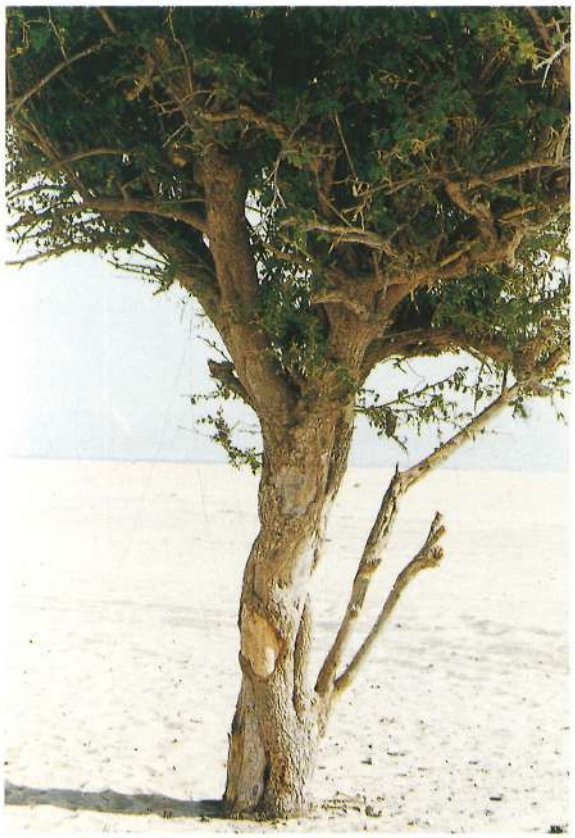


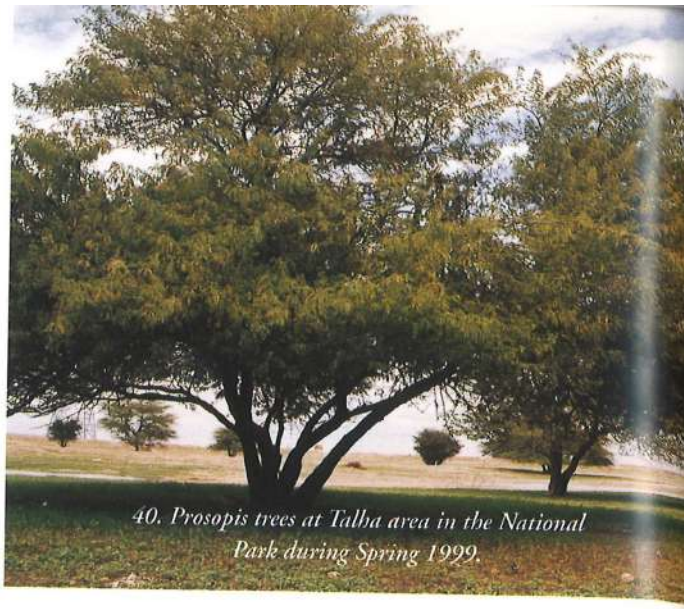
Fig. 15 Phenological progression of prime species in Kuwait.

It is estimated that the age of *Acacia pachyceras* (at Talha) is now over 80 years. For the sake of its protection, the Public Authority for Agriculture and Fish Resources (PAAFR) fenced the tree in 1975 (seep Plate 7). However, the fence attracted many



38. Zizyphus spina-christi near Burgan great oil fields (1997).

39. Lonely Tamarix tree in the northeast of Kuwait.



40. Prosopis trees at Talha area in the National Park during Spring 1999.

types of desert users (hunters, campers, travelers and others) who broke down the fence and camped under the tree. The users cut twigs and branches off the tree to make campfires that caused serious damage to the tree trunk. After Kuwait's liberation in 1991, the tree collapsed and the trunk split into two parts. Miraculously, the tree did not die and new branches sprouted again in 1992. Within the Talha vicinity, PAAFR planted more trees in the 1960s such as *Prosopis, Zizyphus,* and *Acacia* trees (Plate 40).

Tamarix (athal) and *Prosopis* (sifsaf) trees were planted more than thirty years ago and are thus naturalized to the area. There are many significant athal trees standing alone in the desert, particularly in the northern part of Kuwait. In As Subiyah and Faylakah island, some old date palm trees are well adapted, yet they remain dormant during summer. In the past, they provided food (dates) and shelter to travelers.

41. Date palm trees standing alone in As Subiyah.

CHAPTER III

MONITORING VEGETATION

PLANNING FOR DESERT TRIPS

Before going to the desert, one should prepare oneself by taking proper equipment for observing and taking notes, and by taking precautions to ensure his/her personal comfort and safety. Equipment includes stationary, pencils or pens, and pads or notebooks. Writing down observations and feelings will document information in a way that a mere photographic record cannot provide. Binoculars aid in viewing distant landscape features, birds and wildlife. A hand lens (10x - 20x) will give access to a world of smaller desert inhabitants, flowers and parts of living organisms. A small hand-held flashlight is essential to see nocturnal desert animals. A black light may reveal scorpions and other animals.

Some desert plants are spiny, which means wearing strong, well-made footwear is essential for safety. Loose and comfortable clothing is a big advantage, and a hat is indispensable in the hot desert. A first-aid kit in the vehicle and a small one in a day pack for leaving the vehicle are recommended. Cameras and lenses, particularly a macro lens with an UV filter, are needed for photographing the landscapes, plants, and animals. Paper bags for seeds and canvas sacks for collecting specimens, which eventually should be be returned to the wild, are additional tools.

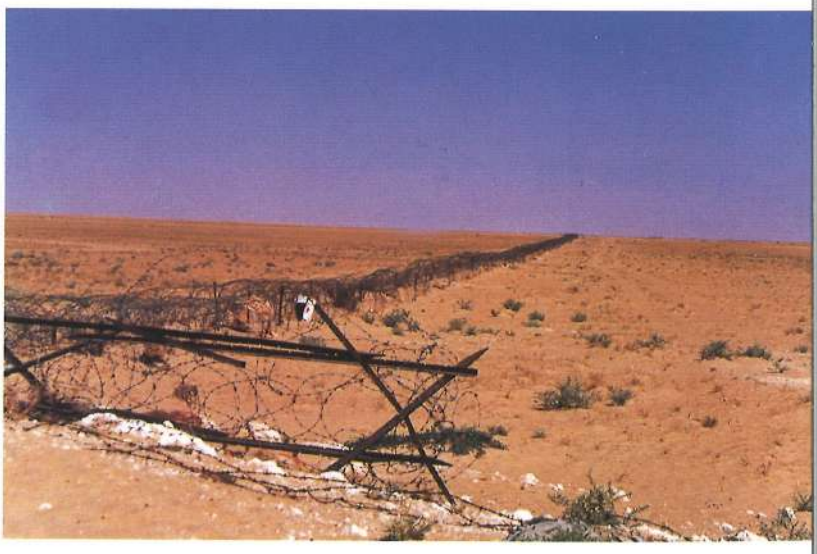
A compass or a Geopgraphic Positioning System (GPS) instrument, and detailed topographic maps with marked routes and roads are important when going to remote areas. Water is essential at all times. The vehicle, even a four-wheel drive, may get stuck in loose sand and mud. If this happens, stay calm and do not spin the wheels further. A jack may enable you to lift the vehicle out of the trouble spot and push it to a more stable surface. During rainy seasons, camping overnight in deep washes and gullies is not recommended.

Very rarely do people get stung by an insect or a scorpion, or are bitten by a spider. If this happens, try to retain the animal for positive identification. It is unlikely that you will be bitten by a venomous snake; however, should this happen, seek help immediately. Catch the snake if possible so that you can take it to the physician or, otherwise, have it positively identified.

Due to the Iraqi invasion and subsequent war, many areas in the desert have become unsafe. Areas that are polluted or subjected to mines and munitions should be avoided at all times. Mine

42. Oil lake in Burgan and other locations should be avoided at all times.

43. A mine field implanted by the Iraqi forces in the southwestern areas (1998).



fields were seen in the desert before they were declared clear by the MOD in 1993. The chances of encountering a mine or munitions in the desert are possible even in areas declared clean by military standards. Do not pick up any object, be it metal or plastic, that looks suspicious; it could be a booby trap. If you see a mine, stay away and, if possible, post a red flag in the area. Areas polluted with oil lakes, such as the oil lakes in Burgan and As Sabriyah, are hazardous and should be avoided at all times.

While in the desert, it is important to respect the plants, animals, and geologic structures there. Some plants require years to grow and may not recover from an unnatural disturbance. Wildlife hunting and collection of plants for fuel or fodder is strictly prohibited. Driving off the road damages soil and vegetation. Try to keep on the existing road track and avoid making new routes. Life in the desert already has a hard enough time surviving under a harsh physical environment. Further pressure by human activities is often damaging to the desert fragile ecosystem and, hence, should be prevented.

This information is not intended to dissuade the reader. Desert adventure can undoubtedly be safe. Enjoy the desert and take photographs to keep good records of the biological diversity of Kuwait's desert.

COLLECTION OF SPECIMENS

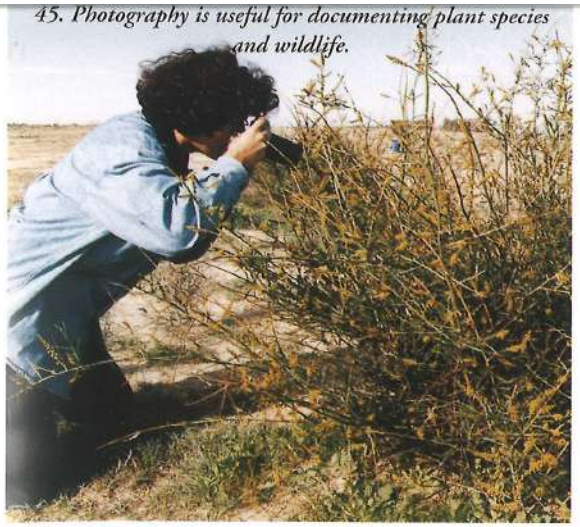
Creating your own herbarium (a collection of plants or plant parts that are picked in the wild or garden, pressed and dried, and then mounted for permanent display and reference), is really a hands-on education in species identification. An herbarium is thus a research tool showing the differences between species and resolving confusion that may occur in species identification.

When starting a herbarium, plant specimens should first be collected. Care should be given to individual living plants and the environment. Removing or causing the destruction of any plant is prohibited in most parks and nature reserves. Threatened or endangered species should never be molested. Even if species appear to be abundant, collect sparingly to avoid long-term damage to the habitat. To collect plant specimens, plastic bags, a towel, a sharp blade and pruning clippers are necessary. A notebook will be useful for recording information on the specimens collected during the visit. Plant presses of different sizes can be used in pressing species or plant parts. All plant presses, no matter how large or elaborate, have two simple features. One is a material for absorbing moisture, and the other is a source of pressure. Newspapers for instance, can be used for absorbing moisture, and heavy books can be used to apply for pressure. Plywood with holes or cardboard can be placed between layers of newspaper to provide ventilation. For applying pressure, two straps with tension buckles serve nicely. After cleaning, plant specimens can be placed between folded newspapers. The position and arrangement of specimens at this point should be considered permanent, since as a specimen dries, it becomes harder to rearrange without breaking. Longer stems can be curled or cut into parts. The field notes can be fixed to the drying specimen. Information such as the date of collection, location, name of the collector, habitat, and plant's scientific and local names can be added to the field notes. Clear plastic wrap can be used to protect mounted specimens. Store them in drawers or a special herbarium cabinet to protect them against bending. Alphabetical arrangement by species is a common approach to make the collection easily accessible.

44. Plant specimens and plant press.

PHOTOGRAPHY

As a research and reference tool, photography can be very useful, particularly for documenting living



45. Photography is useful for documenting plant species and wildlife.

plants and their habitats. A good 35-mm single-lens-reflex camera will yield good results in photographing whole plants. However, a close-up lens may be needed for photographing small flowers and parts of plants. Avoid images blurred by a breeze that flutters a plant or from an unsteady grip on the camera. A tripod for mounting the camera and a cardboard windbreak can help resolve these problems. A high-speed film (>400 ASA) may also help solve the problem of movement. Photography is a great way for young and old people to appreciate and feel the beauty of nature. The results can be most rewarding when the photos are displayed in the annual exhibitions and competitions held by many organizations such as the Kuwait Environmental Protection Society or the Kuwait Foundation for the Advancement of Sciences.

NOMENCLATURE

To avoid confusion in the common names of plants, scientists use a standardized two-part naming system called binomial nomenclature for both plants and animals. The first part of a plant's name refers to its genus and the second indicates its species. Thus, *Plantago boissieri* is the scientific name for the genus *Plantago*, the group to which the plant belongs, and the species *boissieri*, is the particular kind of plant in the genus *Plantago*. A botanical name is often followed by an abbreviation of the name of the person who first classified the plant scientifically. For example the initial L follows *Plantago boissierri*, for C. Linnaeus, the 18th Century Swedish naturalist who set-up the system of rules for plant nomenclature in his book. Genera that share similar characteristics are grouped into families, usually ending with the suffix ceae.

PLANT GROUPS

Plants are divided into five groups; algae, bryophytes, pteridophytes gymnosperms, and angiosperms. The first is the simplest form of plant life and lives mostly in marine and freshwater. Examples of bryophytes are mosses, hornworts and liverworts, which are very small in size, about 20 cm in length. They grow on land usually in marshy ground. Pteridophytes are ferns that depend on water for spore fertilization. This restricts them to moist places. The most highly developed plants, the conifers (gymnosperms) and the flowering plants (angiosperms), are distinguished from other plants by their production of seeds.

The flora of Kuwait presented in this book represent the diversity of species under each group with the exclusion of algae and bryophutes:

Angiosperms
|
Gymnosperms
|
Pteridophytes
|
Bryophytes
|
Algae

Plant Groups

VEGETATION MEASUREMENT

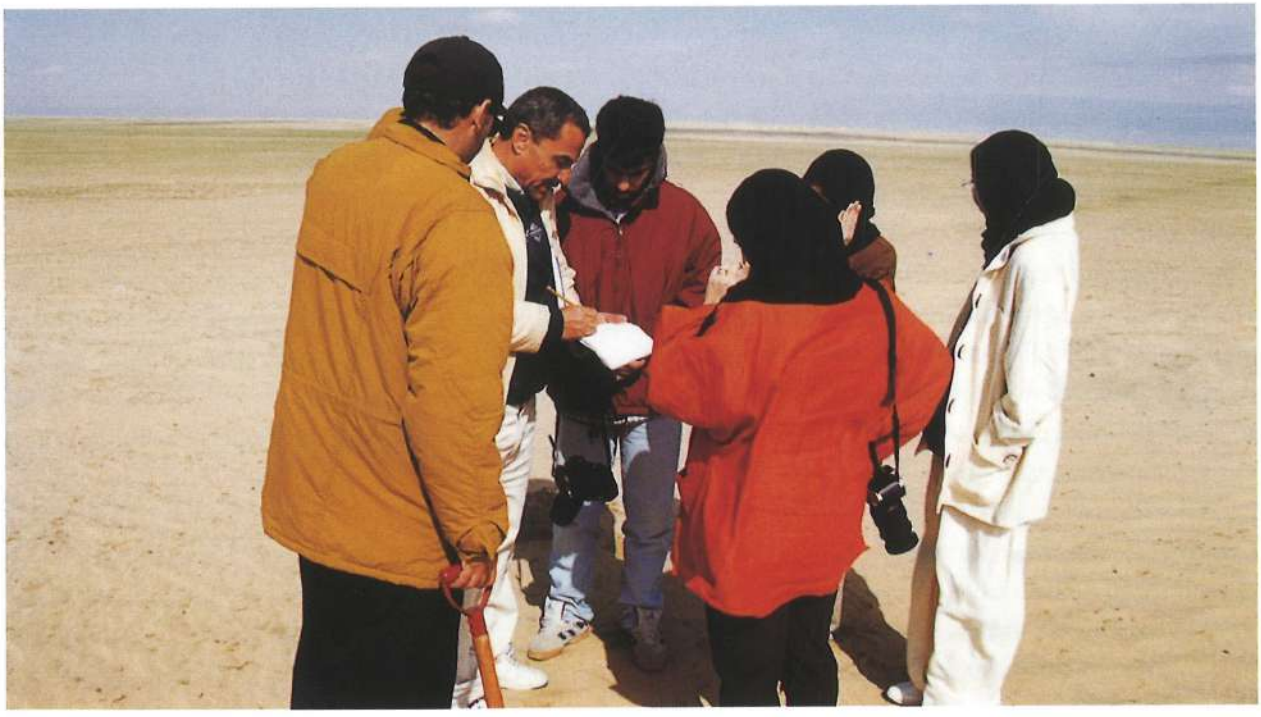
Vegetation measurement is useful for assessing status of rangelands and making judgments about selecting proper rehabilitation techniques. There are many techniques used to measure and/or estimate vegetation. Each technique is selected based on the objective of the surveyor. For example, to measure the percent cover of vegetation in an area, the site should be carefully assessed and selected. Avoid selecting a disturbed site or one non-homogenous in landform or soil type. Use a small quadrat (size 20x20cm) to randomly select the location of your larger size quadrat (1x1m). This can be done by throwing the small quadrat over your head and where it lands will be your quadrat location. Estimates of all plant species can be made by visual observation

46. Vegetation measurement by quadrat technique.

of each plant species in the quadrat and recording its percent cover. Large number of quadrats should be measured and recorded in order to make interpretations of the overall percent vegetative cover in an area.

DESERT ROUTES

During mild seasons, many people like to camp in the desert. The desert becomes more interesting and attractive to desert lovers. For those who would like to wander safely in the desert, we suggest three/one-day tours in the desert. Starting from Kuwait City, you may select any of the following routes in the desert: As Subiyah-Umm Niqa, Sulybiah-Umm Qdair, or Al-Shegaya-Al-Abraq.



47. Monitoring desert ecosystem.

AS SUBIYAH-UMM NIQA ROUTE

The road to As Subiyah has many diversities in landscape. You will be able to watch the Jal Az-Zor escarpment, which extends parallel to the shore-line of Kuwait Bay. There are many interesting scenery areas along the road (Fig.15). Al Khwaisat near Kazma, which is a historical area, is a typical coastal area with a diversity of saline tolerant plant species. On sandy areas, *Nitraria* and *Zygophyllum* are common. *Juncus rigidus* can be seen near the shoreline (Plate 26). On both sides of As Subiyah road, the National Park fence and the two opposite facing gates of the park can be seen. Both were established by the Ministry of Defense in 1996. As you pass the national park area, notice the thick stands of *Haloxylon salicornicum* on both sides of the road. You may stop anywhere to take photographs of the Jal Az-Zor escarpment. On the slopes of the Jal Az-Zor, sand accumulates in different shapes forming large dunes. As Subiyah terraces (Plate 27) can be seen along the coastal ridge near Mughairah, which was an important watering point for herdsmen in the past (see Plate 9). At the end of the road, the bridge to Bobyan island becomes apparent. The bridge was hit by the allies during the Gulf War in 1991. Up to year 1999, the bridge was still broken. You may be able to spot steppe eagles around the broken parts of the deserted buildings in the area. Unfortunately, bird hunters use this area excessively and many times we saw dead eagles near the athal and sifsaf trees. Towards the north, the vegetation begins to change. More halophytes can be seen near the coastal zone. Lonely trees such as date palms, and athal (Plates 39 &41) can be spotted near As Subiyah and Al Maghasil.

Due to good military protection, the vegetation near As Sabriyah is more dense. *Haloxylon salicornicum* is the dominating species in the area. *Lycium shawii* can be also seen near the coastal zone. On many occasions, we saw dhub laying on its back on the asphalt road during early morning hours. This is the way it seems they regulate their body temerature during winter. Groups of foxes can be also seen in the area. Umm Niqa is in the northwest side of the road. This is a nice picnic area where large barchan dunes are formed. Avoid driving over

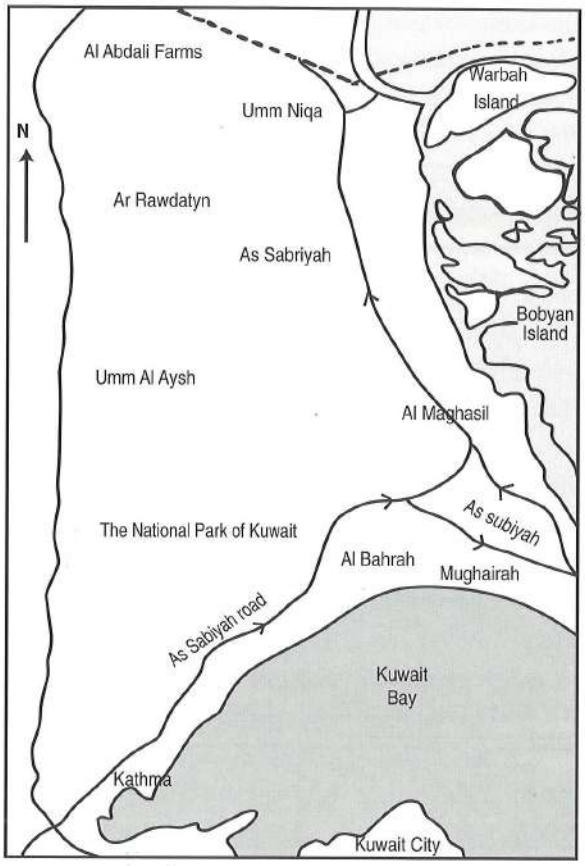


Fig.16. As Subiyah-Umm Niqa route in the northeast of Kuwait.

the dunes or camping near them. The wind can blow the sand easily and deposit it on any obstacle that stands in the way, including your tent.

SULAYBIA-UMM QUDAYR ROUTE

This route is further south. From Jahra road after passing Sulaybikhat, take a left on Sulaybia road (Fig. 16). This road passes through intensively grazed areas and feedstock grounds. The blue sign of Kuwait Institute for Scientific Research (KISR) will appear before the Kabd Broadcasting Station. If you have a permit to enter the Sulaybia Field Station (SFS), KISR site, turn right at the sign. You may notice the large number of campers and herding camps in the area. *Cyperus conglomeratus* dominates outside the protected areas. Inside notice the difference in the vegetation type cover inside and outside the fence. *Rhanterium* community dominates in the protected area. As you exit SFS going further south and turning right on the road towards Al Managish oil fields, you will encounter the livestock paddocks established by the Public Authority for Agriculture and Fish Resources. Going toward the oil fields in Al Managish, you will see the burning flames and water fields at Abdaliyah. *Stipagrostis pulmosa* and *Rhanterium epapposum* can be encountered. It is required that you also carry permits from the KOC to pass through the Umm Qudayr area. On the way to Umm Qudayr and closer to the borders with Saudi Arabia, you will encounter the *Centropodia forskalii* community. Many camels are usually present in the area. Also close to water reservoirs, sheep and goats graze the areas and rest near water points owned by the Government. Some migratory birds can be also encountered. The vegetation is heavily grazed near the water points and only *Cornulaca aucheri* is present. Remember to keep on the road due to the presence of mine fields that could be still encountered in the area. at Umm Qudayr oil fields, turn left towards Ahmad Al Jaber Air base. The vegetation will change into *Cyperus conglomeratus* in association with *Cornulaca* and *Stipagrostis plumosa.*

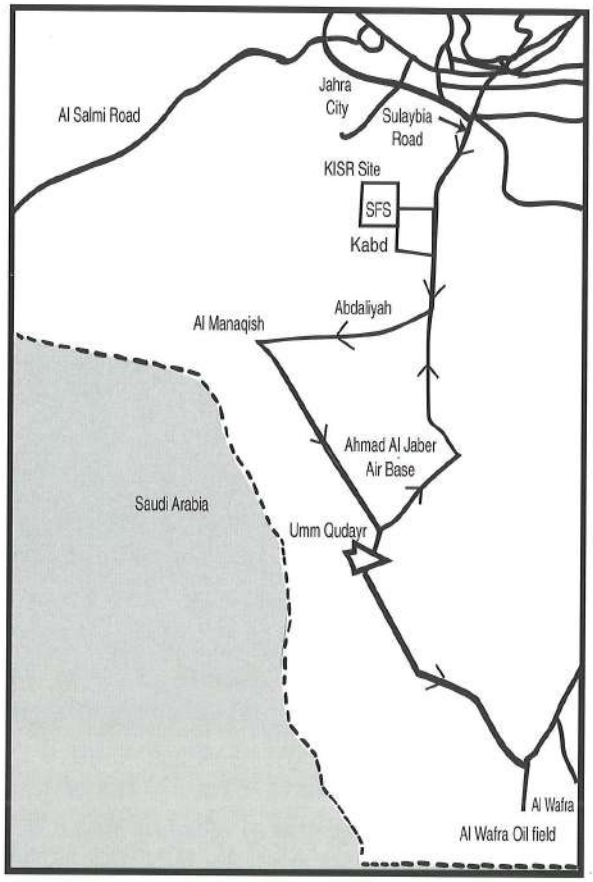
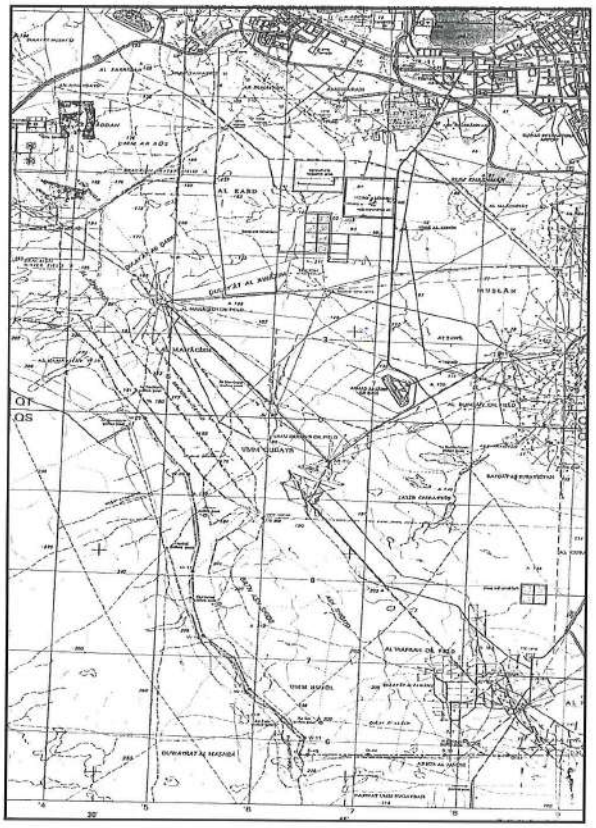
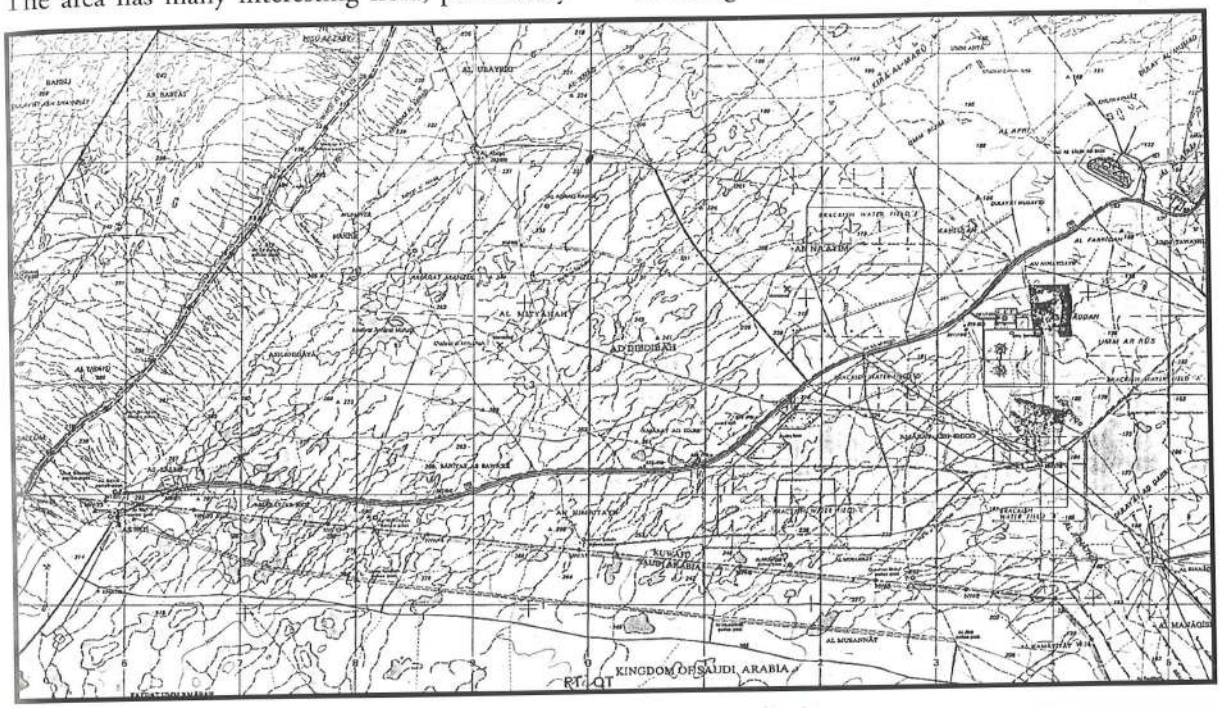


Fig. 17. Sulaybiah-Umm Qudayr route.



AL-SHEGAYA - AL ABRAQ ROUTE

Al Salmi road in the southwest of Kuwait leads to Al Shegaya area and Wadi Al Batin (Fig. 17). The area has many interesting flora, particularly during good rainy seasons. In the past, Al Dubdibah was full of the desert truffle (*Termania* and *Terfezia*), locally known as fuq'a or kamaa. They are believed to be associated with *Helianthemum lippii,* which was common in the area. However, fuqa cannot be seen nowadays due to land degradation problems in the area. The road to Al Abraq will lead you to observe *Astragalus sieberi* near the farm. When reaching Wadi Al Batin, the whole scenery will change. The wadi is very wide and is covered with a colorful mantle of annual plant species, especially during rainy seasons. Snakes can be also encountered in the Wadi. Desert white mushrooms are common in the area.



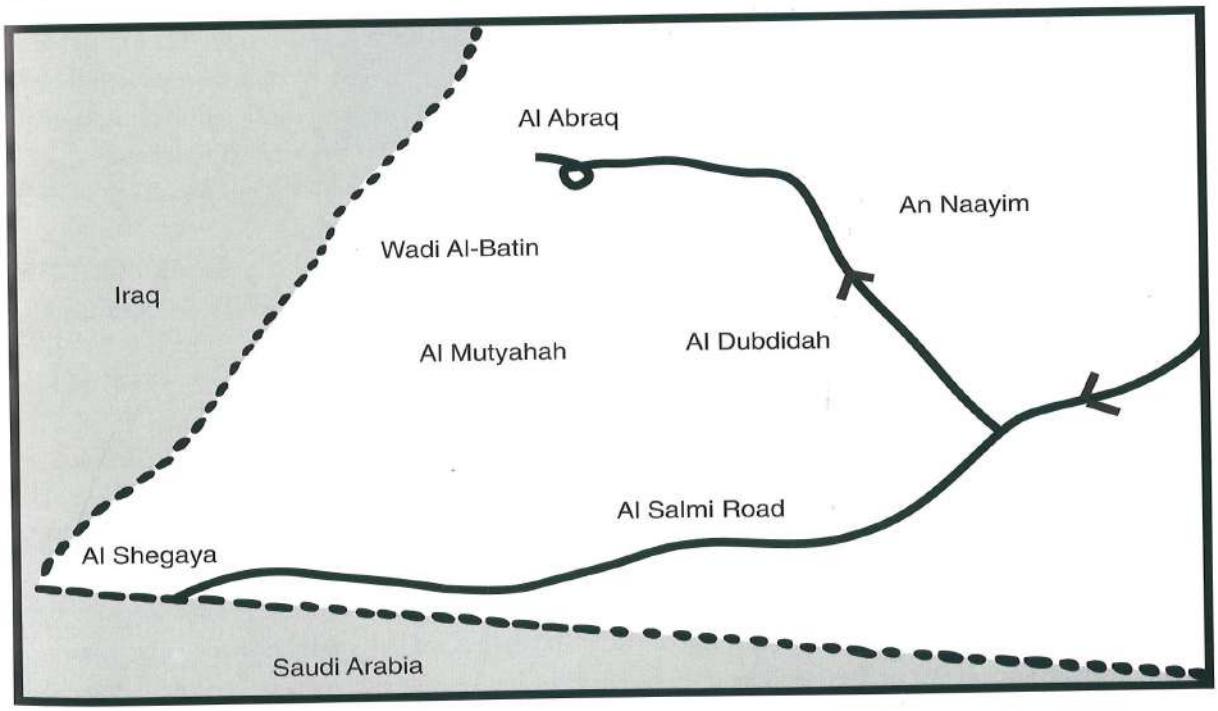
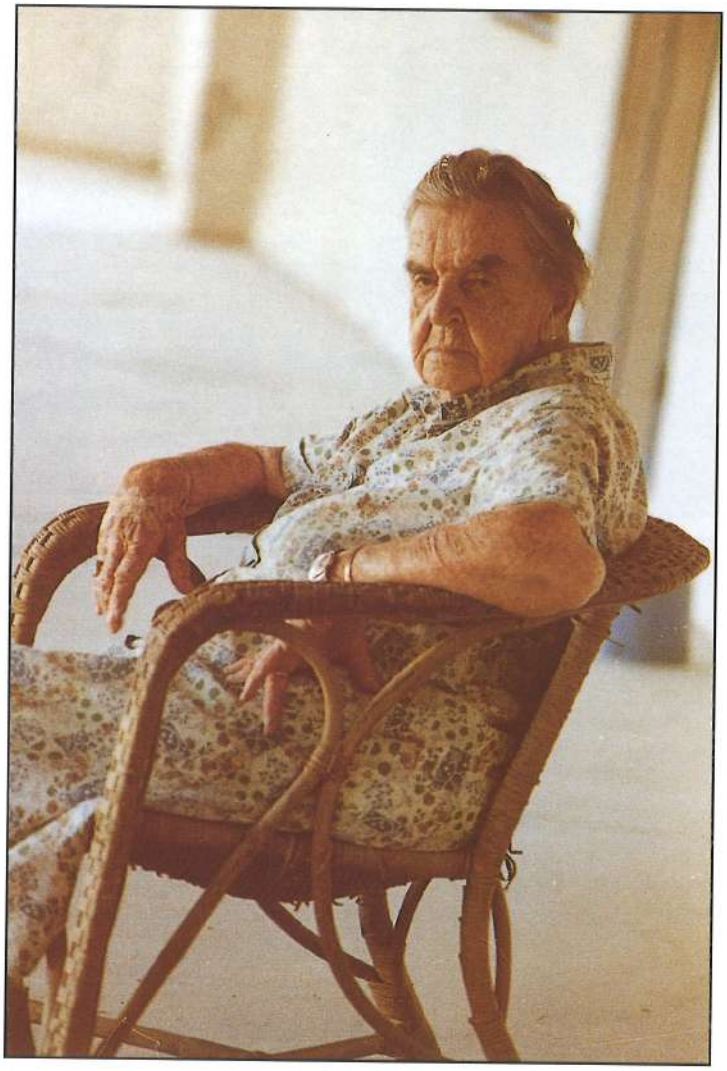


Fig. 18 Al-salmi-Al-Abraq route.

In memory of Dame Violet Dickson (1897 - 1991)



Dame Violet Dickson in 1989, Kuwait

(Private collection of the author)

CHAPTER IV

FLORA OF KUWAIT

In the following section, plants are listed in alphabetical order under their family names. A General description of each plant species and its habitat are presented. Flowering period of most plants varies depending on the amount of moisture in soil. They may continue their growth throughout the year when moisture is available, particularly in irrigated farms. Perennials, however, are more seasonal and their flowering period varies among species. To enhance the identification of species, a pictorial presentation is provided for some plant species. Most of the plant species shown in the checklist flora of Boulos and Al-Dosari (1994) are presented in this section. A species list is prepared followed by the vernacular name. A list of plants encountered in the field work during the period from 1990 to 1999 is presented in Appendix C. The following resources were used in preparing plant descriptions: Boulos (1988), Mabbrtlry (1987), Shuaib (1995) Mandaville (1990), Al-Rawi (1987) and Daoud and Al-Rawi (1978) and others.

ANGIOSPERMAE
DICOTYLEDONEAE

AIZOACEAE

Aizoon canariense L.
Hudq, Plate 48

A small branching succulent annual, this herb is commonly found on compact desert soil. The stems are prostate and are branched alternately forming a compact, star-shaped plant. The leaves are sequenced, fleshy and hairy on alternating sides, and are bright green in color. The flowers are yellow to green, star-shaped with a white center. Seeds are formed into a flattened, five-sided capsule at the end of the growing season. It appears in coastal areas and flowers in March-April.

Aizoon hispanicum L.
Mullayh, Plate 49

An annual herb Aizoon hispanicum appears in coastal areas, on hard desert soil and sometimes inland. The leaves appear in pairs, are bright green, elongated, and succulent. The plant blooms between March and April, the flowers are star-shaped and lemony-green in color with a white center approximately 4 mm wide. At the end of the growing season, seeds are formed into a flattened, five-sided capsule. This herb is commonly found in saline depressions in coastal areas near As Subiyah and Ad Dhubaiyah.

Mesembryanthemum nodiflorum L.
Qasool, Plate 50

This is a low-growing succulent herb with shiny leaves. It grows in clusters on sandy soil and reaches approximately 20 cm in height. The leaves are alternate, sessile, and branch upward in a curving fashion. The flowers are solitary, star-shaped, and white to creamy colored with a yellow center. The branches are 3-16 cm long. In dry conditions, towards the end of spring, the green leaves turn to maroon. This herb grows in saline soils and has been recorded in coastal areas and islands. It flowers during April and March.

AMARANTHACEAE

Amaranthus graecizans L.
Aurff Adeik

An annual herb, branched from the base and above. It grows erect, about 10-50 cm high, and is decumbent or prostrate. It is commonly found on farms and waste grounds. The stems are green, striate, angular and glabrous. The leaves are alternate and glabrous, or furnished. They have short hairs on the under surface with long petioled lamina that are broadly ovate or lanceolate to elliptic with

prominent nerves on the under surface. The flowers grow in axillary cymose clusters distributed over most of the plant. They are green with a reddish tinge, and appear between March and April. The seeds are shiny black. They are compressed, slightly reticulate and 1 mm in diameter. Not a very popular plant.

