Egyptian Natural Resources

3

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Abstract

Abstract: The Arab Republic of Egypt is the main northeastern entrance of Africa continent. The total area of Egypt territory is around one million square kilometer and occupied by approximately 95 million inhabitants who live on about 4% of this area. This chapter presents an overview of the land, water, and human resources in Egypt. Egypt land is geographically divided into five sections: Western Desert, Eastern Desert, Sinai Peninsula, Nile Valley, and Nile Delta. These sections involve 33 soil units in which sandy areas and loamy sand/sandy loam soils cover over 57% of their surface. Despite that, agriculture is the fundamental economic activity in Egypt. The Egyptian agricultural lands could be classified as Oldlands and Newlands. The Oldlands are assigned for the fertile and intensively cultivated lands in Nile Valley and Delta that have been farmed since ancient time till now, whereas the newly reclaimed areas that have been cultivated relatively recently or in the process of reclamation now are known as Newlands. The natural water resources in Egypt are inadequate since the primary water source is the annually fixed share of Nile River of 55.5 BCM that is utilized for almost all human activities despite the high growth rate of population. The Egyptian government adopts strategies to utilize the non-conventional water resources (mainly recycled agricultural drainage, shallow groundwater, and treated wastewater) in irrigation as the agricultural sector consumes 80–85% of available freshwater in Egypt. At the administrative level, Egypt involves 27 governorates in which New Valley governorate represented 42% of total Egypt's area and occupied with only 0.25% of the Egypt total population. Conversely, the Great Cairo (involves Cairo, Giza, and Kalyoubia governorates) occupied by around 25% of the total population. Agricultural sector supports the livelihood to approximately two-thirds of the Egyptians and considers the primary source of income to about 60% of Egyptians.

Keywords

Land resources • Water resources • Human resources
Soil map

3.1 Introduction

Egypt, a common name of Arab Republic of Egypt, is a part of Sahara (largest hot desert in the world) in the Northern Africa region (Fig. 3.1). The Nile River and its deposits make Egypt rich with its black soils with the fertile deposits that cover the area around the Nile Valley and Delta and make obvious green area over the extended desert (Fig. 3.1). This green area supported the settlement of ancient Egyptians who built one of the oldest and greatest civilizations in the world history (Zahran and Willis 2009; Negm et al. 2017).

The ancient Egyptian civilization is obviously depended on agriculture as the ancient Egyptians settled around the Nile over 3000 B.C. (Zahran and Willis 2009; Negm et al. 2017; Embabi 2018). Since then, the agricultural sector in Egypt has been continuously evolved and developed, and the investments in agriculture have been exponentially increased with time. With the vast population growing (Egypt is the largest Arab world country in the population), more pressure is added to the Egypt's natural resources especially land and water resources.

Egypt covers an area of little over one million square kilometers (1,004,458 km^2) with around 95 million inhabitants (CAPMAS 2017a) who are settled on about 4% of the Egypt territory (in Nile Valley and its Delta) and the rest of Egypt's land (around 96%) is preserved as desert land (Bakr

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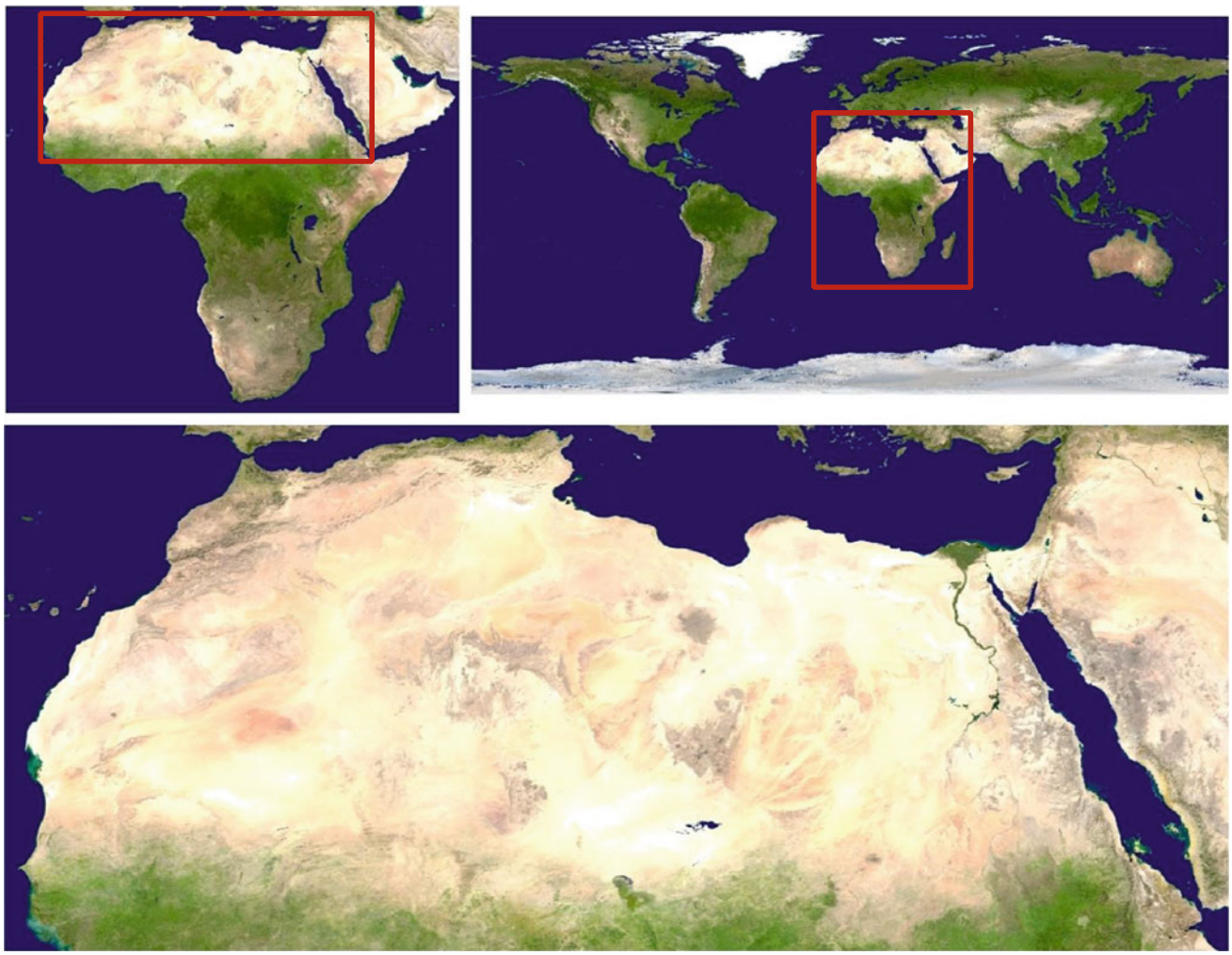

