

## 1.2 LIBYA

### Introduction

Libya is bounded by Egypt in the east, by Sudan, Chad and Niger in the south, by Algeria in the west, and by the Mediterranean Sea in the north. It has an area of 1 759 540 km<sup>2</sup>, a population of 3 224 000, and thus has a mean population density of 1.8 persons/km<sup>2</sup>. It extends approximately 1460 km from south to north between latitudes 19°33' and 33°13'N, and 1550 km from west to east between longitudes 9°21' and 25°09'E.

The coastline is over 1500 km long, and apart from an area in the east, between Benghazi (32°07'N/20°04'E) and Darnah (32°46'N/22°39'E), this rises gently on passing inland. In the west, the Gefara Plain, which lies along the coast, tends to be saline and rises gently in the south to the Jabal Tarabulus (Jabal Nafusa), a Cretaceous limestone formation 300-600 m high. This in turn leads southwards to the great rocky plateau of the Al Hammadah al Hamrah covering some 49 000 km<sup>2</sup>. In the central region, along the Gulf of Sirte, the coastal plain is at first 50-70 km wide but opens inland, from the southeastern gulf, to a vast lowland area between the coastal highlands of the east and the high desert lands along the southern borders. Here some 200 000 km<sup>2</sup> of land lies below the 100 m contour, and a peripheral zone of equivalent area lies below the 200 m contour. East of the Gulf of Sirte, the coastal plain is narrow, 10-15 km wide, and rises by the north-facing terraces of the Al Jabal al Akhdar to a highland block 400-600 m high. This hilly region is 200 km long, parallel with the coast, and 70 km wide. On the south side it slopes down to the interior plain. To the east of these highlands, the coast is flat and backed by undulating land on which a belt of sparse vegetation extends some 20 km inland. The highest land in Libya is found in the far central south where a promontory of the Tibesti Mountains, over 1500 m asl, reaches northwards into the country from Chad. A sand desert covers most of interior lowland Libya, occupying much of the eastern, southeastern, central and southwestern sectors.

There are no perennial rivers in Libya, but numerous dry watercourses (wadis or ouadis) are filled by flash floods after local rain. They dry quickly, but pools and trickling streams may persist for a time. There are large artesian water resources, and there are plans, already partially implemented, to pump water from the interior to the coast for irrigation. It is planned that eventually a total of 578 wells will produce 3 000 000 m<sup>3</sup> water/day.

### Climate

The climate of Libya is jointly influenced by the desert to the south and the Mediterranean Sea to the north, there being no natural barriers between. In winter the coastal areas and the Tibesti Mountains are quite cold, the latter subject to frosts, while in summer the whole country is hot. Tarabulus (Tripoli) has a mean annual temperature of 19.8°C. That at Benghazi is very similar but the annual range and daily fluctuations are greater at Tarabulus. A hot dust laden wind, known locally as the ghibli, may reach the coast from the Sahara at any time, but chiefly during the spring and autumn. This raises temperatures dramatically, and an absolute maximum of 58°C has been recorded on the Gefara Plain.

Precipitation at first declines on passing eastwards along the coast, but rises briefly over the Al Jabal al Akhdar. Mean annual rainfall at Tarabulus is 371 mm, 247 mm at Misratah and 113 mm

at Bu Ayrat al Hasun (31°26'N/15°44'E), but this increases again to 260 mm at Banghazi and may reach 500 mm on the seaward heights of the Al Jabal al Akhdhar. Annual variations are marked and the coastal regions are prone to periods of drought. The interior is very dry. Rainfall decreases rapidly away from the coast and 95% of the country receives less than 100 mm/yr, and much receives less than 40 mm. Most of the southwest, including the Tibesti Massif, has a mean annual rainfall of less than 20 mm. Insolation in the interior is extreme and potential evaporation reaches or exceeds 4500 mm/yr.