Amaranthus hybridus L.
Aurff Adeik

An erect, glabrescent, annual plant reaching 10-50 cm in height, *Amaranthus hybridus* is sometimes very stout. The leaves are alternate, ovate, acute or obtuse. They are up to 12 cm long and 8 cm wide on longish petioles, about 1/3 to 1/2 the length of the blade. The flowers are small, 2-2.5 mm long. This plant is commonly found in waste ground and gardens.

Amaranthus lividus L. var. *accendins* (lois) Thell
Kaf Al Muhanna, Plate 51

An annual herb that is often found growing around towns on pavements and waste ground. The stems are green and sometimes have a reddish tint. They are glabrous and usually branched from the base. The leaves are almost glabrous, ovate, rhomboid or deltoid, and long-petioled. The margins are entire, and the apex is obtuse and notched. The flowers are green and are arranged in dense terminal and lateral spike-like cymose clusters. The perianth is shorter than the capsule. Fruits are ellipsoid to subglobular, and the capsule ruptures irregularly. The seeds are shiny black. Flowering in October.

ASCLEPIADACEAE

Calotropis procera (Ait) Ait.F
Ushar, Plate 52

An erect, glaucous shrub with copious latex. *Calotropis procera* is woody below with pale corky bark, and coarsely succulent- herbaceous above. It reaches heights of 1.5-4 m and grows in coastal villages such as Finaitees where it has grown for many years. Leaves are opposite, oblong or obovate, sessile, obtuse with acute mucro, and weakly auriculate at the base. They are 10-25 cm long and 8-17 cm wide. They are fine, mealy, tomentose when young, becoming glabrous as they mature. Inflorescence is an umbel-like cyme on stout primary peduncles. The flowers have ovate-triangular corolla lobes that are pale green-white on the outside, and flushed with purple within the upper-half. The fruit is a smooth or somewhat wrinkled, inflated ovoid follicle that is 8-13 cm long. The seeds are poisonous and disperse by wind. Flowers in April.

BORAGINACEAE

Anchusa hispida Forssk.
Zraija, Plate 53

This spring annual is commonly found in shallow sand or on limestone. It has dark green lanceolate leaves, which radiate from the base, and has arched stems. Every part of this plant, except the flowers, is covered with long bristly hairs. It is about 20 cm wide and 10 cm high. Its tiny blue flowers are a few millimeters across, and tubular in shape.

Arnebia decumbens (Vent.) Coss & Kralik
Kahil, Plate 54

An annual herb that is one of the most common of the desert flowers that blooms early in spring. It is a narrow-leafed herb with yellow flowers arranged densely on a V-shaped cyme. Later in the season, the curving stems elongate and bear more yellow flowers. It can reach 20 cm in height where there is sufficient moisture. The leaves are stiff and have bristles along the stem, are alternate and lanceolate. The roots produce a red dye that can be rubbed off with the fingers and applied to the skin as a rouge. The plant flowers in February.

Arnebia linearifolia DC.
Kahil

An annual herb, that is commonly found in sandy or silty grounds. Usually, it branches from the base and is 5-25 cm high. It has appressed hairs on the leaf faces. The lower leaves are linear, oblanceolate to spathulate, obtuse, and sessile or tapering to an indistinct petiole. The upper leaves are smaller. The

flower is yellow in color and nearly sessile, with a calyx strongly growing in the fruit. The pubescent fruit is 15-25 mm long. Nutlets, which angle ventrally, are rounded at back, verrucose or pitted, and 2-3 mm long. Flowers in March.

Arnebia tinctoria Forssk.
Kahil, Plate 55

Another spring flowering annual, this herb is approximately 10 cm high. It is very similar to *Arnebia decumbens,* except that it has bluish-mauve flowers that grow on a one-sided cyme. It has greyish green leaves and it is covered with bristly white hairs. It is seen less frequently than *Arnebia decumbens,* and it lives on coarse, sandy and gravelly soils. Flowers in March

Echium rawolfii Delile
Kahil, Plate 56

An attractive, noticeable plant, *Echium rawolfii* has been seen in the south and east of the Shigaya police station. The flowers are bell shaped, red veined and produced in different shades of blue and red. Flowers in April.

Heliotropium bacciferum Forssk.
Ramram, Plate 57

This dark grayish-green multi-branched perennial has a woody base and small linear to elliptic leaves covered with small bristles. This plant is widespread in sandy and calcareous soils such as those found in coastal areas and on rocky outcroppings. Its white flowers are tubular with a yellow center. They are arranged in a spiral fashion on a cyme. It has medicinal value and spreads in disturbed sites. It flowers in February.

Heliotropium kotschyi Bunge
Ramram

This ascending dark green or grayish multi-branched perennial is a slightly woody shrub with hard, appressed hairs and larger often tubercle-based bristles. The leaves are narrowly elliptic, tapering at the base, sessile and up to 3.5 cm long. The flowers are white with a mustad-yellow center. They grow close together in a helicoidcyme. The nutlets are sometimes winged. The plant flowers in March and April.

Heliotropium lasiocarpum Fisch. et C.A. Meyer
Agrabana

This is an annual suffrutescent herb that grows up to 60 cm high and has appressed grayish, hispid, hairs. It has large wavy-edged leaves and many closely packed white flowers arranged in a helicoid cyme. Fruits have 4 nutlets. The plant grows in sandy soil and sandy calcareous places. It flowers from March to April.

Lappula spinocarpos (Forssk.) Asch.
Demagh Al Jarbouh

A dwarf annual, the pubescent plant is 3-15 cm high and is usually branched from the base. Leaves are linear to linear-spathulate, 1-3 cm long, and tapering towards base. The flowers are solitary or in very loose racemes, axillary, subsessile or short pedicellate. They are pale-blue in color. Nutlets are triquetrous, pyramidal, irregularly tubercled and usually puberulent at the outer angles. They are dark brown when young, becoming glossy olive gray with a jade-like surface when mature. These plants are frequently found in silty inland plains and basins. Flowers from February to April.

Moltkiopsis ciliata (Forssk.) I.M. Johnston.
Al Hamat, Plate 58

A common spring perennial, this plant is commonly seen all over Kuwait, especially in the south where it grows on loose sand. It is a semi-prostrate, bushy herb with bristly, lance-shaped leaves. The flowers are tubular and range in color from white to purple. It is highly drought-tolerant, losing its leaves in the peak of the dry season and putting forth new growth in the early spring. Flowers during spring.

Ogastemma pusillum (Coss. & Durand ex Bonnet & Barratte) Brummitt
Al Hamat

An erect ascending dwarf annual, this plant is found in shallow sands or silty basins and plains. It is not an easy plant to spot and may be more widespread than it appears. The leaves are linear, about 5-25 mm long. The flowers are solitary,

subsessile and yellowish in color. The nutlets are 1.5 mm long, shorter than the fruiting calyx, rounded at the back, and evenly granular-tuberculate. Flowers in April.

CARYOPHYLLACEAE

Gypsophila capillaris (Forssk.) C. Chr.
Ushb Al Dhabi, Plate 59

This is a large, multibranched, slender herb reaching approximately 1 m in height. It is usually found on gypsum-rich soil and flowers between February and April. It is covered with tiny, delicate, white flowers and small, oblanceolate, somewhat fleshy leaves.

Herniaria hemistemon J. Gay
Esh Shawla, Plate 60

This is a very small neat plant often found on limestone rock as well as on sandy soil. It reaches heights of 3-10 cm. The leaves are grayish green, 2-6 mm long, opposite, elliptic-oblong, ciliate are margins and sessile. The flowers are minute axillary clusters that bud and bloom from February to April. It has no petals, just yellow stamens peeping out of a green calyx that looks like the open beak of baby bird, It has been reported to have medicinal properties, especially for curing diuretic and astrigent ailments.

Herniaria hirsuta L.
Esh Shawla

A small. flat, prostrate dwarf annual densely branched, this herb is 20 cm long and covered with coarse hairs. The leaves are grayish green, alternate, ellipti-oblanceolate, and hirsute. The flowers are sessile in axillary clusters, and the calyx is spiny-tipped, white and membranous. Flowers between March and April, and commonly occurs on sandy slopes.

Loeflingia hispanica L.
Eraifija, Rejraija Plate 61

An annual, branching herb approximately 10 cm high. The leaves are subulate, 3-6 mm long with stipules that are filiform. It is connate with the leaf blades and forms lateral appendages. The flowers are sessile, minute and axillary. The seeds are sub-oval to ear-shaped, shiny, minutely punctuate, and brown-gray. The plant is frequently found in sand or silty sandy areas. Flowers in March.

Paronychia arabica (L.) D C.
Rig-Raga, Plate 62

A low growing annual herb with hairy, branching stems and elliptical to linear leaves, around 10 mm long and 2 mm wide. It is recognizable by its bracts and stipules, which are silvery-white. The flowers are tissue-like and greenish-white. It grows on sandy soil and flowers between March and April.

Polycarpaea repens (Forssk.) Asch. & Schweinf.
Rugayigah Plate 63

This is a trailing plant about 25 cm long. Its stems are prostrate, and leaves are opposite or whorled, narrow and linear. Papery flowers appear mostly at the ends of the branches and are approximately 2.5 mm long. It flowers in March and is found in firm sandy soil.

Polycarpaea robbairea (Kuntze) Greuter & Burdet
Qubaira

A pale little plant with white flowers, it can be easily overlooked. It is found in the northeastern end of Faylakah island. An annual herb that flowers during spring.

Polycarpon tetraphyllum (L.) L.
Reehai

An annual, prostrate, tiny herb with pinkish-green forked branches, this plant is mostly found near the sea. The leaves are opposite or whorled in fours. They are spathulate or oboyate, tapering to a narrow base. The flowers grow in dense clusters, are whitish-green, with 5-lobed, and green sepals. The fruit, a capsule, contains pale, smooth seeds, 0.3-0.4 mm long. The plant flowers from February to April and grows as a weed in gardens.

Pteranthus dichotomus Forssk.
Al Mujannah

An annual herb that is 5-25 cm high, branched, usually ascending. The leaves are fleshy, narrow and flat, 8-20 mm long. The flower head looks as though

the white-green flowers have been flattened or squashed between two oval leaves. The fruiting inflorescence becomes somewhat spinescent. It is frequently found on rocky, elevated ground.

Sclerocephalus arabicus Boiss.
Thiraiza, Plate 64

This annual, glabrous herb has opposing linear, smooth fleshy leaves that are cylindrical in shape. Flowers are aggregated into heads on a common peduncle. Petals are absent. Fruits are spinescent. It is a very common plant on alluvial soil; but found on rocky or elevated ground also. It flowers from February to April.

Silene arabica Boiss.
Lussaig, Plate 65

A slender annual, branching herb approximately 30 cm high. It has 5 deeply divided petals that are white with a pink stripe on the back of the flower. The petals curl upward when the sunlight is intense, and uncurl as the sun sets. *Silene arabica* has fewer and narrower flowers than *Silene villosa*. The leaves are sessile, lanceolate, acute, glandular and pubescent. It flowers in April.

Silene arenosa C. Koch
Refaia

This is the twiggy (anorexic) silene with its thin stems and fine leaves. Its' 5 deeply divided petals vary in color from white to mauve. As the petals curl up tightly in the broad daylight peeping out slightly as the light fades, it is very difficult to spot.

Silene conoidea L.
Zaafar, Plate 66

This is an erect, rather stout annual, growing up to 10-50 cm in height, is branched and has glandular pubescence. Leaves are linear-lanceolate, acute, and finely puberulent. The corolla is strong pink. It is a desert plant, rarely found in a cultivated ground and along the roadside. The seeds are reniform, grayish and papillose.

Silene villosa Forssk.
Turba, Plate 67

Silene villosa is a showy annual herb with an abundance of white flowers. It grows in sandy soils amongst *Rhanterium epapposum* and *Cyperus conglomeratus*. The leaves are fleshy, opposite, oblong and sticky, attracting fine particles of sand. The flower has five petals, which are 15 mm long; it is white, lobed and blooms at sunset. Flowers in February.

Spergula fallax (Lowe) E.H. L. Krause
Glaiglah

A glabrous, slender annual herb that grows 10-25 cm high, this plant has a linear, small, whorled, dark-green capillary and obtuse leaves about 5 cm long. It has pale mauve to white flowers with petals that are shorter than the sepals. The seeds are black, lenticular with hyaline wings that have papillae. The plant grows densely in the shade of *Zizyphus* and *Acacia* trees on alluvial soils. It flowers from February to May.

Spergularia diandra (Guss.) Heldr. & Sart.
Um Thraib, Plate 68

A very delicate branching annual, this plant has slender, thread-like leaves about 20 mm long and 0.5 mm wide. It has a mauve flower comprising 5 petals. It is found on sandy soil, such as coastal areas, and it flowers between February and April.

Spergularia marina (L.) Griseb.
Um Thraib

This is an annual or biennial erect or spreading herb about 5-25 cm high with stems branching from the base. The mature plant is glandular above. The leaves are linear and fleshy, and the inflorescence is an irregular cyme. It has pinkish flowers that often have reduced petals and greenish or purplish glandular sepals. The capsule is ovoid with blackish-brown seeds. The plant is widely spread over moist brackish-ground, salt marshes, the edges of fields and irrigation canals in saline soils.

Stellaria media (L.) Vill.
Najmah

This is a richly branched, sprawling annual herb with a single-line of hairs on the stem. The leaves are opposite, ovate, acute, long-petioled below to sessile above and glabrous or ciliate at the base. The inflorescence is cymose and has few flowers. The pedicels are usually longer than the flowers. The

anthers are red-violet. The pedicels bend down with the weight of mature fruit. The seeds are reniform brownish, papillose or tuberculate. This plant is an uncommon winter weed that usually grows in fine-textured soils and under the shade of trees. It flowers from January to May.

Telephium sphaerospermum Boiss.

A tiny semi-prostrate herb, with blue-green leaves. The flowers are white, 4 cm wide. The plant flowers in the evenings.

Vaccaria hispanica (Mill.) Rauschert

Al Bakary

An erect glabrous annual that reaches 60 cm high and is often swollen at the nodes. The leaves are glabrous, and the lower leaves taper at the base while the upper clasping and frequently connate. The flower is a paniculate inflorescence with 5 conspicuous dark green winged whitish-green calyxes and 5 heart-shaped pink petals. Capsule enclosed in the calyx, ovoid to globose with a hard yellow exocarp, seeds subglobose, brown, papillose-verruculose. This winter weed is abundant in Faylakah island growing in crop fields. It flowers from March to April.

CHENOPODIACEAE

Agathophora alopecuroides (Delile) Fenzl ex Bunge

Sharan, Plate (69)

An annual, rather stiff, glabrous shrublet, this plant has whitish bark up to 40 cm height. The leaves are scattered or clustered, rather distant, teretish, and club-shaped or sometimes nearly globose. Those of the spring season are 5-12 mm long, terete, succulent, and tipped with a conical spinule 1-2 mm long, and the autumn leaves are mostly 2-7 mm long with a straight or bent, needle-like spinule 2-4 mm long. The flowers form bracteate clusters in the woolly axils. The plant is rare to occasional, and is usually found in barren limestone country, rocky wadis or gravel plains.

Anabasis lachnantha Aellen & Rech. f.

Ujayrum

A perennial shrublet reaching a height of 60 cm, this plant has branches and shoots that are woody below. Leaves are virtually absent, or reduced to opposing triangular scales or lobes 1 mm long forming capsules at the joints. The flowers are axillary in spikes near the ends of the terminal shoots. The fruit perianth is furnished outside with 5 spreading, membranous, yellow to pink wings. Usually, this plant grows in shallow, gritty to silty soil over limestone.

Anabasis setifera Moq.

Sharan, Plate 70

This is a glabrous succulent shrublet about 60 cm tall with numerous erect stems and fleshy cylindrical, club-shaped, horizontal leaves, 8-10 mm long, 4-6 mm wide ending in a deciduous bristle. The flower cluster in the upper axils. The fruiting perianth with 5 wings, which are often compressed laterally due to crowding of the fruits. The plant is commonly found in hot deserts, moist saline regions and wadi beds, often on gypsaceous ground. It flowers between August and November.

Atriplex dimorphostegia Kar. & Kir.

Al Rughl

An annual herb, this plant is 10-15 cm high with a glabrous, prostrate to ascending branched stem. The leaves are alternate, petiolate, grayish-green, 8-16 mm long and 8-13 mm wide, entire, beset with crystalline papillae and almost glabrous above. The flower is axillary or terminal and paniculate. Both pistillate flowers and staminate flowers are clearly seen. The fruit is utricle with free membranous pericarp, included in the persistent foliacous bracts and which hang down when ripe. The seeds are flattened, vertical, with an annular embryo surrounding the scanty endosperm. The plant is commonly found on saline, sandy soil along the roadside, and it flowers in March.

Atriplex leucoclada Boiss.

Al Rughl, Plate 71

This is a woody shrub about 40 cm tall with silvery twigs that branch in a prostrate fashion. The silvery leaves are alternate, triangular and undulate. Bud-like clusters of flowers appear in the axils and on terminal clusters. It is commonly found on sandy calcareous soil such as the type found in Ad-Dhubaiyah and Al Khiran.

Bassia eriophora (Schrad) Asch.
Qittaina, Plate 72

It is an annual herb commonly found in disturbed areas or in areas irrigated by brackish water. It is about 15 cm tall, identified by its cotton-like appearance of the Fruit that is enclosed in balls of dense white hairs. Flowering February-April.

Bassia muricata (L.) Asch.
Haitham, Qutaynah, Plate 73

An annual herb, densely tomentose plant reaches 30 cm in height with many erect to decumbent stems branching from base. The stem is reddish and pubescent. The leaves are linear, alternate, densely hairy, and sessile. The flowers are solitary or clustered in the axils. The fruit is perigonium, star-shaped, yellow with 5 spines twice the length of the disc. The plant is found on sandy and stony ground, and flowers between February and March.

Bassia scoparia (L.) A.J. Scott syn. *Kochia scoparia* (L.) Schrad.
Shaar Al Banat

Also known as *Kochia scoparia* (L.) Schrad. A Mediterranean weed that grows in Europe to Japan. Introduced to local farms.

Beta vulgaris L.
Seilg

A perennial or sometimes annual herb. This plant has a glabrous or sparingly pilose, erect or decumbent, much branched and conspicuously ribbed, green or dark red stems. The stems are with radical leaves that are oblong-ovate and obtuse up to 10 cm long, and cauline leaves that are rhombic-oblong to laceolate. The plant flowers in clusters of 1-3 flowers in long interrupted spike-like leafy inflorescence. There are 5 perianth lobes that are green, fleshy, thickening in fruit, and often in-curved. The plant occurs in moist saline soils at the edges of cultivated ground and along irrigation canals and it flowers in March.

Bienertia cycloptera Bunge. ex Boiss.
Golleman, Plate 74

Halophytic or salt-loving, this plant grows in the salt marsh areas and on sabkha grounds. It is about 60 cm high and has apple green, glabrous, succulent, linear leaves. It has minute flowers about 2 mm in diameter loosely arranged on a raceme, and is followed by a fruit embedded in a disc-shaped wing. Flowers in November.

Chenopodium album L.
Aifajan, Plate 75

This plant is an annual herb, branched or unbranched 10-80 cm high, pale green or greyish-white, mealy with subglabrous, and often has a red-striped stem. Radical leaves are ovate-spathulate and obtuse to acute while cauline leaves are rhombic, ovate, lanceolate or linear. The flowers are gray-green with a red tinge, and the perianth segments into 5 broadly ovate, keeled lobes that are dense, externally mealy and with scarious margins. The anthers are yellow, and the seeds are lenticular, 1.5 mm diameter, black. The plant is a weed that grows in irrigated localities and damp places. It flowers from June to November.

Chenopodium glaucum L.
Ghubayra

An annual procumbent, decumbent or erect plant, often *Chenopodium glaucum* is a red-flushed plant. The leaves are narrowly oblong, petioled, fleshy with a few obtuse teeth or sinuate, and white mealy underneath. They are 12-45 mm long and 3-22 mm wide. The seeds are 1-1.2 mm in diameter and dullish. This plant is a weed of gardens, farms and waste grounds.

Chenopodium murale L.
Khbaitha, Plate 76

This is a large, leafy green plant with rhombic to ovate-triangular leaves and serrated margins. This plant occurs as a weed in gardens and wastelands. It is occasionally seen in the desert around abandoned sheep stalls. The stems and petioles of the leaves are sometimes red. The flowers are minute and green, and occur in clusters in the leaf axils and at the end of the stem. Flowers in April.

Chenopodium opulifolium Schrad.
Natna

This plant is a glabrous ascending annual, sometimes stout, and up to 80 cm high. The leaves are rather distant, ovate to deltoid, 1-5 cm long,

0.5-4 cm wide, acutely serrate, often with 5-8 teeth on each side, and grayish underneath, especially when young. The flowers form in somewhat distant clusters in spicate-paniculate terminals and with upper-axile inflorescence; the petals are green and keeled medially with a white margin. The plant occurs commonly in farms or gardens.

Cornulaca aucheri Moq. Syn. *Cornulaca leucacantha* Charif & Aellen
Al Had, Plate 77

An annual herb that is currently visible in disturbed areas of the desert. It is about 80 cm tall, and has stems that branch from the base with new growth in the summer. The leaves are smooth, very spiny and end with a sharp white to silvery spine. These spines become stiffer as the plant matures. The plant has tiny flowers in the leaf axil with a protruding yellow stamen. Flowering in September.

Cornulaca monacantha Delile.
Al Had, Plate 78

This is a blue-green, glabrous, prickly, shrublet up to 40 cm high that is highly branched. The leaves are short, re-curved and tapering from a clasping base into a rigid spine; the axils are woolly. The flowers, clustered in-groups of 3-5 in the axils, are hidden by dense wool. Hairs with 1 or 2 clearly exerted spines subtend the fruits. This shrublet inhabits seashore sandy soils and flowers from October to November.

Halocnemum strobilaceum (Pall.) M. Beib.
Theluth, Thullayth, Plate 79

This is a halophytic shrub that is easily recognized by its numerous, small decussate, green tubercles along the branches. The leaves are minute, connate, opposite and have rudimentary lamina. The flowers grow in a cluster of 3, forming lateral and terminal spikes. The plant grows in the littoral salt marshes, which are usually inundated by seawater. It flowers in October to November.

Halothamnus iraqensis Botsch.
Gadgad, Plate 80

This is not a very common plant and inhabits *Haloxylon* areas with shallow sand in hilly, somewhat rocky terrain, and is usually scattered. It is a shrublet that reaches up to 50 cm height. The leaves are fine, and linear in spring, and reduced to triangular rudiments during summer and autumn. The flowers are spikes on lateral shoots but are sometimes crowded with the wings of adjacent overlapping perianth. The fruit is showy. In the autumn, the pale yellow-beige, papery wings of the fruit appear. Flowering is during October-November.

Haloxylon salicornicum (Moq.) Bunge ex Boiss Syn. *Hammada salicornica* (Moq.) Iljin
Rimth, Plate 81

This species is commonly found in areas northeast of Kuwait and south in coastal areas. It is a low sprawling shrub, about 60 cm tall. It has jointed stems with leaves reduced to triangular scales. Flowers appear in dense lateral spikes at the end of the terminal and lateral shoots. The fruit is disc-shaped and winged. The plant is a great sand binder and lizards like to live under its branches. Flowers during October -November.

Salicornia europaea L. Syn. *Salicornia herbacea* L.
Khraiza, Plate 82

These plants are halophytes, grow in the mudflats of Kuwait or the intertidal areas of Kathma. Stem segmented. The leaves are reduced to scales, which are opposite, conical and rudimentary. The small flowers are deeply embedded in terminal spikes, and the seeds are grayish to pale brown and lack wings. *Salicornia europaea* was once used as fuel, and its ashes were once used as a soda for making soap.

Salsola cyclophylla Baker.
Hamdh

This plant is extremely drought-resistant and may be found in the driest imaginable spots on elevated rocky ground. Northern and southern specimens differ in inflorescence dimensions. The far northern ones have broader spikes, 5-7 mm in diameter, and broader perianths.

Salsola imbricata Forssk. Syn. *Salsola baryosma* (Roem. and Schult.) Dandy
Mulaih, Gathraf, Plate 83

Low-growing, halophytic shrubs, these plants smell like rotting fish when crushed. They have ascending branches, and the leaves are ascending and wide, spreading from the base. New shoots are bright and red in color. The leaves are clusters of small balls that are triangular and scale-like. The flowers are tiny, and are followed by the appearance of conspicuous winged fruit. The plants flower between June and September.

Salsola jordanicola Eig.
Homaidh, Plate 84

This is an annual, yellowish, papillose-mealy and petulous-villous plant. The stem is erect, greatly and divaricately branched from the base, and whitish in color. The leaves are linear or oblong linear, 10-20 mm long, 1.5-2 mm wide, and dilated at the base, but soon deciduous. The flowers are solitary in the axils, and distant or sometimes crowded over the stems. The fruit includes a dry utricle, and a horizontal seed. The plant occurs in saline sandy soil and flowers from October to November.

Seidlitzia rosmarinus Ehrenb ex. Bunge
Al Shinan, Plate 85

An perennial rounded, glabrous shrub up to 60 cm high, this plant is greatly branched from the base. The branches are opposite, whitish, glossy, and glabrous, except at the nodes. The leaves are opposite, decussate, sessile, fleshy silver-green, cylindrical, linear, semiterete, and become thicker towards the apex. The flowers are axillary, solitary, and congested with two fleshy bracts. The fruiting perianth is about 10 mm in diameter, and the wings are unequal. The fruit is a membranous utricle that is depressed; the seeds are horizontal, black, compressed, and coin-shaped. The plant is found in saline soil at low elevations and rarely on elevated rocky ground. It flowers from September to October.

Suaeda aegyptiaca (Hasselq.) Zohary Syn. *Schanginia aegyptiaca* (Hasselq.) Alellen
Hartabrl, Golleman. Plate 86

This plant is an annual, densely leafy, soft succulent, glabrous, glaucous or somewhat mealy herb up to 60 cm high with erect, and decumbent stem. The leaves are cylindrical, fleshy, obtuse, incurved, and 10-30 mm long and 1-5 mm wide. The flowers are clustered in leafy spikes. The fruiting perianth is about 3 mm long, top-shaped with lobes becoming inflated, spongy, green, and sometimes ripening to purple or black. The plant grows plentifully on saline ground around the Shuwaikh secondary school campus. It flowers between September and October.

Suaeda vermiculata Forssk. ex J.F. Gmel. Syn. *Suaeda fruticosa* Forssk. ex J.F. Gmel.
Suaida, Sawad, Plate 87

These are low, silvery green, erect shrubs that turn black when dried. They are divaricately branched with glaucous stems. The leaves are blue-green, short petioled, glaucous, oblong to obvate, flattened above, 4-15 mm long and 2-6 mm wide. The flowers are perfect, solitary and axillary with 2-3 bracteoles arranged in a short, loose, leafy, spike-like inflorescence. The perianth is parted into 5 equal green sepals united at the base, with 3 yellow stigmas. The seeds are vertical and shiny. The plant grows in salty areas near the coast and flowers in October.

Traganum nudatum Delile
Zamran, Plate 88

This is a woody, glabrous, whitish, branched plant that reaches a height of 100 cm. The leaves are fleshy, alternate, sessile, keeled at the back, somewhat recurved, papillate, fleecy at the axils, and usually fasciculate. The flowers are solitary and axillary; the perianth has 5 membranous, erect, oblong, obtuse lobes and somewhat horn-shaped, hard protruberances. The fruit is globose and somewhat depressed, with a membranous, free pericarp included in the persistent, woody base of the perianth. The plant flowers in March.

CISTACEAE

Helianthemum kahiricum Delile
Al Hashma, Plate 89

This is a perennial small shrublet that is branched

from base up to 40 cm height and is covered with tomentose, stellate hairs. The leaves are cauline, alternate, simple, revolute, margined and have minute stipules. The flowers are ephemeral. The pedicels are slender, curved and a little longer than the calyx. The petals only slightly exceed the calyx and are lemon yellow in color. The stamens are spirally coiled around the style. The fruit is a capsule brownish ovate that has 3 opening valves. The seeds are minute, and brown. The plant grows on rocky ground, especially on calcareous rocks. It flowers from March to April.

Helianthemum ledifolium (L.) Mill.
Jeraid

An erect annual herb about 20 cm high, this plant has stems branching from the base. The leaves are covered with a mat of hairs. The flowers are yellow and have 5 petals, and they appear between March and April.

Helianthemum lippii (L.) Dum. Cours.
Rag-Rug, Plate 90

A small perennial shrub, this plant is between 10 and 45 cm high with white stems. The leaves are small, grayish-green and pubescent. The flowers are yellow and about 5 mm wide. The mycelium of the desert truffles, *Tirmania* and *Terfezia*, is associated with the roots of *Helianthemum lippii*. It is a symbiotic relationship, and when the plant is absent, so is the truffle.

Helianthemum salicifolium (L.) Mill.
Jeraid

An annual herb, this plant is approximately 5-25 cm high and often branches from near the base. It has one erect stem and 2 or more ascending or decumbent lateral branches. The leaves are cauline, simple opposite, canescent, and stipulate. The flowers are yellow and small on upwardly curved, slender pedicels that are supported by broadly ovate, lanceolate bracts that are shorter than the pedicels. The fruit is a three-valved, loculicidal capsule with one locule that contains many glabrous seeds. The seeds are many, brown in color, ovoid-conical, and covered with white papillae. The plant grows in sandy soil and flowers in March.

COMPOSITAE

Aaronsohnia factorovskyi Warb. & Eig
Al Grease, Plate 91

An erect annual herb approximately 10-18 cm high, this plant has stems branching from the base. The leaves are serrated and fleshy. The flowering stems are 12 cm long with yellow button-like, non-aromatic flowers, 8 mm wide. The plant flowers between March and April.

Acantholepis orientalis Less.
Acantolips

This is an ascending gray-green, woolly tomentose annual herb. The leaves are lanceolate and spinulose at the apex, and entire or with fine spinules at margins. The heads are ovoid, 1.5 cm long and 2 cm in diameter. Bracts are short-lanceolate, closely depressed, spinulose, and longer than the headlets. The pappus is barbellate, pale and united at the base. This plant is abundant locally and flowers between March and April.

Achillea fragrantissima (Forssk.) Sch. Bip.
Qaisoom

This is a strongly fragrant perennial plant with erect, virgate stems that branch from a woody base up to 100 cm height. The leaves are small, sessile, entire, oblong, thickish, gray and hairy, becoming glabrous. The heads form in clusters of compound corymbs on short peduncles. The florets are yellow in color. This is a rare plant and grows mostly in gravelly-compact soil. It flowers from July to October.

Anthemis deserti Boiss.
Iqhowan, Plate 92

This is a leafy annual herb about 15 cm high with showy white flowers 2.5 cm wide. The leaves are gray-green in color, alternate and deeply toothed. The ray florets are white with yellow center. The plant is sweet smelling and widespread in Kuwait.

Anthemis pseudocotula Boiss.
Iqhowan, Plate 93

This is an annual herb with erect or decumbent, subglabrous stems that branch greatly from the base.

The plant has thinly adpressed pilose, bipinnatisect leaves. It has white flowers with yellow discs with persistent, brownish longitudinally ribbed achenes. It grows along the roadsides and at the edges of cultivated sandy soils.

Anvillea garcinii (Burm. f.) DC.
Nuqd

This plant is a low-growing perennial shrub with large yellow flower heads composed of disc florets up to 2 cm across, framed by long, grayish bracts. The fruit is an achene 3-4 mm long, with 4 angles, somewhat compressed, sometimes ciliate at margins, and without pappus. The plant grows near the Salmi border post. It is very popular with painted lady butterflies and other insects. It flowers from March to April.

Artemisia herba-alba Asso
Shih, Geysum

A perennial, this strongly aromatic shrublet is sometimes wider than high, greyish and tomentose, about 20-50 cm high. The leaves of sterile branches are petioled, and ovate-orbicular in outline. The plant grows in dry places and flowers from July to September.

Artemisia scoparia Waldst. & Kit.
Adhir, Silmas, Plate 94

This is an annual or biennial shrubby plant with dark, feathery leaves, an erect stem that branches throughout its whole length into a spreading panicle. The radical leaves are petioled and the cauline leaves are sessile. The tiny yellow flowers may be found blooming any time from early summer to November.

Aster squamatus (Spreng.) Hieron.
Najmah

An annual or perennial, this shrub is about 120 cm high and has very faint, remotely serrulate leaves. The flowering heads have yellow disc florets and white or sometimes pale pink-violet ray florets. The fruiting heads are lanceolate, glabrous and pappus with whitish hairs 5-6 mm long and sometimes kinky near the base. The plant is frequently found only around farms or waste places, usually near irrigation runoff.

Asteriscus hierochunticus (Michon) Wiklund Syn. *Asteriscus pygmaeus* (DC) Coss. & Durand
Ain Al Bukar, Plate 95

These plants are dwarf, annual, stemless herbs covered with villous hairs. The leaves are oblong and linear and taper to a long petiole. The head is heterogamous, radiate, solitary, sessile and hairy. The anthers are sagittate at base with a long line or tail. The style branches are dilated at apex. The achenes are silky and ribbed. The ray florets are pale yellow, and the disc florets are short and darker yellow. The plant flowers from February to March.

Atractylis cancellata L.
Um Drus

An annual, this thistle-like plant is 10-16 cm high with stems that usually branch mainly from the base. The leaves are linear, ciliate-prickly. The heads are solitary and ovate, about 15 mm long with linear pectinate-prickly outer scales. The flowers are tubular, pale mauve in color and are enclosed in many thorny leaves. The white hairs of the pappus are joined in a ring at the base, one- and-one-half times as long as the lanate achene. The plant is mostly found in sandy places and flowers between March and May.

Atractylis carduus (Forssk.) C. Chr.
Al Jalwa, Plate 96

This is a perennial herb, that is 10-20 cm high, appressed, woolly, and branching from the base. The leaves are leathery, lanceolate, sinuate, lobed and prickly. The heads are terminal, solitary, 20-30 mm long, radiate, and ovate. The florets are yellow, sometimes turning purple. The dead foliage dries to a golden brown, and during summer, it makes beautiful shapes and shadows on the sand. It grows in sandy places and flowers from March to April.

Calendula arvensis L.
Hanuwa, Plate 97

This plant is an annual, semi-prostrate, leafy herb, about 15 cm high. Its leaves are simple, alternate, entire or toothed. As it is slightly glutinous, and sand sometimes sticks to the leaves. The flowers are orange-yellow and about 8 mm wide. The seed head consists of a ring of hard, curved, wingless fruits. Flowers in February.

Calendula tripterocarpa Rupr.
Hanuwah, Ushbot Al-Ghurab

An annual herb with many branches, this plant is approximately 40 cm tall. The flowering heads are 0.5-1.5 cm wide with florets that are yellow to rich orange. The disc and ray florets are of the same color (concolorous). The fruiting heads have at least 3 winged achenes that are smooth or only denticulate at the back. Cymbiform and annulate achenes are present. The plant rarely occurs as a weed. It flowers from February to April.

Carduus pycnocephalus L
Shadq Al-Jamal, Plate 98.

An upright branching prickly herb, this plant is about 15-50 cm high. Its stems are spiny and slightly winged. The leaves are oblong in outline, angular, prickly and toothed. The flowers are deep pink and arranged in a capitulum at the tip of the winged branch. Flowers during April.

Carthamus oxyacantha M. Bieb.
Zafaran, Usfur, Palate 99

This is a summer-flowering annual, about 40-80 cm high, most commonly seen near disturbed land. It is an erect, prickly-leafed herb with bright, shiny leaves that have numerous yellow to saffron-colored spines, hence, the name zaiafaran in Arabic. The florets are orange-yellow or bright yellow approximately 1 cm long. Flowers during April and May.

Centaurea bruguierana (DC.) Hand.-Mazz.
Kassoob

This is an erect, branched annual herb reaching a height of 35 cm with white stems with spreading crisp hair. The leaves are thin, sessile, lower lanceolate, sparsely white ciliate at the margins. The flowers are thistle-like with long, white, protruding spines. The florets are pale purplish. The achenes are minute. The plant grows on unused land between houses in Jabriya and also in Umm Al-Rimam. Flowering from April to May.

Centaurea mesopotamica Bornm.
Al Techelba

A prostrate slightly branching herb, up to 35 cm long. The entire plant, especially the buds, are short, white, and hairy. The flowers are pale yellow and 1.5 cm wide. The plant is highly aromatic.

Centaurea pseudosiniaca Czerep
Kassoob, Marar
Kassoob, Murar, Plate 100

Annual plant with stems and branches narrowly winged. leaves oblong-linear in outline. About 10-35 cm high. Florets are yellow. Found in rocky areas or desert basins. Formerly assigned to *Centaurea sinaica* DC. by many authors.

Chrysanthemum coronarium L.
Iqhowan Al Hadaeg Plate 101

A glabrous annual herb, this plant has bipinnatisect leaves. The heads are large, solitary, and terminate with bright yellow to yellowish-white ray florets. This is a cultivated plant also found along roadsides or on waste ground as an escape. It flowers from March to April.

Conyza bonariensis (L.) Cronquist
Hashesh Al Jabal, Plate 102

An annual herb up to 60 cm high, this plant has an erect, densely leafy, long-spreading and hairy stem. The leaves are entire or sparsely dentate, tapering to a petiole. The capitula are small, shortly ligulate, and heterogamous. The female florets are all filiform, very slender, and whitish while hermophrodite florets are yellow in their upper part. The pappus is brownish-white, and is much longer than the achene. This is a weed that grows in both irrigated and wastelands. It is widely distributed throughout the warmer regions of the world. Flowers during March.

Echinops blancheanus Boiss.
Shouk Al Jemal

This is a thistle-like perennial herb about 50-90 cm high with simple or sparsely branched stems. The leaves are alternate, lanceolate, prickly lobed, 10-25 cm long and 5-10 cm wide. The plant has scabrous bristles with involucral bracts. Very rare plant seen in remote deserts in gullies near Shegaya, western areas. Camels

like to eat this plant. It flowers from April to June.

Filago pyramidata L.
Al Quttaynah, Plate 103

A small, furry herb up to 15 cm high, this plant is common on compact, gravelly and sandy desert soils, especially after rain. It is a semi-prostrate, narrow-stemmed herb with grayish-white leaves. The florets are small and yellow, appearing between February and April.