Fig. 3.1 The extend of Sahara Desert in the northern Africa continent. Updated from NASA visible earth, https://visibleearth.nasa.gov/view.php?id=57752

et al. 2010). Based on Hamdi and Abdelhafez (2001), the width of the Nile Valley is about 18 km, whereas the total area coverage of Nile Delta is reported between 19,000 and 22,000 km^2 which represents around 2% of Egypt area, support over 60% of the total fertile land in Egypt, and populated with around half of the Egypt's total population.

Historically, the branches of the Nile in the Delta region were seven, namely, from west to east, Canopic (currently, Rosetta Branch), Bolbitinic, Sebennitic, Fatmetic (currently, Damietta Branch), Mendisy, Tanitic, and Pelusiac Branchs (Zahran and Willis 2009). Now, only two main branches can be recognized (Fig. 3.2): Rosetta branch (235 km length) in the west and Damietta branch (240 km length) to the east (Stanley and Warne 1993; Hamdi and Abdelhafez 2001; Negm et al. 2017).

This chapter focuses on three natural resources in Egypt: land, water, and human resources. General idea about the main geographical locations and geological features in Egypt territory will be discussed. Besides, this chapter provides a general knowledge of the soil map of Egypt with its different units. The geographic information system tools are intensively used in this chapter to provide the results in attractive and easier ways to be understandable by the decision-makers and the scientific community at national and international levels.

3.2 Egyptian Natural Resources

3.2.1 Geographical Location and Land Resources in Egypt

Egypt is geographically located in the northeastern corner of Africa between latitudes of 22° and 32° N and longitudes 25° and 37° E (Fig. 3.3). Based on the location map (Fig. 3.3), two inland countries are bounded west and south borders of Egypt, Libya, and Sudan, respectively. Besides, two water bodies are touched east and north boundaries: Red