## Vegetation

In years of good rainfall the coastal plains are covered by annual grasses and other herbaceous vegetation, including species of *Asphodelus*, while the highlands of the Al Jabal al Akhdhar support tall (3-4 m) sclerophyllous scrubland, known locally as macchia. Floristically this is quite diverse but usually contains an abundance of *Juniperus phoenicea* and *Pistacia lentiscus*. Several grasses and the low shrub, *Poteriutn spinosum*, occur as an under-storey in more open stands, and becomes dominant where grazing pressure is intense. Macchia is a form of degraded woodland, probably once dominated by species of *Cupressus*, *Juniperus*, *Olea* and *Quercus*. In the west the Jabal Tarabulas is less densely vegetated, and the natural vegetation is of low grasslands between barren hills. There are several important oases in the interior, where vegetation is comparatively lush.

## Wetlands

Salt pans (sabkhas) and salt-marshes occur along the coastal strip, formed by the ponding and subsequent evaporation of water behind the coastal dunes. These arise where run-off collects, but the capillary rise of groundwater from a shallow water table has also contributed to the development of these features. Just west of the Tunisian border, in the bay of Bu Kammash (37°03'N/11°43'E), there is slight tidal movement and small tidal salt-marshes occur there. Semi-permanent and temporary pools occur in some wadis and there are several important oases in the interior.

## List of Wetlands Described

1. Coastal Wetlands
  - (a) The West Coast
  - (b) The Gulf of Sirte
2. Oases
  - (a) Oases of the Ghat Region
  - (b) Oases of the Sabha District
  - (c) The Lakes of Wau en Namus
  - (d) The Oases of Kufrah
  - (e) Other Oases

### 1. Coastal Wetlands

**Wetland Name:** THE WEST COAST

**Country:** Libya

**General:** Some slight tidal rise and fall (maximum 40 cm) occurs along the coast west of Tarabulus and some mudflats in the Bay of Bu Kammash (37°03'N/11°43'E) carry salt-marsh vegetation. In addition there are saline pans and marshes on the Plain of Gefara inland. These sites carry halophytic vegetation as described in the regional introduction. Between Az Zawiyah (32°45'N/12°44'E) and Misratah (32°23'N/15°06'E) run-off from the Jabal Tarabulus is, in places, impounded in depressions behind the coastal dunes, and some water bodies so formed may persist from year to year. The most important of these are in the Wadi Kiam between Al Khums (32°39'N/14°16'E) and Zlitan (32°28'N/14°34'E), and in the Wadi Turhat some 50 km east of Tarabulus. These water bodies are brackish and fringed by reeds, rushes and sedges. All these sites are important to wintering and migrating waders and are unprotected.

**Wetland Name:** THE GULF OF SIRTE

**Country:** Libya

**General:** Drainage from the eastern end of the Jabal Tarabulus is by several wadis to the great sabkhat of Tawurgha which extends along shore behind the sand beach for 100 km between Misratah and Bu'ayrat al Hasun. This area of salt-marsh and salt pan is up to 25 km wide and covers 230 000 ha, with fresh water springs at several places on the landward side, e.g. at the village of Tawurgha (32°03'N/15°06'E). The flora and fauna are as described in the regional introduction and the area is unprotected.

Other salt pans, some of considerable extent, occur inland on the Plain of Sirte. One of the largest, parts of which may be temporarily, and very shallowly inundated, is immediately north of Maradah, and at its western end, wells yield potable water. Another, brackish pan, 90 m asl, the Sabkhat al Qunayyin (29°59'-30°26'N/20°50'-21°10'E), covers 120 000 ha and extends N-S for 45 km with a maximum width of 30 km. It lies 100 km northwest of the northern end of the Calanscio Sand Sea, and a chain of small oases stretches between the sand sea and the pan. However, the most important wetland in this region is the great marsh (30°22'-30°55'N/19°50'-20°11'E) behind the coastal dunes at Ajdabiya. This is 70 km long and 12 km wide in places, and carries typical salt-marsh/swamp vegetation. There are clusters of salt pans at its southern and northern ends, but the marsh itself is virtually at sea level, and is permanently wet and brackish. Again, this is an important site for wintering and migrating birds, and also for other elements of the wetland fauna.

North of this, continuing up the eastern side of the Gulf of Sirte towards Banghazi, there is a series of salt pans subject to temporary inundation behind the barrier beach. These begin at Qaminis (31°40'N/20°01'E) and continue as far as Tukrah (32°32'N/20°35'E). Immediately north of Qaminis, a system of pans reaches 40 km inland from the sea. Many carry halophytic vegetation including species of *Juncus*, *Limonium*, *Salicornia*, *Sarcocornia* and *Suaeda*, with *Phragmites* and some sedges along watercourses which frequently carry water. Others north of Banghazi have freshwater pools, but these particular sites are very much disturbed and threatened by the encroachment of urban development. All these sites are important for wintering and migrating birds including *Phoenicopterus ruber*, and all support populations of amphibians and grass snakes.