Flaveria trinervia (Spreng.) Mohr

An erect, glabrous, somewhat diffusely branched annual herb, this plant has opposite, sessile, acute leaves. The heads are clustered, sessile or sub-sessile in the stem forks with yellow florets. The achenes are 2 mm long, and 10-12 are striate without pappus. This is a weed of farms or gardens.

Gymnarrhena micrantha Desf.
Ain Al Barin, Plate 104

This is a very leafy herb which is called "camel's eyes" in Arabic. It is so described because the leaves are arranged in a rosettes around spiny bud-like flowers in spherical clusters. The leaves are lanceolate, approximately 3-10 cm long and 1 to 15 cm wide. Flowers in April.

Ifloga spicata (Forssk.) Sch. Bip.
Neayma, Tarabah, Plate 105

This is an erect herb around 5 or 6 cm tall. The leaves are entire, small and slender, and densely arranged spirally on the stem. It is a widespread herb often found on gravel grounds. Its tiny yellow flowers, only 1 mm across, are produced in leaf axils between February and March.

Koelpinia linearis Pall.
Lahiat Al Tais, Plate 106

A slender herb with a few branches, this plant is about 8-20 cm high. The stems are narrow with linear elongate leaves. The flowers are yellow and hardly noticeable. The fruits are elongated and curved with short spines along the outer edge. The fruits look like the curved beard of a billy goat, and, hence, the name lahiat al tais in Arabic. Flowers in March - April.

Lactuca serriola L.
Lubaina, Plate 107

An erect glabrous annual or biennial plant about 120 cm high, this plant has a glossy, whitish to yellowish stem. The leaves are rigid, with leathery texture (coriaceous), oblong in outline, sessile and sagittate-clasping at the base with spinulose margins. The heads are numerous in a terminal flowering axis. The flowers are yellow in color. The plant is a weed of neglected farm fields and waste ground around agricultural areas.

Launaea angustifolia (Desf.) Kuntze
Murrar

A stout annual herb, this plant is about 20 cm high. A fleshy stem carries leaves with deeply cut lobes that do not extend to the mid-rib. The plant has yellow flowers about 2 cm wide and cotton-like pappus on the seeds.

Launaea capitata (Spreng.) Dandy
Huwaa, Plate 108

A prostrate, annual or perennial herb, this plant is about 15 cm high. Leaves form a dense rosette around the base. The flower heads, about 1 cm wide, are pale yellow and almost sessile. Flowers in April.

Launaea mucronata (Forssk.) Muschl.
Adhid, Plate 109

This plant is an almost leafless, multi-branched perennial herb that grows up to 40 cm high. The leaves are deeply lobed, mucronate, and form rosettes around the base. Stem leaves are smaller and toothed. Flower heads are about 2.5 cm wide, yellow and appear between March and April.

Launaea nudicaulis (L.) Hook. f.
Huw - Al Ghazal

A perennial branching herb, this plant is between 20 and 50 cm high. The leaves form a rosette at the base. They are deeply lobed, toothed, and white along the margins. The stems have no leaves at all. The flowers, which are yellow and about 2 cm wide, appear in the spring.

Leontodon laciniatus (Bertol.) Widder
Murrar

An annual herb about 30 cm high, stiff hairy or glabrous; this plant has a slender taproot. The scapes are procumbent to ascendant, with leaflets slightly swollen above with a single flower head. The leaves are rosetted, coarsely toothed or pinnatifid. The long, thin stems are topped with bright yellow flowers that look like dandelions. The pappus is persistent with about 10 feathery hairs. The plant grows in sandy, gravelly, loose soil and flowers from February to April.

Matricaria aurea (Loefl.) Sch. Bip.
Babouej, Al Zafeera

A sweet aromatic annual herb, this plant is about 25 cm high, and is branched from the base with several stems either ascending or erect. The leaves are alternate, bipinntisect, finely dissected with divergent lobes. The plant has small heads of golden yellow flowers, more or less conical, axillary and terminal. The achenes are small, and naked or have an oblique ear-like crown. The plant flowers from March to April.

Picris babylonica Hand. Mazz.
Howaithan, Plate 110

An erect branching herb, this plant is 10-20 cm high and covered with soft fine hairs. It has a basal rosette of lobed leaves that are coarsely toothed. The flowers are about 4.5 cm wide with dentate-tipped ray florets with a black center. This desert daisy covers sandy and gravelly soil during the spring.

Pulicaria undulata (L,) C.A. Mey. Syn. *Pulicaria crispa Forssk.*
Jithjath, Plate 111

An perennial shrub, this plant is about 30 cm high. It has many white-colored stems that branch from the base. It has a knob-like yellow aromatic flower, circa 8 mm wide, with short ray florets. The leaves are crinkled and grayish green, and the plant flowers between March and June.

Reichardia tingitana (L.) Roth
Murrar, Plate 112

A small compact herb, this plant is just a few centimeters high. It has a leafy, basal rosette that may or may not be deeply lobed. The flower heads, which are large and thick, are deep yellow with a darker center. The seed pods are fat and have large bracts.

Rhanterium epapposum Oliv.
Arfaj, Plate 113

This is the national plant of Kuwait. It is a very bushy shrub approximately 80 cm high with many stems branching out from the base. The leaves are small and narrow, and in late spring, it is covered with straw-yellow flowers about 1.5 cm wide. It is considered one of the main desert forage plants for camels and sheep. Flowers in April - May.

Scorzonera papposa DC.
Al Dabha , Rubahlah, Plate 114

A perennial herb, this plant is about 45 cm high, with a tuberous root, and a thick, erect stem. The leaves are very often wavy and margined, tapering at the base to a petiole or sessile. The heads are solitary and terminal with showy flowers of pink to purplish florets. The anthers are yellowish sagittate. The style branches are bifid, filiform, obtuse, and longer than the stamens. The achenes are linear, 1 cm long, glabrous, muricate, and have 4 angles. The plant is usually seen in crevices on rocky ground and in limestone areas. It flowers in April.

Scorzonera tortuosissima Boiss.
Al Dabha , Rubahlah

A perennial, this silvery-greyish plant is about 50 cm high. It has a closely whitish canescent, finely lined or ribbed stem, with few leaves. The heads are small, with only a few flowering on the long slender peduncles. The flowers are yellow and are longer than the involucre. The achenes are about 8-12 mm long, slender, glabrous, whitish, striate, and smooth. This plant is found in sand, often over rocky ground.

Senecio glaucus L.
Zamlug, Plate 115

This annual herb is widespread in Kuwait. It provides patches of yellow color alongside roads after rainfall. It is leafy herb with leaves divided into a few well-spaced, linear lobes with a toothed margin. Masses of yellow flowers cover the plant,

and are followed by seeds on parachutes. It flowers between March and April.

Senecio vulgaris L.
Zamlug
Annual spreading plant that resembles *S. glaucus* found in cultivated grounds. Flowers during spring.

Sonchus oleraceus L.
Khas Al Waz, Plate 116
Annual or perennial erect herb 10-80 cm high. Stem branching sulcate, glandular in the upper part. Inflorescence irregularly branched. Leaves are basal pinnastisect with a large terminal lobe and few lateral ones, attenuated into a winged petiole. It is abundant in gardens, orchards, fields, moist ground, and also in sandy deserts. Flowers in April.

Sonchus tenerrimus L.
Tafaf
Not a common species, however, it was reported in Kuwait in a few cultivated grounds.

Urospermum picroides (L.)
Al Adhid
This is an annual herb with ascending, simple or branched stems about 15-50 cm high, oblong-spathulate leaves tapering at the base, and stem leaves that are sessile and denticulate. It is a tall plant with yellow flowers. The calyx has distinct little prickles. The plant is an uncommon weed found in gardens and cultivated ground. It was recorded as new to Kuwait in April 1987.

Xanthium strumarium L.
Shubbait
A stout-stemmed, branching herb 50 cm tall, this plant has downy, palmate leaves. The large, oblong leaves have numerous stiff, hooked hairs that are an important feature of the plant. The greenish male florets in round heads are 5 mm wide. The flowers are minute. The plant is found in disturbed places, and flowers in summer.

CONVOLVULACEAE

Convolvulus arvensis L.
Khatmi, Plate 117
A perennial herb, this plants has a creeping rootstock that penetrates deeply into the soil. The leaves are spear-shaped and dark green, and the pink or white flowers are very beautiful. The plant is abundant in cultivated and waste ground and on roadsides. It twines through grass and hedges to reach light and shelter, and is usually seen in rather neglected gardens.

Convolvulus cephalopodus Boiss. Syn. *and Convolvulus buschiricus* Bornm.
Rukhama, Plate 118
These perennials were found growing on Faylakah island and in and near the Burgan oil fields. It is a beautiful little shrub with a display of delicate pink flowers. It is 30-40 cm high and multi-branched from the base. The leaves are velvety green, linear to oblong with distinct venation.

Convolvulus oxyphyllus Boiss.
Ethris, Udhris, Plate 119
This is a bare-looking, shrubby plant up to 60 cm high. It is dichotomously and divaricately branched with grayish leaves and branches that end in sharp tips. The flowers are solitary or fasciculate with 2-3 combined. They are axillary, glabrous and sessile with funnel-shaped, white corolla, and black seeds. When in full bloom, the plant looks as though it is covered with snowflakes. It grows in coarse sandy soil and flowers from April to June.

Convolvulus pilosellifolius Desr.
Al Khatmi, Plate 120
It is a perennial herb that branches from the base and creeps on the desert floor. Its leaves are pale green, alternate, lanceolate and have wavy margins. The flowers are round, about 2 cm wide, and pale pink. The plant grows in silty basins, sandy soil and sometimes, as a weed in irrigated areas.

Cressa cretica L.
Shuwayla Nadwa, Plate 121
This small prostrate plant is commonly found on salt flats or sabkha soil. It has tiny, grayish-green leaves, and it is multi-branched. The leaves are sessile, wrapping themselves around the stem, alternate, about 5 mm long and ovate-lanceolate in shape. The flowers are white to cream and the prominent stamens protrude from the center.

CRASSULACEAE

Crassula alata (Viv.) A. Berger
Maklda

This reddish annual herb is about 1.5-5 cm high with 3 angled, minute longitudinal wings. The leaves are opposite, lanceolate, connate at the base, 1-3 mm long. The flowers are 1-3 mm long, and short-pedicelled in the axils. The plant is found in silty soils in basins in the north.

CRUCIFERAE

Alyssum homalocarpum (Fisch. & Mey.) Boiss.
Anam

This is a tiny plant found growing in inhospitable stony ground near the bottom of Wadi Al Batin. The flowers are recemes with minute, yellowish petals equaling or somewhat shorter than the sepals.

Alyssum linifolium Steph. ex Willd.
Draihma

This erect or ascending stellate-pubescent annual is about 5-20 cm high with several branched stems near the base. The leaves are narrowly oblanceolate, 8-15 mm long. The flowers are minute and white- to cream- colored. The plant is rarely found; it grows mostly in rocky areas.

Anastatica hierochuntica L.
Kaff Mariam

This is a small annual herb found on compact gravelly soils. It is about 15 cm high, and it has obovate-spathulate leaves tapering into a petiole. Tiny white flowers are formed between February and March. As the plant matures, its dry stems curve inwards to form a fist-shaped seed pod. The fist opens when there is enough moisture, releasing the seeds, and the cycle begins again. Flowers in March.

Brassica juncea (L.) Czern. & Coss.
Fjailah

This is an annual herb cultivated in India and many other countries. It is about 80 cm high, glabrous with sparsely pilose, lyrate pinnatisect and linear leaves. The petals are bright yellow, 7-9 mm long. The fruiting pedicels are 7-15 with an owl-shaped beak. The plant flowers from March to April.

Brassica tournefortii Gouan
Harraidah, Suffayr, Plate 122

This is a multi-branched, shrubby, annual herb about 40 cm high. At the base, it has radical rosette-forming leaves that are stiff and covered with hairs. Its stems are stick-like, and it has yellow cross-shaped flowers. Its seed pods are long and split in the middle when mature. When its life cycle is over, this shrub is seen tumbling around in the desert. Flowers in February.

Cakile arabica Velen. & Bornm.
Slaih, Plate 123

This annual herb covers the desert with a splash of lilac color. This multi- branched plant has deeply lobed leaves, cross-shaped lilac flowers, and beak-shaped seed pods.

Cardaria draba (L.) Desv.
Najmah, Jenaibrah

This is an annual or perennial erect herb, gray-pubescent about 50 cm high with dentate, petioled, spathulate basal leaves, and sessile, spreading or erect stem leaves. The inflorescence is terminal and corymbose with white flowers. The fruit is cordate-reniform. Fruiting pedicels spread about 3 times as long as the fruit. It is a weed of cultivated areas.

Carrichtera annua (L.)DC.
Al Nefagh, Plate 124

This is a leafy herb with many branches and hairy leaves. It is about 40 cm high and has deeply lobed leaves. The flowers are creamy white to yellowish with conspicuous green veins. It has short hairy fruits that are shaped like a duck's head.

Coronopus didymus (L.) Sm.
Rashad Al Barr, Plate 125

This is an annual herb with a procumbent or ascending stem up to 25 cm high. It has bipinnate, basal leaves and glabrous, lanceolate, lobed stem leaves. The flowers are minute, corymbose clusters when young, and elongating recemes when mature. The fruit has a narrow septum and is reticulate-rugose. The seeds are kidney-shaped and finely reticulate. It is found in lawns and gardens. Flowers in April.

Diplotaxis acris (Forssk.) Boiss.
Al Yegh

This is an erect annual, glabrescent herb with some scattered erect hairs on the flower and fruit pedicels. The leaves are bright green and radical. The flower is a terminal inflorescence with pink-purple petals 10-12 mm long. The seed pods stay upright. It grows in sandy ground and flowers in March.

Diplotaxis harra (Forssk.) Boiss.
Al Kshain, Plate 126

This branching annual herb is approximately 30 cm high. It is bright green and covered with a layer of whitish hairs. Its stems are often branched at the base, and the flowers are sulfur-yellow in color with a strong sour smell. Flowers in March.

Eremobium aegyptiacum (Spreng.) Asch. & Schwienf. ex. Boiss.
Ghurayra, Gurhan

This annual is about 30 cm high with linear, sessile leaves. The flowers vary in color from white to pink or mauve, and are sometimes tinged with yellow.

Eruca sativa Mill.
Al Gargeer, Plate 127

This is an annual herb often seen near cultivated sites. It is about 50 cm high and very leafy. The stems are multi-branched and they become rigid towards the end of the season. The basal leaves are rosette-forming, and the cross- shaped flowers are creamy-white streaked with greenish-brown veins. Flowers in March. It is also edible.

Farsetia aegyptia Turra
Al Lbanah, Plate 128

This is a gray-green, woody perennial about 30 cm high. It has slender, smooth and multi-branched stems. The flowers are creamy brown with four petals. Two rows of seeds are formed in an oval-shaped seed pod. Flowers in April.

Farsetia burtonae Oliv.
Hadarah

This is a low, perennial plant, often woody at the base, 3-25 cm high with linear, elliptical leaves. The flowers are white or pink-purplish with a sweet fruity fragrance. The plant grows in silty inland soils, often in rocky terrain.

Horwoodia dicksoniae Turrill
Khuzamah, Plate 129

A sweet-scented annual herb, this plant is named after Dame Violet Dickson who is locally known as Umm Saud. It is a leafy plant with stems that are ascending to prostrate and slightly hairy. It has deep lilac flowers and large, round and winged fruit. It is abundant in sandy soil in the Sulaybia area.

Lepidium aucheri Boiss.
Jenaibrah, Rishad

This is an annual herb that sometimes flowers in dwarf conditions on drying ground. The basal leaves are rosetted, and the upper leaves are nearly entire or serrate. The flowers are minute and white. This is a common plant, particularly near rain pools.

Lepidium sativum L.
Rishad

This is an annual erect herb about 60 cm high. It has irregularly lobed leaves with terminal, axillary inflorescence of white flowers, and sepals with short, violet anthers. It is found on waste ground.

Leptaleum filifolium (Willd.) DC.
Rishad

This is a small annual plant with thin grass-like, simple or pinnate with filiform segmented leaves, and white or pink flowers. It is immediately recognizable by its extremely fine, hairy leaves.

Malcolmia africana (L.)R. Br.
Rujaija

A recently recorded species rarely found in the desert.

Malcolmia grandiflora (Bunge) O. Kuntze
Selaih, Plate 130

This annual herb is about 30 cm tall with multiple branches from the base and a basal rosette of dentate leaves. The flowers are cross-shaped and

deep purple with a cream-colored center. They fill the air with a sweet honey perfume.

Malcolmia pygmaea (Delile) Boiss. Syn. *and Hesperis pygmaea* Delile
Selaih

This is a tiny annual plant with very pale pink yellow united flowers and long thin, shiny brown seed pods. It grows in sandy soil and flowers from March to April.

Maresia pygmaea (Delile) O.E. Schultz
Shgarah

This is a delicate, stellate pubescent dwarf herb with very fine branches ascending from the base. The leaves are mostly pinnately lobed, long, and tapering to a petiole. The flowers have pink petals that are 5-8 mm long. The fruits are linear-terete on subcapillary pedicels. It grows on well-drained sands.

Matthiola longipetala (Vent.) DC.
Manthor

This ascending, branching annual herb is about 30 cm tall with bluish-green stems and small serrated leaves. The flowers are tattered-looking and deep purple in color with a white and yellow center.

Neotorularia torulosa (Desf.)Hedge & J. Leonard.
Syn. *Torularia torulosa* (Desf.) O.E. Schultz
Al Hassar

These are small, white, hairy plants with several white flowers on thick pedicels at the top of the stem. These plants are easily recognized by their dense, coiled fruits.

Notoceras bicorne (Aiton) Amo
Hathara

This is a prostrate or decumbent annual herb covered with straight, white, translucent hairs. The flowers form in terminal racemes with white to yellowish petals. The fruits are more or less appressed to the stem constricted between seeds with a distinct lateral nerve and 2 diverging horns at the apex.

Savignya parviflora (Delile) Webb
Al Glaiglan, Plate 131

This is a slender erect herb about 20 cm high. It is a delicate herb found on gravelly soil. Its stems branch from the base and are forked in 1 or 2 pairs. Its leaves are 2 cm long and slightly hairy. The flowers are white to pale pink and very tiny. Its fruits are flat and oval with a silvery tissue- like central partition. They stand on a long pedicel and resemble earrings. Flowers in April.

Schimpera arabica Hochst et. Steud.
Sufar, Plate 132

This annual desert plant is one of the first to bloom after the spring rains. It is a multi-branched, erect-standing herb with yellowish-green basal leaves and many yellow flowers. The desert floor looks like a mustard field when these plants are in bloom. Seeds are produced after the flowering season, and they are shaped like a duck's bill.

Sinapis arvensis L.
Khardal

This annual herb has a branched, distinctly furrowed, often purple-stained stem. Its basal leaves are petiolate and pinnatisect, whereas the upper leaves are much smaller, sessile and slightly lobed. The flowers have thick pedicels. The fruits are yellow in color, and the seeds are globose, 1.5 mm in diameter, and dark brown in color. The plant flowers from February to May and found mostly in gardens.

Sisymbrium erysimoides Desf.
Selaih

This is an annual, biennial or a perennial, glabrous or pubescent herb with an erect stem. The leaves are mostly lyrate cleft. The flowers are yellow, sometimes white or pink, and more or less clawed. The fruiting racemes are elongated, glabrous, and the seeds, 15-25 in each locule, are oblong and orange-yellow. The plant is commonly found in the shade of *Zizyphus* bushes, and it flowers from January to May.

Sisymbrium irio L.
Shiliat, Plate 133

This is an erect, many branched, hairy annual herb with petiolate leaves. The inflorescence is densely corymbose becoming lax racemose in the fruiting stage. The flowers have yellow petals tapering into a short claw. The anthers are yellow, and the seeds, 20-40 in each locule, are 1 mm in diameter and

yellowish-brown. This is a weed found in cultivated and waste grounds. It flowers from February to May.

Sismbrium orientale L.
Slaih

This is an erect, branched, annual herb up to 90 cm tall with a purple-tinged, hairy stem. Its basal leaves are long and petiolate with narrower lateral lobes, and the upper leaves are short and petiolate. The inflorescence is at first corymbose, and later forming a lax raceme. The flowers are soon overtopped by the developing fruit. The petals are yellow or whitish-yellow and 0.8-1.0 cm long. The stamens are unequal with yellow anthers. The seeds are short, oblong, reddish-brown, and finely granulate. The plant is found on roadsides, and waste and cultivated ground. It flowers from February to May.

Sisymbrium septulatum DC.
Howairah

This erect annual is about 40 cm high with rosetted, deeply lyrate-pinnatisect leaves and narrowly linear, segmented stem leaves. The petals are yellow and 7-14 mm long, greatly exceeding the sepals. The siliques are spreading- ascending, and linear with bilobed stigma on 2-4 mm long pedicels about as thick as the fruit.

Zilla spinosa (Turra) Prantl
Shubrum

This is a small, spiny, desert shrub with fleshy, deciduous leaves. The flowers are short-pedicelled, violceous or lilac and rather showy. The fruits form on a thick pedicel, and are globular and 6-ribbed with transverse wrinkles between the ribs and the spiny back. The plant flowers from March to May.

CUCURBITACEAE

Citrullus colocynthis (L.) Schard.
Al Sherry, Hanthal, Plate 134

A plant well-known locally for its medicinal value. Creeping scabrid perennial herbs with stems tendril-bearing, sometimes over 1 m long. Its' melon-like fruit when ripe turns yellow and bares the seeds inside. Flowers with yellow corolla. Grows on sandy or silty ground, particularly in wadis and depressions. The pulp and seeds of the fruit are strongly laxative and, in excessive doses, poisonous. Fruits are ripe in September.

CUSCUTACEAE

Cuscuta planiflora Ten.
Arooq, Shubaykah

Members of this family are parasites, living off leaves or stems of other plants. They have no chlorophyll and, therefore, have to extract nutrients by twining their stems around a host by means of suckers. The flowers are white, approximately 2 mm long, and appear in clumps.

CYNOMORIACEAE

Cynomorium coccineum L.
Tarthuth

This is a dark red, fungus-like plant that can be seen poking through the sand. It is a root-parasite on a variety of hosts, but most commonly on salt bushes such as *Zygophyllum qatarense*. The flowering stem, which is about 10-20 cm high, consists of small, bisexual flowers clustered on a thick fleshy axis. It is usually covered that insects that are attracted to the flowers by their bad odor. This plant is harvested as it has a sweet taste.

DIPSACACEAE

Scabiosa olivieri Coult.
Dharba, Plate 135

This is an annual, erect herb of the Teasel family. It has densely hairy, sessile, undivided, elongate leaves and a somewhat reddish stem. It has a pale, purple, scabious dense head of small flowers with dark red, protruding bristles. The fruit is a globular berry, and the seeds are mostly flattened and minutely pitted. It flowers from March to April.

Scabiosa palaestina L.
Dharba

This is an annual herb about 30 cm high with hairy, divaricate branches, and leaves that are opposite and sessile to petiolate. It has a dense involucre of bracts and pale yellowish-white flowers about 12-15

mm long on peduncled heads. The yellowish corollas are hairy outside, 5-lobed and 4-5 mm long. The marginal flowers have longer corolla. It grows in sandy soil and flowers from March to April.

EUPHORBIACEAE

Andrachne telephioides L.
Libana, Plate 136

This is a perennial herb about 30 cm high with many bluish-green stems and fleshy, ovate leaves, 2-2.5 mm long. The white flowers are tiny, and the fruit is a 3-celled capsule with 2 seeds in each locule. The seeds are brown in color. It grows both in silty saline soil and in rocky cracks amid dune sand. It flowers from March to April.

Chrozophora obliqua (Vahl) A. Juss. ex Spreng
Tanoum, Nakad

This is a perennial herb, varied in appearance, with leaves that vary from entire to sharply incised-dentate, obtuse or acute. There are 4-10 stamens, rarely up to 12, in 1-2 whorls. The fruits are pediceled and reflexed, and the seeds are scabrous-tubercled.

Chrozophora tinctoria (L.) Raf. [Syn. *Croton tinctorius* L.]
Hashisha Al Aqrab

These are annual, gray-green, hairy herbs with big, well-varied, wavy-edged leaves. They have pale yellow flowers clustered in a hairy head with minute petals and narrowly linear sepals. They start growing in April and flower throughout the summer.

Chrozophora verbascifolia (Willd.) A. Juss. ex Spreng.
Zuraige, Plate 137

This leafy herb is about 40 cm high and is found in small groups in Mutla'. It has velvet-like gray-green leaves and yellow flowers about 3 mm wide. Flowers in September.

Euphorbia densa Schrenk.
Um Al Haleeb

This is an annual, glabrous plant about 8 cm high with dichotomously branched stems and diamond-shaped leaves. The flowers are very small, and green in color. The plant is found growing in compact sandy soil and flowers from March to May.

Euphorbia granulata Forssk.
Liban, Labnah

This annual, is a velvety herb with a grayish-green to yellowish stem and closely packed oval leaves. The flowers are minute, pink and petal-less, like little cups only 1 mm across. It grows in sandy soil, along roadsides, and flowers from March to April.

Euphorbia grossheimii Prokh. Syn. *Tithymalus grossheimii* Prokh
(*Euphorbia isthmia* Tackh).
Um Al Haleeb

These are annual or perennial, many branched herbs about 15 cm high with sessile, basal leaves and denticulate upper leaves. They have cyathia in the upper axils. They grow in silty basins or plains.

Euphorbia helioscopia L.
Halablab

This is an ascending to erect, glabrous annual with simple or branched stems about 10-40 cm high. It has 2.5-3 mm long pedicellate cyathia with lobed involucre and greenish glands. It is a weed of gardens and farms.

Euphorbia hirta L.
Halab
Plate 138

This annual herb is about 25 cm high with reddish multicellular hairy stems and ovate-eliptic leaves. It has axillary clusters of inflorescence with minute cyathia and triangular, hairy-glanded involucre. It is an uncommon weed, and it flowers throughout the summer and into the autumn.

Euphorbia indica Lam.
Halab

This is an annual herb with sympodially branched stems. The stems are swollen at the nodes. The leaves are short, petioled and ovate-oblong or elliptic. It has cyathia with glands of pinkish petaloid appendages. It is an uncommon weed and grows in lawns, gardens and orchards.

Euphorbia peplus L.
Halab

This is an erect, annual, bright green herb with alternate or sub-opposite, obovate to orbicular leaves. It has several-times forked, terminal umbels with 3 rays and a glabrous capsule with 2 wing-like keels.

It is an uncommon weed in cultivated land, and flowers from February to March.

Euphorbia serpens Kunth

Halab

This is a glabrous, annual, prostoate herb. Its stem has fleshy conical protruberances on the underside of each node and ovate leaves. It has cyathia and narrow, white-margined, reddish glands. It is a weed of farms and damp places.

Euphorbia supina Raf.

Halab, Plate 139

An ascending or procumbent perennial that branches from near the base. Stems are long and spreading. Leaves sessile, lanceolate to oblong, rather weakly acute. Flowers in groups of 2 to 6 crowded at the end of short-villous peduncles. Grows on silty grounds near the coast. Our specimen was taken from Al Shuwaikh district at KISR premises. Matures in May.

FRANKENIACEAE

Frankenia pulverulenta L.

Mulaih, Abu thurayb, Plate 140

This branching, prostrate mat-forming herb is about 15 cm across. The stems are trailing, slender and reddish in color. The leaves are very small, about 4 mm, fleshy, deep green, and spathulate to obovate. The flowers that appear in March are papery- pink, and many seeds are formed in capsules.

FUMARIACEAE

Fumaria parviflora Lam.

Shahtarj

This is a glabrous, branched, annual herb with angular stems and several pinnatisect leaves with linear lobes. It has flowers about 4-6 mm long with small dentate sepals and white to pink corolla. It is a weed of gardens or farms.

Hypecoum littorale Wulfen (Syn. *Hypecoum geslinii* Coss. & Kralik)

Mdeihina, Hushaim

This annual herb is about 10 cm high. Its' branching stems are prostrate, and it has finely divided leaves. The flowers are yellow consisting of two large petals and two small petals that are boat-shaped.

Hypecoum pendulum L.

Hushaim

This annual glabrous herb has an ascending stem up to 15 cm high with long petioled leaves that are crowded at the base. The flower is yellow with two long petals tipped with green and two smaller short inner petals that have purple spots at their base. Its' long thin seed pods hang down in pairs, one on each side of the stem. It grows in sandy soil and flowers in March.

GERANIACEAE

Erodium bryoniifolium Boiss.

Dahma, Plate 141

This annual or perennial is a gray-green sometimes pinkish herb with gray canescent 3-5-lobed leaves. Its flowers are umbelled in the upper axils with yellowish-margined sepals and pink petals. The fruit has 5-8 cm long beaks, pinkish-grayish in color and feathery all over. It grows in shallow, silty soils and flowers from April to May.

Erodium ciconium (L.) LíHer.

Rajem, Raqam

This is an annual herb that is glandular and hairy with a prostrate, furrowed stem and lobed leaves with winged rachis. The flowers are umbelled with long mucronate, membranous margined sepals and purplish-blue obovate petals. The fruit is an achene that is obconical with erect hairs. This plant is easily recognized by its large flowers and very large fruit. It flowers from March to April.

Erodium cicutarium (L.) L.íHer.

Bakhtari

This annual canescent herb is about 20-40 cm high with pinnately compound leaves with narrow, finely dissected leaflets. It has a long, pedicellate flower with small purple petals that are shorter than the sepals. The fruit has a central column with 5 slightly bristly valves.

Erodium glaucophyllum (L.) Ait.

Dabgha, Plate 142

Branched perennial herb. Leaves ovate or

subcordate to oblong. Petals are bright purple. Fruit beaks extend up to 7 cm long. It grows on rocky terrain on shallow sandy soil.

Erodium laciniatum (Cav.) Willd.
Humbaz, Plate 143

This slender annual herb is procumbent to ascending. It grows on sandy soil and even in the cracks of paved traffic medians. It is about 10 cm high and up to 30 cm across. It has mauve flowers, about 5 mm across with purple venation. The leaves are oval to heart-shaped, pinnately divided nearly to the base, and slightly hairy. It has a distinctive seed pod, which looks like a beak, about 12 cm long and rigid. Flowers in March - April.

Monsonia nivea (Decne.) Decne. ex Webb
Khuzam

This perennial, creeping herb is about 10-15 cm high. It has a woody stem and oval to elliptical leaves that are felt-like, toothed and silvery-green. A long stalk carries pinkish flowers with 5 petals, and the fruit is born on a beak-like stalk. It grows on sandy and gravelly soil.

LABIATAE

Lallemantia royleana (Benth.) Benth.

This pubescent annual herb has a simple or branched stem. Its lower leaves are petiolate and 10-20 mm long, and the upper leaves are sessile and small. The flowers are subtended by bracts with a nerved calyx and tuberous white corolla. The nutlets are oblong, 2.5 mm long, brown, somewhat compressed, 3-angled, and very finely reticulate-punctate. The plant grows along rocks.

Salvia aegyptiaca L.
Shajarat Al Ghazal

This is an perennial, low undershrub that is intricately branched. It is hardly aromatic with short, petiolate lower leaves and smaller sessile, revolute-margined upper leaves. The flowers are formed in remote whorls of 2 to 4. The flowers have white corolla with dense blue-white spotting. The plant is found on coarse- and fine- textured soils in various habitats, and flowers from March to June.

Salvia lanigera Poir.
Simsimat Al Bur

This perennial, hairy herb is about 25-40 cm high with numerous erect stems ending in a verticillate, long inflorescence. The leaves are opposite, ovate in outline, linear, bullate-wrinkled, and set at right angles to the axis, with revolute margins. It has prominently lipped purple flowers arranged in circles of 6, above one another on the flowering stem. It flowers from March to April and grows in sandy gypseous soil.

Salvia spinosa L.
Shajarat Al Ghazal

This is a perennial, viscid pubescent herb about 20-40 cm high with an erect quadrangular stem. It has a large, pale green rosette of pubescent leaves and white flowers with a prickly calyx. It flowers in March-April.

Teucrium oliverianum Ging. ex. Benth.
Gasbaa

This perennial herb with long hairs is up to 40 cm high. It has a thick, rigid, and erect stem. Its' soft gray leaves are gently indented, and its blue flowers flaunt its reddish purple stamens and style. It flowers from April to May.

Teucrium polium L.
Al Jaadah

This is a white, fleecy herb that is somewhat shrubby at the base. It is pale green with flowers clustered in hairy heads. The corolla are woolly and somewhat longer than the calyx. It grows in sandy soil on the edge of water courses and flowers in April. Its dried leaves can be used as an insecticide.

LEGUMINOSAE

Acacia pachyceras O. Schwartz var. *najdensis* (Chaudhary) Boulos Syn. *Acacia gerrardii*
Al Talha, Plate 144

This is a perennial tree with a distinct trunk about 3-10 m high with whitish 2-5 cm long spines sometimes reduced to paired horn-like spikelets. It has pale yellow to white flowers in solitary or clustered globular heads with finely pubescent pods. It flowers in April. Found in Talha area at the National Park of Kuwait.

Alhagi graecorum Boiss.
Aagoul, Plate 145

This small green spiny shrub forms dense colonies near disturbed areas. Found only in few areas near the Shuwaikh petrol station. It has pale green spines that are sparsely covered with leaflets. The flowers are tiny, deep red with a white edge. The pods grow from spines and are about 2.5 cm long. Flowers during May-June.

Astragalus annularis Forssk.
Asab Al Arous
Asb Al Arous, Plate 146

This annual herb is about 15 to 30 cm high. The leaflets are hairy, alternately arranged in pairs of 3 or 4. Between March and April, pink flowers about 5 mm wide appear. The seed pod is flat-sided but curved, with red streaks and blotches. Flowers in February.

Astragalus bombycinus Boiss.
Khanaser Al Arous

This annual, or perennial branches from base with densely pubescent stems with imparipinnate leaves that are appressed hairy on the lower surface and glabrous on the upper surface. The flowers are short-pedicelled with tubular, black and white woolly calyxes and white to pink corolla. It has hairy pods that turn peach-pink as they dry. It flowers from March to April.

Astragalus corrugatus Bertol.
Abu Qurainah
Abou Qurainah, Plate 147

This is an annual, glabrous to sparingly appressed hairy plant with densely branched stems. Its' leaves are made up of 11-17 leaflets, with their tips cut straight across. The flowers are white to pinkish in short recemes. It has erect, almost cylindrical, semicircular smooth pods 3-4 cm long. It grows on fine shallow soils and flowers from March to April.

Astragalus hauarensis Boiss.
Qafaa, Plate 148

This is a grayish, canescent, annual herb with more or less pubescent, basally branched stems up to about 25 cm long. The leaves are imparipinnate with 7-9 broad leaflets that are concave at the tip. It has white to pale mauve flowers, and the pods are slightly hairy and speckled with red or curved with a furrow along the back. It grows in a sandy habitat and flowers from March to April.

Astragalus schimperi Boiss.
Holb
Halb, Plate 149

This small annual herb is about 15-40 cm across. The leaves are 4-5 cm long with leaflets arranged in 6-7 pairs. They are covered with small white hairs on both sides. The flowers are bluish-white and sessile, and the seeds are sickle-shaped. Flowers in March.

Astragalus sieberi DC.
Qafaa, Plate 150

This is a cushion-like, antroresely pubescent perennial with the lower leaves becoming spinescent with the falling of the leaflets. The flowers are bright, sulfur yellow, about 2 cm long, and tend to be hidden under the foliage as are its' thorns. Its' seed pod is hairy with pencil- pointed ends. It is only found in the west of the country along the road to Salmi, and flowers in April.

Astragalus spinosus (Forssk.) Muschl.
Schidad, Kidad Plate 151

This is a very spiny shrub about 60 cm high. The branches are erect and covered with 10 cm long white spines. The leaflets are grayish-green, small and arranged in 5-6 pairs. The seeds are protected by a papery white membrane that looks like a balloon. Flowers in January.

Astragalus tribuloides Delile
Rukhami, Qafaa

This is a small, silvery, hairy, annual herb with numerous prostrate stems and 15-19 little, pointed, furry leaflets to a leaf. The flowers are pale purple with tubular, glabrous or white hairy calyxes and whitish corolla. The pods are stellately divergent, 5-12 mm long, slightly curved with acute tips and the seeds are quadrangular or nearly smooth and yellow. It is a sandy-soil habitat plant and flowers from March to April.

Coronilla scorpioides (L.) Koch
Jlubban

This is a blue-gray, hairless, annual up to 40 cm

in height. The leaves usually have 3 leaflets, of which the central leaflets are large, egg-shaped, and blunt. The flowers are small, 0.5 cm long and yellow, and they have very narrow pods about 5-7 cm long constricted between the seeds and curved like a sickle, with a fine bristle at the end. The plant is found in fields, waste places and cultivated ground, and flowers from March to June.

Hippocrepis areolata Desv. Syns., *Hippocrepis bicontorta* Loisel., and *Hippocrepis cornigera* Boiss.
Um Gurain, Plate 152

These prostrate branching herbs are about 30-45 cm long. Their flowers are yellow, and they are arranged in clusters at the end of the stem. Their slender seed pods have horseshoe-shaped joints, and they coil and twist as they ripen, giving the appearence of a chain. Flowers in January and February.

Hippocrepis unisiliquosa L.
Um Gurain

This is a glabrescent, prostrate, annual herb. Its' leaves are imparipinnate with 3-7 paired leaflets, that are mucronate at the apex. The flowers are sub-sessile in the axils of the upper leaves with yellow corolla that are longer than the calyx. The pods are straight and linear, composed of 4-12 flattened segments with more or less papillary or glabrous seeds. The plant grows in sandy, loamy soil and flowers from March to April.

Lotus halophilus Boiss. & Sprun.
Qarn Al Ghazal, Plate 153

This prostrate, branching, leafy herb has branches about 20-30 cm long. The leaves are 5-foliate, fuzzy and have a short petiole. The flowers are yellow appearing singly or in pairs at the tip of the stem. The seed pods are linear and about 7 cm long. When the seed pod is ripe, it splits and twists, thus dispersing the seed.

Medicago laciniata (L.) Mill. var. *brachyacantha* Boiss.
Hassak, Plate 154

This small, annual, prostrate, branching herb is found on coarse, compact, sandy soil. Its' leaves are trifoliate, and it has yellow flowers approximately 3 mm wide. The seed pods are spirally coiled and covered with spines that stick to the wool of animals.