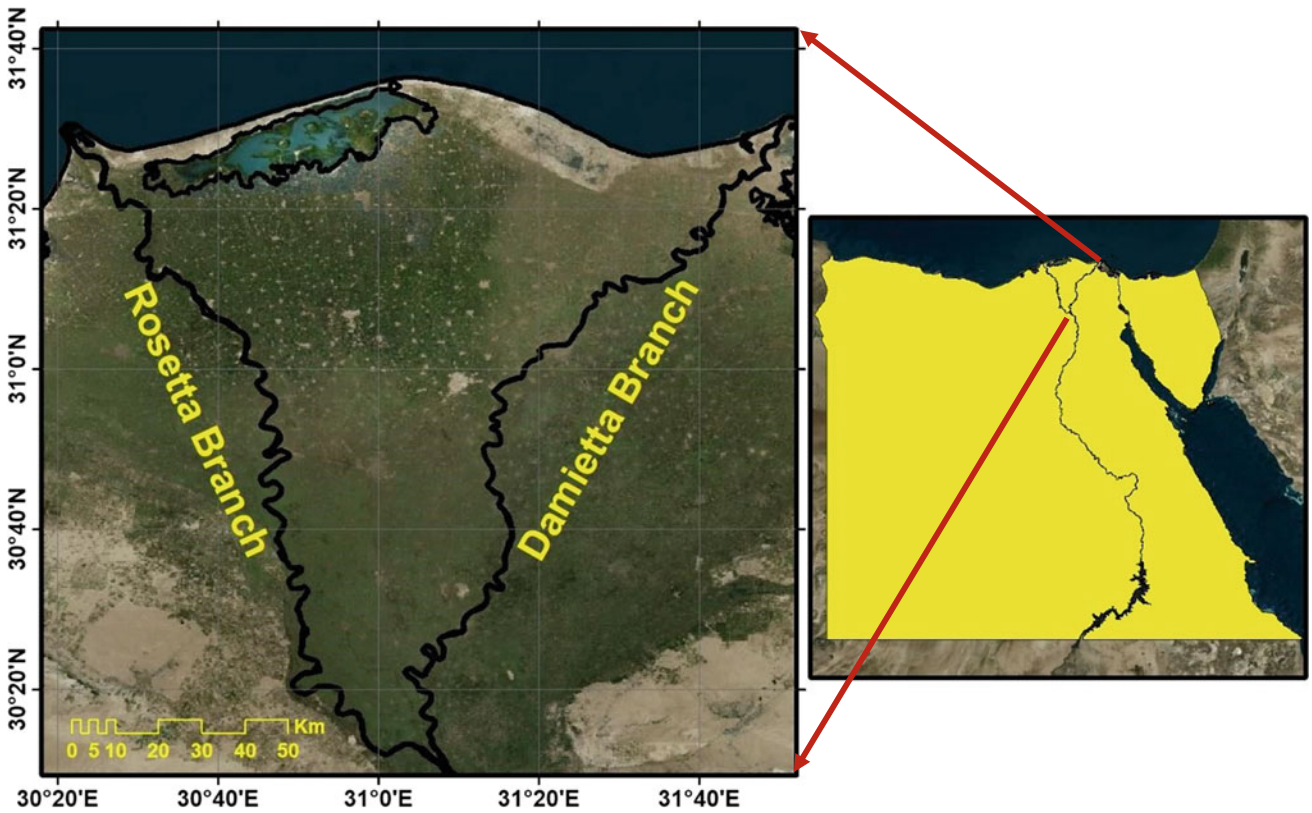

Fig. 3.2 The two main branches of the Nile Delta, Egypt. Created by authors

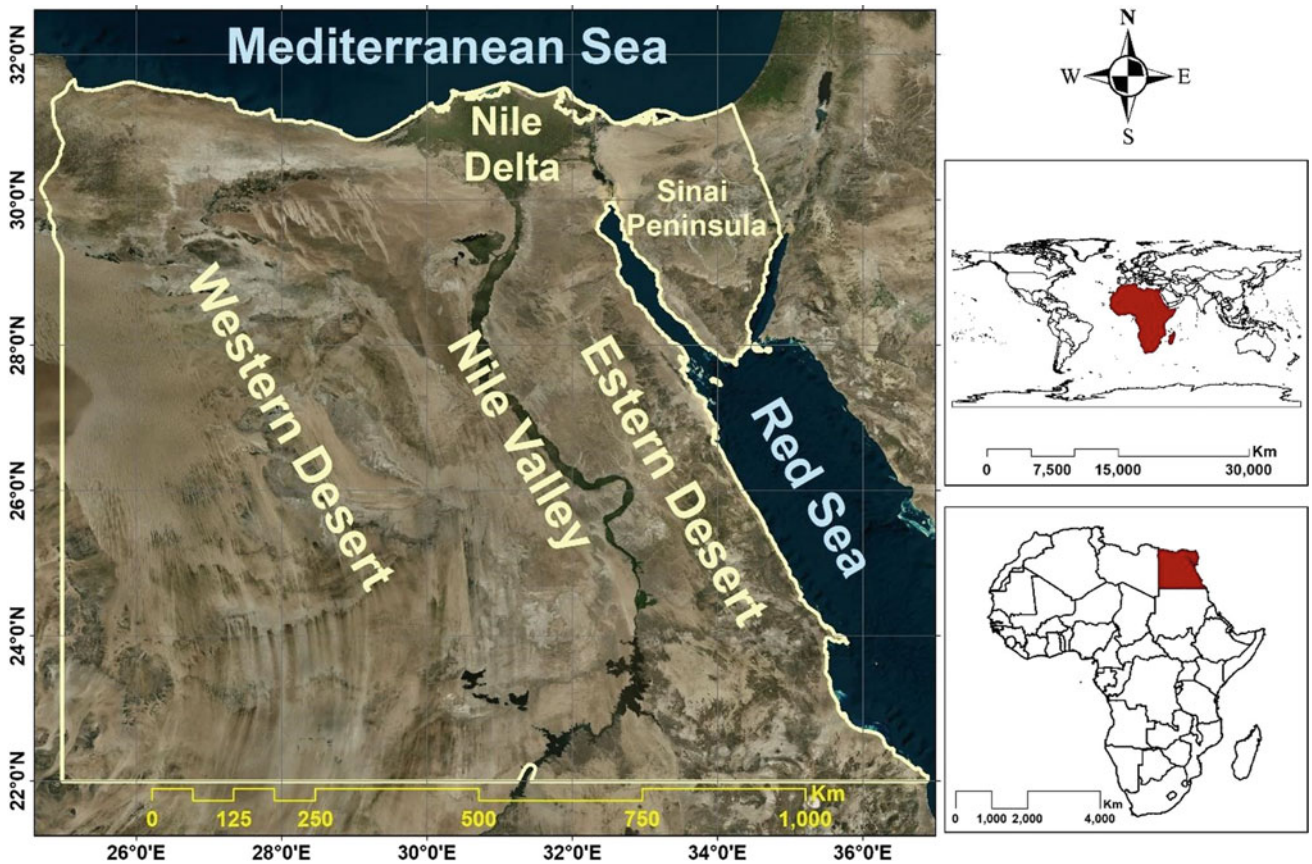

Fig. 3.3 Arab Republic of Egypt general location with the main geographical zones. Created by authors