## 2. Oases

### **Wetland Name: OASES OF THE GHAT REGION**

**General:** The city of Ghat (24°58'N/10°11'E) is situated 640 m asl, close to the Algerian border, under the western slopes of a high promontory (Jabal Arakus) which reaches north from the Tassili N'Ajjer into Libya. There are some 20 natural springs in the city itself, which water gardens and plantations of *Phoenix dactylifera*, and there are numerous wells. Another 15 springs and more wells occur at Tounin, 1 km west of Ghatel, where again, there are extensive date palm plantations. Close by there are 3 permanent spring fed lakes at Tin Djeraben, another at Habschat, and at Feuet, just east of Ghat, three more spring fed pools. At Al Barcat, 12 km south of Ghat, there are numerous pools and areas of natural swampland. There is also a large pan, the Sabkha of Ghat, which holds water temporarily after rainstorms. Water from the springs and wells is fresh, that of the sabkha is saline.

**Flora & Fauna:** The shallow pools and the swamps of Al Barcat support macrophytes, both emergent species, e.g. *Juncus* spp., *Phragmites australis*, *Scirpus holoschoenus* and *Typha capensis*, and submerged species such as *Ceratophyllum demersum*, *Potamogeton* spp., and *Utricularia* spp. Species of *Chara* abound in most of the pools, and there is an abundant plankton. Mosquitoes are present, as well as three molluscs, *Biomphalaria pfeifferi*, *Bulinus truncatus* and *Melanoides tuberculata*; thus both bilharzia and malaria occur here. Four fishes are known from the area. *Barbus deserti* occurs in the pools and swamps of Al Barcat (the type locality) and *Clarias lazera* in most wadis. *Hemichromis bimaculatus* is also present in the ponds of Al Barcat, while *Gambusia affinis* has been introduced to almost all the local ponds, frequently at the expense of the other species. *Bufo regularis*, *B. viridis*, *Rana ridibunda* and *Tomopterna cryptotis* are common. Several small mammals are found here, including cats and rodents.

**Human Impact & Utilisation:** The area has long been inhabited and has supported agriculture for centuries. The city of Ghat is growing and encroaching upon the oasis. There are extensive *Phoenix dactylifera* plantations.

**Conservation Status:** Unprotected.

### **Wetland Name: OASES OF THE SABHA DISTRICT**

**General:** The greatest concentration of oases in Libya, comprising many seguias, springs and pools, is set within a great rectangle of desert, 263 km long and 175 km wide, defined by the 4 co-ordinates 25°54'N/12°56'E; 27°29'N/12°56'E; 27°29'N/15°26'E; and 25°54'N/15°26'E. Within this area the great Idhan (erg) of Ubari extends eastwards from Algeria into Libya, narrowing and terminating in a point, known as the Ramlat az Zallaf, northeast of the city of Sabha (27°03'N/14°26'E). This extension of the erg lies between two valleys, both oriented roughly E-W. These are the Wadi ash Shati on the northern side and the Wadi al Hayah on the southern side. Along the northern side of the erg, 50 km north of Sabha, sands have intruded into the Wadi ash Shati, over a distance of about 160 km between Idri (27°44'N/13°10'E) in the west and Ashkidar (27°32'N/ 14°30'E) in the east. A large number of springs occur along both sides of this wadi giving rise to settlements at Idri, Qattah, Al Qardah and Ashkidhar, and *Phoenix dactylifera* plantations occur almost throughout the valley.

Other springs and saltwater lakes occur in depressions between the dunes of the erg proper, in the area between Ubari (26°35'N/12°46'E) to the SW and Sabha to the NE. The lakes occur where the water table reaches the surface, and in some places it appears that the water emerges under pressure. The most important are at Al Emba (26°52'N/13°01'E), Mandara (26°47'N/13°19'E), Umm al Hasan (26°55'N/13°22'E), Fredga (26°59'N/13°22'E), Bahar et Truna (26°58'N/13°36'E), Nesc'nuscia (27°00'N/13°41'E), Umm al Ma (26°52'N/13°41'E), Bahar ed Dud (26°46'N/13°45'E) and Tadcema (26°52'N/13°54'E). While some of these lakes are marked at different co-ordinates on different maps we believe the positions given here to be accurate.