Medicago polymorpha L.
Barsim, Nafel

This annual is glabrous, 10-30 cm tall and branches from base. Its leaves are trifoliate, petioled, and stipulate. The flowers form in dense spiciform raceme up to 60 mm long in the upper axils. The pods are discoid, glabrous, spiny or unarmed coiled surfaces with many radial veins. It is a common weed in gardens, lawns and cultivated areas. It flowers from January to March and is grazed by animals.

Melilotus indica (L.) All.
Judiaibah

This leafy annual herb is about 30 cm tall. It usually occurs in areas where there is abundant water. The leaves are trifoliate and slightly hairy with dentate margins. Its yellow flowers appear on spikes and are about 3 mm long. The seed pods are ovoid, brown and about 2 mm long.

Onobrychis ptolemaica (Delile) DC.
Hatlah, Plate 155

This leafy perennial herb is about 40 cm high. The tall stems carry compound leaves with leaflets arranged in 7-10 pairs. Pale yellow, hairy flowers with crimson veins appear between March and April. This plant is commonly seen in sandy, gravelly soil such as that found along the coast.

Ononis reclinata L.
Shabrak

This annual herb, 3-20 cm high, is greatly branched from the base, covered with glandular hair and silky simple hairs. The leaves are trifoliate and denticulate along the apex. The flowers are solitary and pink to bluish- purple in color. The pods are linear, oblong, pendulous and somewhat longer than calyx.

Ononis serrata Forssk.
Zaitah, Plate 156

This leafy, prostrate herb is about 10 to 30 cm high. Its' leaves are clover- like, sparingly pubescent and sharply serrated. Between March and April, it has pale pink flowers that are followed by small ovoid pods.

Prosopis farcta (Banks & Sol.) J.F. Macbr.
Kharnob

This is a small bush with many branched stems,

and leaves with many small leaflets. It has spikes of small creamy flowers, and ovoid or irregularly swollen pods that eventually look like lumps of charcoal. It is a shrubby weed of wasteland and is distributed around agricultural areas. It flowers from May to June.

Scopiurus muricatus L.
Thanb Al Agrab

This annual has angular stems and spathulate, 3-5-nerved, petiolate leaves. It has an umbellate, axillary inflorescence, which has up to 4 yellow flowers tinged with red. The seed pods are red and spiny, spiralling and coiling in an overdone imitation of a scorpion's tail. It is an uncommon weed that flowers from March to April.

Trifolium lappaceum L.
Barsem
Found in cultivated grounds.

Trifolium resupinatum L.
Barsem

This erect, decumbent or prostrate, glabrous annual reaches 30 cm in height and has petiolate, trifoliate leaves. The flowers are crowded, sessile, and have small scarious bracts and pink to mauve corolla. The pod is ovoid and enveloped by the inflated calyx. It is a weed that grows among irrigated crops, especially in well-irrigated lawns. It flowers from March to April.

Trigonella anguina Delile
Nifal

This annual, glabrous, prostrate herb has many branched stems and petiolate, trifoliate leaves. The flowers are sessile, clustered in the axils, and yellow in color. The pods are 4.5-6.5 mm long, zig zag, appressed hairy, stellately, spreading and 2-6 seeded. The plant is palatable to sheep and goats, and it grows in sandy soil. It flowers between March and April.

Trigonella hamosa L.
Nifl, Qurrays, Plate 157

This annual, prostrate to decumbent herb has stems that are roughly 20 cm long. The leaves are trifoliate and dentate. During the spring, it has yellow, narrow, pea-shaped flowers about 5 mm long clustered on long peduncles. It is commonly found on sandy and silty soil.

Trigonella stellata Forssk.
Nifl

This is a bright green annual mat-forming herb, which spreads quickly, especially where there is abundant water. The leaves are trifoliate and dentate. It has yellow flowers and a clover-like scent. The pods are 4-7 mm long, straight, 6-12 clustered and stellatetly spreading. Common in the sandy desert, roadsides and on pavements.

Vicia sativa L.
Begeiha

This is a sparsely pubescent, decumbent or scrambling annual about 5 cm high with basally branched stems. The leaves are paripinnate, ending in fine tendrils. The flowers are solitary or paired, sessile or sub-sessile in the axils with blue-violet corolla. The pods are linear, compressed, and glabrous accumulate at the apex, ripening to a very dark shining brown. The seeds are nearly spherical, 3-5 mm in diameter, smooth and gray-brown. It is a weed on farmlands.

MALVACEAE

Althaea ludwigii L.
Khatma, Plate 158

This annual prostrate herb has many branched-ascending stems. Its deeply lobed leaves are divided into 5 sections like fingers on a hand with small whitish-pink axillary flowers. The fruits are like cupcakes, and the seeds are reniform, brown and rugulose. It grows in loamy and gravelly soil, and flowers from March ao April.

Malva nicaeensis All.
Khubbaizah

This annual or biennial herb has many branches, ascending or procumbent, glabrous or sparingly pilose stems and long petiolate, reniform leaves. It has mauve, 2-3 flowered clusters in the axils. The fruit is 0.8-1 cm in diameter. It flowers in April.

Malva parviflora L.
Khubbaizah, Plate 159

This is a leafy herb that usually appears near irrigated fields and waste areas. Ariel stems 10-50 cm tall. Its leaves are round or kidney-shaped with notched margins. The flowers are very pale pink

and about 6 mm wide. This plant is sometimes harvested in the spring and cooked like spinach.

NEURADACEAE

Neurada procumbens L.
Sadan, Plate 160

This small, prostrate annual herb has small, lobed, woolly leaves. Its flowers are whitish-yellow and about 6 mm across. Its fruits are relatively large, spiny and nut-like. The spring seeds plunge into the skin when stepped on and is rather painful!

OROBANCHACEAE

Cistanche tubulosa (Schrenk) Wight
Halook, Dhnun, Plate 161

This is a sturdy-looking root parasite photographed in Sulaybiya adjacent to its host, *Lycium shawii*. It has a thick, fleshy, aerial stem approximately 30-40 cm high, and has an elongate, bulb-shaped underground stem, which, in turn has long thread-like roots that attach to the roots of the host. The funnel-shaped flowers are bright yellow with purple-tipped flowers usually seen between February and May.

Orobanche aegyptiaca Pers.
Auwehirra, Plate 162

This parasitic root annual totally lacks chlorophyll and relies on its host for nourishment. An erect spike, it is approximately 15-30 cm tall with funnel-shaped mauve flowers, 2.5 cm long and 1.5 cm wide with a white base.

Orobanche cernua Loefl.
Daqn Al Ader, Plate 163

This parasitic root annual totally lacks chlorophyll and relies on its host for nourishment. An erect spike, it is approximately 10-20 cm tall. Its flowers are funnel-like and dull whitish in color tipped with purple and have no scent.

Orobanche minor Sm.
Halook

This species was never sighted other than in the literature.

Orobanche ramosa L.
Halook, Plate 164

This annual or perennial root parasite has glandular, hairy stems that branch from the swollen base. Its' leaves are reduced to yellow or purplish scales up to 8 mm long, and the corolla is tubular to funnel-shaped and yellow to violet with a white-base constricted above the ovary and tubular calyx. It is a common weed of rain-fed pulses and is very often associated with tomato plants. It flowers from September to March.

OXALIDACEAE

Oxalis corniculata L.
Dadahan

This is a creeping annual or perennial with a slender taproot and greatly branched, hairy stems often rooting at the nodes. The leaves are trifoliate with obcordate leaflets, usually broader than long. The flowers are axillary, umbellate inflorescence with yellow petals that are twice as long as the calyx. The capsule is cylindrical, 5-furrowed, and hairy with transversely ribbed, strongly compressed seeds. It is cultivated in the gardens of Riyadh as fodder. It flowers between April and June.

PAPAVERACEAE

Glaucium corniculatum (L.) Rudolph
Naman

This annual herb has a short stem only 25-30 cm high with spreading hairs and rough hairy leaves. It has small scarlet, orange-red or yellow flowers, that often have a black spot at the base of each petal. It has large, long seed pods. It is found in cultivated fields and waste places, and flowers in April.

Papaver rhoeas L.
Shaqiq Al Nuaman

This hairy annual is 25-90 cm high, has white sap and lobed leaves with lance-shaped, acute segments. The flowers are large, showy, solitary, deep scarlet and often have a dark blotch at base of the petals. The pod is as long as it is broad, with 7-10 radiating stigmas. This corn poppy is clearly distinguished by this globular, flat-topped pod. Its seeds are used as a tonic for horses by the Arabs and

Turks, and infusions from the fruits are good for coughs. It flowers between April and July.

Roemeria hybrida (L.) DC.
Bakhtery, Plate 165
This is a beautiful annual herb photographed in Ad-Dhubaiyah. It is a wild poppy about 25 cm high, and has deep purple flowers. It has deeply dissected leaves and long, slender seed pods that are formed after the corolla withers away. Flowers in March.

PLANTAGINACEAE

Plantago amplexicaulis Cav.
Mosbaq, Plate 166
This is an annual that is sparingly hairy and stemless or has only a short but conspicuous stem. Its leaves are lanceolate and clasping at the base from which the flowering head grows. It is short and round with pale pink flowers and an elliptic capsule about 6 mm long. It flowers from February to April.

Plantago boissieri Hausskn. & Bornm.
Rublah, Plate 167
There are 8 *Plantago* species in Kuwait, and this species occurs predominantly. It is an annual herb with strap-like leaves emerging from a central rosette. The blades are linear, narrowly tapering, and covered with silky hairs. These plants appear shortly after rainfall and are heavily grazed by animals. They have a cylindrical inflorescence axis about 15 cm tall and small creamy-colored flowers clustered on the upper part of the flower stalk. Flowers in February and April.

Plantago ciliata Desf.
Quraitha, Plate 168
This small herb has obovate to spathulate leaves. The herb is covered with tiny hairs giving it a velvet-like texture that attracts fine particles of sand. It is about 10 cm across and is commonly found on hard, gravelly soil. The creamy white flowers are born on a spike at the terminal end of the inflorescence axis.

Plantago coronopus L.
Wadinah, Wadainah, Plate 169
This annual herb has basal leaves characteristically emerging from a rosette. The leaves are lanceolate and pubescent with a toothed leaf margin. Cylindrical stems ascend from the rosette, which carry the flowers clustered in an elongated, dense spike. It is commonly found on hard desert soil and is grazed by sheep and goats.

Plantago lanceolata L.
Lisan Al Kalb
This perennial, stemless herb has parallel veined, lanceolate, glabrous leaves with scapes that are angled and much longer than the leaves. The anterior sepals are glabrous and usually united into one. The posterior sepals are usually hairy along the keel. The corolla lobes are ovate, triangular, and glabrous. The plant occurs in cultivated areas and flowers from June to November.

Plantago notata Lag.
Zebad
This annual herb is pale green, stemless and has hairy, lobed, linear leaves 3-7 cm long. The scape is ascending and is longer than the leaves. The spikes are oblong cylindrical and 1-2 cm long. The flowers have glabrous, buff- colored, ovate- orbicular corolla and glabrous, elliptic calyxes. The capsule is a broad, ovoid and ellipsoid with brown, narrowly elliptic seeds. It flowers from March to April.

Plantago ovata Forssk.
Lugmat Al Naaja, Plate 170
This annual plant has long, slender, strap-like leaves that taper towards both ends. It has fine hairs on the leaves and a leafless flower stalk arising from the basal rosette. The flowers are borne on an oval flower spike.

Plantago psammophila Angew & Chal.-Kabi
Rublah
This is an annual, silky, fleecy, silvery, stemless herb with linear leaves gradually tapering from the base to the apex. It is silvery and fleecy on both surfaces. The green flowering spikes with their tiny flowers are the same length as the leaves. The capsules dehiscing near the middle, and the seeds are gray with a brown center stripe. It flowers from March to April.

PLUMBAGINACEAE

Limonium carnosum (Boiss.) Kuntze
Mlaih, Qataf

This is a perennial sub-shrub, that is woody at the base with thick, fleshy finely punctate leaves covered with fine whitish crystals of excreted salts. The flowers having pale pinkish-violet petals and a funnel-shaped or tubular calyx are borne on the spikes. The fruit is a thin-walled utricle. This is a plant of salty and silty soil, and it flowers from July to October.

Limonium thouinii (Viv.) Kuntze
Sibsab

This annual, glabrous, bluish-green, erect herb have several stems ascending from a basal rosette of leaves. The upper stems are winged. The flowers are in terminal helicoid cymes, and the inflorescence branches below the flowers expands into a cuneate, leaf-like wing with branching nerves,. The calyx limb is papery, and the corolla is cream, but soon deciduous. The plant flowers in April.

Psylliostachys spicata (Willd.) Nevski Syn. *Statice spicata* Willd.
Sibsab

These annuals are up to 30 cm tall with radical, densely covered hairs on the mid-rib and scattered on the lamina. The scapes are a little longer than the leaves, and the spikelets have 2-4 flowers each. Each spikelet is brownish, papillose, stepitate and in-curved. The flowers are pale pink or whitish- cream. It is most commonly found in saline places on Faylakah island, and it flowers from March to April.

POLYGONACEAE

Calligonum polygonoides L.
Artah, Plate 171

This is a perennial shrub that can reach 120 cm in height. The older branches are white, and the newer ones consist of bundles of green stems with leaves. The leaves are minute and inconspicuous. The flowers are white with pink- tipped stamens. The fruits are red or greenish-yellow and are covered with branched stiff bristles that look like hairy strawberries. This plant is found almost always in deeper sands and flowers between March and April.

Emex spinosa (L.) Campd.
Hembizan, Plate 172

This is a prostrate, leafy, annual herb about 60 cm long with a reddish stem and a basal rosette of leaves. Basal and cauline leaves are large, deep green, ovate to oblong and truncate at the base. The flowers are tiny and appear in clusters on the leaf nodes. The white fleshy taproot is edible. This plant often appears as a weed in disturbed areas. Flowers in March.

Polygonum patulum M. Bieb.
Gurdhab

This is an annual glabrous herb with a greatly branched, angular, decumbent or prostrate stem. The leaves are thin and lanceolate, and the flowers are pink-greenish having yellow anthers and a glabrous ovary. It is commonly found in gardens, orchards and on lawns. It flowers from February to March.

Rumex pictus Forssk.
Hambasis

This plant is less common than *Rumex vesicarius.* It is an annual, semi-prostrate herb about 15 cm high. It has dark green pinnatifid leaves and small flowers clustered on the stem, forming a dense terminal stalk. The winged fruits are first yellow turning pink to reddish with age. The leaves are edible to humans and animals. The leaves are used in the preparation of yigut (local food) to increase its acidity.

Rumex vesicarius L.
Hummayd, Plate 173

This is a leafy, erect, succulent annual herb. The leaves are triangular in shape and truncate at the base. The flowers are small and clustered on the stem. The fruit is more conspicuous than the flower. Each fruit has 3 deep pink tissue-like membranous wings with red venation. The plant is commonly found in sandy soils and sometimes in pavement cracks.

PORTULACACEAE

Portulaca oleracea L.
Barbir, Plate 174

This is a succulent, branching herb about 10-20 cm high with ascending or procumbent stem. Leaves are opposite, or alternate and dark green. It has bright yellow petals. It is a weed of gardens and walk edges and is widely used in salads. It flowers from April to September.

PRIMULACEAE

Anagallis arvensis L.
Ain Al Qitt, Plate 175

This very pretty annual usually occurs as a weed in irrigated areas. It is a prostrate herb with dark green, alternate, sessile, ovate, entire leaves. The flower has 5 petals that are bright blue with a reddish center and yellow stamens emerging from it. It flowers between March and April.

RHAMNACEAE

Zizyphus spina-christi (L.) Willd.
Sidr, Plate 38

A common tree about 12 m high. Leaves are ovate or oblong, obtuse with 3 main nerves from the base. Flowers are yellowish-green. The fruit is edible. Local harvests are sold in markets. Introduced in gardens. Flowers in December. Fruit ripen during spring (March and April).

RANUNCULACEAE

Adonis dentata Delile
Ain Al Bazoon

This annual herb has spirally arranged, deeply dissected, carrot-like leaves. It is 15-20 cm high, and its flowers are orange to yellow with a blackish center. The fruit is clustered along a spike. This plant is very rare.

RESEDACEAE

Caylusea hexagyna (Forssk.) M.L. Green
Denaibah, Denban

This is a biennial herb with several stems emerging from the woody base. The leaves are simple and alternate with undulate margins. The flowers are white with gynophores. The fruit is a depressed, globular, capsule with stellately spreading black or brown seeds. This plant is found in the desert on sandy clay in slight depressions.

Ochradenus baccatus Delile
Gurdhi, Plate 176

This large shrub is found in sandy, stony areas such as those found at Mutla' ridge and in Wadi Umm Al-Rimam. It is a dense shrub approximately 2 m tall, with gray-green linear leaves. Its yellow apetalous flowers grow on a raceme. They appear in the spring followed by whitish berries containing black seeds.

Oligomeris linifolia (Hornem.) J. F. Macbr. Syn. *Reseda linifolia* Hornem.
Thenban, Plate 177

These annual, erect-standing herbs are about 25 cm high. They have slender linear, blue-gray lanceolate leaves. The flowers are minute, appearing on a spike-like raceme between March and April. The plants have conspicuous seed capsules that are attached on an elongated stem.

Oligomeris subulata (Webb & Berth.) Webb
Denbanab, Dhenban

This annual low herb has branched, erect, glabrous stems with narrowly linear to oblanceolate leaves and spikes of tight green flowers. The fruit is a chartaceous capsule 2-2.5 mm in diameter with many round-reniform shiny, black seeds. It grows in a habitat with coarse, sandy soil and flowers from March to April.

Reseda arabica Boiss.
Ethniban, Plate 178

This annual herb is about 30 cm high and arises from a basal rosette. It is multi-branched and has toothed, gray-green leaves. It is similar to *Reseda decursiva,* but it is a more sprawling herb than erect-standing. It has a showy spike of light yellow flowers. It is usually found on gravelly soil, and flowers between March and April.

Reseda decursiva Forssk. Syn. *Reseda alba* L.
Thnaibah

These erect-standing herbs with light green stems branch from the base. The leaves are deeply dissected and have rippled margins. White flowers are densely clustered on a raceme, and are followed by the appearance of elliptic seed pods.

Reseda muricata C. Presl
Dhuniban, Plate 179

This is multi-stemmed feathery perennial herb reaching 80 cm in height and branching from a basal rosette. The leaves are alternate and smooth to scabrous because of minute, stiff hairs on the leaf. It flowers between April and May when the tip of the shrub carries a spike of creamy white flowers.

RUBIACEAE

Crucianella membranacea Boiss.
Mustawthah, Plate 180

This is an erect-standing herb about 15 cm tall. It has several erect stems branching from the base. The leaves are opposite, sessile and lanceolate with acuminate leaf tips. Its yellow flowers are tucked between the stem and the leaves, which are arranged on a spike.

Galium tricornutum Dandy
Dobaika

This is a climbing or scrambling annual herb with a glandular, hairy, green, quadrangular stem and linear leaves arranged in whorls. The flowers are white, 4-petalled and joined to form a tube. The fruits are sticky. It is a weed of gardens or field crops usually found under the shade of *Zizyphus* trees. It flowers from March to April.

RUTACEAE

Haplophyllum tuberculatum Forssk.
Al Musaikah, Plate 181

This erect, branching perennial herb is about 40 cm high. It has many erect ascending stems and leaves of variable form. They are dotted with wart-like glands that emit a strong, unpleasant odor. The flowers are yellow and are about 8 mm wide. Flowers in March.

SCROPHULARIACEAE

Linaria albifrons (Sm.) Spreng.
Halj Al Bazoon

This annual herb has a glabrous, erect stem about 15 cm high and pale green triangular leaves. It has a few, small, nearly capitate flowers with short-pedicelled, lobed calyxes and whitish with violet tube of yellow throated corolla. It flowers from March to April.

Linaria simplex Desf.
Kitanieh

This is an annual herb with erect stems and short, sterile shoots at the base. The leaves are linear and whorled, and those of flowering shoots are whorled below and alternate above. The flowers have linear spathulate, glandular, hairy calyxes and bright yellow, tubular, upper-lipped, violet-veined corolla. The seeds are discoid and membranously margined. This plant commonly occurs in sandy soil, and flowers from March to April.

Scrophularia deserti Delile
Zaitah, Plate 182

This perennial usually grows on hard rocky ground such as that found behind the chalets at Ad-Dhubaiyah. It is an erect-standing plant that has a leafy base and small, dark red flowers with conspicuous yellow stamens. The leaves on the stem are opposite, oval-shaped and deeply lobed. New growth arises from the previous years' woody base.

SOLANACEAE

Datura innoxia Mill.
Daturah, Plate 183

This is an annual, densely pubescent, grayish herb about 130 cm high. The stems are stout and greatly branched with alternate, long, petioled leaves. The flowers are large and solitary in the bifurcations of the stems having 5- lobed, tubular calyxes and white, trumpet-shaped corolla. The seeds are reniform, light-brown and minutely pitted. The fruit is the thorny apple, and seeds are toxic. The plant is poisonous found in moist waste ground. It flowers from March to September. It has

medicinal value.

Hyoscyamus muticus L.
Benj, Safari

This is a bushy, leafy herb reaching about 1m in height with pointed, glaucous leaves. It has green, densely blotched leaves with purple flowers. It grows in hard sand.

Hyoscyamus pusillus L.
Benj, Sekran

This is a spreading, leafy herb with upward-curving stems 15 cm long. The flowers are 1 cm wide and yellow with a deep purplish throat, cupped in a very large calyx. The plant has capsules with dome-shaped lids. It grows in sandy or silty sandy ground or sometimes around desert wells.

Lycium shawii Roem. & Schult.
Awsaj, Plate 184

This is a very spiny shrub that can reach up to 1.5 m in height. It is commonly found at Wadi Umm Al-Rimam, in the gullies of the Az-Zor ridge and in the areas behind the chalets. It has purple, sometimes white, trumpet-like flowers and sharp thorns that are used by the shrike to impale its prey. The leaves are elliptical and congested in close clusters. Red, juicy berries are produced in the summer.

Solanum nigrum L.
Khurma

This is an annual, erect herb with greatly branched, angular stems. The leaves are dark green with narrowly winged petioles. It has white flowers with a cone of yellow stamens. The fruit is a pale green berry that becomes black like pepper at maturity. It is frequent in waste and cultivated ground and flowers from April to May.

Withania somnifera (L.) Dunal
Haml Al Balbul

This is a branching leafy, slightly downy shrublet that grows up to 1 m high. It has short, pedicelled, yellowish-green flowers and the bright red ripe berry is enclosed in a persistent calyx. This is a very widespread plant in waste ground and cultivated areas.

TAMARIACEAE

Tamarix aucheriana (Decne.) B.R. Baum
Athal, Tarfa, Plate 185

This plant favors saline areas such as those found on the coast in Sulaibikhat. It is a large shrub, about 1.2-1.5 m high, with scale-like leaves. The flowers are deep rosy pink and appear on a terminal spike. Cone-shaped seed pods can be seen from February to April and again from October to November.

THYMELAEACEAE

Thymelaea mesopotamica (C. Jeffrey) B. Peterson
Al Methnan

This is an annual herb about 5-15 cm tall with simple or branched, slender stems. The leaves are alternate and sessile; it has pale greenish-yellow flowers in the axils of the leaves, and the fruits closely adherent to the ovary. It is a rare plant found on sandstone, and flowers from March to April.

UMBELLIFERAE

Ammi majus L.
Khilla

This is an annual erect, glabrous herb with greatly branched stems. It has large primary leaves and finely cut leaves with white flower heads. The flowers are umbel-shaped with white petals and pinkish-white anthers. It is an uncommon plant and is found in disturbed areas. It flowers from April to May.

Anisosciadium lanatum Boiss.
Basbas, Plate 186

This annual is a member of the carrot family. It can be detected by its smell. A desert annual, about 20 cm high, it is one of the most common desert umbelifers. It is easily identified by its deeply dissected carrot-like leaves. The stems are striped green and white, carrying a umbrella-shaped, dense umbel of white flowers. The barbed seeds harden at maturity.

Bupleurum semicompositum L.
Zafaran, Plate 187

This is a branched annual up to 20 cm tall with dark grayish-green, narrow, pointed leaves. The

flowers are yellowish-brown in an umbel shape surrounded by thin, pointed, green bracts. The fruits are conspicuously stalked, globular and glandular with white swellings over the surface. The plant flowers from April to May.

Deverra triradiata Hochst. ex Boiss. Syn. *Pituranthos triradiatus* (Hochst. ex Boiss.) Asch. & Schweinf.
Hazhaz, Plate 188

These are shrubby perennial with leafless, rigid, whitish, striate, alternately branched stems. The upper cauline leaves are reduced to triangular membranous scales. The flowers are in semiclosed umbel shapes. This plant grows to a good size in protected areas and is very popular with grazing camels.

Ducrosia anethifolia (DC.) Boiss.
Al Haza, Plate 189

This perennial is an erect, branched, stemmy herb up to 1 m tall with feathery blue-green leaves. It has tiny, yellow flowers in an umbel and a strong pleasant smell. It flowers in April.

URTICACEAE

Urtica urens L.
Qurrays

This is an annual herb with branched, ascending, pubescent, quadrangular stems. The leaves are opposite, deeply dentate with stinging hairs. Male and female flowers are separate, and the female flowers are green with no petals. The plant grows in cultivated grounds and gardens in moist shady places. It flowers from December to March.

VALERIANACEAE

Valerianella dufresnia Bunge ex Boiss.
Semnah

This is an annual, small, neat herb with a thick, branched stem and pale green, simple leaves. It has flower heads of tiny white-petaled flowers surrounded by a leafy bract with a crown-like, funnel-rim-shaped calyx. It is found in sandy soil and flowers in March.

VERBENACEAE

Phyla nodiflora (L.) Greene
Thayell Sini

This perennial procumbent herb has quadrangular stems and roots at the nodes. It has white flowers at the top of an elongated peduncle, aggregated compactly into an oval inflorescence. It grows in lawns and moist ground, and is becoming a popular plant for lawns in Kuwait. It flowers from May to June.

ZYGOPHYLLACEAE

Fagonia bruguieri DC.
Janbah, Plate 190

This small branching spiny herb is about 15 cm high and 10-40 cm across. It has many stems that grow laterally and horizontally. The leaves are trifoliate and lanceolate. The flowers have 5 petals and are pale pink.

Fagonia glutinosa Delile
Shikaa, Plate 191

This prostrate, spiny herb has many horizontal, lateral branches that spread from a central woody stem. Its small leaves are trifoliate or sometimes reduced to a single leaf. The flowers are mauvish pink. The stems and fruit are slightly sticky due to which sand grains stick to the leaves.

Fagonia indica Burm. f.
Hulwayah, Plate 192

This is a procumbent perennial herb up to 30 cm high with a glabrous, erect, branched stem. The leaves are simple, dark green, and entire with stipular spines. It has pink, solitary, axillary flowers with pubescent capsules. It commonly occurs in sandy soils and flowers from March to April.

Nitraria retusa (Forssk.) Asch.
Ghardaq, Plate 193

This is a salt-tolerant bush found in the coastal areas of Kuwait and on Mutla ridge. It is a large shrub about 150 cm high. The branches are woody and thorny, and it is grazed upon heavily by animals. It has bluish-green, leathery leaves, and greenish-

yellow flowers in the spring followed by red berries. This shrub is a useful addition to a desert garden.

Peganum harmala L.
Harmal, Plate 194

This plant is rarely seen in Kuwait. However, this specimen was found at the Umm Al-Aish satellite station. It is a leafy shrub about 40 cm high with yellowish-white flowers about 2 cm across. Its stems are woody at the base and multi-branched. The leaves are dark green and linear. The seeds are formed in small capsules. This is a beautiful plant, and it is worth using as an addition to a garden.

Seetzenia orientalis Decne.
Abu Shawke, Habian

The perennial prostrate herb is about 30 cm having a divaricately branched stem and trifoliate, whitish-margined leaves. The flowers are solitary, axillary, and pedicellate with sepals, and they are petal-less. The fruit is a capsule that is yellow in color and has a glossy, waxy coat. The plant flowers between March and June.

Tribulus macropterus Boiss.
Zahr

This prostrate, leafy, hairy herb is about 1 m long. The flowers are yellow up to 1.5 cm wide, and the fruits are hairy with winged angles and soft spines.

Tribulus terrestris L.
Sharsheer, Plate 195

This prostate, spreading annual herb has leafy branches and stems, and is up to 70 cm across. The leaves are opposite with 5 - 6 pairs of leaflets. The plant is usually found in sandy soil and along roads. It has a 5-petalled yellow flower about 1.5 cm wide and a large, coarsely spined fruit.

Zygophyllum qatarense Hadidi
Harm, Plate 196

This is a medium-sized shrub commonly found in coastal areas and depressions. It has succulent, almost spherical leaves and tiny yellow flowers on short pedicels. Its fruits are erect, smooth and oblong, and appear in mid-summer.

MONOCOTYLEDONEAE

AMARYLLIDACEAE

Ixiolirion tataricum (Pall.) Herbert
Enselan

This is a small bulbous perennial with brown tunics and a few slender leaves that are longer than the axillary flowers. It has beautiful, delicate, blue-violet funnel-shaped flowers with oblong, ellipsoid capsules. It is found only on Faylakah island and flowers from March to April.

CYMODOCEACEAE

Halodule uninervis (Forssk.) Asch.

A submerged marine perennial herb, this plant often forms dense beds with spreading rhizomes on the sea bottom. Its leaves are clustered at the nodes, ascend narrowly, are up to 25 cm long and are dentate at the apex. It is common locally and is found in the nearshore area on sea bottoms at depths of 1-15 m.

CYPERACEAE

Cyperus conglomeratus Rottb.
Thandah, Plate 197

This sedge colonizes mainly sandy areas of Kuwait. It is about 60 cm tall, spreads by rhizomes and forms a dense cluster at the base. Brown or green flower spikes appear in compact heads arranged in clusters. Its leaves are bright green, stiff, grooved and curving. It is an excellent sand stabilizer as hillocks of fine sand form on the leeward side of the plant. Grazing animals like to forage on this sedge.

Cyperus rotundus L.
Sahed, Plate 198

This perennial rhizomatous herb is about 10-50 cm high with slender, brownish-red scales covering rhizomes and culms. The flowers form an umbel, are yellowish to reddish-brown and have brownish, trigonous nuts. The plant grows in lawns, and in cultivated and waste ground, especially during summer time.

GRAMINEAE (POACEAE)

Aegilops bicornis (Forssk). Jaub. & Spach
Abu Shareb

This annual grass with tufted, erect or geniculately ascending culms is up to 25 cm tall, smooth and glabrous, and has rather stout spikes up to 12 cm long with fragile axis. This is a grass that grows on limestone slopes, grassy clay hillsides or plains. It flowers from May to June.

Aegilops kotschyi Boiss.
Abu Shareb

This annual grass with numerous ascending culms is often kneed below. Its leaf blades and sheaths are often ciliated or covered with fine hairs. Its spikes are solitary, terminal, and lanceolate, and the glumes are produced into 3 or 4 scabrous awns. It is commonly found on elevated ground and is sometimes found on disturbed ground.

Aegilops triuncialis L.
Abu Shareb

This is a glaucous annual grass about 8 cm tall. It is branched at the base and stands erect. It has linear, glabrous or sparsely hairy leaf blades and hairy leaf sheaths. It has spikelets whose glumes are covered with short silvery hairs and with shallow furrows between them. It was introduced from Europe.

Aeluropus lagopoides (L.) Trin. ex Thwaites
Ikrish, Plate 199

This perennial is a pubescent grass that sometimes has densely tufted culms and, at other times, has widely spreading, prostrate stems. It has stolons or rhizomes covered with overlapping scales and inflorescence with a terminal head of hairy spikelets. It is a halophyte and grows on saline ground around cultivated areas and salt marshes.

Aeluropus littoralis (Gouan) Parl.
Sherib, Ikrish, Plate 200

This perennial plant has spreading rhizomes, creeping, woody stolons, terminal rooting nodes and pungent leaves. Its' elongate is panicle up to 8 cm consisting of a large number of spikes less than 1 cm each with spikelets. It is commonly found in saline ground around cultivated areas with irrigation runoff and in salt marshes.

Ammochloa palaestina Boiss.
Eraifjan

This dwarf annual has smooth, glabrous culms. Its' leaf blades are mostly radical, linear, flat or folded. The spikelets are pale, almost sessile on very short branches at the top of the peduncle forming a globular inflorescence with scarious glumes. It grows in sandy places and dunes, and flowers from March to April.

Avena barbata Pott ex Link
Al Shaiyrah, Plate 201

This is an annual weed that grows around cultivation or occasionally in the desert. The culm is solitary, green, glabrous, and up to 1 m tall with linear acuminate leaf blades about 30 cm long and 3 flowered spikelets.

Avena fatua L.
Thenban

This is an erect, glabrous plant up to 60 cm tall with less pubescent leaf blades and sheath. Spikelets have 2-3 flowers in a spreading panicle. The flowers fall one by one from the rachilla on maturity. It flowers from March to May.

Avena sativa L.
Showfan

An erect, glabrous weed, *Avena sativa* has glabrous leaf blades and spikelets of 2-3 flowers. The subequal glumes are pedicellate in a spreading or nodding panicle. This is the cultivated oat, that grows spontaneously around farms.

Avena sterilis L.
Showfan

A coarse annual grass, *Avena sterilis* has erect culms about 1 m high with a small number of large spikelets of 2-3 flowers. The flowers are connate and fall as a unit. The lemmas having long spreading hairs varying in color from cream to brown or black, with bifid but not awned tips. It is a weed of fields and the surrounding area.

Brachypodium distachyum (L.) P. Beauv.
Denban

An annual, this plant has glaucous, stiff, clustered

culms and grows up to 30 cm tall with short, flat broad leaf blades and short pedicelled, crowded spikelets in solitary inflorescence. The glumes and lemma are strongly nerved, and the lemma is awned. It grows in sandy gravel and gypsum plains, and flowers from March to April.

Bromus catharticus Vahl.
Ashwahra
A temperate grass, if at all sighted, is a weed.

Bromus danthoniae Trin.
Abukneitleh, Sneisleh
An annual grass, this plant has genicualte, ascending, fascicled culms up to 40 cm tall, and inflorescence of solitary, hairy, lanceolate spikelets. The lemmas consist of 3 purplish or reddish-purple-colored awns. The plant is found on the roadside and as a weed in irrigated fields. It flowers from April to May.

Bromus madritensis L.
Sabel Abu Al Hassin, Plate 202
This is an annual grass with solitary, erect or ascending, glabrous culms and an erect or slightly noded panicle. The spikelets are green or purple, wedge-shaped and an awned lemma about 12-19 mm long and 3 mm wide. In dry specimens, the panicle is fan-shaped. The plant grows on stony ground and sandy gravel areas. It flowers between March and April.

Bromus sericeus Drobov
Hentah Zerbaa
An annual, this pubescent grass has many fasciculate culms and is about 15-30 cm high. The leaf blades are sparsely hairy, linear accuminate up to 8 cm long. The panicle is racemose with pilose, filiform branches and curved pedicels. The awns are 20-40 mm long; they are longer than the glumes. It occurs in sandy, gravelly places and flowers from March to April.

Bromus tectorum L.
Al Zereaah
A fine slender annual, this pubescent grass reaches 60 cm in height and has tufted or solitary culms. It has long acuminate, usually minutely hairy leaf blades and short, and soft, tassel-shaped panicle of crowded spikelets on capillary pedicels. It grows on wasteland and fields, and flowers from April to May.

Cenchrus ciliaris L.
Subbat, Thumum, Plate 203
This perennial grass is sometimes shrubby with tufted culms ascending from a stout woody rhizome up to 100 cm long having linear acuminate, glabrous or hairy leaf blades. The inflorescence is pale or purplish, has false spikes, and is often flexuous with solitary or clusters of 2-3 spikelets enclosed by an involucre of 2 kinds of bristles. It grows on compact soil and flourishes along the margins of irrigated roads. Flowers mainly in the spring, but also in other seasons.

Cenchrus setigerus Vahl.
Yarah, Plate 204
This perennial or annual grass has tufted, glabrous or hairy branches and a dense spike-like racemose inflorescence up to 8 cm long and 5-8 mm wide. It is composed of small, green, toothed burs and awn-like bristles forming a fringe at the base of the bur. It grows in wadis on rocks.

Centropodia forsskalii (Vahl) Cope Syn. *Asthenatherum forsskalii* (Vahl)
Halfa, Qasba, Plate 205
These perennial, loosely tufted, densely leafy desert grasses, are procumbent at the base and often branched with very thick, sand-covered roots. The culms are woolly with lax sheath, often scarious below, covered with silky hairs. The panicle is dense and consists of pale yellow or purple-tinged spikelets, sub-equal glumes and pubescent lemma. It is a common desert grass that grows in a sandy habitat and flowers in summer.

Cutandia dichotoma (Forssk.) Trabut in Batt & Trab.
Khafoor
This is a small, very slender grass about 5-10 cm high with many fasciculate, congested culms covered with inflated sheaths to the base of the panicle. The panicle is less branched and has shorter internodes,

shorter than the length of a spikelet and the spikelets have more appressed, pungent, patent flowers. It grows in sandy or gravelly desert, and flowers from March to April.

Cutandia memphitica (Spreng.) Benth
Khafoor, Plate 206

This annual grass has numerous, fascicled, purple-noded, ascending, smooth, glabrous culms branched in tufts. It grows up to 30 cm tall having conspicuously dilated sheaths at the nodes. The leaf blades are narrower than the sheath, and the inflorescence have a forked branching and 5-10 cm long panicle. Each branch is divided into a short, pedicelled spikelet. The lemma ends in an awn-like, short, pungent, mucro. The plant grows in sandy habitats and on sand hills. It flowers from March to April.

Cymbopogon commutatus (Steud.) Stapf
Nejeel

This is a perennial, densely tufted, strongly aromatic grass with densely tufted culms up to 1 m long and narrow filiform leaf blades. It has erect, spatheate, narrow, interrupted panicles up to 4 cm long forming racemes in pairs. The lowest joint of the sessile raceme is prominently swollen and hardened with a spirally twisting column of kneed awn. It grows in compact, sandy gravel and flowers from March to May.

Cynodon dactylon (L.) Pers.
Nejeel, Plate 207

A perennial grass with extensively creeping rhizomes and stolons, produces rows of leafy culms up to 30 cm high and roots at the nodes. The leaves are more or less distichiously arranged, up to 6 cm long, and acuminate, and the leafy shoots end in a cluster of digitate spikes often purplish, 2-5 cm long, bearing crowded spikelets. It is a common weed in gardens and fields, and flowers more or less throughout the year.