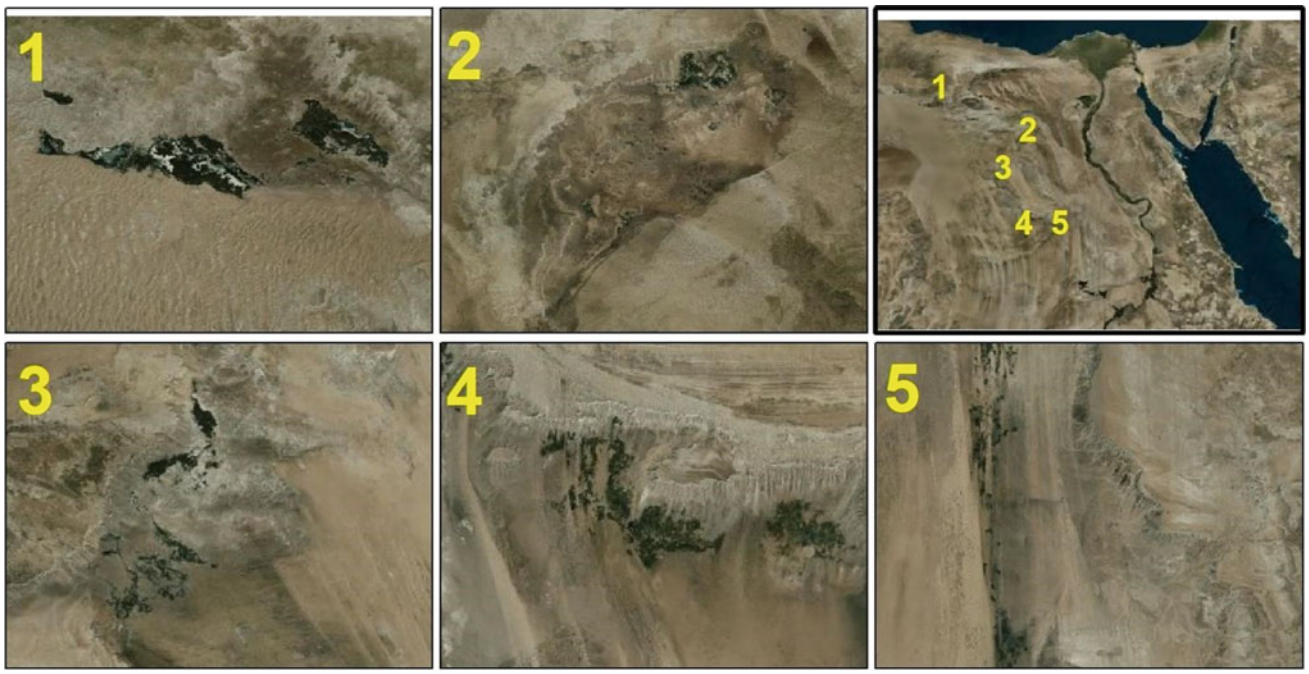

Fig. 3.4 The location of the five oases in the western desert, Egypt, namely, from north to south; (1) Siwa, (2) Bahariya, (3) Farafra, (4) Dakhla, and (5) Kharga oases. Created by authors

and Mediterranean Seas, respectively. The total area of Egypt is around one million Km^2. Geographically, the Nile valley and Delta divided the desert land in Egypt into two main parts: western desert (represents two third of Egypt territory) and eastern desert. Additionally, Sinai Peninsula represents 6% of the Egypt area and belongs to Asia continent which makes Egypt a trans-continental country (Omran 2017).

3.2.1.1 Western Desert

The Western Desert (almost two-thirds of total Egypt area) is characterized by different features. Besides the grazing, as one of the main economic activities in the desert areas, a scattered rained barley crop (as a main annual cultivated crop) has been grown in the northern Mediterranean coastal region of Egypt which is characterized by a seasonal rainfall during winter months. Figs, olives, and almonds are successfully cultivated in that region. Besides, xerophytes are the most abundant natural vegetation species in that coastal area (Zahran and Willis 2009). The Western desert also involved well-known oases, namely, Siwa, Bahariya, Farafra, Dakhla, and Kharga Oases (Fig. 3.4). Besides the oases, three common depressions are highly recognized in the western desert, namely, Fayoum, Wadi El-Natrun, and Qattara depressions. From them, only Fayoum depression is intensively cultivated just like Nile Valley and Delta (Fig. 3.5), whereas the other two depressions are salty areas with less agricultural activities. Rather than those areas, the rest of the western desert is almost barren soils with no observed agricultural activities. Some efforts for reclamation are taken place in different areas in western desert close to the Nile Valley and Delta (Bakr et al. 2010).

3.2.1.2 Eastern Desert

The Egypt's Eastern desert occupies around one-fifth of Egypt area. It characterized by high relief due to the presence of Red Sea Mountains that formed a narrower coastal area compared with the wider coastal land for the Mediterranean region in the north. Due to the high relief and multiple mountains in this region, there are intensive numbers of dry Wadis that are spread over the eastern desert (Fig. 3.6). The coral reefs are the most known water species that occur along the Red Sea coastal area width of 50–100 m wide (Zahran and Willis 2009).

3.2.1.3 Sinai Peninsula

Sinai Peninsula occupies around 6% of Egypt territory and formed as a triangular plateau (Fig. 3.7). Gulf Suez and Aqaba bordered the Peninsula from the west and the east sides, respectively, whereas the Mediterranean and Red Seas bordered its north and south sides, respectively. Wadi El-Arish basin is one of the most well-known geographical features in the northern Sinai (Embabi 2018). Zahran and Willis (2009) stated that due to the difference in the environment within north, central, and south Sinai, hundreds of flora can be recognized in this region.