On the southern side of the erg extension (Ramlat az Zallaf) there are springs and plantations at Ubari, and passing eastwards, others along the Wadi al Hayah in the vicinity of Al Fjayj (26°33'N/13°19'E), and yet others at Sabha and Samnu (27°17'N/14°56'E).

An elevated rocky strip of land some 60-70 km wide, separates the Idhan Ubari (Ramlat az Zallaf) in the north from another great erg, the Idhan Murzuq to the south. Wadis fringe the northern margins of this latter erg, and oases again occur in their beds. There are several springs between the towns of Tsawah (25°59'N/13°29'E) and Murzuq (25°56'N/13°58'E) on the Wadi Atabah, surrounded by extensive date palm plantations. Further east a long and narrow extension of the erg carries many more springs along its northern flank, from Umm al Aranib (26°09'N/14°48'E) eastwards for 53 km towards Tmissah (26°19'N/15°45'E), and again this strip of desert is heavily planted with *Phoenix dactylifera*.

In this region, which has few recording stations, June is the hottest month, with a mean temperature of 32.3°C at Sabha, and January the coldest month, with a mean temperature of 11.2°C. Absolute minimum temperatures at ground level are extremely close to 0°C, though no frost has been recorded at Sabha, and absolute maxima in the area probably approach 50°C, e.g. 49°C was recorded at Murzuq in July 1932. Clouds are uncommon in the sky and mean annual rainfall probably does not exceed 10 mm throughout the region. Totally rainless years are not uncommon.

**Hydrology & Water Quality:** The spring waters are generally fresh, but those of the pools and swamps between dunes are often highly saline with conductivities approaching 2750 µSiemens/cm.

**Flora & Fauna:** Algae occur in the pools, where *Chara* spp. are common and often abundant. *Phragmites* and *Scirpus* grow around some pools, but most natural trees have been cleared and replaced with *Phoenix dactylifera*. The fauna is not well known but *Bulinus truncatus* is widespread and bilharzia occurs in the area. No fish are recorded from the area. However, the pools on the erg (Ramlat az Zallaf) are famous because the brine shrimp, *Anemia oudneyi*, occurs in them. Species of *Bufo* and *Rana* occur at oases in the wadis. The typical spectrum of desert mammals is present.

**Human Impact & Utilisation:** The pools of the erg are little disturbed and support small communities of negroid people, who have clearly been isolated for a great length of time. The valley oases are the sites of settlements, large and small. Herding and the culture of dates and other crops occurs at most of them. The natural vegetation of the oases has largely been destroyed. Sabha has a population in excess of 300 000 and water is piped in from other oases.

**Conservation Status:** Unprotected.

**Wetland Name:** THE LAKES OF WAU EN NAMUS

**Country:** Libya

**General:** In southern central Libya, on an isolated and elevated stony plain, is the volcanic crater of Wau en Namus (24°54'N/17°47'E). It is a young volcano, formed about 5000 years ago, and part of a sporadic chain of volcanoes leading away to the northwest. The crater is 4 km in diameter with a central cone 120 m high, about the foot of which are 5 small lakes, 434 m asl, totalling 32 ha in extent. The lakes are saline although fed by freshwater springs, some of which are hot. Their salinity is presumably due to the fact that over the long period of their existence, c. 5000 yrs, they have concentrated salts with rates of evaporation which could be as high as 5000 mm/yr. Over most of the crater floor the water table is barely 1 m deep. Three lakes are thought to be permanent, while the two smallest ones are known to dry up periodically.

**Flora & Fauna:** The lakes are fringed by *Phragmites australis* and there is a grove of *Hyphaene thebaica* and *Tamarix nilotica*. We have no information regarding the fauna except that it is a stopping off point for migrating waterfowl.

**Human Impact & Utilisation:** The oasis is visited by travellers along the caravan route between the large oases at Sabha (27°03'N/14°26'E) and Al Kufrah (24°10'N/23°15'E). However, traffic along this route has declined in recent years. The oasis is not inhabited and is virtually undisturbed.