Dactyloctenium aegyptium (L.) P. Beauv.
Bahma, Plate 208

This is an annual grass with compressed, richly branched, ascending culms spreading at the base and rooting at the nodes. It is about 40 cm long and has flat leaf blades that are somewhat undulate or wavy at margin and have bulbous-based hairs. The glossy yellow-gray to greenish digitately spreading spikes are 2-4 cm long and bear spikelets. It is a very common weed in shady places, along irrigation channels and in date palm groves. It flowers from May to October.

Dichanthium annulatum (Forssk.) Stapf
Zamzoum

This perennial grass has a thick woody rhizome and ascending or erect, densely tufted culms attaining 1 m in height, with bearded nodes. The inflorescence usually comprises 3-9 spikes consisting of numerous overlapping, sessile and pedicelled spikelets. The sessile spikelets are awned. It is a weed that grows on irrigated farmland and is locally distributed in Faylakah island.

Dichanthium foveolatum (Delile) Roberty
Zamzoum

This is a tufted perennial grass with fibrous roots and erect ascending branched culms above with 3 bearded nodes up to 50 cm high. It has narrow, blue-green, rigid leaves and solitary, erect inflorescence. The spikelets are white, hairy, linear, oblong with short, ciliated-tipped glumes and long, twisted, slender, bent awns. It is found in experimental nurseries, and it flowers in March.

Digitaria ciliaris (Retz.) Koeler
Al gameh

This annual grass has geniculately branched culms, often rooting from the nodes about 50 cm high, and leaf blades tapering to an apex, is somewhat hairy near the mouth of the sheath, glabrous above, and sometimes wavy at margins. It has short, pedicelled, acuminate spikelets that are hairy on the lower back with fine-ciliated, nerved lemma. It is a weed of gardens, farms or well-watered waste ground.

Digitaria sanguinalis (L.) Scop.
Dafrah, thafrah

This annual grass has basally branched culms and linear, acuminate leaf blades. The leaf sheaths are covered below with dense, hirsute, tubercle- based

hairs. The spikes have 3 mm long pubescent spikelets, and the lower lemma have glossy scabridities near the tip. The plant is found in ditches and channels in gardens. It flowers from August to December.

Dinebra retroflexa (Vahl) Panzer
Dinab

This is an annual grass with erect or geniculately ascending, glabrous, branched culms up to 60 cm tall and deep green or glaucous, white-hairy, flacid, leaf blades. The inflorescence consists of alternately arranged spikes with spikelets on a central axis. The lower spikes are up to 6 cm long, gradually decreasing in length towards the top. The plant is found on irrigated land, in shade by a channel, or on moist wasteland. It flowers from July to October.

Echinochloa colona (L.) Link
Hashish Hamra

This annual pink grass grows up to 20-30 cm high, and has decumbent culms rooting at the lower nodes. The leaves are linear, glabrous and pinkish-green in color with an absence of ligule. The panicle is 6-8 cm long with pink, alternate spikes about 1-2 cm long, each with spikelets of 4 rows. It grows in moist places, fields and gardens, and flowers in April.

Eragrostis barrelieri Daveau
Basharah

This is an annual, densely tufted grass about 40 cm high with linear acuminate leaf blades and striated sheaths with a dark ring at the base. It has axillary branched panicles about 15-25 cm long with 12-16 flowered spikelets 1 cm long. It is used as fodder for animals and grows in lawns and gardens. It flowers from April to May.

Eragrostis minor Host
Basharah

This annual grass has erect or shortly decumbent, fasciculate, branched culms up to 60 cm high with a ring of glands below the nodes. It has linear lanceolate, glandular leaf blades and inflorescence with a very dense, usually steel-gray panicle of crowded spikelets set on very short pedicels. It is a weed found in gardens, lawns, and moist sandy loam soils. It flowers from February to March.

Eremopoa persica (Trin.) Rosch.

This is an erect, annual with solitary or densely fasciculated, glabrous or smooth culms and linear, narrow, flacid leaf blades up to 20 cm long. Its' panicles vary extraordinarily in size, and all the branches are strictly whorled. Lemmas 5-nerved and glumes eliptic gaclute. It grows in stony hillsides, and rocky crevices. It flowers from March to June.

Eremopyrum bonaepartis (Spreng.) Nevski
Samt

This is an annual grass with central, erect, glaucous, glabrous culms and flat or folded, glabrous leaf blades. It has a strongly compressed spike with a long peduncle bearing spikelets of 3-5 flowers. The glumes gradually taper, and are sharp-pointed and awned. It is very common on sandy patches and sometimes grows in saline soil. It flowers from March to April.

Eremopyrum distans (C. Koch) Nevski
Sheairah

This is an annual dwarf grass with smooth, glabrous, ascending culms and hairy, linear, glabrous leaf blades. The spikes are compressed and oblong with 3-5 flowers in the woolly spikelets. The glumes are awned. The plant grows in sandy gravel and flowers from March to April.

Hordeum marinum Huds. Subsp. *gussonedum* (Parl.) Tell
Shaeer, Plate 209

This annual grass has solitary or loosely tufted culms about 30 cm tall. It has linear, acuminate, flat, hairy leaf blades and cylindrical spikes; spikelets in threes and with lanceolate glumes that are ciliate at base, tapering into awns that are broadly winged at the base. It is locally distributed along the sea coast and flowers from March to June.

Hordeum murinum L. Subsp. *glaucum* (Steud.) Tzvelv.
Shaeer

This annual grass has erect or ascending, solitary or loosely fasciculate, geniculate culms about 10-50 cm tall, with leaf blades that are linear, acuminate, long and glabrous. It has short, thick spikes with

spikelets. The hairy glumes of the lateral spikelets are long, ciliated on both edges, and wider than those of the middle spikelet. The plant grows in dry sandy places and flowers between March and June.

Imperata cylindrica (L.) P. Beauv
Halfa

This is a perennial, rhizomatous herb with culms up to 120 cm tall and glabrous nodes. The leaf blades are stiff, erect, rolled or with inrolled margins ending in a sharp tip. The plant has a cylindrical, silky, white, fluffy panicle up to 20 cm long with 1 flowered spikelet surrounded by callous hairs. It grows as a weed in gardens, along canal banks, and in sandy places near riverbanks. It flowers from April to June.

Lasiurus scindicus Henrard
Sbat, Plate 210

This is an erect, perennial grass up to 1 m high with woody rhizomes below, and branched culms. It has terminal racemes with short, pedicelled spikelets and glumes that are unequal, ciliate, and hirsute from the margins and keels. It grows usually on rocky ground or shallow, silty, sandy soils, and flowers from November to April.

Leptochloa fusca (L.) Kunth
Seifon

This perennial tufted, glabrous grass has erect, often branched culms up to 1.5 m high. The panicle is mostly 20-30 cm long with numerous ascending simple branches and greyish-green, short, pedicelled spikelets bearing unequal glumes. The lemmas are bifid at the apex with a greenish mid-nerve prolonged in a short mucro. It is a weed found in wet, irrigated lands.

Lolium multiflorum Lam.
Shylam

This is an annual, nearly glabrous grass with culms about 1 m high. It has flat leaf blades, and the sheaths are auriculate at their mouth. The spikelets bear 8-15 flowers and have glumes and lemmas with fine, straight, sometimes inconspicuous awns 2-10 mm long. The plant flowers from March to April.

Lolium rigidum Gaudin
Rwaitah, Smeir Plate 211

This annual has many, fascicled, geniculately ascending culms about 80 cm and is tall often branched at the base. The spikelets are 1-2 cm long, flattened, and bear 4-12 flowers. The upper glumes are more than half as long as the spikelet. It is an occasional weed in gardens and moist habitats, and flowers from March to April.

Lolium temulentum L.
Rwaitah, Zwan

This is an annual grass, with culms that are stout-tufted, rarely solitary and up to 60 cm tall with linear acuminate, auricled leaf blades. It has a short ligule with variable-sized spikelets of 6-10 flowers. The glumes are very firm and nerved. The lemmas are weakly awned, becoming swollen, hard and turgid when mature. It grows in fields of crops and flowers from April to May.

Panicum antidotale Retz.
Thamam, Plate 212

This is a stout perennial grass with thick rootstock and erect, swollen, noded culms about 1.7 m high. The leaves are 15-40 cm long, and the ligule is indistinct, appearing along its upper margin as a rim of very fine hairs. The spikelets are numerous. It is a weed of abandoned farm plots or ditches and is usually found in ground that is somewhat wet.

Panicum turgidum Forssk.
Thamam, Plate 213

This is a perennial desert grass growing in desert bushes up to 1 m high. The culms are densely tufted with swollen nodes and large secondary shoots arising from joints. The nodes are brown and prominent, and the spikelets are solitary; glumes ribbed. This tufted grass is good fodder for camels and other animals. It flowers from April to June.

Parapholis incurva (L.) C.E. Hubbard.
Oaija, Plate 214

This is a somewhat glaucous annual, 10-15 cm high, with many erect stems often arched above. The spikes are up to 10 cm long, straight or incurved to form a

semicircle or almost a circle, with the basal part usually being enclosed in the uppermost leaf sheath. The plant grows in dry and moist steppe on limestone or alluvium, and flowers from March to May.

Pennisetum divisum (Gmel.) Henrard
Thumam, Sbatt, Plate 215

This is a tall perennial grass up to 1-1.5 m high with rigid, tufted branches. The leaf blades are sharp with large, yellow, empty sheaths at swollen nodes. The inflorescence is a cylindrical spike with solitary spikelets and white, unequal awns. The rachis of the involucre are scabrous. It grows in sandy places and flowers from February to April.

Phalaris minor Retz.
Rashad, Plate 216

This is a tufted annual with geniculate or erect culms that grows up to 1 m tall. The upper sheath is inflated, sheathing the cylindrical panicle. The glumes are firmly compressed, and winged on the keel with one or more teeth. It is common in desert regions of the world and flowers from March to April.

Phalaris paradoxa L.
Fanbouh

This annual grass is up to 1 m long and has erect glabrous culms. It has linear leaves and a pink-tinged panicle enclosed in the uppermost sheath. The spikelets are compact with 1 being fertile and 5 being sterile. The glume is keeled with a serrate wing. It is commonly distributed in gardens and among cultivated gardens and flowers in April.

Phragmites australis (Cav.) Trin. ex Steud.
Bous, Qasba, Plate 217

This tall perennial reed swamp grass grows up to 3-4 m high. The roots are rigid, creeping rhizomes. The leaves are lanceolate, flat, acuminate, and rough. It has branched panicles that are brown and silvery-white when it matures. Its spikelets are 3-6 flowered with unequal-keeled glumes. It grows on marshes and near water. It flowers in April.

Poa annua L.
Quba

This small, tufted annual grass has bright green, erect or geniculately decumbent culms often rooting at the base. The leaves are flaccid, linear, flat, up to 10 cm long and dark green with hooded tips. It has open pyramidal inflorescence with solitary green or variegated violet spikelets. It is commonly seen in fields and damp places.

Poa infirma Kunth .
Zwan

This is an annual grass with many tufted, erect, hardly geniculate culms about 30 cm long, rather loosely invested by the sheath. It has soft, flat leaf blades up to 10 cm long and inflorescence with spikelets appressed to the spreading branches. The anthers are much shorter, about half as long as those of *Poa annua*. It is a weed found in gardens and in damp places. It flowers from February to March.

Poa sinaica Steud.
Anazah

This is a perennial grass that is closely related to *Poa bulbosa* L. It has tufted, erect, slender, stiff and glossy culms with white scarious sheaths. The leaves are capillary, and the spikelets are crowded and glossy white with 5-6 flowers. It grows on dry sandy gravel plain, and dry silt plain. It flowers from February to March.

Polypogon monspeliensis (L.) Desf.
Thail Al Qitt, Plate 218

An erect annual grass about 60-80 cm high, this plant has erect, glabrous culms. The leaf blades are flat, dark green, and up to 15 cm long. The sheath usually covers the stems. It has spikelets with 1 flower, and the glumes are notched at the apex and hairy on the margin. The lemma is short and awned. It grows in fields. It flowers between April and July.

Rhynchelytrum repens (Willd.) C.E. Hubb.

This annual grass has geniculate, decumbent culms about 80 cm tall with roots at the lower nodes. The leaf blades are flat, linear-attenuate with short leaf sheaths up to 12 cm long and 6 mm broad. The panicle is irregularly spaced and white in early anthesis and densely clothed in long, silky-white to pinkish-hairy spikelets. The awns are very small, and the upper glume and lower lemma are bilobed or

emarginate, shortly awned. It is a weed found in nurseries. It flowers from June to September.

Rostraria cristata (L.) Tzvelev Syn. *Koeleria phleoides* (Vill.) Pers. and *Lophochloa phleoides* (Vill.) Rchb.
Abu Sunbulah

These annual grasses have erect, glabrous, up to 30 cm tall culms with white hairy leaf sheaths and a dense panicle as inflorescence. The spikelets are subsessile, the glumes are unequal, and the lemmas have a curiously tessellate appearance between the nerves. The awn is as long as the lemma and is inserted immediately below the tip of it. It is a weed found in fields and in desert depressions and wadis, and on sandy, gravelley and silty soil. It flowers from March to May.

Rostraria pumila (Desf.) Tzvelev Syn. *Lophochloa pumila* (Desf.) Bor
Abu Sunbulah, Plate 219

This is a small annual grass with erect, fascicled, smooth, glabrous culms having deep green, shortly-ciliated leaf blades up to 6 cm long and a dense panicled inflorescence, often somewhat lobed, up to 4 cm long. The glumes are equal and dark green with scarious margins. The green part is covered with hairs, and the rachilla is furnished with long hairs. This is a sandy desert grass that flowers from February to May.

Schismus arabicus Nees
Um Rouss, Khafour

This is a small, annual grass about 10-15 cm high with erect, tufted, glabrous culms. The leaf blades are very narrow, involute, and often covered with long white hairs on the upper surface towards the base. The inflorescence is compact, with erect, green to pinkish panicles with long spikelets and equal glumes. The lemmas are 2-3 mm long, bilobed, and hairy in the lower half. This is a desert plant that is also a weed. It flowers between March and April.

Schismus barbatus (L.) Thell.
Khafour, Plate 220

This very common annual desert grass has erect or prostrate, very numerous, smooth culms about 7-15 cm tall with very narrow involute leaf blades that are green or purplish, erect, panicled inflorescence up to 3 cm long. The spikelets are 4-7 mm long, each with 5-10 fertile florets and a rudimentary upper one. The almost equal glumes are acute, glabrous, and persistent. The lemma is bilobed and hairy on the margins. This grass grows in various habitats and is grazed by animals. It flowers from February to March.

Setaria verticillata (L.) P. Beauv.
Luzzayq

This is a densely tufted annual grass up to 90 cm tall and is notably branched with geniculate culms and flat, scabrous, leaf blades. The inflorescence has green or purplish panicles that are 3-10 cm long, and often solitary spikelets. This is a common weed in moist ground in damp, shady gardens and flowers in the summer.

Setaria viridis (L.) P. Beauv.
Zeil Al Faar

This loosely tufted annual grass has weak, erect, geniculate culms that grows up to 30 cm long. The leaf blades are soft, flacid, lanceolate, acuminate and rather dull green. It has an erect, cylindrical, false-spiked panicle with spikelets seated on cushion-tipped pedicels supported by an involucre of 1-3 greenish purplish bristles. It is a weed found in moist places in gardens, and it flowers from August to September.

Sorghum halepense (L.) Pers.
Al Halian

This is a perennial tall grass with stout, erect culms, flat leaf blades and large, terminal, naked or compact panicles. Each spikelet has one sessile fertile spikelet and one pedicelled male spikelet. The awn arises from the sinus of the bifid lemma, and it is deciduous. It is rare in cultivated areas under permanent irrigation, and flowers in the summer.

Sphenopus divaeciatus (Gouan)Reichb.
Al Sebakhiyah, Plate 221

A purplish annual grass found in sabkha areas. Culms are ascending, often kneed near the base,

30 cm high. Panicle terminal, ovate-oblong in outline. Spikelets pedicelled on the final branches, laterally compressed. Usually associated with *Frankenia pulverulenta*. Flowers in April.

Sporobolus arabicus Boiss.
Dafra, Rashad, Plate 222

This is a stiff, pale perennial grass with creeping stolons and many erect, dense culms. The leaf blades are glabrescent, involute or convolute, narrow, and lanceolate, tapering into an acute point up to 25 cm long and 2-3 mm broad. It has an open panicle up to 20 cm long, pyramidal in outline with branches and linear, lanceolate spikelets 2 mm long with distinguished lower and upper glumes of different lengths. It dominates a community abounding in depressions and wadis with saline soils, and flowers in spring and early summer.

Stipa capensis Thunb.
Samaa, Plate 223

This annual is profusely branched at the base with very densely tufted, erect or short decumbent culms reaching a height of 40 cm. The leaf blades are erect, narrow, and convolute, and the sheaths are lax, with the uppermost often being inflated and including the base of the inflorescence. It has an erect panicle of very densely crowded, silvery spikelets with long awns, 5-10 cm long. This plant is palatable when young, but injurious to animals when fruiting. It flowers from March to April.

Stipagrostis ciliata (Desf.) de Winter
Al Sahn, Hmaira, Plate 224

This is a dense caespitose perennial with erect or geniculately ascending culms that grow up to 60 cm long, which are conspicuously bearded at the nodes. The leaf blades are convolute, filiform, flexuous and up to 15 cm long, and the sheaths are pale yellow and glabrous. The spikelets are 12 mm long, pale, and often with a purple spot at the base. The glumes are sub-equal, and the lemma is articulated at its middle point with the column. It grows in a sandy desert habitat and in gravelly sandy places. It flowers from March to April.

Stipagrostis drarii (T.) de Winter
Sabat

This is a perennial grass with few to several stiff erect culms arising from a woody rootstock that grows up to 150 cm high, and the internodes are densely, closely woolly. The leaves are unusual in that the sheath and lamina often appear to outgrow some of the culm branches. The panicle is terminal, lanceolate, pyramidal, and contracted with ascending branches about 10-35 cm long with pedicelled spikelets and equal-sized glumes. It is a very distinctive Arabian grass and grows in deep sands and somewhat mobile dunes.

Stipagrostis obtusa (Delile) Nees
Sabat

This is a perennial, tufted grass in which the culms emerge from the closely packed, sheathed base. It grows up to 30 cm long with short, filiform, curved, white, hairy leaf blades and persistent sheaths. It has a short, narrow panicle about 12 cm long with long spikelets and branched awns. It is common on compact soil and in gravelly habitats and it flowers in April and May.

Stipagrostis plumosa (L.) Munro ex T. Anders.
Nussi, Plate 225

This densely tufted perennial grass has erect or short, geniculate culms up to 40 cm tall. The nodes and internodes are covered with wool. The inflorescence is a panicle about 15 cm long; the central awn long, up to 3-5 cm, plumase except at base; lateral awns glabrous. It is a multiform species and is considered to be good fodder. It grows on gravelly and stony ground where the plant accumulates a small heap of sand around its body. Flowering is mainly from March to May.

Trisetaria linearis Forssk.
Thalathy Al Safat

This is an annual herb with solitary or fascicled culms, erect or geniculate at base, up to 30 cm tall, but only reaching a few centimeters in the desert. The leaf blades and the leaf sheaths are covered with

a soft, white, retrose pubescence. The inflorescence is a dense, spicate panicle, enclosed at the base by the uppermost leaf sheath. The spikelets are crowded and shining. The plant grows in sandy places and flowers from March to April.

HYDROCHARITACEAE

Halophila ovalis (R. Br.) Hook.f.
Hamol Al Baher

This is a perennial, submerged, marine plant with small leaves ascending in pairs from nodes in a creeping, buried rhizome. The blades are oblong to obovate, elliptical and entire, and the petiole most often equals or somewhat exceeds the blade, with small sheaths at the blades insertion at the nodes. The plant grows near coastal areas.

IRIDACEAE

Gladiolus italicus Mill.
Seif Al Ghurab

This is a perennial, erect, stout herb about 30-70 cm tall growing erect from a scalled, brown, ovoid corm with sword-like leaves up to 25 cm long. The inflorescence is a lax spike bearing 5-10 flowers, lengthening after anthesis with a bright pink perianth about 3-4 cm long and with yellow anthers. The capsule is ovoid and umblicate at the apex, 3 grooved with brownish, sub-globose seeds 2 mm in diameter. This plant grows in cornfields and is restricted to Faylakah island. It flowers from March to April.

Gynandriris sisyrinchium Parl. Syn. *Iris sisyrinchium* L.
Unsail, Plate 226

These bulbs used to appear in large colonies in Wadi Umm Al-Rimam, unfortunately, they no longer exist there. However, now they are found in protected areas such as Sulaibiya Field Station. This is a perennial herb with a corm. It has several long narrow, channeled leaves. The deep lilac-blue flowers with a white to yellow throat appear during January, February and March.

JUNCACEAE

Juncus rigidus Desf.
Wussal, Plate 227

This is a pale green, densely crowded perennial herb with slender pungent stems up to 100 cm arising from a creeping rhizome. The leaves are terete and pungent. It has the inflorescence of many flowered cymes typically contracted with large pale, separated flowers. The capsule is long, broad, slightly tapering at the apex, and the seeds have a short white tail. It is widely distributed along muddy shores and stagnant waters. It flowers from May to June.

LILIACEAE

Allium sindjarense Boiss. & Hausskn.
Al Teeta, Plate 228

This is a perennial desert garlic up to 15 cm high with a leathery, oblong, striate, sub-reticulate bulb. The stem is covered with an outer leathery tunic. The leaves are narrow and finely grooved. The inflorescence is an umbel of many greenish-white buds that open to reveal nearly white petals with a dark red vein running through each one. It flowers in March and April.

Allium sphaerocephalum L.
Khurait, Plate 229

This leafy-based bulb has stems about 1 m tall. Its purple flowers appear on a globular head about 6 mm wide. It appears near outcrops of gypsum in the sandy desert. Flowers in April.

Asphodelus tenuifolius Cav. Baker
Barwag, Plate 230

This elegant lily is about 30 cm high. It has bright green, grass-like leaves arising from the base. The flowers are white and bell-shaped with a brownish mid-rib down each petal. The seeds are formed in a globular capsule about 3 mm across. The plant has fibrous roots rather than a bulb, as typically seen in lilies. Flowers in February.

Asphodelus viscidulus Boiss.
Barwag
This small slim, tender, annual herb is about 20 cm tall and appears after heavy rain. It has whitish flowers with a crimson stripe down the middle of the petal.

Bellevalia saviczii Woronow
Alanda, Plate 233
This is a perennial herb with longer, broader leaves than the other lilies. The inflorescence has a head of white, bell-shaped flowers and purple stamens on a short, reddish stem. It grows at As-Subiyah in soft sand and flowers from March to April.

Dipcadi erythraeum Webb. & Berth.
Basal Ma Ansalan, Plate 231
This bulb usually has two long, narrow leaves. It's fleshy flowers, which are greenish-brown in color, appear on a one-sided raceme. It has no scent, and it is commonly found on sandy and loamy ground. Flowers in February.

Gagea reticulata (Pall.) Schult.. & Schult.f.
Dahreej, Plate 232
This is a small bulbous herb with solitary leaves and a short naked stem with bright yellow, star-shaped flowers. It blooms very early in the year, a real forerunner of spring. The capsule is oblong, about 1 cm long, and the seeds are flat and angular. It grows on high exposed ground in the desert and is common on bare stony ridges.

TYPHACEAE

Typha domingensis (Pers.) Poir. ex Steud.
Bardy
This is a perennial, robust, rhizomatous, aquatic, monoecious herb about 1-3 m high. It has very long, thin leaves up to 120 cm long, and flowers on a long, cylindrical spike. The fruit is 1-seeded and furnished with long hairs on the gynophore; the seed is yellowish, with membranous testa. In India, the plant is used for food and medicinal purposes, as well as for making ropes and matting.

GYMNOSPERMAE

EPHEDRACEAE
Ephedra alata Decne.
Alanda, Plate 233
This is a stiff, yellow-green, densely branched shrublet about 40-100 cm tall and often wider than its height. The twigs are striate, often whorled and appear leafless due to a reduction of the leaves to scales. It has sessile cones clustered in the axils covered by many pairs of broadly scarious bracts. It grows in gritty calcareous or sometimes gypsoferous soil.

PTERIDOPHYTA

OPHIOGLOSSACEAE
Ophioglossum aitchisonii (C.B.Cl.) J.D. Almeida
This annual, glabrous, dwarf, stemless fern is generally less than 8 cm high. It usually has 1-3 sterile fronds that are leaf-like, entire, and partly folded longitudinally. The fertile fronds are solitary, linear, greenish, stalked and arise from the sterile fronds with a sporangiferous acute spike. The plant grows in drifted or stable sands usually not far from the coast and often over limestone.

THE PLATES

Hudq حـدق

48 - *Aizoon canariense*

Mullayh مليح

49 - *Aizoon hispanicum*

Qasool غاسول

50 - *Mesembryanthemum nodiflorum*

Kaf Al Muhanna كف المحنا

51 - *Amaranthus lividus*

Ushar عشر

52 - *Calotropis Procera*

Zraija زريجة

53 - Anchusa hispida

Kahil كحيل

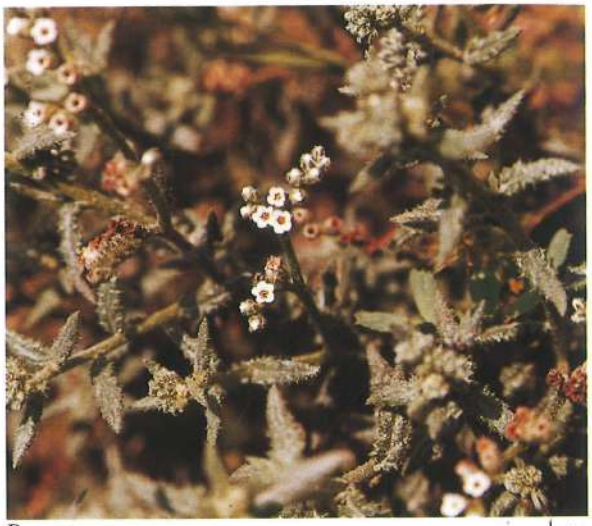
54 - *Arnebia decumbens*

Kahil كحيل

55 - *Arnebia tinctoria*

Kahil كحيل

56 - *Echium rawolfii*



Ramram رمرام

57 - *Heliotropium bacciferum*

Al-Hamat الحماط

58 - *Moltkiopsis ciliata*

Ushb Al Dhabi عشب الظبي

59 - *Gypsophilla capillaris*

Esh Shawla عش الشوله

60 - Herniaria hemistemon

Eraifija, Rejraija عريفيجة، رجريجة

61 - Loeflingia hispanica

Rig-Raga رقراقة

62 - Paronychia arabica

Rugayigah الرقيقة

63 - Polycarpaea repens

Thiraiza ضريسة (ثريزة)

64 - *Sclerocephalus arabicus*

Lussaig لصيق

65 - *Silene arabica*

Zaafar زعفر

66 - *Silene conoidea*

Turbah تربة

67 - *Silene villosa*

Um Thraib أم ثريب

68 - *Spergulara diandra*

Sharah شعران

69 - *Agathophora alopecuroides*

Sharan شعران

70 - *Anabasis setifera*

Al Rughl الرغل

71 - *Atriplex leucoclada*

Qittaina قطينة

72 - Bassia eriophora

Haitham, Qutaynah هيثم، قطينة

73 - Bassia muricata

Golleman قلمان

74 - Bienertia cycloptera

Aifajan عيفجان

75 - Chenopodium album

Khabaitha خبيثة

76 - Chenopodium murale

Al Had الحاد

77 - Cornulaca aucheri

Al Had الحاد

78 - Cornulaca monacantha

Theluth, thullayth ثلوث، ثليث

79 - Halocnemum strobilaceum

Qadqad قضقاض (قصقاص)

80 - Halothamnus iraqensis

Al Rimth الرمث

81 - Haloxylon salicornicum

Khariza خريزة

82 - Salicornia europaea

Mulaih, Gathraf مليح، خذراف

83 - Salsola imbricata

Homaidh حميض (خذراف أردني)

84 - Salsola jordanicola

Al Shinan الشنان

85 - Seidlitzia rosmarinus

Qulman قلمان، هرطبل

86 - Suaeda aegyptiaca

Suaida, sawad سويدة، سواد

87 - Suaeda vermiculata

Zamran ضمران

88 - Traganum nudatum

Al-Hashma الحشمة

89 - Helianthemum kahiricum

Rag-rug رقروق

90 - Helianthemum Lippii

Al-Grease القريص

91 - Aaronsohnia factorvskyi

Iqhowan أقحوان (صحراوي)

92 - Anthemis deserti

Iqhowan أقحوان

93 - Anthemis pseudocotula

Adhir, Silmas عاذر، سلماس

94 - Artemisia scoparia

Ain Al Bukar عين البقر

95 - Asteriscus hierochunticus

Al Jalwa الجلوة

96 - Atractylis carduus

Hanuwa حنوة

97 - Calendula arvensis

Shadq Al-Jamal شدق الجمل

98 - Carduus pycnocephalus

Zafaran, Usfur زعفران، عصفر

99 - Carthamus Oxyacantha

Kassoob كسوب

100 - Centaurea pseudosinaica

Iqhowan Al hadaeg أقحوان الحدائق

101- Chryanthemum coronarium

Hashesh Al Jabal حشيش الجبل

102 - Conyza bonariensis

Al Guttaynah القطينة

103 - Filago pyramidata

Ain Al Barin عين البعارين

104 - Gymnarrbena micrantha

Neayma, Tarbah نعيمة، طربة

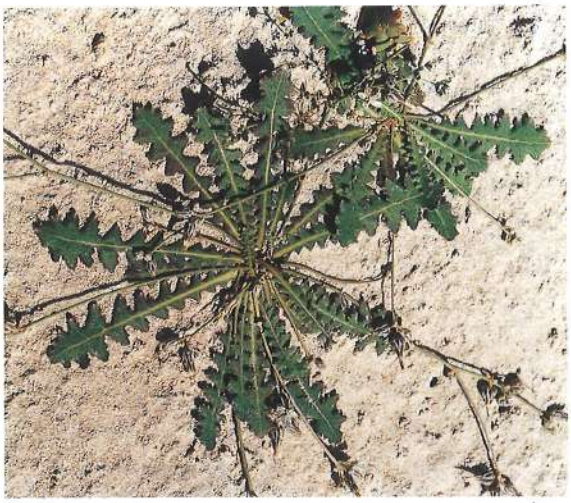
105 - Ifloga spicata

Lahiat Al-Tais لحية التيس

106 - *Koelpinia linearis*

Lubaina لبينة (الخس البري)

107 - Lactuca serriola



Huwwa حواء

108 - Launaea capitata

Adhid عضيد

109 - Launaea mucronata

Howaithan حويذان

110 - *Picris babylonica*

Jithjath جثجاث

111 - *Pulicaria undulata*

Murrar مرار

112 - *Reichardia tingitana*

Arfaj عرفج

113 - *Rhanterium epapposum*

Rubahlah, Al Dabha ربحلة، الذبح

114 - Scorzonera papposa

Zamlug زملوق (زملوك)

115 - Senecio glaucus

Khas Al Waz خس الوز

116 - *Sonchus oleraceus*

Khatmi خاتمي

117 - *Convolvulus arvensis*

Rukhama رخامة

118 - *Convolvulus cephalopodus*

Ethris, Udhris عضرس

119 - *Convolvulus oxyphyllus*

Al Khatmi الخاتمي

120 - *Convolvulus pilosellifolius*

Shuwayla Nadwa شويلة ندوة

121 - *Cressa cretica*

Harraizah, Suffayr حريضة، صفير

122 - Brassica tournefortii

Slaih سليح

123 - *Cakile arabica*

Al-Nefagh النفاج (النفيج)

124 - Carrichtera annua

Rashad Al Barr رشاد البر

125 - Coronopus didymus

Al-Kshain الخشين (الحارة)

126 - Diplotaxis Harra

Al-Gargeer الجرجير

127 - *Eruca sativa*

Al-Lbanah اللبانة

128 - *Farsetia aegyptia*

Khuzamah خزامى

129 - Horwoodia dicksoniae

Selaih سليح

130 - *Malcolmia grandiflora*

Al Glaiglan القليقلان

131 - Savignya parviflora

Sufar صفار

132 - Schimpera arabica

Shiliat شليات

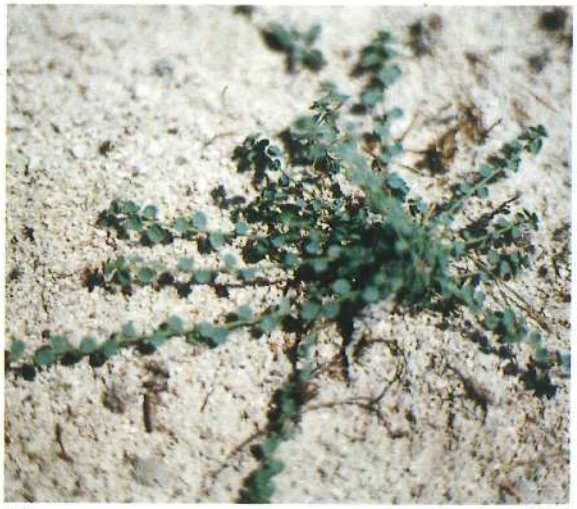
133 - *Sisymbrium irio*

Al-Sherry, Hanthal الشرى، حنظل

134 - *Citrullus colocynthis*

Dharba طربة

135 - *Scabiosa olivieri*



Libana لبانة

136 - *Andrachne telephioides*

Zuraige زريج

137 - *Chrozophora verbascifolia*

Halab حلاَب

138 - Euphorbia hirta

Halab حلاَب

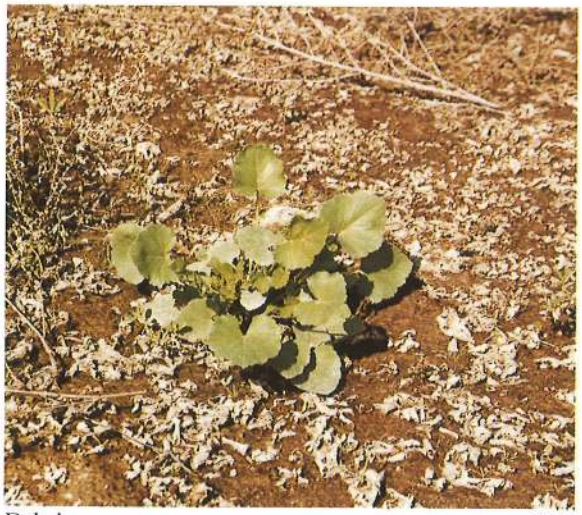
139 - Euphorbia supina

Mulaih, Abu thurayb مليح، أبوثريب

140 - Frankenia pulverulenta

Dahma دهمة

141 - *Erodium bryoniifolium*



Dabgha دبغة

142 - *Erodium glaucophyllum*

Humbaz حمباز

143 - *Erodium laciniatum*

Al- Talha الطلحة

144 - Acacia pachyceras

Aagoul عاقول

145 - Albagi graecorum

Asab Al-Arous أصابع العروس

146 - Astragalus annularis

Abou Qurainah أبو قرينة

147 - *Astragalus corrugatus*

Qafaa قفعاء

148 - *Astragalus hauarensis*

Holb حلب (حالب)

149 - Astragalus schimperi

Qafaa قفعاء (قفيعة)

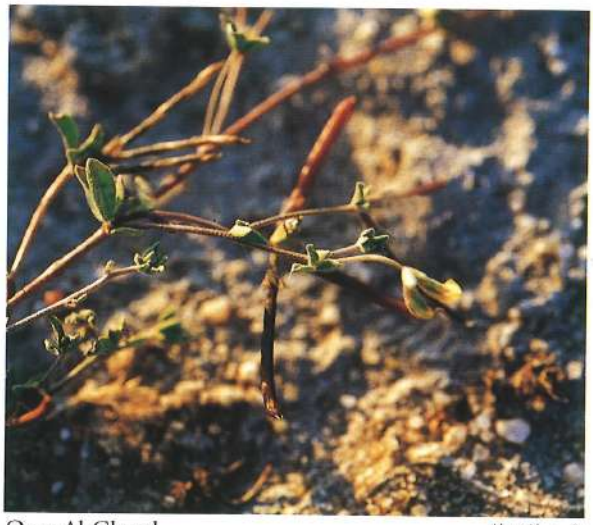
150 - Astragalus sieberi

Schidad, Kidad شداد، كداد (قتاد)

151 - Astragalus spinosus

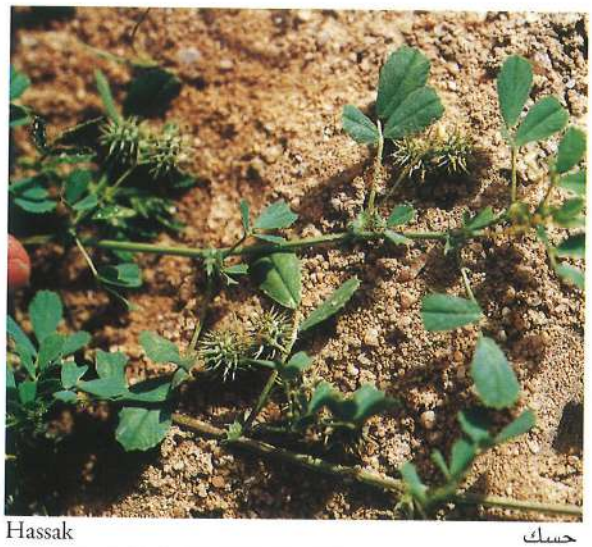
UmGurain أم قرين

152 - *Hippocrepis areolata*



Qarn Al-Ghazal قرن الغزال

153 - *Lotus halophilus*



Hassak حسك

154 - Medicago laciniata

Hatlah حتلة

155 - *Onobrychis ptolemaica*

Zaitah زيتة

156 - *Ononis serrata*

Nafal نفل، قريص

157 - Trigonelle hamosa

Khatma ختمة

158 - Althaea ludwigii

Khubbaizah خبيزة

159 - Malva parviflora

Sadan سعدان

160 - *Neurada procumbens*

Halook, Dhnun هالوك، ذئنون

161 - *Cistanche tubulosa*

Auweyhirra عويهيرة

162 - *Orobanche aegyptiaca*

Daqn Al Ader ذقن العاذر

163 - *Orobanche cernua*

Halook هالوك

164 - Orobanche ramosa

Bakhtery بختري

165 - *Roemeria hybrida*

Mosbaq مسباق

166 - *Plantago amplexicaulis*

Rublah ربلة

167 - *Plantago boissieri*

Quraitha قريطة

168 - *Plantago ciliata*

Wadainah ودينة

169 - *Plantago coronopus*

Lugmat Al-Naaja لقمة النعجة

170 - *Plantago ovata*

Artah أرطى

171 - Calligonum polygonoides

Hembizan حمبزان

172 - *Emex spinosa*

Hummayd حميض

173 - *Rumex vesicarius*

Barbir بربير

174 - *Portulaca oleracea*

Ain Al-Qitt عين القط

175 - *Anagallis arvensis*

Gurdhi قرظي

176 - Ochradenus baccatus

Thenban ذنبان

177 - *Oligomeris linifolia*

Ethniban إذنبان

178 - *Reseda arabica*

Dhuniban دنيبان

179 - Reseda muricata

Al Mustawthah المستوظة

180 - Crucianella membranacea

Al Musaikah المسيكة

181 - *Haplophyllum tuberculatum*

Zaitah زيتة

182 - *Scrophularia deserti*

Daturah داتورة (نفير)