Fig. 3.5 Three main depressions in the western desert, Egypt: (1) Fayoum, (2) Wadi El-Natrun, and (3) Qattara depressions. Created by authors

3.2.1.4 Nile Valley and Delta

The band of the Nile in both of its sides represents that the Nile Valley (also its common name is upper Egypt) has an area around 11,000–12,000 km^2 over a distance of >1000 km (Fig. 3.8) whereas Lower Egypt is a common name of the Nile Delta region (Zahran and Willis 2009). The soils of the Nile Valley and Delta consist of alluvial deposits (Nile mud, besides gravel and sand). Before the construction of Aswan High Dam, the Nile water was carrying the silt particles which gave an annual increase in sediment by a rate of 1 m of mud every 1000 years (Abdel Meguid 2017). Those two areas (Nile Valley and Delta) represent the oldland that are the main cultivated land in Egypt and support over 90% of the agriculture activities in the whole country except the sand areas, salt marshes, sabkha, and swamps features in the northern Nile Delta Mediterranean coast (Fig. 3.8).

The new reclaimed areas around the two Delta Fringes (Fig. 3.8) had taken places over the last six decades till now. Modern irrigation technologies and systems (sprinkler and drip irrigation) have been used to increase the water use efficiency and reduce the water unit requirements per cultivated unit area (ICARDA 2013). The area outside the two fringes of Nile Delta (eastern and western sides) attracts the attention of stakeholders, scientists, and decision-makers as a promising reclaimed area for agriculture development, as those areas are adjacent to the center area of Egypt (Nile Delta). Cropping system in the

Fig. 3.6 The main drainage network in the eastern desert. Created by authors

Fig. 3.7 Sinai Peninsula, Egypt. Created by authors

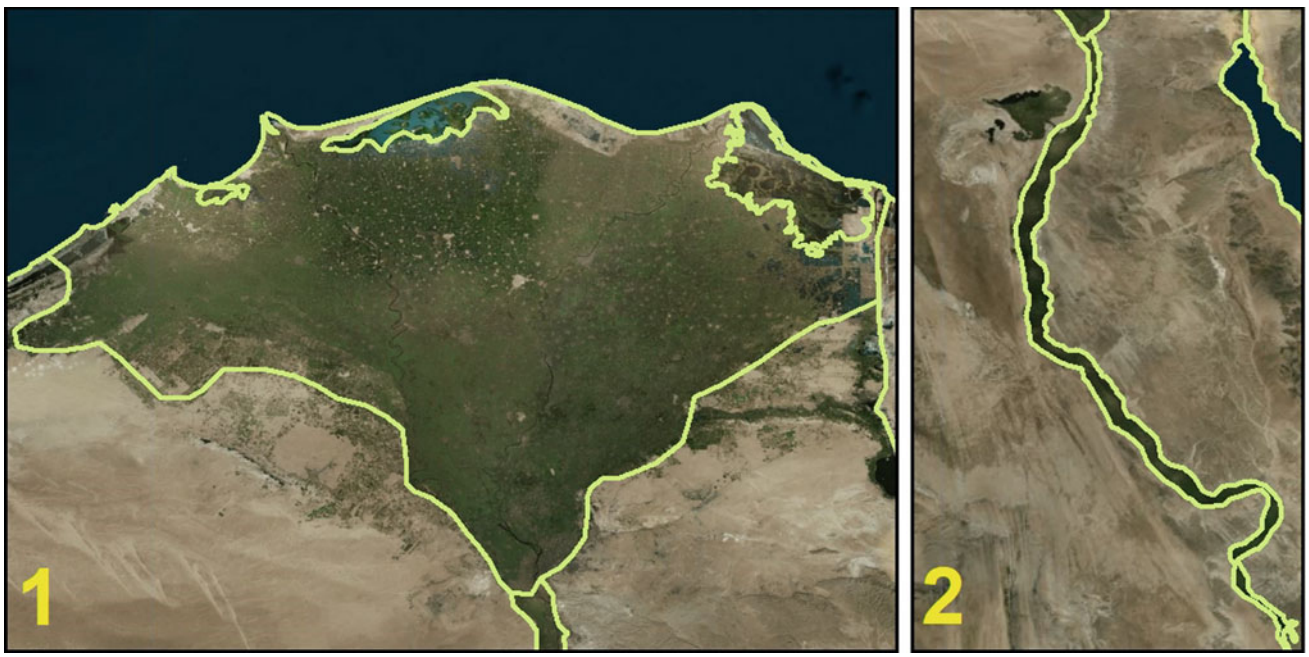

Fig. 3.8 Nile Delta and its extension (1) and the Nile Valley (2), Egypt. Created by authors

oldland has three consecutive cropping seasons: winter, summer, and *nili* seasons, which all depend on the traditional surface irrigation systems from the Nile. Additionally, some areas are cultivated with annual crops, such as sugarcane (mainly in Upper Egypt) and fruit trees. This cropping rotation is exponentially the cropping area to around 13.7 million feddans with crop intensity of 172% (Abdel Meguid 2017).