**Conservation Status:** Unprotected.

**Wetland Name:** THE OASES OF KUFRAH

**Country:** Libya

**General:** The town of Al Kufrah with its several oases is situated in an elliptical trough, measuring 100 km from E-W and 60 km from N-S, in the southeastern desert. The basin has a flat sandstone floor at an altitude of 465 m asl, and is surrounded by scarps and low hills reaching 600 m asl on the north, east and south, with a sand desert, the Ramlat Rabyanah on the west. The water table is close to the surface throughout the trough and lakelets occur in depressions between dunes adjacent to the trough in the Ramlat Rabyanah, e.g. at Rabyanah (24°14'N/21°59'E), 'Ayn (24°26'N/22°26'E) and Buzaymah (24°44'N/22°03'E). In the Al Kufrah trough the principal oases are at Bir al Ikwan (24°30'N/23°26'E), 'A 'ilat al Judayyid (24°22'N/23°30'E), Buwaymah (24°14'N/23°24'E), At Taj (24°13'N/23°17'E), Al Kufrah (24°08'N/23°18'E) and At Tallab (24°08'N/23°11'E).

There is a series of small saline (natron) lakes in the Al Kufrah trough, some of which are hypersaline with crystalline sodium sulphate on their beds. Nevertheless, it appears that all the lakes derive their water from the underlying groundwater, and not from the evaporation of rainwater which is virtually nil. Mean annual precipitation at Al Kufrah is less than 2 mm and one year in every 2.6 is completely rainless. The maximum annual precipitation recorded was 12.5 mm. The mean monthly temperatures of the hottest month, August, are around 31°C and those of the coolest month, January, 12°C. Absolute maxima are in excess of 45°C throughout the trough while absolute minima are about -2°C. Potential evaporation is said to approach 6000 mm/yr.

**Flora & Fauna:** A species of *Ruppia* occurs in some lakelets between dunes in the erg, and these are fringed by *Cyperus laevigatus* with stands of *Phragmites australis*, all backed to landward by *Juncus maritimus*, and this in turn by *Tamarix* bushes and palms, originally

*Hyphaene* but now largely *Phoenix dactylifera*. Many of the springs and ponds of the trough are also reed fringed and contain abundant algae, chiefly *Chara vulgaris*. There are extensive *Phoenix* plantations in the trough. We have no reliable information regarding the fauna.

**Human Impact & Utilisation:** Dates are grown and water from the oases supports a substantial human population in several small towns. Major irrigation schemes were inaugurated in the 1960s and it is planned to pump water supplies from the underground basin to the coast via the Sarir Water Wells Field (27°35'N/21°26'E).

**Wetland Name:** OTHER OASES

**Country:** Libya

**General:** Vast water supplies lie beneath the Ramlat Rabyanah, and natural oases occur on the northern fringes of the erg at Zighao (25°28'N/22°04'E), 245 m asl, and at Tazirbu (25°43'N/21°06'E), 184 m asl. Water is extracted from the artesian basin south of Tazirbu and pumped from the water wells there to the Sarir field en route to the coast.

Other oases occur at Wau al Kabir (25°20'N/16°43'E) 415 m asl, in the central south, and at Al Awaynat (25°52'N/10°36'E) 105 km north of Ghat. In the north central district, south of the Plain of Sirte, there are oases at Waddan (29°12'N/15°56'E), Al Fuciha (27°52'N/16°22'E), Zallah (28°33'N/17°34'E) and Maradah (29°15'N/19°11'E).

The most easterly group of oases is situated near the Egyptian border in the vicinity of Al Jaghbub (29°42'N/24°38'E). The most northerly is at Saniyat ad Daffah (30°07'N/24°08'E), and the most southerly is in the Great Sand Sea at Bir at Tarfawi (29°34'N/24°03'E). Two others, Ayn Malfa (29°49'N/24°50'E) and Ayn al Qusaybayah (29°35'N/24°48'E), are right on the border, the latter below sea level. This group is of biological interest because the oasis at Al Jaghbub contains molluscs of marine origin, including a population the relict cockle, *Cardium edule* ssp. *rectidens*.