183 - Datura innoxia

Awsaj عوسج

184 - *Lycium shawii*

Athal, Tarfa أثل، طرفه

185 - *Tamarix aucheriana*

Basbas بسباس

186 - Anisosciadium lanatum

Zafaran زعفران

187 - *Bupleurum semicompositum*

Hazahs حزّز (ذنيبات الجدي)

188 - Deverra triradiata

Al Haza الحزاء

189 - Ducrosia anethifolia

Janbah جنبة

190 - *Fagonia bruguieri*

Shikaa شكاعى

191 - Fagonia glutinosa

Hulwayah حلواية

192 - Fagonia indica

Ghardaq غردق

193 - *Nitraria retusa*

Harmal حرمل

194 - *Peganum harmala*

Sharsheer شرشير (قطب)

195 - Tribulus terrestris

Harm هـرم

196 - *Zygophyllum qatarense*

Thandah ثداء (ثندة)

197 - *Cyperus conglomeratus*

Sahed سعد (سعيدة)

198 - Cypers rotundus

Ikrish عكرش

199 - *Aeluropus lagopoides*

Sherib شريب (عكرش)

200 - *Aeluropus littoralis*

Al-Shaiyrah الشعيرة

201 - *Avena barbata*

Sabel Abu Al Hassin سبل أبو الحصين

202 - Bromus madritensis

Subbat, Thumum سباط، ثمام

203 - *Cenchrus ciliaris*

Yarah يراح

204 - Cenchrus setigerus

Halfa, Qasba حلفا، قصبا

205 - *Centropodia forsskalii*

Khafoor خافور

206 - *Cutandia memphitica*

Najeel نجيل

207 - *Cynodon dactylon*

Bahma بهمة

208 - *Dactyloctenium aegyptium*

Shaeer شعير (بري)

209 - Hordeum marinum

Sbat سبط (سباط)

210 - Lasiurus scindicus

Rwaitah, Smeir رويطة، زميرة

211 - Lolium rigidum

Thamam ثمام

212 - Panicum antidotale

Thamam ثمام

213 - *Panicum turgidum*

Oaija عويجة

214 - *Parapholis incurva*

Thumam ثمام

215 - *Pennisetum divisum*

Rashad رشاد (شعير الفأر)

216 - Phalaris minor

Bous, Qasba بوص، قصبة

217 - Phragmites australis

Thail Al Qitt ذيل القط

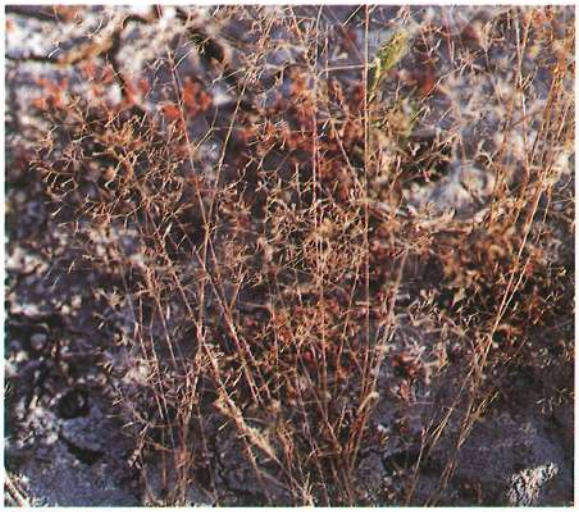
218 - *Polypogon monspeliensis*

Abu Sunbulah أبو سنبلة

219 - *Rostraria pumila*

Khafour خافور

220 - *Schismus barbatus*



Al Sebakhiyah السباخية

221 - Sphenopus divaricatus

Dafrah, Rashad دفرة، رشاد

222 - *Sporobolus arabicus*

Samaa صمعاء

223- *Stipa capensis*

Al-Sahn, Hmaira الصحن، حميرة

224 - *Stipagrostis ciliata*

Nussi نصي

225 - *Stipagrostis plumosa*

Unsail عنصيل

226 - *Gynandriris sisyrinchium*

Wussal وصال

227 - *Juncus rigidus*

Al Teeta الطيطة

228 - Allium sindjarense

Khurait قريط (كرات)

229 - Allium sphaerocephalum

Barwag بروق

230 - Asphodelus tenuifolius

Basal Al Ma, Ansalan بصل الماء، عنصلان

231 - Dipcadi erythraeum

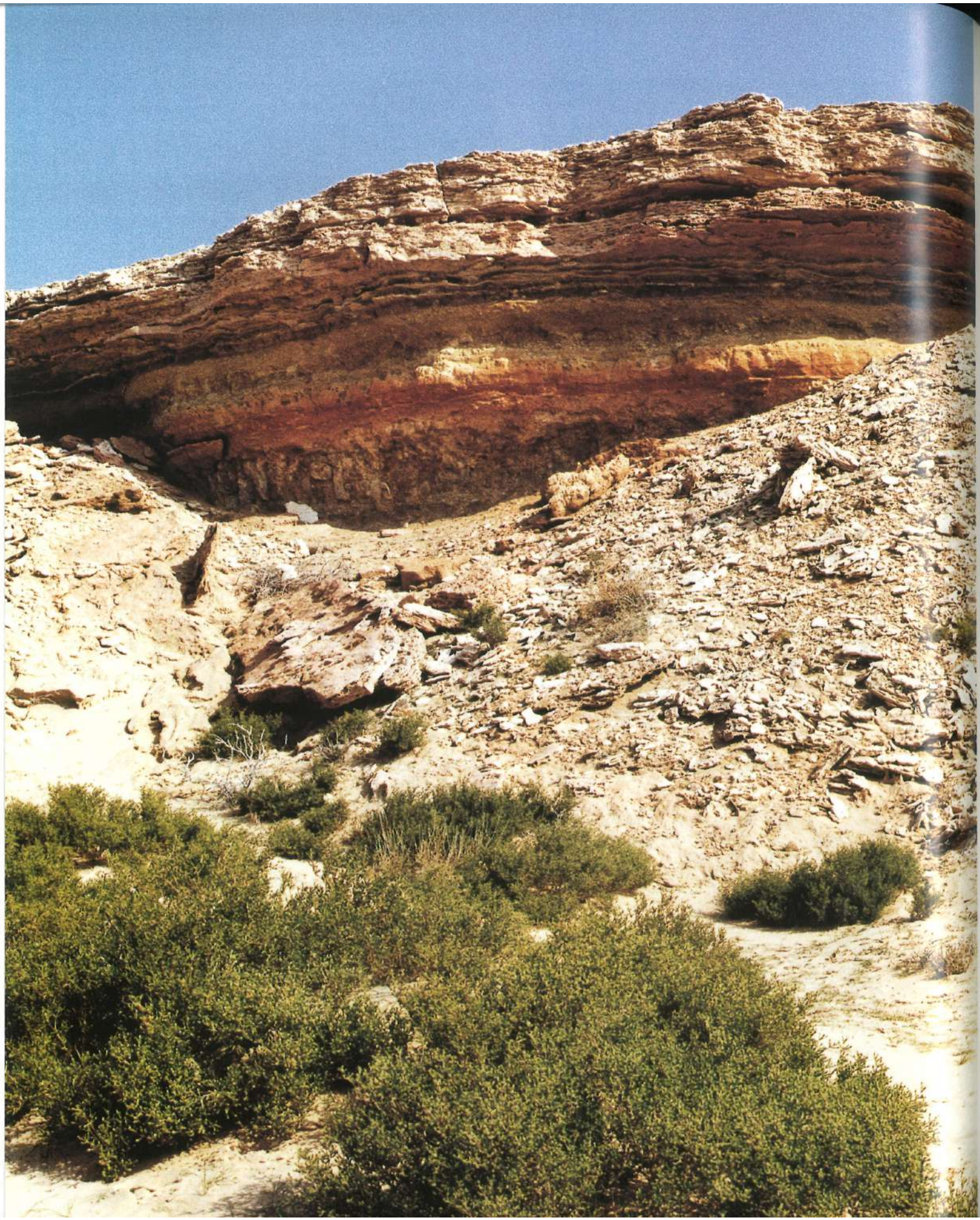
Alanda (1) علندى (1)

233 - Ephedra alata

Dahreej دحريج

232 - Gagea reticulata

(1) Photo by. Fawzy Abu Rahma.



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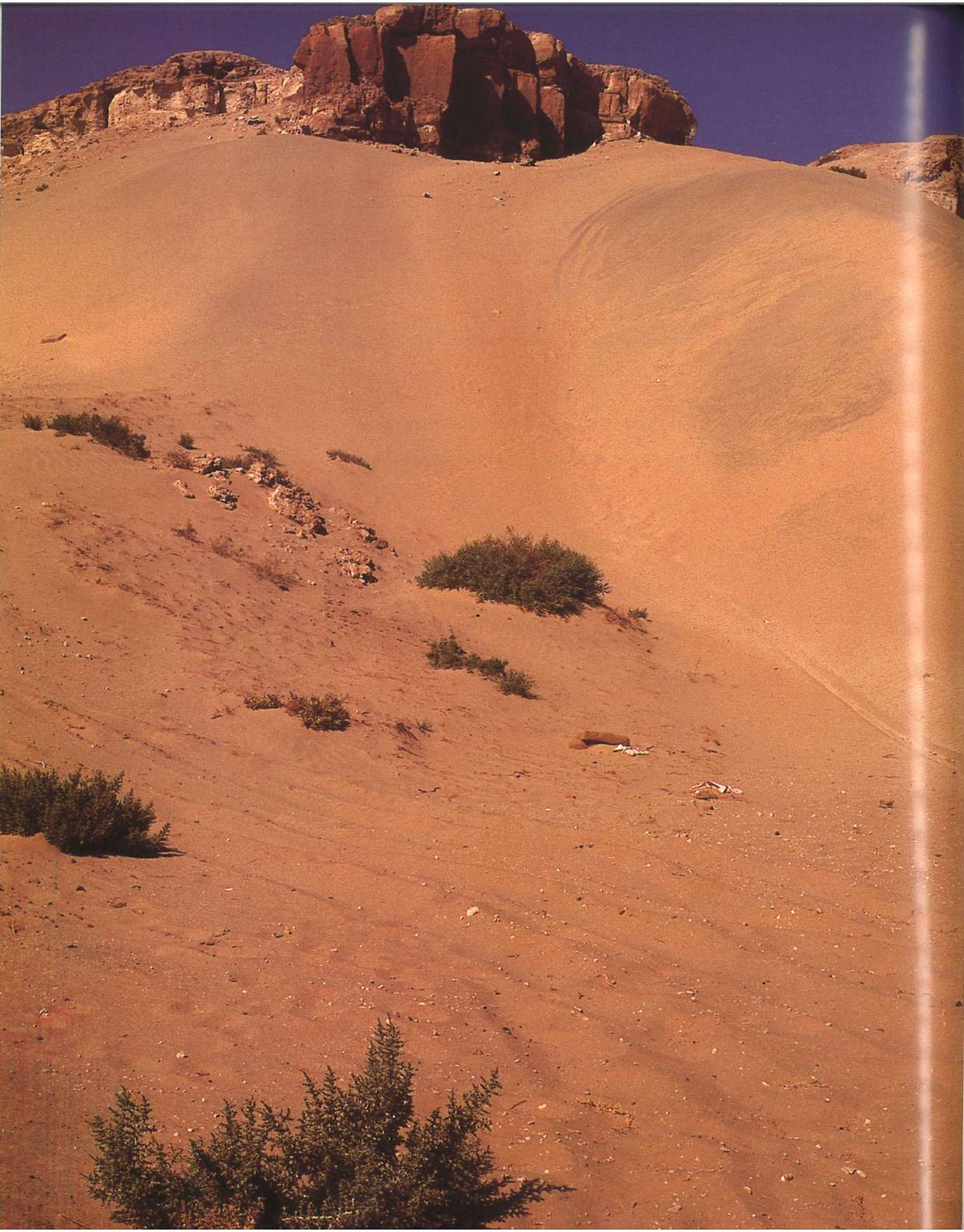
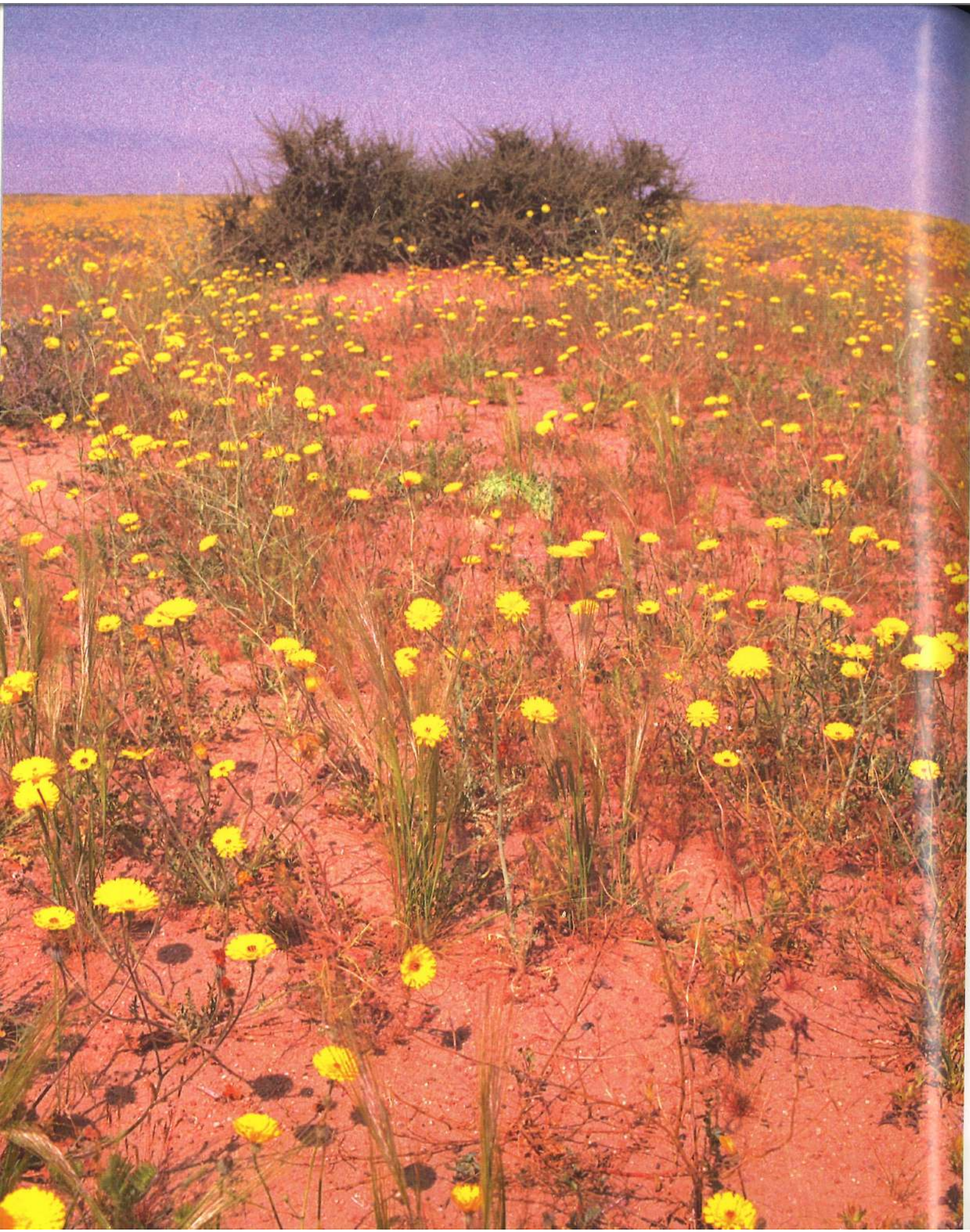


APPENDICES

Appendix A. Species List
Appendix B. Propogation, Growth, Life Form and Values
Appendix C. List of Plants Recorded During the Study Period 1990-99



APPENDIX A

SPECIES LIST

Scientific Name	Family	Vernacular Name	الاسم العربي	page No.
Aaronsohnia factorovskyi Warb. & Eig.	*Compositae*	*Al Grease*	القريص	56
Acacia pachyceras O. Schwartz	*Leguminosae*	*Al Talha*	الطلحة	68
Acantholepis orientalis Less.	*Compositae*	*Acantolips*	أكنتوليبس	56
Achillea fragrantissima (Forssk.) Sch. Bip.	*Compositae*	*Qaisoom*	قيصوم (عطري)	56
Adonis dentata Delile.	*Ranunculaceae*	Ain Albazoon	عين البزون	75
Aegilops bicornis (Forssk). Jaub. & Spach.	*Gramineae*	Abu Shareb	أبو شارب	80
Aegilops kotschyi Boiss.	*Gramineae*	Abu Shareb	أبو شارب	80
Aegilops triuncialis L.	*Gramineae*	Abu Shareb	أبو شارب	80
Aeluropus lagopoides (L.) Trin. Ex Thwaites.	*Gramineae*	Ikrish	عكرش	80
Aeluropus littoralis (Gouan) Parl.	*Gramineae*	Sherib	شريب (عكرش)	80
Agathophora alopecuroides (Delile) Fenzl ex Bunge.	*Chenopodiaceae*	Sharan	شعران	52
Aizoon canariense L.	*Aizoaceae*	Hudq	حدق	47
Aizoon hispanicum L.	*Aizoaceae*	Mullayh	مليح	47
Alhagi graecorum Boiss	*Leguminosae*	Aagoul	عاقول	69
Allium sindjarense Boiss. & Hausskn.	*Liliaceae*	Al Teeta	الطيطة	88
Allium sphaerocephalum L.	*Liliaceae*	Khurait	قريط (كرات)	88
Althaea ludwigii L.	*Malvaceae*	Khatma	ختمة	71
Alyssum homalocarpum (Fisch. & Mey.) Boiss.	*Cruciferae*	Anam	عنام (عنم)	62
Alyssum linifolium Steph. ex.Willd.	*Cruciferae*	Draihma	دريهمة	62
Amaranthus graecizans L.	*Amaranthaceae*	Aurff Adeik	عرف الديك	47
Amaranthus hybridus L.	*Amaranthaceae*	Aurff Adeik	عرف الديك	48
Amaranthus lividus L.	*Amaranthaceae*	Kaf Al Muhanna	كف المحنا	48
Ammi majus L.	*Umbelliferae*	Khilla	خلة	77
Ammochloa palaestina Boiss.	*Gramineae*	Eraifjan	عريفجان	80
Anabasis lachnantha Aellen & Rech. F.	*Chenopodiaceae*	Ujayrum	عجرم	52
Anabasis setifera Moq.	*Chenopodiaceae*	Sharan	شعران	52
Anastatica hierochuntica L.	*Cruciferae*	Kaff Mariam	كف مريم	62
Anchusa hispida Forssk.	*Boraginaceae*	Zraija	زريجة	48
Andrachne telephioides L.	*Euphorbiaceae*	Libana	لبانة	66
Anagallis arvensis L.	*Primulaceae*	Ain Al Qitt	عين القط	75
Anisosciadium lanatum Boiss.	*Umbelliferae*	Basbas	بسباس	77
Anthemis deserti Boiss.	*Compositae*	Iqhowan	أقحوان (صحراوي)	56
Anthemis pseudocotula Boiss.	*Compositae*	Iqhowan	أقحوان	56
Anvillea garcinii (Burm.f.) DC.	*Compositae*	Nugd	نقد	57
Arnebia decumbens Vent. Coss & Kralik	*Boraginaceae*	Kahil	كحيل	48
Arnebia linearifolia DC.	*Boraginaceae*	Kahil	كحيل	48

Scientific Name	Family	Vernacular Name	الاسم العربي	page No.
Arnebia tinctoria Forssk.	*Boraginaceae*	Kahil	كحيل	48
Artemisia herba -alba auct.non Asso.	*Compositae*	Geysum, Shih	جيسوم، الشيح	57
Artemisia scoparia Waldst. & Kit.	*Compositae*	A'dhir, Silmas	عاذر، سلماس	57
Asphodelus tenuifolius Cav. Baker	*Liliaceae*	Burwug	بروق	88
Asphodelus viscidulus Boiss.	*Liliaceae*	Burwug	بروق	89
Aster squamatus (Spreng.) Hieron.	*Compositae*	Najmah	نجمة	57
Asteriscus hierochunticus (Mich)Wiklund.	*Compositae*	Ain Al-Bukar	عين البقر	57
Astragalus annularis Forssk.	*Leguminosae*	Asab Al Arous	أصابع العروس	69
Astragalus bombycinus Boiss.	*Leguminosae*	Khnaser Al Arous	خناصر العروس	69
Astragalus corrugatus Bertol.	*Leguminosae*	Abou Qurainah	أبو قرينة	69
Astragalus hauarensis Boiss.	*Leguminosae*	Qafaa	قفعاء	69
Astragalus schimperi Boiss.	*Leguminosae*	Holb	حلب (حالب)	69
Astragalus sieberi DC.	*Leguminosae*	Qafaa	قفعاء (قفيعة)	69
Astragalus spinosus (Forssk.) Muschl.	*Leguminosae*	Schidad, Kidad	شداد، كداد (قتاد)	69
Astragalus tribuloides Delile.	*Leguminosae*	Rukhami, Qafaa	رخامي، قفعاء	69
Atractylis cancellata L.	*Compositae*	Um Drus	أم ضروس	57
Atractylis carduus (Forssk.) C. Chr.	*Compositae*	Al Jalwa	الجلوة	57
Atriplex dimorphostegia Kar. & Kir.	*Chenopodiaceae*	Al Rughl	الرغل	52
Atriplex leucoclada Boiss	*Chenopodiaceae*	Al Rughl	الرغل	52
Avena barbata Pott ex Link in Schrad.	*Gramineae*	Al Shaiyrah	الشعيرة	80
Avena fatua L.	*Gramineae*	Thenban	ذنبان (شوفان)	80
Avena sativa L.	*Gramineae*	Showfan	شوفان	80
Avena sterilis L.	*Gramineae*	Showfan	شوفان	80
Bassia eriophora (Schrad) Asch.	*Chenopodiaceae*	Qittaina	قطينة	52
Bassia muricata (L.) Asch.	*Chenopodiaceae*	Haitham, Qutaynah	هيثم، قطينة	52
Bassia scoparia (L.) A.J. Scott	*Chenopodiaceae*	Shaar Al Banat (مكنسة الجنة)	شعر البنات	53
Bellevalia saviczii Woronow.	*Liliaceae*	Ansalan	عنصلان	89
Beta vulgaris L.	*Chenopodiaceae*	Seilg	سلق (شائع)	53
Bienertia cycloptera Bge. Ex Boiss.	*Chenopodiaceae*	Golleman	قلمان	53
Brachypodium distachyum (L.) P. Beauv.	*Gramineae*	Denban	دنبان	80
Brassica juncea (L.) Czern.	*Cruciferae*	Fjailah	فجيلة	62
Brassica tournefortii Gouan	*Cruciferae*	Harraizah, Suffayr	حريضة، صفير	62
Bromus catharticus Vahl.	*Gramineae*	Ashwahra	الشويعرة	81
Bromus danthoniae Trin. In C.A. Mey.	*Gramineae*	Abu Kneitleh , Sneisleh	أبو كنيتلة، سنيسلة	81
Bromus madritensis L.	*Gramineae*	Sabel Abu Al Hassin	سبل أبو الحصين	81
Bromus sericeus Drobov.	*Gramineae*	Hentah,Zerbaa	حنطة،زربعة	81
Bromus tectorum L.	*Gramineae*	Al Zereaah	الزريعة	81
Bupleurum semicompositum L.	*Umbelliferae*	Zafaran	زعفران	77
Cakile arabica Velen. & Bornm.	*Cruciferae*	Slaih	سليح	62
Calendula arvensis L.	*Compositae*	Hanuwa	حنوة	57
Calendula tripterocarpa Rupr.	*Compositae*	Hanuwa-Ushbot Al-Ghurab	حنوة، عشبة الغراب	58
Calligonum polygonoides L.	*Polygonaceae*	Artah	أرطى	74
Calotropis procera (Ait) Ait. F.	*Asclepiadaceae*	Ushar	عشر	48

Scientific Name	Family	Vernacular Name	الاسم العربي	page No.
Cardaria draba (L.) Desv.	*Cruciferae*	Najmah, Jenaibrah	نجمة، جنيبرة	62
Carduus pycnocephalus L.	*Compositae*	Shadq Al Jamal	شدق الجمل	58
Carrichtera annua (L.) DC.	*Cruciferae*	Al Nefagh	النفاج (النفيج)	62
Carthamus oxyacantha M. Bieb.	*Compositae*	Zafaran, Usfur	زعفران، عصفر	58
Caylusea hexagyna (Forssk.) M.L. Green	*Resedaceae*	Denaibah,Denban	دنيبة، دنبان	75
Cenchrus ciliaris L.	*Gramineae*	Subbat, Thumum	سبط، ثمام	81
Cenchrus setigerus Vahl.	*Gramineae*	Yarah	يراح	81
Centaurea bruguierana (DC.) Hand.-Mazz.	*Compositae*	Kassoob	كسوب	58
Centaurea mesopotamica Bornm.	*Compositae*	Al Techelba	التكليبة (كسوب)	58
Centaurea pseudosinaica czerep	*Compositae*	Kassoob, Marar	كسوب، مرار	58
Centropodia forsskalii (Vahl) Cope	*Gramineae*	Halfa,Qasba	حلفا، قصبا	81
Chenopodium album L.	*Chenopodiaceae*	Aifajan	عيفجان	53
Chenopodium glaucum L.	*Chenopodiaceae*	Ghubayra	غبيرة	53
Chenopodium murale L.	*Chenopodiaceae*	Khbaitha	خبيثة	53
Chenopodium opulifolium Schrad.	*Chenopodiaceae*	Natna	نتنة	53
Chrozophora obliqua (Vahl) A.	*Euphorbiaceae*	Tanoum, Nakad	تنوم، نكد	66
Chrozophora tinctoria (L.) Raf.	*Euphorbiaceae*	Hashishat Al Aqrab	حشيشة العقرب	66
Chrozophora verbascifolia (Willd.) A. Juss. ex Spreng.	*Euphorbiaceae*	Zuraige	زريج	66
Chrysanthemum coronarium L.	*Compositae*	Iqhowan Al Hadaeg	أقحوان الحدائق	58
Cistanche tubulosa (Schrenk) Wight	*Orobanchaceae*	Halook, Dhnun	هالوك، ذئنون	72
Citrullus colocynthis (L.) Schard.	*Cucurbitaceae*	Al Sherry, Hanthal	الشرى، حنظل	65
Convolvulus arvensis L.	*Convolvulaceae*	Khatmi	خاتمي	61
Convolvulus cephalopodus Boiss.	*Convolvulaceae*	Rukhama	رخامة	61
Convolvulus oxyphyllus Boiss.	*Convolvulaceae*	Ethris, udhris	عضرس	61
Convolvulus pilosellifolius Desr. in Lam.	*Convolvulaceae*	Al Khatmi	الخاتمي	61
Conyza bonariensis (L.) Cronquist	*Compositae*	Hashesh Aljabal	حشيش الجبل	58
Cornulaca aucheri Moq.	*Chenopodiaceae*	Al Had	الحاد	54
Cornulaca monacantha Delile.	*Chenopodiaceae*	Al Had	الحاد	54
Coronilla scorpioides (L.) Koch	*Leguminosae*	Jlubban	جلبان (عقربي)	69
Coronopus didymus (L.) Sm.	*Cruciferae*	Rashad Al Barr	رشاد البر	62
Crassula alata (Viv.) A.	*Crassulaceae*	Maklda	مخلدة	62
Cressa cretica L.	*Convolvulaceae*	Shuwayla, Nadwa	شويلة، ندوة	61
Crucianella membranacea Boiss.	*Rubiaceae*	Al Mustowthah	المستوضة	76
Cuscuta planiflora Ten.	*Cuscutaceae*	Aroog, Shubaykah	عروق، شبيكة	65
Cutandia dichotoma (Forssk.) Trabut in Batt. & Trab.	*Gramineae*	Khafoor	خافور	81
Cutandia memphitica (Spreng.) Benth	*Gramineae*	Khafoor	خافور	82
Cymbopogon commutatus (Steud.) Stapf	*Gramineae*	Nejeel	نجيل	82
Cynodon dactylon (L.) Pers.	*Gramineae*	Najeel	نجيل	82
Cynomorium coccineum L.	*Cynomriaceae*	Tarthouth	طرثوث	65
Cyperus conglomeratus Rottb.	*Cyperaceae*	Thandah	ثنداء (ثندة)	79
Cyperus rotundus L.	*Cyperaceae*	Sahed	سعد (سعيدة)	79
Dactyloctenium aegyptium (L.) P. Beauv.	*Gramineae*	Bahma	بهمة	82
Datura innoxia Mill.	*Solanaceae*	Daturah	داتورة (نفير)	76
Deverra triradiata Hochst. Ex Boiss.	*Umbelliferae*	Hazhas	حزّز (ذنيبات الجدي)	78

Scientific Name	Family	Vernacular Name	الاسم العربي	page No.
Dichanthium annulatum (Forssk.) Stapf.	*Gramineae*	Zamzoum	زمزوم	82
Dichanthium foveolatum (Delile) Roberty.	*Gramineae*	Zamzoum	زمزوم	82
Dipcadi erythraeum Webb. et Berth	*Liliaceae*	Basal Al Ma, Ansalan	بصل الماء، عنصلان	89
Digitaria ciliaris (Retz.) Koeler.	*Gramineae*	Al gameah	القمعية (ذفرة)	82
Digitaria sanguinalis (L.) Scop.	*Gramineae*	Dafrah, Thafrah	ذفرة (دفرة)	82
Dinebra retroflexa (Vahl) Panzer.	*Gramineae*	Dinab	ضناب (نجيل النمر)	83
Diplotaxis acris (Forssk.) Boiss.	*Cruciferae*	Al Yegh	اليهق (خفج)	63
Diplotaxis harra (Forssk.) Boiss.	*Cruciferae*	Al Kshain	الخشين (الحارة)	63
Ducrosia anethifolia (DC.) Boiss	*Umbelliferae*	Al Haza	الحزاء	78
Echinochloa colona (L.) Link	*Gramineae*	Hashish Hamra	حشيش حمرا	83
Echinops blancheanus Boiss.	*Compositae*	Shouk Al Jemal	شوك الجمل	58
Echium rauwolfii Delile.	*Boraginaceae*	Kahil	كحيل	49
Emex spinosa (L.) campd.	*Polygonaceae*	Hembizan	حمبزان	74
Ephedra alata Decne.	*Ephedraceae*	Alanda	علندى	89
Eragrostis barrelieri Daveau.	*Gramineae*	Basharah	بشارة	83
Eragrostis minor Host.	*Gramineae*	Basharah	بشارة	83
Eremobium aegyptiacum Asch.& Sch. ex. Boiss.	*Cruciferae*	Ghurayra, Gurhan	قريرة، قرعان	63
Eremopoa persica (Trin.) Rosch. In Komarov	*Gramineae*	-	–	83
Eremopyrum bonaepartis (Spreng.) Nevski,	*Gramineae*	Samt	سمط (قمحاء)	83
Eremopyrum distans (C. Koch) Nevski,	*Gramineae*	Sheairah	شعيرة (قمحاء)	83
Erodium bryoniifolium Boiss.	*Geraniaceae*	Dahma	دهمة	67
Erodium ciconium (L.) L. Her.	*Geraniaceae*	Rajem, Raqam	رجم، رقم	67
Erodium cicutarium (L.) L. Her.	*Geraniaceae*	Bakhtari	بختري	67
Erodium glaucophyllum (L.)Ait.	*Geraniaceae*	Dabgha	دبغة	67
Erodium laciniatum (Cav.) Willd.	*Geraniaceae*	Humbaz	حمباز	68
Eruca sativa Mill.	*Cruciferae*	Al Gargeer	الجرجير	63
Euphorbia densa Schrenk.	*Euphorbiaceae*	Um Al Haleeb	أم الحليب	66
Euphorbia granulata Forssk.	*Euphorbiaceae*	Liban, Labnah	لبان، لبنة	66
Euphorbia grossheimii (Prokh.) *(E. isthmia)*	*Euphorbiaceae*	Um Al Haleeb	أم الحليب	66
Euphorbia helioscopia L.	*Euphorbiaceae*	Halablab	حلبلاب (لبين)	66
Euphorbia hirta L.	*Euphorbiaceae*	Halab	حلاّب	66
Euphorbia indica Lam.	*Euphorbiaceae*	Halab	حلاّب	66
Euphorbia peplus L.	*Euphorbiaceae*	Halab	حلاّب	66
Euphorbia serpens Kunth	*Euphorbiaceae*	Halab	حلاّب	67
Euphorbia supina Raf.	*Euphorbiaceae*	Halab	حلاّب	67
Fagonia bruguieri DC.	*Zygophyllaceae*	Janbah	جنبة	78
Fagonia glutinosa Del.	*Zygophyllaceae*	Shikaa	شكاعى	78
Fagonia indica Burm. F.	*Zygophyllaceae*	Hulwayah	حلواية	78
Farsetia aegyptia Turra	*Cruciferae*	Al Lbanah	اللبانة	63
Farsetia burtonae Oliv.	*Cruciferae*	Hadarah	حثرة (حذرة)	63
Filago pyramidata L.	*Compositae*	Al Quttaynah	القطينة	59
Flaveria trinervia (Spreng.) Mohr	*Compositae*	-	–	59
Frankenia pulverulenta L.	*Frankeniaceae*	Mulaih, Abuthurayb	مليح، أبوثريب	67

Scientific Name	Family	Vernacular Name	الاسم العربي	page No.
Fumaria parviflora Lam.	*Fumariaceae*	Al Shahtarj	الشاهترج (بقلة الملك)	67
Gagea reticulata (Pall.) Schult.. & Schult. f.	*Liliaceae*	Dahreej	دحريج	89
Galium tricornutum Dandy	*Rubiaceae*	Dobaika	دبيقة، دحريجة	76
Gladiolus italicus Mill.	*Iridaceae*	Seif Al Ghurab	سيف الغراب	88
Glaucium corniculatum (L.) Rudolph	*Papaveraceae*	Naman	نعمان	72
Gymnarrhena micrantha Desf.	*Compositae*	Ain Al Barin	عين البعارين	59
Gynandriris sisyrinchium Parl.	*Iridaceae*	Ansail	عنصيل	88
Gypsophila capillaris (Forssk.) C.	*Caryophyllaceae*	Ushb Al Dhabi	عشب الظبي	49
Halocnemum strobilaceum (Pall.) M. Beib.	*Chenopodiaceae*	Theluth, Thullayth	ثلوث، ثليث	54
Halodule uninervis (Forssk.) Asch.	*Cymodoceaceae*	-	–	79
Halophila ovalis (R. br.) Hook. f.	*Hydrocharitaceae*	Hamol Al Baher	حامول البحر	88
Halothamnus iraqensis Botsch.	*Chenopodiaceae*	Qadqad	قضقاض (قصقاص)	54
Haloxylon salicornicum (Moq.)Bunge ex Boiss.	*Chenopodiaceae*	Al Rimth	الرمث	54
Haplophyllum tuberculatum Forssk. A, Juss.	*Rutaceae*	Al Mesaicah	المسيكة	76
Helianthemum kahiricum Delile	*Cistaceae*	Al Hashma	الحشمة	55
Helianthemum ledifolium (L.) Mill.	*Cistaceae*	Jeraid	جريد	56
Helianthemum lippii (L.) Dum. Cours	*Cistaceae*	Rag-rug	رقروق	56
Helianthemum salicifolium (L.) Mill.	*Cistaceae*	Jeraid	جريد	56
Heliotropium bacciferum Forssk.	*Boraginaceae*	Ramram	رمرام	49
Heliotropium kotschyi Bunge.	*Boraginaceae*	Ramram	رمرام	49
Heliotropium lasiocarpum Fisch. et. C. Meyer	*Boraginaceae*	Agrabana	عقربانة	49
Herniaria hemistemon J. Gay.	*Caryophyllaceae*	Esh Shawla	عش الشولة	50
Herniaria hirsuta L.	*Caryophyllaceae*	Esh Shawla	عش الشولة	50
Hippocrepis unisiliquosa L.	*Leguminosae*	Um Gurain	أم قرين	70
Hippocrepis areolata Desv.	*Leguminosae*	Um Gurain	أم قرين	70
Hordeum marinum Huds. Subsp. *gussonedum* (p.) T.	*Gramineae*	Shaeer	شعير (بري)	83
Hordeum murinum L. Subsp.*glaucum* (s.) Tz.	*Gramineae*	Shaeer	شعير (أبو شويرب)	83
Horwoodia dicksoniae Turrill	*Cruciferae*	Khuzamah	خزامى (خزام)	63
Hyoscyamus muticus L.	*Solanaceae*	Benj, Safari	بنج، صفاري	77
Hyoscyamus pusillus L.	*Solanaceae*	Benj, Sekran	بنج، سكران	77
Hypecoum littorale Wulfen	*Fumariaceae*	Mdeihina, Hushaim	مديهينة، هشيم	67
Hypecoum pendulum L.	*Fumariaceae*	Hushaim	هشيم	67
Ifloga spicata (Forssk.) Sch.Bip.	*Compositae*	Neayma, Tarabah	نعيمة، طربة	59
Imperata cylindrica (L.) P. Beauv	*Gramineae*	Halfa	حلفة	84
Ixiolirion tataricum (Pall.) Herbert.	*Amaryllidaceae*	Enselan	عنصيلان	79
Juncus rigidus Desf.	*Juncaceae*	Wasal	وصال	88
Koelpinia linearis Pall.	*Compositae*	Lahiat AL Tais	لحية التيس	59
Lactuca serriola L.	*Compositae*	Lubaina	لبينة (الخس البري)	59
Lallemantia royleana (Benth.) Benth.	*Labiatae*	-	–	68
Lappula spinocarpos (Forssk.) Asch.	*Boraginaceae*	Demagh Al Jarbouh	دماغ الجربوع	49
Lasiurus scindicus Henrard	*Gramineae*	Sbat	سبط (سباط)	84
Launaea angustifolia (Desf.) Kuntze	*Compositae*	Murrar	مرار	59
Launaea capitata (Spreng.) Dandy	*Compositae*	Huwwa	حواء	59