3.2.2 Egypt Landform

The general climate of Egypt is hot dry summers and warm rainless moderate winters. The rain is limited to the narrow strip of north coastal area with less than 200 mm/year during winter season (Zahran and Willis 2009). The detailed climate information and data are discussed in Chap. 5. Based on the digital elevation model (DEM), the relief of Egypt is ranged

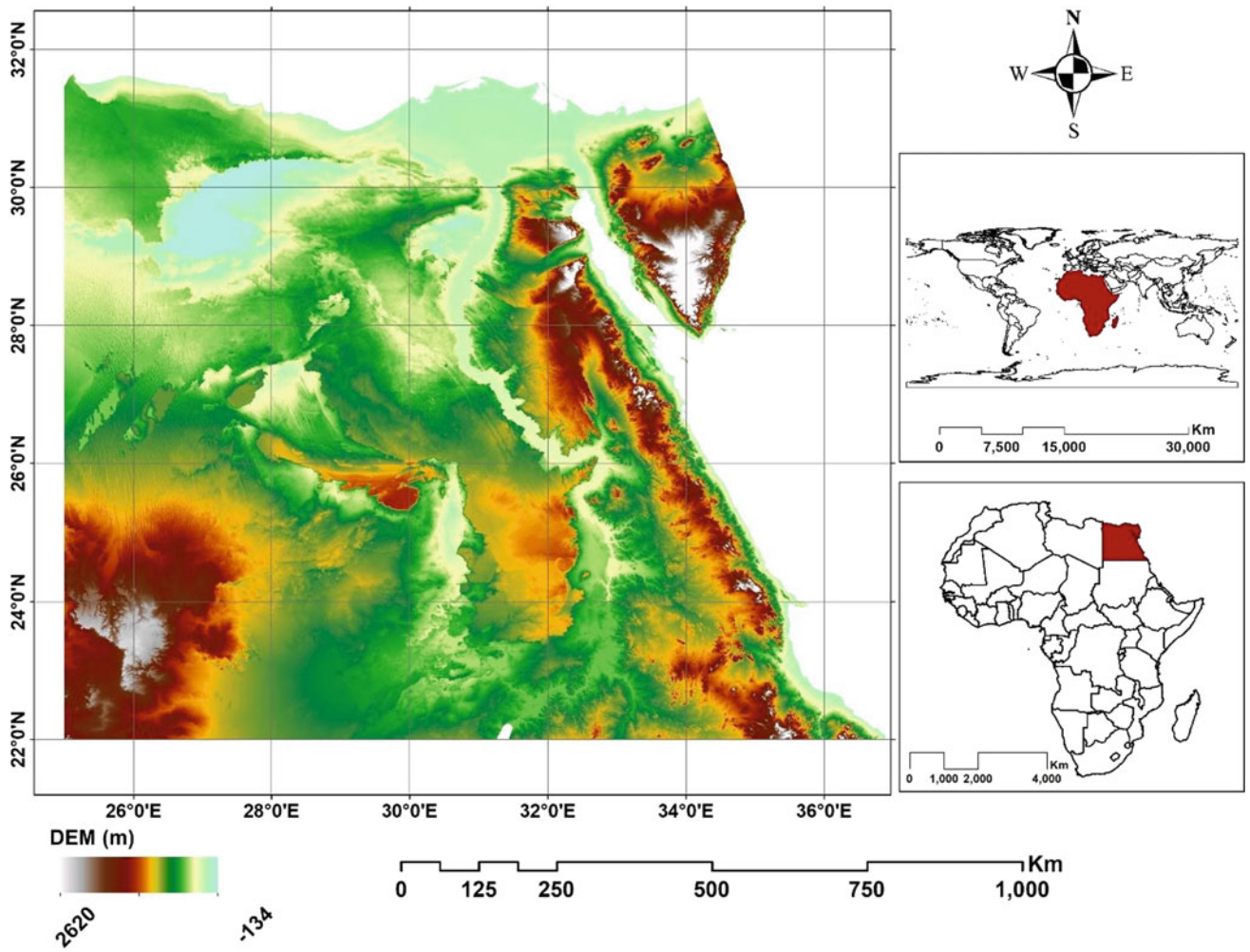

Fig. 3.9 The digital elevation model (DEM) of Egypt. Created by authors

from −133 m below the sea level (lowest point in Qattara Depression) to a maximum of 2620 m above sea level at Mount Catherine in southern of Sinai Peninsula (Fig. 3.9). Other high altitudes can be observed in the Red Sea Mountains along the Red Sea coast in the eastern desert and the Gilf Kebir plateau in the southeastern corner of Egypt (Worldatlas 2017). The final DEM was produced based on the NASA Shuttle Radar Topographic Mission (SRTM) data, 90 m resolution that was downloaded from the US Geological Survey website, in georeferenced tagged image file format (GeoTIFF), using Earth Explorer (U.S. Geological Survey 2017). The Global Mapper 17 software was used to mosaic the different scenes together and produced the final DEM map (Fig. 3.9). Embabi (2018) discussed the main landforms of Egypt territory as

- Nile Delta includes Deltic Plain, sabkhas and stabilized sand dunes, and Nile Valley.
- Eastern Desert with four major landform: (a) El-Galalah Plateaus in the northern eastern desert which involve El-Galalah El-Bahariyah, north, El-Galalah El-Qibliyah, south, and Wadi Araba, in between; (b) dune fields in southeastern corner of eastern desert (El-Hebal dunes, El-Allaqi dune, a Wadi Kraf dune); (c) drainage basin such as Wadi Qena; and (d) Red Sea Mountains that include dyke swarms, intermountain basins, and ring complexes circular mount.
- Sinai Peninsula; Sinai mountains (south Sinai) involve same features like Red Sea Mountains. North Sinai involves north Sinai Sand Sea, different types of dunes, and Wadi El-Arish.
- Western Desert involves carbonate ridges, coastal lagoons, and sabkhas in northwest coast, sandstone plateaus of Gilf Kebir and Abu Ras in southwest, Qattara, Kharga–Dakhla, and Fayoum depressions, Karstified Carbonate Platforms, Great Sand Sea, and Ghard Abu Moharik.

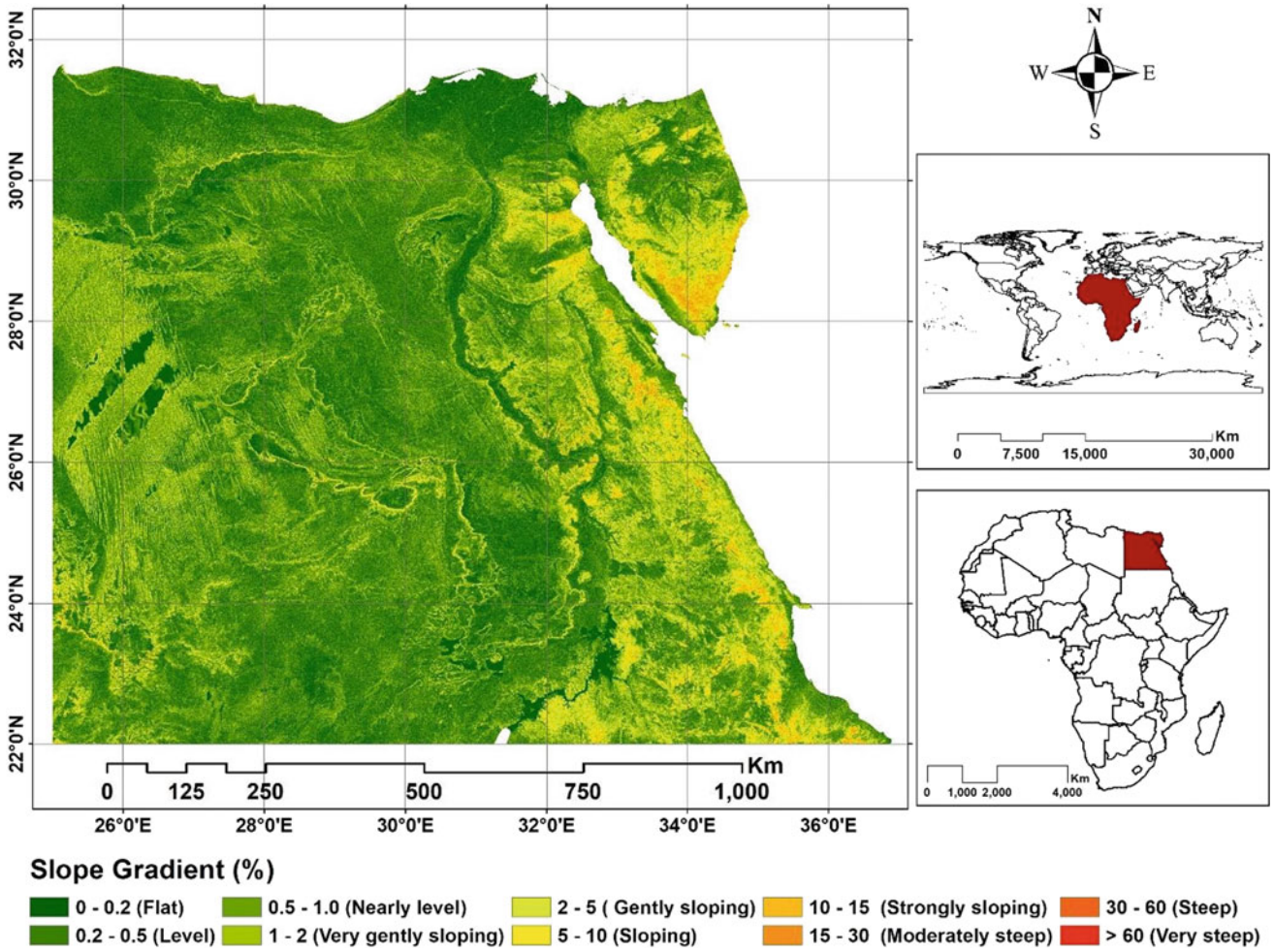

Fig. 3.10 The slope gradient of Egypt extracted from DEM. Created by authors

From the obtained DEM, the slope percentage was calculated for the entire country. The resulted slope map indicated that the flat slope (<2%) can be observed in the Nile valley and Delta regions as well as the northwestern corner of western desert (Fig. 3.10). The highest slope (very steep slope > 60%) is shown in the southern Sinai Peninsula where Mount Catherine locates. Other high slopes can also be noticed along the coastal zone of Red Sea Mountains. Generally, the eastern desert and Sinai Peninsula have higher slope compared with the western desert.

3.2.3 Water Resources in Egypt

The natural water resources in Egypt are very limited as almost all human activities are depending on a fixed share of Nile River of 55.5 BCM annually. Due to the vast increases in the Egyptian population (around 94 million in 2017, CAPMAS 2017a), the annual share per capita decreases to 700 m^3 in 2011, which is already below the water poverty line of 1000 m^3/capita/year and expected to be 500 m^3 by 2030 (Egyptian Ministry of Agriculture and Land Reclamation, MALR 2009). The other natural water resources such as rainfall and groundwater are contributed by significantly smaller amounts which are not sufficient to meet the increasing demand of the population needs. CAPMAS (2016) stated that in 2015, the total water resources of Egypt were around 76 BCM involving the 55.5 BCM of the Nile share and the non-conventional water resources which include mainly recycled agricultural drainage (around 12 BCM), shallow groundwater in the Nile Valley and Delta (about 7 BCM), and wastewater recycling (1.3 BCM) (Elbana et al. 2017). These non-conventional water sources can be used in irrigation as the agricultural