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Launaea mucronata (Forssk.) Muschl.	*Compositae*	Adhid	عضيد	59
Launaea nudicaulis (L.) Hook.f.	*Compositae*	Huw Al Ghazal	حواء الغزال	59
Leontodon laciniatus (Bertol.) Widder	*Compositae*	Murrar	مرار	60
Lepidium aucheri Boiss.	*Cruciferae*	Jenaibrah, Rishad	جنيبرة، رشاد	63
Lepidium sativum L.	*Cruciferae*	Rishad	رشاد	63
Leptaleum filifolium (Willd.) DC.	*Cruciferae*	Rishad	رشاد	63
Leptochloa fusca (L.) Kunth,	*Gramineae*	Seifon	سيفون	84
Limonium carnosum (Boiss.) Kuntze.	*Plumbaginaceae*	Mlaih, Qataf	مليح، قطاف	74
Limonium thouini (Viv.) Kuntze	*Plumbaginaceae*	Sibsab	سبساب	74
Linaria albifrons (Sm.) Spreng.	*Scrophulariaceae*	Halj Al Bazoon	حلق البزون	76
Linaria simplex Desf. (Willd.) DC.	*Scrophulariaceae*	Kitanieh	كتانية	76
Loeflingia hispanica L.	*Caryophyllaceae*	Eraifija, Rejraija,	عريفيجة، رجريجة	50
Lolium multiflorum Lam.	*Gramineae*	Shylam	شيلم (متعدد الأزهار)	84
Lolium rigidum Gaudin	*Gramineae*	Rwaitah, Smeir	رويطة، زميرة	84
Lolium temulentum L.	*Gramineae*	Rwaitah, Zwan	رويطة، زوان	84
Lotus halophilus Boiss. & Sprun.	*Leguminosae*	Qarn Al Ghazal	قرن الغزال	70
Lycium shawii Roem. & Schult	*Solanaceae*	Awsaj	عوسج	77
Malcolmia africana (L.)R. Br.	*Cruciferae*	Rujaija	رجيجة	63
Malcolmia grandiflora (Bunge) O. Kuntze	*Cruciferae*	Selaih	سليح	63
Malcolmia pygmaea (Delile) Boiss	*Cruciferae*	Selaih	سليح(رقيقة)	64
Malva nicaeensis All.	*Malvaceae*	Khubbaizah	خبيزة	71
Malva parviflora L.	*Malvaceae*	Khubbaizah	خبيزة	71
Maresia pygmaea (Delile) O.E. Schultz	*Cruciferae*	Shgarah	شقارة	64
Matricaria aurea (Loefl.) Sch. Bip.	*Compositae*	Babounej, Al Zafeera	بابونج، الزفيرة	60
Matthiola longipetala (Vent.) DC.	*Cruciferae*	Manthor	منثور	64
Medicago laciniata (L.) Mill. Var. brachyacantha Boiss.	*Leguminosae*	Hassak	حسك	70
Medicago polymorpha L.	*Leguminosae*	Barsim, Nafel	برسيم، نفل	70
Melilotus indica (L.) All.	*Leguminosae*	Judaibah	جديبة (محيلبة، حندقوق)	70
Mesembryanthemum nodiflorum L.	*Aizoaceae*	Qasool	غاسول	47
Moltkiopsis ciliata (Forssk.).I.M.Johnst on.	*Boraginaceae*	Al Hamat	الحماط	49
Monsonia nivea (Decne.) Decne. ex Webb	*Geraniaceae*	Khuzam	خزام	68
Neotorularia torulosa (Desf.) Hedge & J. Leonard	*Cruciferae*	Al Hassar	الحسار	64
Neurada procumbens L.	*Neuradaceae*	Sadan	سعدان	72
Nitraria retusa (Forssk.) Asch.	*Zygophyllacea*	Ghardaq	غردق	78
Notoceras bicorne (Aiton) Amo	*Cruciferae*	Hathara	هثارا	64
Ochradenus baccatus Delile.	*Resedaceae*	Gurdi	قرظي	75
Ogastemma pusillum (Coss. & Durand ex Bonnet & Barratte) Brummitt.	*Boraginaceae*	Al Hamat	الحماط	49
Oligomeris linifolia (Hornem.) J. F. Macbr.	*Resedaceae*	Thanban	ذنبان	75
Oligomeris subulata (Webb & Berth) Webb	*Resedaceae*	Dhenban, Denbanab	دنبان، دنبناب	75
Onobrychis ptolemaica (Delile) DC.	*Leguminosae*	Hatlah	حتلة	70
Ononis reclinata L.	*Leguminosae*	Shabrak	شبرق (الحمارية)	70
Ononis serrata Forssk.	*Leguminosae*	Zaitah	زيتة	70
Ophioglossum aitchisonii (C.B.C1.) J.D. Almeida	*Ophioglossaceae*	-	لسان الحية	89

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Orobanche aegyptiaca Pers.	*Orobanchaceae*	Auweyhirra	عويهرة	72
Orobanche cernua Loefl.	*Orobanchaceae*	Daqn Al Ader	ذقن العاذر	72
Orobanche minor Sm.	*Orobanchaceae*	Halook	هالوك	72
Orobanche ramosa L.	*Orobanchaceae*	Halook	هالوك	72
Oxalis corniculata L.	*Oxalidaceae*	Dadahan	داداها (حميض)	72
Panicum antidotale Retz.	*Gramineae*	Thamam	ثمام	84
Panicum turgidum Forssk.	*Gramineae*	Thamam	ثمام	84
Papaver rhoeas L.	*Papaveraceae*	Shaqiq Al Nuaman	شقائق النعمان	72
Parapholis incurva (L.) C.E. Hubbard	*Gramineae*	Oaija	عويجة	84
Paronychia arabica(L.) D C.	*Caryophyllaceae*	Rig-Raga	رقراقة	50
Peganum harmala L.	*Zygophyllaceae*	Harmal	حرمل	79
Pennisetum divisum (Gmel) Henrard	*Gramineae*	Thumam	ثمام	85
Phalaris minor Retz.	*Gramineae*	Rashad	رشاد (شعير الفأر)	85
Phalaris paradoxa L.	*Gramineae*	Fanbouh	فنبوع	85
Phragmites australis (Cav.) Trin. Ex Steud.	*Gramineae*	Bous, Qasba	بوص، قصبة	85
Phyla nodiflora (L.) Greene.	*Verbenaceae*	Thayell Sini	ثيل صيني	78
Picris babylonica Hand. Mazz.	*Compositae*	Howaithan	حويذان	60
Plantago amplexicaulis Cav.	*Plantaginaceae*	Mosbaq	مسباق	73
Plantago boissieri Hausskn. & Bornm.	*Plantaginaceae*	Rublah	ربلة	73
Plantago ciliata Desf.	*Plantaginaceae*	Quraitah	قريطة	73
Plantago coronopus L.	*Plantaginaceae*	Wdainah	ودينة	73
Plantago lanceolata L.	*Plantaginaceae*	Lisan Al Kalb	لسان الكلب	73
Plantago notata Lag.	*Plantaginaceae*	Zebad	زباد	73
Plantago ovata Forssk.	*Plantaginaceae*	Lugmat Al Naaja	لقمة النعجة	73
Plantago psammophila Angew & chal.-Kabi.	*Plantaginaceae*	Rublah	ربلة	73
Poa annua L., Sp. Pl.	*Gramineae*	Quba	قبا (سميحة)	85
Poa infirma Kunth in Humb.	*Gramineae*	Zwan	زوان (سميحة)	85
Poa sinacia Steud.	*Gramineae*	Anazah	النزع (قبا سيناء)	85
Polycarpaea repens (Forssk.) Asch. & Schweinf.	*Caryophyllaceae*	Rugayigah	الرقيقة	50
Polycarpaea robbairea (Kuntze) Greuter & Burdet.	*Caryophyllaceae*	Qubaira	غبيرة	50
Polycarpon tetraphyllum (L.) L.	*Caryophyllaceae*	Reehai	ريحاي	50
Polygonum patulum M. Bieb.	*Polygonaceae*	Gurdhab	قرضاب	74
Polypogon monspeliensis (L.) Desf.	*Gramineae*	Thail Al Qitt	ذيل القط	85
Portulaca oleracea L.	*Portulacaceae*	Barbir	بربير	75
Prosopis farcta (Banks & Sol.) J.F. Macbr.	*Leguminosae*	Kharnob	خرنوب (خرينيبة)	70
Psylliostachys spicata (Willd.) Nevski	*Plumbaginaceae*	Sibsab	سبساب	74
Pteranthus dichotomus Forssk.	*Caryophyllaceae*	Al Mujannah	المجنح	50
Pulicaria undulata (L.) C.A.	*Compositae*	Jithjath	جثجاث	60
Reichardia tingitana (L.) Roth	*Compositae*	Murrar	مرار	60
Reseda arabica Boiss.	*Resedaceae*	Ethniban	إذنبان	75
Reseda decursiva Forssk.	*Resedaceae*	Thnaibah	ذنيبة	76
Reseda muricata C. Presl.	*Resedaceae*	Dhuniban	دنيبان	76
Rhanterium epapposum Oliv.	*Compositae*	Arfaj	عرفج	60

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Rhynchelytrum repens (Willd.) C.E. Hubb.	*Gramineae*	-	-	85
Roemeria hybrida (L.) DC.	*Papaveraceae*	Bakhtery	بختري	73
Rostraria cristata (L.) Tzvelev	*Gramineae*	Abu Sunbulah	أبو سنبلة	86
Rostraria pumila (Desf.) Tzvelev	*Gramineae*	Abu Sunbulah	أبو سنبلة	86
Rumex pictus Forssk.	*Polygonaceae*	Hambasis	حمبصيص	74
Rumex vesicarius L.	*Polygonaceae*	Hummayd	حميض	74
Salicornia europaea L.	*Chenopodiaceae*	Khraiza	خريزة	54
Salsola cyclophylla Baker.	*Chenopodiaceae*	Hamdh	حمض	54
Salsola imbricata Forssk.	*Chenopodiaceae*	Mulaih,Gathraf	مليح، خذراف	54
Salsola jordanicola Eig.	*Chenopodiaceae*	Homaidh	حميض (خذراف أردني)	55
Salvia aegyptiaca L.	*Labiatae*	Shajarat Al Ghazal	شجرة الغزال	68
Salvia lanigera Poir.	*Labiatae*	Simsimat Al Bur	سمسمة البر	68
Salvia spinosa L.	*Labiatae*	Shajarat Al Ghazal	شجرة الغزال	69
Savignya parviflora (Delile) Webb	*Cruciferae*	Al Glaiglan	القليقلان	64
Scabiosa olivieri Coult.	*Dipsacaceae*	Dharba	طربة	65
Scabiosa palaestina L.	*Dipsacaceae*	Dharba	طربة	65
Schimpera arabica Hochst & Steud.	*Cruciferae*	Sufar	صفار	64
Schismus arabicus Nees	*Gramineae*	Um Rouss, Khafour	أم روس،خافور	86
Schismus barbatus (L.) Thell.	*Gramineae*	Khafour	خافور	86
Sclerocephalus arabicus Boiss.	*Caryophyllaceae*	Thiraiza	ضريسة (ثريزة)	51
Scopiurus muricatus L.	*Leguminosae*	Thanb Al Agrab	ذنب العقرب	71
Scorzonera papposa DC.	*Compositae*	Rubahlah, Al Dabha	ربحلة، الذبح	60
Scorzonera tortuosissima Boiss.	*Compositae*	Rubahlah, Al Dabha	ربحلة، الذبح	60
Scrophularia deserti Delile.	*Scrophulariaceae*	Zaitah	زيتة	76
Seetzenia orientalis Decne.	*Zygophyllaceae*	Abu Shawke, Habian	أبو شوكة،حبيان	79
Seidlitzia rosmarinus Ehrenb ex. Bunge	*Chenopodiaceae*	Al Shinan	الشنان	55
Senecio glaucus L.	*Compositae*	Zamlug	زملوق (زملوك)	60
Senecio vulgaris L.	*Compositae*	Zamlug	زملوق (شائع)	61
Setaria verticillata (L.) P. Beauv.	*Gramineae*	Luzzayq	لزيق (لصيق)	86
Setaria viridis (L.) P. Beauv.	*Gramineae*	Zeil Al Faar	ذيل الفأر	86
Silene arabica Boiss.	*Caryophyllaceae*	Lussaig	لصيق	51
Silene arenosa C. koch Linnaea.	*Caryophyllaceae*	Refaia	رفيعة	51
Silene conoidea L.	*Caryophyllaceae*	Zaafar	زعفر	51
Silene villosa Forssk.	*Caryophyllaceae*	Turbah	تربة	51
Sinapis arvensis L.	*Cruciferae*	Khardal	خردل	64
Sisymbrium erysimoides Desf.	*Cruciferae*	Slaih	سليحي (أصفر)	64
Sisymbrium irio L.	*Cruciferae*	Shiliat	شليات	64
Sisymbrium orientale L.	*Cruciferae*	Slaih	سليح (شرقي)	65
Sisymbrium septulatum DC.	*Cruciferae*	Howairah	حويرة	65
Solanum nigrum L.	*Solanaceae*	Khurma	خرمة (عنب الديب)	77
Sonchus oleraceus L.	*Compositae*	Khas Al Waz	خس الوز	61
Sonchus tenerrimus L.	*Compositae*	Tafaf	تفاف (جعضيض)	61
Sorghum halepense (L.) Pers.	*Gramineae*	Al halian	الحليان (حشيشة حلب)	86

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Spergula fallax (Lowe) E.H. L.	*Caryophyllaceae*	Glaiglah	قليقلة	51
Spergularia diandra (Guss.) Heldr. & Sart.	*Caryophyllaceae*	Um Thraib	أم ثريب	51
Spergularia marina (L.) Griseb.	*Caryophyllaceae*	Um Thraib	أم ثريب	51
Sphenopus divaricatus (Gouan) Reichb.	*Gramineae*	Al Sebakhiyah	السباخية	86
Sporobolus arabicus Boiss.	*Gramineae*	Dafrah, Rashad	دفرة، رشاد	87
Stellaria media (L.) Vill.	*Caryophyllaceae*	Najmah	نجمة (قزاز، عشبة الطيور)	51
Stipa capensis Thunb.	*Gramineae*	Samaa	صمعاء	87
Stipagrostis ciliata (Desf.) de Winter,	*Gramineae*	Al Sahn,Hmaira	الصحن، حميرة	87
Stipagrostis drarii (T.) de Winter	*Gramineae*	Sabat	سباط (سبط)	87
Stipagrostis obtusa (Delile) Nees	*Gramineae*	Sabat	سباط (سبط)	87
Stipagrostis plumosa (L.) Munro ex T. Anders.	*Gramineae*	Nussi	نصي	87
Suaeda aegyptiaca (Hasselq.) Zohary	*Chenopodiaceae*	Hartabel,Golleman	هرطبل،قلمان	55
Suaeda vermiculata Forssk.ex J.F. Gmel.	*Chenopodiaceae*	Suaida, Sawad	سويدة، سواد	55
Tamarix aucheriana Decne.	*Tamaricaceae*	Athal, Tarfa	أثل، طرفاء	77
Telephium sphaerospermum Boiss.	*Caryophyllaceae*	-	-	52
Teucrium oliverianum Ging. ex.Benth.	*Labiatae*	Gasbaa	قصباء	68
Teucrium polium L.	*Labiatae*	Al Jaadat	الجعدة	68
Thymelaea mesopotamica (C. Jeffrey) B.	*Thymelaeaceae*	Al Methnan	المثنان	77
Traganum nudatum Delile.	*Chenopodiaceae*	Zamran	ضمران	55
Tribulus macropterus Boiss.	*Zygophyllaceae*	Zahr	زهر (حسك)	79
Tribulus terrestris L.	*Zygophyllaceae*	Sharsheer	شرشير (قطب)	79
Trifolium lappaceum L.	*Leguminosae*	Barsem	برسيم (قرط)	71
Trifolium resupinatum L.	*Leguminosae*	Barsem	برسيم	71
Trigonella anguina Delile	*Leguminosae*	Nifal	نفل	71
Trigonella hamosa L.	*Leguminosae*	Nifal, Qurrays	نفل، قريص	71
Trigonella stellata Forssk.	*Leguminosae*	Nifal	نفل (قرقاص)	71
Trisetaria linearis Forssk.	*Gramineae*	Thalathy Al Safat	ثلاثي السفاة	87
Typha domingensis (Pers.) Poir. Ex Steud.	*Typhaceae*	Bardy	بردي	89
Urospermum picroides (L.)	*Compositae*	Al Adhid	العضيد	61
Urtica urens L.	*Urticaceae*	Qurrays	قريص (محرق)	78
Vaccaria hispanica (Mill.) Rauschert.	*Caryophyllaceae*	Al Bakry	البقري (فول البقر)	52
Valerianella dufresnia Bunge ex Boiss.	*Valerianaceae*	Semnah	سمنة	78
Vicia sativa L.	*Leguminosae*	Begeha	بيقية (جلبان)	74
Withania somnifera (L.) Dun.	*Solanaceae*	Haml Al Balbul	حمل البلبل (سم الفراخ)	77
Xanthium strumarium L.	*Compositae*	Shubbait	شبيط (شبيت)	61
Zilla spinosa (Turra) Prantl	*Cruciferae*	Shubrum	شبرم (سلة)	65
Ziziphus spina-christi (L.) Willd	*Rhamnaceae*	Sidr	سدر	75
Zygophyllum qatarense Hadidi.	*Zygophyllaceae*	Harm	هرم	79

APPENDIX B

* PROPAGATION, GROWTH, LIFE FORM AND VALUES

Scientific Name	Propagation	Growth Form	*Life Form	Value
Aaronsohnia factorovskyi	s	f	a	o
Acacia pachyceras	s	t	p	s,f
Acantholepis orientalis	s	f	a	f
Achillea fragrantissima	s	s	p	f ,m
Adonis dentata	s	f	a	o
Aegilops bicornis	s	g	a	f
Aegilops kotschyi	s	g	a	f
Aegilops triuncialis	s	g	a	f
Aeluropus lagopoides	r	g	p	f
Aeluropus littoralis	r	g	p	f
Agathophora alopecuroides	s	s	a	f
Aizoon canariense	s	f	a	o
Aizoon hispanicum	s	f	a	o
Alhagi graecorum	s	s	p	o
Allium sindjarense	s, b	l	p	o
Allium sphaerocephalum	s, b	l	p	o
Althaea ludwigii	s	f	a	f
Alyssum homalocarpum	s	f	a	f
Alyssum linifolium	s	f	a	f
Amaranthus graecizans	s	f	a	o
Amaranthus hybridus	s	f	a	o
Amaranthus lividus	s	f	a	o
Ammi majus	s	f	a	f
Ammochloa palaestina	s	g	a	f
Anabasis lachnantha	s	s	p	f
Anabasis setifera	s	s	p	f
Anastatica hierochuntica	s	f	a	m
Anchusa hispida	s	f	a	o
Andrachne telephioides	s	f	p	f
Anagallis arvensis	s	f	a	m
Anisosciadium lanatum	s	f	a	f
Anthemis deserti	s	f	a	o
Anthemis pseudocotula	s	f	a	o
Anvillea garcinii	s	s	p	o
Arnebia decumbens	s	f	a	d
Arnebia linearifolia	s	f	a	f
Arnebia tinctoria	s	f	a	d

* The key of the appendix idioms at the end of the list.

* References may differ on few plants, which is due to the limited availability of applied studies on the types of thier life form.

Scientific Name	Propagation	Growth Form	Life Form	Value
Artemisia herba -alba	s	s	p	o
Artemisia scoparia	s	s	a,b	m,o
Asphodelus tenuifolius	s	l	a	o
Asphodelus viscidulus	s	l	a	o
Aster squamatus	s	s	a,p	f
Asteriscus hierochunticus	s	f	a	f
Astragalus annularis	s	f	a	f
Astragalus bombycinus	s	f	a,p	f
Astragalus corrugatus	s	f	a	f
Astragalus hauarensis	s	f	a	f
Astragalus schimperi	s	f	a	f
Astragalus sieberi	s	s	p	o
Astragalus spinosus	s	s	p	o
Astragalus tribuloides	s	f	a	f
Atractylis cancellata	s	f	a	-
Atractylis carduus	s	f	p	-
Atriplex dimorphostegia	s	f	a	f
Atriplex leucoclada	s	s	p	f
Avena barbata	s	g	a	f
Avena fatua	s	g	a	f
Avena sativa	s	g	a	f
Avena sterilis	s	g	a	f
Bassia eriophora	s	f	a	o
Bassia muricata	s	f	a	f,o
Bassia scoparia	s	f	a	f
Bellevalia saviczii	s	g	p	f
Beta vulgaris	s	f	a,p	-
Bienertia cycloptera	s	f	a	f
Brachypodium distachyum	s	g	a	f
Brassica juncea	s	f	a	f
Brassica tournefortii	s	f	a	f
Bromus catharticus	s	g	a	f
Bromus danthoniae	s	g	a	f
Bromus madritensis	s	g	a	f
Bromus sericeus	s	g	a	f
Bromus tectorum	s	g	a	f
Bupleurum semicompositum	s	f	a	f
Cakile arabica	s	f	a	f,o
Calendula arvensis	s	f	a	f,o
Calendula tripterocarpa	s	f	a	f,o
Calligonum polygonoides	c, s	s	p	s,f,o
Calotropis procera	s	s	p	m
Cardaria draba	s	f	a,p	-
Carduus pycnocephalus	s	f	a	f,o

Scientific Name	Propagation	Growth Form	Life Form	Value
Carrichtera annua	s	f	a	f,o
Carthamus oxyacantha	s	f	a	f
Caylusea hexagyna	s	f	b	-
Cenchrus ciliaris	s	g	p	f,o
Cenchrus setigerus	s	g	a,p	f,o
Centaurea bruguierana	s	f	a	f,o
Centaurea mesopotamica	s	f	a	f,o
Centaurea pseudosinaica	s	g	a	f,o
Centropodia forsskalii	s	g	p	f
Chenopodium album	s	f	a	f
Chenopodium murale	s	f	a	f
Chenopodium opulifolium	s	s	a	f
Chrozophora obliqua	s	f	p	f,o
Chrozophora tinctoria	s	f	a	f,o
Chrozophora verbascifolia	s	f	a	f,o
Chrysanthemum coronarium	s	f	a	-
Cistanche tubulosa	t	f	p	m
Citrullus colocynthis	s	f	p	m,o
Convolvulus arvensis	c, s	f	p	f,o
Convolvulus cephalopodus	s	f	p	f,o
Convolvulus oxyphyllus	s	s	p	m,o
Convolvulus pilosellifolius	s	f	p	f,o
Conyza bonariensis	s	f	a	-
Cornulaca aucheri	s	f	a	f
Cornulaca monacantha	s	s	p	f
Coronilla scorpioides	s	f	a	-
Coronopus didymus	s	f	a	f
Crassula alata	s	f	a	f
Cressa cretica	s	f	p	f,o
Crucianella membranacea	s	f	a	f
Cuscuta planiflora	-	f	a	f
Cutandia dichotoma	s	g	a	f
Cutandia memphitica	s	g	a	f
Cymbopogon commutatus	s	g	p	f,o
Cynodon dactylon	r	g	a	f
Cynomorium coccineum	-	f	p	f
Cyperus conglomeratus	r, s	g	p	f
Cyperus rotundus	r, s	g	p	f
Dactyloctenium aegyptium	s	g	a	f
Datura innoxia	s	f	a	m,o
Deverra triradiata	s	f	p	f
Dipcadi erythraeum	b, s	g	a	m,o
Dichanthium annulatum	s	g	p	-
Dichanthium foveolatum	s	g	p	-

Scientific Name	Propagation	Growth Form	Life Form	Value
Digitaria ciliaris	s	g	a	-
Digitaria sanguinalis	s	g	a	-
Dinebra retroflexa	s	g	a	-
Diplotaxis acris	s	f	a	f,o
Diplotaxis harra	s	f	a	f,o
Ducrosia anethifolia	s	f	p	o
Echinochloa colona	s	g	a	f
Echinops blancheanus	s	f	p	-
Echium rauwolfii	s	f	a	f,o
Emex spinosa	s	f	a	f
Ephedra alata	s	f	p	-
Eragrostis barrelieri	s	g	a	f
Eragrostis minor	s	g	a	-
Eremrobium aegyptiacum	s	f	a	f
Eremopoa persica	s	g	a	-
Eremopyrum bonaepartis	s	g	a	f
Eremopyrum distans	s	g	a	f
Erodium bryoniifolium	s	f	a	f
Erodium ciconium	s	f	a	f
Erodium cicutarium	s	f	a	f
Erodium laciniatum	s	f	a	f
Eruca sativa	s	f	a	f, fd
Euphorbia densa	s	f	a	-
Euphorbia granulata	s	f	a	-
Euphorbia grossheimii	s	f	a,p	-
Euphorbia helioscopia	s	f	a	-
Euphorbia hirta	s	f	a	-
Euphorbia indica	s	f	a	-
Euphorbia peplus	s	f	a	-
Euphorbia serpens	s	f	a	-
Euphorbia supina	s	f	p	-
Fagonia bruguieri	s	s	p	m
Fagonia glutinosa	s	f	p	m
Fagonia indica	s	f	p	-
Farsetia aegyptia	s	s	p	f
Farsetia burtonae	s	s	p	f
Filago pyramidata	s	f	a	f
Flaveria trinervia	-	f	a	f
Frankenia pulverulenta	s	f	a	f
Fumaria parviflora	s	f	a	-
Gagea reticulata	b, s	g	p	-
Galium tricornutum	s	f	a	-
Gladiolus italicus	b, s	g	p	-
Glaucium corniculatum	s	f	a	f

Scientific Name	Propagation	Growth Form	Life Form	Value
Gymnarrhena micrantha	s	f	a	f
Gynandriris sisyrinchium	b, s	g	p	-
Gypsophila capillaris	s	f	a, p	f
Halocnemum strobilaceum	s	s	p	f
Halodule uninervis	r	f	p	-
Halophila ovalis	-	-	p	-
Halothamnus iraqensis	s	f	p	-
Haloxylon salicornicum	s	s	p	m, f
Haplophyllum tuberculatum	s	s	p	m, f
Helianthemum kahiricum	s	s	p	f
Helianthemum ledifolium	s	f	a	f
Helianthemum lippii	s	f	p	-
Helianthemum salicifolium	s	f	a	f
Heliotropium bacciferum	s	s	p	m, fu
Heliotropium kotschyi	s	s	p	-
Heliotropium lasiocarpum	s	s	a	m, fu
Herniaria hemistemon	s	f	p	m
Herniaria hirsuta	s	f	a	f
Hippocrepis unisiliquosa	s	f	a	f
Hippocrepis areolata	s	f	a	f
Hordeum marinum	s	g	a	f
Hordeum murinum	s	g	a	f
Horwoodia dicksoniae	s	f	a	f
Hyoscyamus muticus	s	f	a	-
Hyoscyamus pusillus	s	f	a	-
Hypecoum littorale	s	f	a	f
Hypecoum pendulum	s	f	a	f
Ifloga spicata	s	f	a	f
Imperata cylindrica	-	g	p	-
Ixiolirion tataricum	b	f	p	-
Juncus rigidus	r	g	p	-
Koelpinia linearis	s	f	a	-
Lactuca serriola	s	f	a,b	-
Lallemantia royleana	s	f	a	-
Lappula spinocarpos	s	f	a	f
Lasiurus scindicus	s	g	p	f
Launaea angustifolia	s	f	a	f
Launaea capitata	s	f	a,p	f
Launaea mucronata	s	f	p	f
Launaea nudicaulis	s	f	p	f
Leontodon laciniatus	s	f	a	f
Lepidium aucheri	s	f	a	-
Lepidium sativum	s	f	a	-
Leptaleum filifolium	s	f	a	m

Scientific Name	Propagation	Growth Form	Life Form	Value
Leptochloa fusca	s	g	p	-
Limonium carnosum	s	s	p	m
Limonium thouini	s	f	a	m
Linaria albifrons	s	f	a	f
Linaria simplex	s	f	a	f
Loeflingia hispanica	s	f	a	f
Lolium multiflorum	s	g	a	f
Lolium rigidum	s	g	a	f
Lolium temulentum	s	g	a	f
Lotus halophilus	s	f	a	m
Lycium shawii	c	s	p	s, f
Malcolmia africana	s	f	a	f
Malcolmia grandiflora	s	f	a	f
Malcolmia pygmaea	s	f	a	f
Malva nicaeensis	s	f	a	f
Malva parviflora	s	f	a	f
Maresia pygmaea	s	f	a	f
Matricaria aurea	s	f	a	f
Matthiola longipetala	s	f	a	f
Medicago laciniata	s	f	a	f
Medicago polymorpha	s	f	a	f
Melilotus indicus	s	f	a	m
Mesembryanthemum nodiflorum	s	f	a	f
Moltkiopsis ciliata	s	f	p	f
Monsonia nivea	s	f	p	f
Neotorularia torulosa	s	f	a	f
Neurada procumbens	s	f	a	f
Nitraria retusa	c	s	p	s, f
Notoceras bicorne	s	f	a	f
Ochradenus baccatus	s	s	p	m
Ogastemma pusillum	s	f	a	f
Oligomeris linifolia	s	f	a	f
Oligomeris subulata	s	f	a	f
Onobrychis ptolemaica	s	f	p	f
Ononis reclinata	s	f	a	f
Ononis serrata	s	f	a	f
Ophioglossum aitchisonii	s	fn	a	fd
Orobanche aegyptiaca	t	f	a	m
Orobanche cernua	t	f	a	m
Orobanche minor	-	-	-	-
Orobanche ramosa	t	f	a,p	m
Oxalis corniculata	s	f	a,p	f
Panicum antidotale	s	g	p	f
Panicum turgidum	s	g	p	f

Scientific Name	Propagation	Growth Form	Life Form	Value
Papaver rhoeas	s	f	a	m
Parapholis incurva	s	g	a	f
Paronychia arabica	s	f	a	f
Peganum harmala	s	s	p	-
Pennisetum divisum	s	g	p	f
Phalaris minor	s	g	a	f
Phalaris paradoxa	s	g	a	f
Phragmites australis	s	g	p	f
Phyla nodiflora	c, s	f	p	-
Picris babylonica	s	f	a	f
Plantago amplexicaulis	s	f	a	f
Plantago boissieri	s	f	a	f
Plantago ciliata	s	f	a	f
Plantago coronopus	s	f	a	f
Plantago lanceolata	s	f	p	f
Plantago notata	s	f	a	f
Plantago ovata	s	f	a	m
Plantago psammophila	s	f	a	f
Poa annua	s	g	a	f
Poa infirma	s	g	a	f
Poa sinacia	s	g	p	f
Polycarpaea repens	s	f	p	f
Polycarpaea robbairea	s	f	a	f
Polycarpon tetraphyllum	s	f	a	f
Polygonum patulum	s	f	a	f
Polypogon monspeliensis	s	g	a	f
Portulaca oleracea	s	f	a	f
Prosopis farcta	-	t	p	-
Psylliostachys spicata	s	f	a	f
Pteranthus dichotomus	s	f	a	f
Pulicaria undulata	s	s	p	m
Reichardia tingitana	s	f	a	f
Reseda arabica	s	f	a	f
Reseda decursiva	s	f	a	f
Reseda muricata	s	f	p	f
Rhanterium epapposum	s	s	p	f, fu
Rhynchelytrum repens	s	g	a	-
Roemeria hybrida	s	f	a	m
Rostraria cristata	s	g	a	f
Rostraria pumila	s	g	a	f
Rumex pictus	s	f	a	f
Rumex vesicarius	s	f	a	f
Salicornia europaea	s	f	a	f
Salsola cyclophylla	s	s	p	f

Scientific Name	Propagation	Growth Form	Life Form	Value
Salsola imbricata	s	s	p	m
Salsola jordanicola	s	f	a	f
Salvia aegyptiaca	s	f	p	m
Salvia lanigera	s	f	p	m
Salvia spinosa	s	f	p	m
Savignya parviflora	s	f	a	f
Scabiosa olivieri	s	f	a	f
Scabiosa palaestina	s	f	a	f
Schimpera arabica	s	f	a	f
Schismus barbatus	s	g	a	f
Sclerocephalus arabicus	s	f	a	f
Scopiurus muricatus	s	f	a	f
Scorzonera papposa	t, s	f	p	f, fd
Scorzonera tortuosissima	t, s	f	p	f
Scrophularía deserti	s	s	p	m
Seetzenia orientalis	s	f	p	-
Seidlitzia rosmarinus	c	s	p	m
Senecio glaucus	s	f	a	f
Senecio vulgaris	s	f	a	-
Setaria verticillata	s	g	a	-
Setaria viridis	s	g	a	-
Silene arabica	s	f	a	f
Silene arenosa	s	f	a	f
Silene conoidea	s	f	a	f
Silene villosa	s	f	a	f
Sinapis arvensis	s	f	a	f
Sisymbrium erysimoides	s	f	a,b	f
Sisymbrium irio	s	f	a	f
Sisymbrium orientale	s	f	a	f
Sisymbrium septulatum	s	f	a	f
Solanum nigrum	s	f	a	-
Sonchus oleraceus	s	f	a	o
Sonchus tenerrimus	s	f	a	o
Sorghum halepense	s	g	p	f
Spergula fallax	s	f	a	f
Spergularia diandra	s	f	a	f
Spergularia marina	s	f	b, a	f
Sphenopus divaricatus.	s	g	a	f
Sporobolus arabicus	s	g	p	f
Stellaria media	s	f	a	f
Stipa capensis	s	g	a	f
Stipagrostis ciliata	s	g	p	f
Stipagrostis drarii	s	g	p	f
Stipagrostis obtusa	s	g	p	f

Scientific Name	Propagation	Growth Form	Life Form	Value
Stipagrostis plumosa	s	g	p	f
Suaeda aegyptiaca	s	f	a	f
Suaeda vermiculata	s	s	p	f
Tamarix aucheriana	c	s	p	s, f
Telephium sphaerospermum	s	f	a	f
Teucrium oliverianum	s	s	p	m
Teucrium polium	s	s	p	m
Thymelaea mesopotamica	s	f	a	f
Traganum nudatum	s	s	p	f
Tribulus macropterus	s	f	a	-
Tribulus terrestris	s	f	a	m
Trifolium lappaceum	s	f	a	f
Trifolium resupinatum	s	f	a	f
Trigonella anguina	s	f	a	f
Trigonella hamosa	s	f	a	f
Trigonella stellata	s	f	a	f
Trisetaria linearis	s	g	a	f
Typha domingensis	r, se	g	p	m
Urospermum picroides	s	f	a	f
Urtica urens	s	f	a	-
Vaccaria hispanica	s	f	a	-
Valerianella dufresnia	s	f	a	-
Vicia sativa	s	f	a	-
Withania somnifera	s	s	p	m
Xanthium strumarium	s	f	a	-
Zilla spinosa	s	s	p	f
Ziziphus spina-christi	s,c	t	p	fd,s
Zygophyllum qatarense	s	s	p	m, f

Key to Appendix B:

Propagation
s = seed
r = rhizome
b = bulb
c = cutting
t = tuber

Growth Form
f = forb
t = tree
s = shrub
g = grass
l = lilly
fn = fern

Life Form
p = perennial
a = annual
b = biennial

Value
f = fodder
s = shade
m = medicinal
o = ornamental
f u = fuel
fd = food
d = dye

APPENDIX C

* LIST OF PLANTS RECORDED DURING THE STUDY PERIOD 1990-99

Plate No.	Scientific Name	Date of Photograph	Location	Photographer
48	*Aizoon canariense*	April 1996	KISR	SO*
49	*Aizoon hispanicum*	March 1990	As Subiyah	YM**
50	*Mesembryanthemum nodiflorum*	April 1995	KISR	SO
51	*Amaranthus lividuls*	October 1997	KISR	SO
52	*Calotropis procera*	April 1997	Shuwaikh	SO
53	*Anchusa hispida*	March 1995	Sulaybiya	YM
54	*Arnebia decumbens*	February 1995	Sulaybiya	YM
55	*Arnebia tinctoria*	March 1990	Sulaybiya	YM
56	*Echium rawolfii*	April 1986	Ad Dhubaiyah	BH***
57	*Heliotropium bacciferum*	February 1996	As Subiyah	YM
58	*Moltkiopsis ciliata*	April 1996	Sulaybiya	SO
59	*Gypsophila capillari*	April 1998	Ad Dhubaiyah	SO
60	*Herniaria hemistemon*	April 1999	Ad Dhubaiyah	SO
61	*Loeflingia hispanica*	March 1998-	Jal Az-Zor	SO
62	*Polycarpaea arabica*	April 1996	Eraifjiah	SO
63	*Polycarpaea repens*	March 1996	Sulaybiya	SO
64	*Sclerocephalus arabicus*	April 1997	Jal Az-Zor	SO
65	*Silene arabica*	April 1999	Ad Dhubaiyah	SO
66	*Silene conoidea*	April 1990	Sulaybiya	YM
67	*Silene villosa*	February 1998	Sulaybiya	SO
68	*Spergularia diandra*	April 1999	Ad Dhubaiyah	SO
69	*Agathophora alopecuroides*	May 1986	Ad Dhubaiyah	SO
70	*Anabasis setifera*	October 1997	As Subiyah	SO
71	*Atriplex leucoclada*	November 1997	Al-Khiran	SO
72	*Bassia eriophora*	March 1988	Umm Al Aysh	YM
73	*Bassia muricata*	May 1997	Sulaybiya	SO
74	*Bienertia cycloptera*	November 1998	Northeast	SO
75	*Chenopodium album*	May 1997	KISR	SO
76	*Chenopodium murale*	April 1997	Sulaybiya	SO
77	*Cornulaca aucheri*	September 1996	Umm Qudair	SO
78	*Cornulaca monacantha*	May 1997	Ghudhai	SO
79	*Halocnemum strobilaceum*	April 1995	National Park	SO
80	*Halothamnus iraqensis*	October 1997	Jal Az-Zor	SO
81	*Haloxylon salicornicum*	November 1998	North Bahrah	SO

* The key of the appendix idioms at the end of the list.

Plate No.	Scientific Name	Date of Photograph	Location	Photographer
82	*Salicornia europaea*	May 1997	Doha	SO
83	*Salsola imbricata*	October 1997	KISR	SO
84	*Salsola jordanicola*	November 1997	Al-Khiran	SO
85	*Seidlitzia rosmarinus*	October 1996	As Subiyah	SO
86	*Suaeda aegyptiaca*	October 1997	KISR	SO
87	*Suaeda vermiculata*	October 1997	KISR	SO
88	*Traganum nudatum*	April 1997	As Subiyah	SO
89	*Helianthemum kahiricum*	April 1997	Jal Az-Zor	SO
90	*Helianthemum lippii*	March 1996	Faylaka	YM
91	*Aarensohnia factorovskyi*	April 1996	Ghudhai	YM
92	*Anthemis deserti*	April 1996	Ghudhai	YM
93	*Anthemis pseudocotula*	April 1997	Ad Dhubaiyah	SO
94	*Artemisia scoparia*	November 1997	Khiran	SO
95	*Asteriscus hierochunticus*	April 1996	Jal Az-Zor	BH/SO
96	*Atractylis carduus*	April 1997	Sulaybiya	SO
97	*Calendula arvensis*	February 1996	Ad Dhubaiyah	YM
98	*Carduus pycnocephalus*	April 1997	Sulaybiya	SO
99	*Carthamus oxyacantha*	May 1997	Sulaybiya	SO
100	*Centaurea pseudosinaica*	May 1990	Shegayah	YM
101	*Chrysanthemum coronarium*	March 1998	Ad Dhubaiyah	SO
102	*Conyza bonariensis*	March 1998	Ad Dhubaiyah	SO
103	*Filago pyramidata*	April 1998	Ad Dhubaiyah	SO
104	*Gymnarrhena micrantha*	April 1995	Jal Az-Zor	SO
105	*Ifloga spicata*	March 1990	Sulaybiya	YM
106	*Koelpinia linearis*	April 1997	Sulaybiya	SO
107	*Lactuca serriola*	May 1997	KISR	SO
108	*Launaea capitata*	April 1998	Ad Dhubaiyah	SO
109	*Launaea mucronata*	April 1998	Ad Dhubaiyah	SO
110	*Picris babylonica*	March 1993	Abraq	SO
111	*Pulicaria undulata*	March 1993	Sulaybiya	SO
112	*Reichardia tingitana*	March 1995	Ad Dhubaiyah	YM
113	*Rhanterium epapposum*	April 1999	Ad Dhubaiyah	SO
114	*Scorzonera papposa*	April 1999	Ad Dhubaiyah	SO
115	*Senecio glaucus*	February 1999	Sulaybiya	SO
116	*Sonchus oleraceus*	April 1999	Ad Dhubaiyah	SO
117	*Convolvulus arvensis*	May 1997	KISR	SO
118	*Convolvulus cephahlopodus*	March 1996	Faylaka	YM
119	*Convolvulus oxyphyllus*	March 1990	Mutla	YM
120	*Convolvulus pilosellifolius*	April 1997	Wafrah	SO
121	*Cressa cretica*	October 1997	Nuwaiseeb	SO

Plate No.	Scientific Name	Date of Photograph	Location	Photographer
122	*Brassica tournefortii*	February 1996	Sulaybiya	SO
123	*Cakile arabica*	February 1995	Ad Dhubaiyah	SO
124	*Carrichtera annua*	March 1997	Sulaybiya	SO
125	*Coronopus didymus*	April 1998	Ad Dhubaiyah	SO
126	*Diplotaxis harra*	March 1996	Umm Al Aysh	SO
127	*Eruca sativa*	March 1997	Nuzha	SO
128	*Farsetia aegyptia*	April 1997	Sulaybiya	SO
129	*Horwoodia dicksoniae*	March 1997	Sulaybiya	SO
130	*Malcolmia grandiflora*	March 1993	Ad Dhubaiyah	SO
131	*Savignya parviflora*	April 1995	Ad Dhubaiyah	SO
132	*Schimpera arabica*	February 1998	Sulaybiya	SO
133	*Sisymbrium irio*	May 1999	Shuwaikh	SO
134	*Citrullus colocynthis*	September 1996	Umm Qudair	SO
135	*Scabiosa olivieri*	April 1996	Sulaybiya	SO
136	*Andrachne telephioides*	May 1997	KISR	SO
137	*Chrozophora verbascifolia*	September 1997	Talha	SO
138	*Euphorbia hirta*	March 1997	Nuzha	SO
139	*Euphorbia supina*	May 1997	KISR	SO
140	*Frankenia pulverulenta*	April 1998	Ad Dhubaiyah	SO
141	*Erodium bryoniifolium*	April 1986	Abraq	BH
142	*Erodium glaucophyllum*	November 1997	Al-Khiran	SO
143	*Erodium laciniatum*	April 1997	Sulaybiya	SO
144	*Acacia pachyceras*	April 1995	Talha	SO
145	*Alhagi graecorum*	May 1999	Shuwaikh	SO
146	*Astragalus annularis*	February 1996	Sulaybiya	SO
147	*Astragalus corrugatus*	April 1999	Ad Dhubaiyah	SO
148	*Astragalus hauarensis*	February 1996	Sulaybiya	SO
149	*Astragalus schimperi*	March 1998	Sulaybiya	SO
150	*Astragalus sieberi*	November 1998	Northeast	SO
151	*Astragalus spinosus*	January 1996	Burgan	SO
152	*Hippocrepis areolata*	February 1997	Al Qurain	SO
153	*Lotus halophilus*	April 1998	Ad Dhubaiyah	SO
154	*Medicago laciniata*	April 1998	Ad Dhubaiyah	SO
155	*Onobrychis ptolemaica*	March 1998	Ad Dhubaiyah	SO
156	*Ononis serrata*	March 1996	Sulaybiya	SO
157	*Trigonella hamosa*	April 1998	Ad Dhubaiyah	SO
158	*Althaea ludwigii*	February 1996	Sulaybiya	SO
159	*Malva parviflora*	April 1997	Sulaybiya	SO
160	*Neurada procumbens*	April 1998	Ad Dhubaiyah	SO
161	*Cistanche tubulosa*	April 1993	Sulaybiya	SO

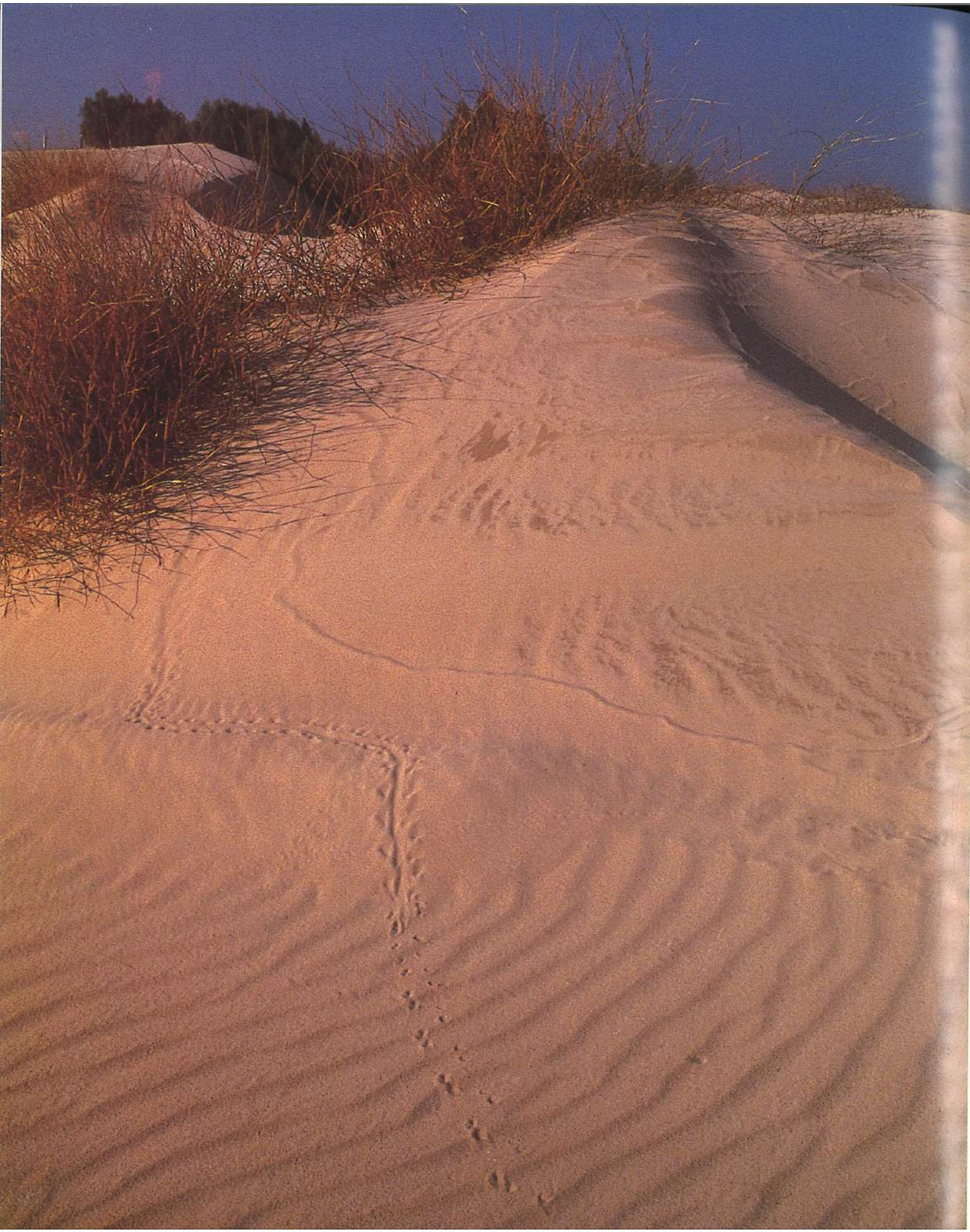
Plate No.	Scientific Name	Date of Photograph	Location	Photographer
162	*Orobanche aegyptiaca*	March 1996	Sulaybiya	YM
163	*Orobanche cernua*	February 1997	Northeast	SO
164	*Orobanche ramosa*	March 1999	Sulaybiya	SO
165	*Roemeria hybrida*	March 1990	Ad Dhubaiyah	YM
166	*Plantago amplexicaulis*	March 1990	Ad Dhubaiyah	YM
167	*Plantago boissieri*	February 1995	Sulaybiya	YM
168	*Plantago ciliata*	March 1995	As Subiyah	YM
169	*Plantago coronopus*	March 1995	Ad Dhubaiyah	SO
170	*Plantago ovata*	March 1990	Ad Dhubaiyah	YM
171	*Calligonum polygonoides*	March 1996	Sulaybiya	YM
172	*Emex spinosa*	March 1995	Ad Dhubaiyah	SO
173	*Rumex vescicarius*	March 1996	Ad Dhubaiyah	SO
174	*Portulaca oleracea*	October 1997	KISR	SO
175	*Angallis arvensis*	February 1993	Sulaybiya	SO
176	*Ochradenus baccatus*	March 1996	Sulaybiya	SO
177	*Oligomeris linifolia*	March 1998	Ad Dhubaiyah	SO
178	*Reseda arabica*	March 1997	Ad Dhubaiyah	SO
179	*Reseda muricata*	March 1996	Jal Az-Zor	SO
180	*Crucianella membranacea*	April 1998	Ad Dhubaiyah	SO
181	*Haplophyllum tuberculatum*	March 1997	Wadi Al Batin	SO
182	*Scrophularia deserti*	March 1995	Ad Dhubaiyah	SO
183	*Datura innoxia*	April 1999	Ad Dhubaiyah	SO
184	*Lycium shawii*	February 1998	Sulaybiya	SO
185	*Tamarix aucheriana*	November 1995	Sulaibikhat	YM
186	*Anisociadium lanatum*	April 1996	Sulaybiya	SO
187	*Bupleurum semicopmositum*	April 1998	Ad Dhubaiyah	SO
188	*Deverra triradiata*	April 1999	Ad Dhubaiyah	SO
189	*Ducrosia anethifolia*	November 1997	Al-Khiran	SO
190	*Fagonia bruguieri*	March 1996	Ad Dhubaiyah	SO
191	*Fagonia glutinosa*	April 1997	Sulaybiya	SO
192	*Fagonia indica*	February 1996	Mutla	YM
193	*Nitraria retusa*	April 1995	Bahrah	SO
194	*Peganum harmala*	April 1995	Umm Al Aysh	SO
195	*Tribulus terrestris*	May 1997	KISR	SO
196	*Zygophyllum qatarense*	April 1995	National Park	SO
197	*Cyperus conglomeratus*	April 1999	Ad Dhubaiyah	SO
198	*Cyperus rotundus*	*April 1999*	Ad Dhubaiyah	*SO*
199	*Aeluropus lagopoides*	March 1997	Kazma	SO
200	*Aeluropus littoralis*	March 1997	Kazma	SO
201	*Avena barbata*	April 1997	Sulaybiya	SO

Plate No.	Scientific Name	Date of Photograph	Location	Photographer
202	*Bromus Madritensis*	April 1999	Ad Dhubaiyah	SO
203	*Cenchrus ciliaris*	April 1997	Jal Az Zor	SO
204	*Cenchrus setigerus*	April 1997	Sulaybiya	SO
205	*Centropodia forskalii*	February 1997	Sulaybiya	SO
206	*Cutandia memphitica*	April 1999	Ad Dhubaiyah	SO
207	*Cynodon dactylon*	April 1997	Sulaybiya	SO
208	*Dactyloctenium aegyptium*	March 1997	KISR	SO
209	*Hordeum marinum*	April 1997	Sulaybiya	SO
210	*Lasiurus scindicus*	March 1997	Umm Al Niqa	SO
211	*Lolium rigidum*	April 1999	Ad Dhubaiyah	SO
212	*Panicum antidotale*	April 1997	Sulaybiya	SO
213	*Panicum turgidum*	April 1997	Sulaybiya	SO
214	*Parapholis incurva*	April 1999	Ad Dhubaiyah	SO
215	*Pennisetum divisum*	March 1998	Ghudhai	SO
216	*Phalaris minor*	April 1997	Sulaybiya	SO
217	*Phragmites australis*	March 1997	Jahra	SO
218	*Polypogon monspeliencisis*	April 1999	Ad Dhubaiyah	SO
219	*Rostraria pumila*	April 1999	Ad Dhubaiyah	SO
220	*Schismus barbatus*	April 1997	Sulaybiya	SO
221	*Sphenopus divaricatus*	April 1998	Ad Dhubaiyah	SO
222	*Sporobolus arabicus*	April 1999	Ad Dhubaiyah	SO
223	*Stipa capensis*	March 1996	Sulaybiya	SO
224	*Stipagrostis ciliata*	April 1999	Ad Dhubaiyah	SO
225	*Stipagrostis plumosa*	March 1997	Sulaybiya	SO
226	*Gynandriris sisyrinchium*	March 1999	Mutla	SO
227	*Juncus rigidus*	May 1997	Kazma	SO
228	*Allium sindjarense*	March 1996	Faylaka	YM
229	*Allium sphaerocephalum*	April 1996	Sulaybiya	SO
230	*Asphodelus tenuifolius*	February 1996	Sulaybiya	SO
231	*Dipcadi erythraeum*	February 1996	Sulaybiya	SO
232	*Gagea reticulata*	February 1996	Sulaybiya	SO

*Samira Omar : SO

**Yasmin Al Mutawa : YM

***Badir Al Haji : BH



GLOSSARY OF TERMS

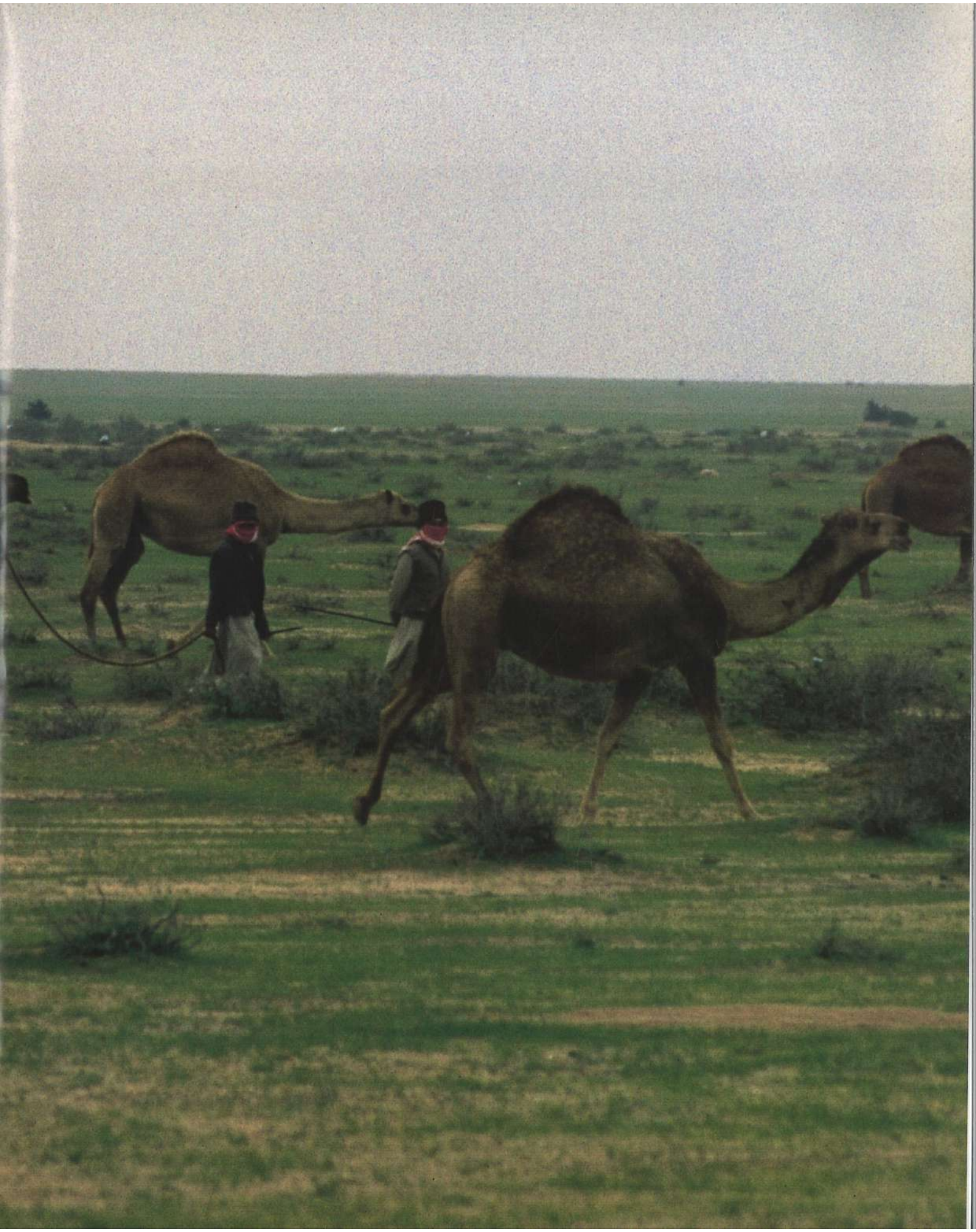
Acuminate	Tapering to a prolonged point.
Acute	Distinctly pointed, the margins meeting at less than a 90 degree angle
Alluvial	A type of a zonal soil formed on the flood plains of river valleys and at river mouths (alluvial fans or deltas)
Alternate	Placed singly at different heights on an axis or stem.
Annual	Completing a life cycle in one year.
Anther	The pollen-bearing portion of a stamen.
Anthesis	The time of flower opening, blooming.
Antrorese	Directed upward, toward the apex.
Apex	The summit, tip of a part.
Appressed	Lying flat against a part or organ.
Awn	A bristle-like appendage, especially in a grass spikelet.
Axil	The upper angle formed by an attached part and an axis, especially a leaf on a stem.
Axile	In or in the axils
Axially	In the axils.
Axis	The main or central line of a plant or plant part.
Ballate	With blistered or puckered surface.
Biennial	Completing a life cycle in two years.
Blade	The broadened portion of a leaf.
Bracteate	With bracts.
Bracteoles	A small bract; the bract of a secondary inflorescence unit.
Bracts	Leaf-like organ subtending a flower or other inflorescence unit.
Bristles	A stiff hair.
Calyx	The outermost floral envelope; the sepals collectively.
Canescent	Finely and closely grey or whitish - pubscent.
Capsules	A dry fruit splitting open along lines or releasing seeds through pores.
Cauline	On or pertaining to a stem.
Compaction	Increase in bulk density due to mechanical forces such as tractor wheels.
Conical	In a shape of a cone.
Connate	United.
Corolla	The inner floral envelope consisting of petals; the petals collectively.
Corymb	A more-or-less flat topped, broadened group of flowers with the outer flowers opening first.

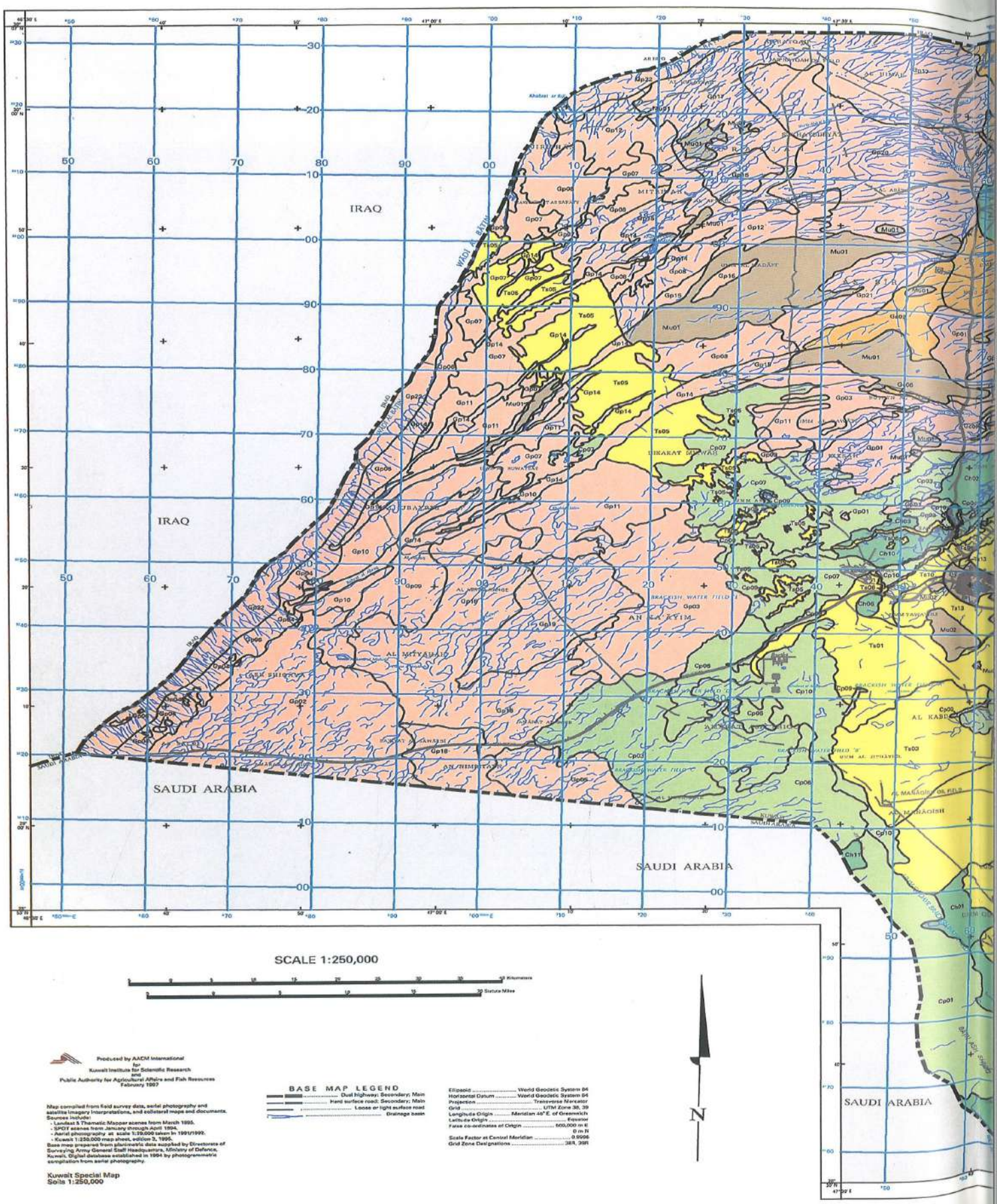
Corymbose	With, or in the form of, corymbs.
Culm	The stem of grasses and sedges.
Cyathium	The specialized, ultimate inflorescence of euphorbia consisting of a trilocular ovary surrounded by single stamens equivalent to a male flower.
Cymbiform	Boat-shaped.
Cyme	A group of flowers, often broad and flat-topped, with the inner flowers opening first.
Cymose	Cyme-like; with cymes.
Decumbent	Reclining but with ascending tips.
Decussate	With pairs alternating at right angles.
Deltoid	Triangular.
Dentate	Edged with outward-pointing teeth.
Denticulate	Finely dentate.
Discoid	Disk-shaped.
Diverging	Inclining away from each other; separating gradually.
Ellipsoid	A solid body of elliptical outline.
Elliptic	Ellipse-shaped, tapering to evenly rounded ends with the sides not parallel.
Embryo	The rudimentary plant formed in the seed.
Endemic	Found only in a given region.
Entire	Without teeth or lobes and evenly margined.
Erect	Upright, standing straight without inclination.
Fascicled	In bundles or clusters.
Filiform	Threadlike; long and slender.
Flexuous	Bent alternately in opposite directions; zig-zag.
Follicle	A dry fruit formed from a single carpal and dehiscing along a suture.
Glabrescent	Nearly glabrous; becoming glabrous.
Glabrous	Devoid of any pubescence.
Globose	Spherical, globular.
Glume	In a grass inflorescence, the scale subtending the spikelet, not enclosing a floret; in sedges, any of the scales of the spikelet.
Granulate	Covered with numerous fine granules; fine-grainy.
Helicoid	Spirally curved, coiled or twisted.
Hirsute	With rather long and sometimes somewhat stiff hairs.
Hispid	With rough, stiff hairs or bristles.
Inflorescence	The mode of flowering or its arrangement; also, the flowers of a plant collectively.

Inundated	Covered completely with water.
Involucre	A group of ring of bracts surrounding several flowers or an inflorescence branch or unit.
Keeled	Ridged more or less sharply, usually longitudinally at back.
Lamina	A thin plate.
Lance	Long with pointed head.
Lanceolate	Rather narrow and tapering to each end, with the broadest part below the middle.
Lemma	The lower of the two bracts or scales immediately enclosing the flower or floret in grasses.
Linear	Elongated and narrow with margins parallel or nearly so.
Lobed	Having segments, parts or divisions; the term sometimes used with a numerical prefix indicating their number.
Locule	A cell or compartment of an ovary.
Lyrate	Pinnatifid with the terminal lobe enlarged and rounded.
Membranous	Thin and translucent.
Mucro	A short fine point.
Mucronate	With a short fine point.
Node	A point or region or a stem that normally bears a leaf or leaves.
Nutlet	A small nut.
Oblanceolate	Reverse-lanceolate, but having the broadest part nearer the apex than the base.
Oblong	Longer than broad, with the margins nearly parallel.
Obtuse	Blunt and rounded at end, with the margins meeting at an angle of more than 90 degrees.
Ovate	Egg-shaped in outline and attached at the broader end.
Ovoid	Egg-shaped as a solid body.
Paniculate	Panicle-like.
Papilla	A minute, nipple-like gland or protuberance.
Papillose	Having papillae.
Pappus	The tuft of hairs, bristles or chaffy appendages on some fruits or seeds, particularly the achenes of Compositae.
Pedicel	The stalk of a single flower or fruit, or, in grasses, of a single spikelet.
Peduncle	The stalk of a group of flower or fruits, or sometimes of a single one.
Pendulous	Hanging downward.
Perennial	Continuing to live for more than two years.

Perianth	The floral envelope of whatever form, often used in reference to flowers without clearly defined calyx and corolla, or with one envelope absent.
Pericarp	The wall of a mature ovary.
Petal	One unit of the inner floral envelope, or corolla, of a polypetalous flower, often colored and showy.
Petiole	The stalk of a leaf.
Pilose	With soft, rather long hairs.
Pinnate	With divisions, segments, or other units side-by-side on both sides of an axis, feather-like, as the leaflets of a pinnately compound leaf.
Pinnatisect	Pinnately cut down to the base or mid-rib.
Pistillate	Having pistils and not stamens; female.
Procumbent	Prostrate, lying more-or-less flat on the ground.
Prostrate	Lying more or less flat on the gourd; procumbent.
Pubescent	Hairy; bearing hairs of any kind.
Punctate	Marked with fine, often depressed dots.
Pungent	Terminating in a sharp, rigid point.
Raceme	A racemose inflorescense in which the flowers are formed on individual pedicels on the main axis (peduncle).
Racemose	Raceme-like; arranged in racemes.
Rachis, Rhachis	An axis bearing flowers or, in a compound leaf, leaflets.
Rachilla	A secondary or small rachis; in grasses and sedges, the axis bearing the florets.
Reniform	Kidney-shaped.
Reticulate	With a net-like pattern.
Revolute	With edges rolled downward, toward the back side.
Rhizome	A root-like, usually underground stem.
Rhomboid	Rhombic in outline, four-sided with some angles obtuse.
Rosette	A group of leaves spreading or radiating from the base of a plant.
Rudimentary	Imperfectly or incompletely developed, usually of smaller than normal size.
Rugose	Wrinkled with sunken veins, such as some leaves.
Rugulose	Finely rugose.
Scabrid, Scabrous	Rough.
Sepal	One of the individual segments of the calyx, usually green and herbaceous.
Sessile	Attached without any stalk.
Sheath	A case or covering a blade.

Silique, Siliqua	The longer the cruciferae, three times or more as long as broad, consisting of two values falling away from a frame upon which the seeds grow and across which a false partition is formed.
Sinuate	With a more or less deeply wavy margin.
Solitary	Single, with only one in the same place.
Spathulate	Generally oblong but broader toward the apex.
Spiciform	Spike-shaped.
Spike	An inflorescence, usually elongated, consisting of sessile flowers on a common axis.
Spikelets	The basic inflorescence unit of grasses, consisting of one or more florets subtended by two glumes.
Spinescent	Ending in a spine or spike-like structure; bearing a spine or spike-like structure; bearing a spine or spines.
Spinule	A little spine.
Stamen	The pollen-bearing organ in the flower; the male organ.
Stellate	Star-shaped, radiating like the points of a star.
Stolons	A runner or any basal branch that tends to root.
Striate	Finely grooved or ridged, usually longitudinally.
Sub-	A prefix adding to a term the meaning "slightly", "nearly", or "somewhat".
Succulent	Fleshy and juicy.
Taper	To become narrower towards one end.
Terete	Circular in cross section.
Tinge	A very small amount.
Tomentellous	Slightly or thinly tomentose.
Tubercles	A small rounded lump on plants.
Tubular	Tubular in form; in Compositae, tubular as opposed to ligulate (a flower or floret).
Tufted	Growing or occurring in clumps or compact groups.
Umbel	A group of several flowers with pedicels attached to, and often spreading from, a common point.
Undulate	Wavy.
Utricle	A small, bladder-shaped fruit covering.
Verticillate	Whorled, inserted around a common node at the same level on a stem or other axis, as some leaves or flowers.
Viscid	Sticky with a tenacious secretion.
Whorl	An arrangement of organs in a circle at the same level on an axis.





SCALE 1:250,000

Produced by AACM International
for
Kuwait Institute for Scientific Research
and
Public Authority for Agricultural Affairs and Fish Resources
February 1997

Map compiled from field survey data, aerial photography and satellite imagery interpretations, and collateral maps and documents. Sources include:
- Landsat 5 Thematic Mapper scenes from March 1995.
- SPOT scenes from January through April 1994.
- Aerial photography at scale 1:39,000 taken in 1991/1999.
- Kuwait 1:250,000 map sheet, edition 3, 1995.

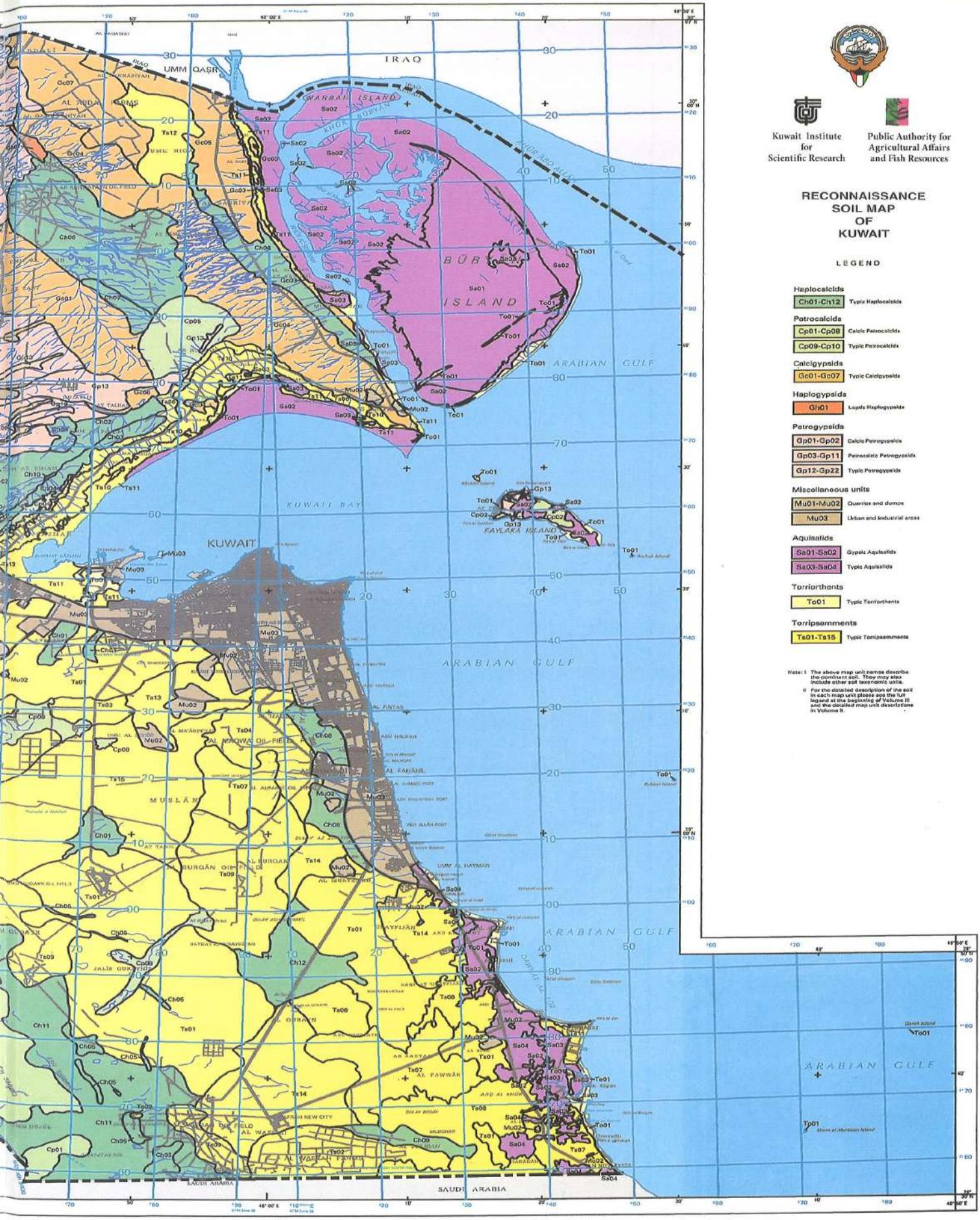
Base map prepared from planimetric data supplied by Directorate of Surveying, Army General Staff Headquarters, Ministry of Defence, Kuwait. Digital database established in 1994 by photogrammetric compilation from aerial photography.

Kuwait Special Map
Soils 1:250,000

BASE MAP LEGEND

- Dual highway; Secondary; Main
- Hard surface road; Secondary; Main
- Loose or light surface road
- Drainage basin

Ellipsoid	World Geodetic System 84
Horizontal Datum	World Geodetic System 84
Projection	Transverse Mercator
Grid	UTM Zone 38, 39
Longitude Origin	Meridian 45° E. of Greenwich
Latitude Origin	Equator
False co-ordinates of Origin	500,000 m E 0 m N
Scale Factor at Central Meridian	0.9996
Grid Zone Designations	38R, 39R



Kuwait Institute for Scientific Research

Public Authority for Agricultural Affairs and Fish Resources

RECONNAISSANCE SOIL MAP OF KUWAIT

LEGEND

Haplocalcids

- Ch01-Ch12 — Typic Haplocalcids

Petrocalcids

- Cp01-Cp08 — Calcic Petrocalcids
- Cp09-Cp10 — Typic Petrocalcids

Calcigypsids

- Gc01-Gc07 — Typic Calcigypsids

Haplogypsids

- Gh01 — Lopdic Haplogypsids

Petrogypsids

- Gp01-Gp02 — Calcic Petrogypsids
- Gp03-Gp11 — Petrocalcic Petrogypsids
- Gp12-Gp22 — Typic Petrogypsids

Miscellaneous units

- Mu01-Mu02 — Quarries and dumps
- Mu03 — Urban and industrial areas

Aquisalids

- Sa01-Sa02 — Gypsic Aquisalids
- Sa03-Sa04 — Typic Aquisalids

Torriorthents

- To01 — Typic Torriorthents

Torripsamments

- Ts01-Ts15 — Typic Torripsamments

Note: I The above map unit names describe the dominant soil. They may also include other soil taxonomic units.

II For the detailed description of the soil in each map unit please see the full legend at the beginning of Volume III and the detailed map unit descriptions in Volume II.

A field guide to the desert of Kuwait with photographic illustrations