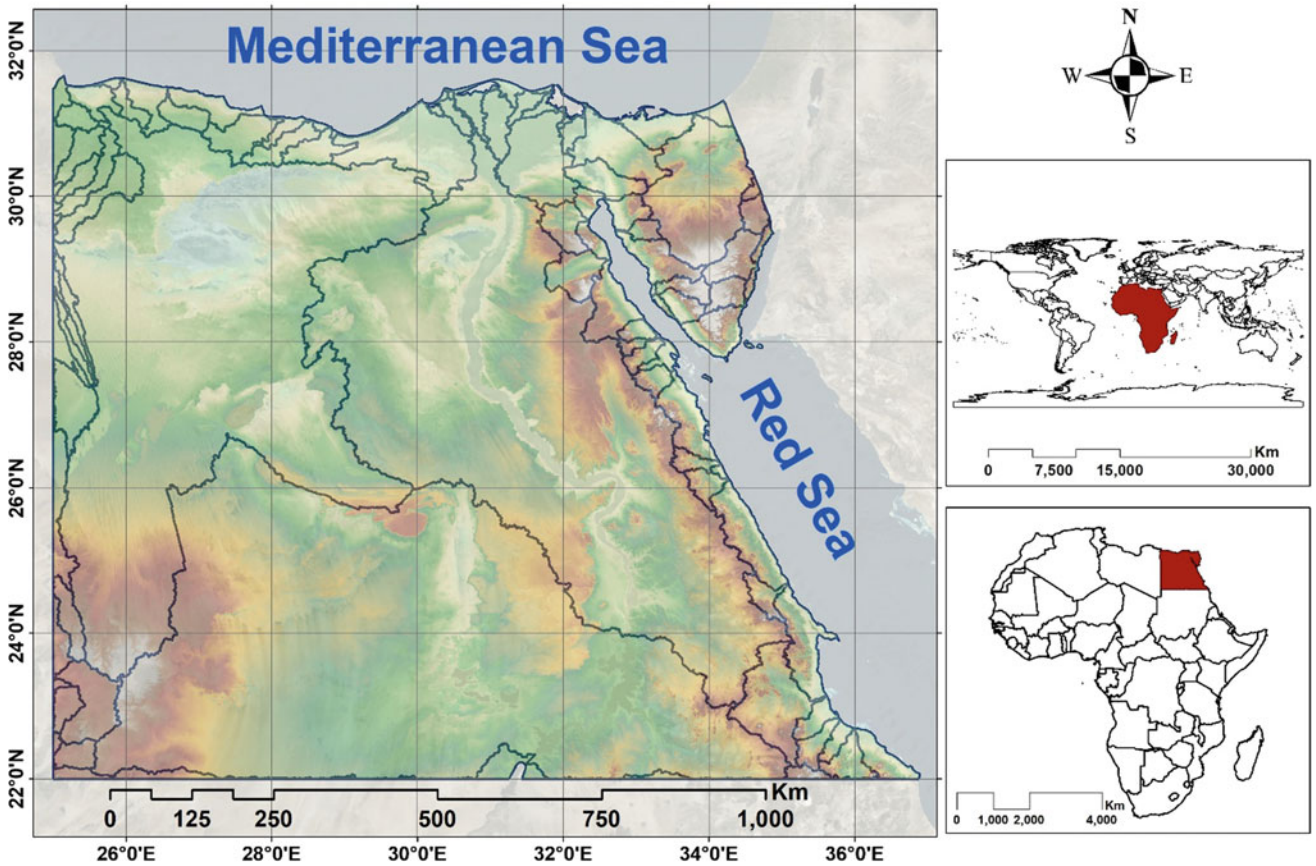

Fig. 3.11 The main basins in Egypt based on hydrological analysis of DEM in Egypt. Created by authors

sector consumes from 80 to 85% of available freshwater in Egypt (Ali and Mahmoud 2004; MWRI 2014). Based on the digital elevation model, the hydrology tools in ArcMap were used to extract the main basins for the entire country. Different basins can be recognized in Egypt as shown in Fig. 3.11.

Additionally, the hydrology tools were also used to extract the natural streams (drainage network) in each basin. Due to the excessive number of basins in Egypt, some basins were selected to study the natural streams in them separately. Those main selected basins were three largest basins (east, west, and south parts of the country), another three basins in Nile Delta, besides one basin in Sinai Peninsula which is mainly Wadi El-Arish basin (Fig. 3.12). Embabi (2018) stated that there are 40 basins in Sinai (Fig. 3.11) among them Wadi El-Arish basin (Fig. 3.12) represents 36% (21,700 km^2) of Sinai Peninsula area.

The Nile River and its branches, as the main source of natural water resource in Egypt, besides the main natural drainage network as well as the main surface water areas for the entire country are presented in Fig. 3.13. As the relief in Sinai Peninsula and eastern desert increases, the drainage network is intensively existed in those areas. Based on Zahran and Willis (2009), wadis are one of the main and important ecosystems of the Egyptian deserts. Wadis represent drainage systems that are used to collect water from the catchment areas and additionally are spread over the northwestern coast (NWC) of Egypt. Embabi (2018) illustrated that the eastern desert involved 21 and 28 basins from Nile (e.g., Wadi Qena) and Red Sea (e.g., Wadi Araba) drainage systems, respectively. This is why eastern desert had extensive drainage networks.

3.2.4 Human Resources and Socioeconomic Sittings in Egypt

At a national level, Egypt involves 27 administrative divisions that are known as governorates (CAPMAS 2017a) (Fig. 3.14; Table 3.1). Five governorates have shared boundaries with

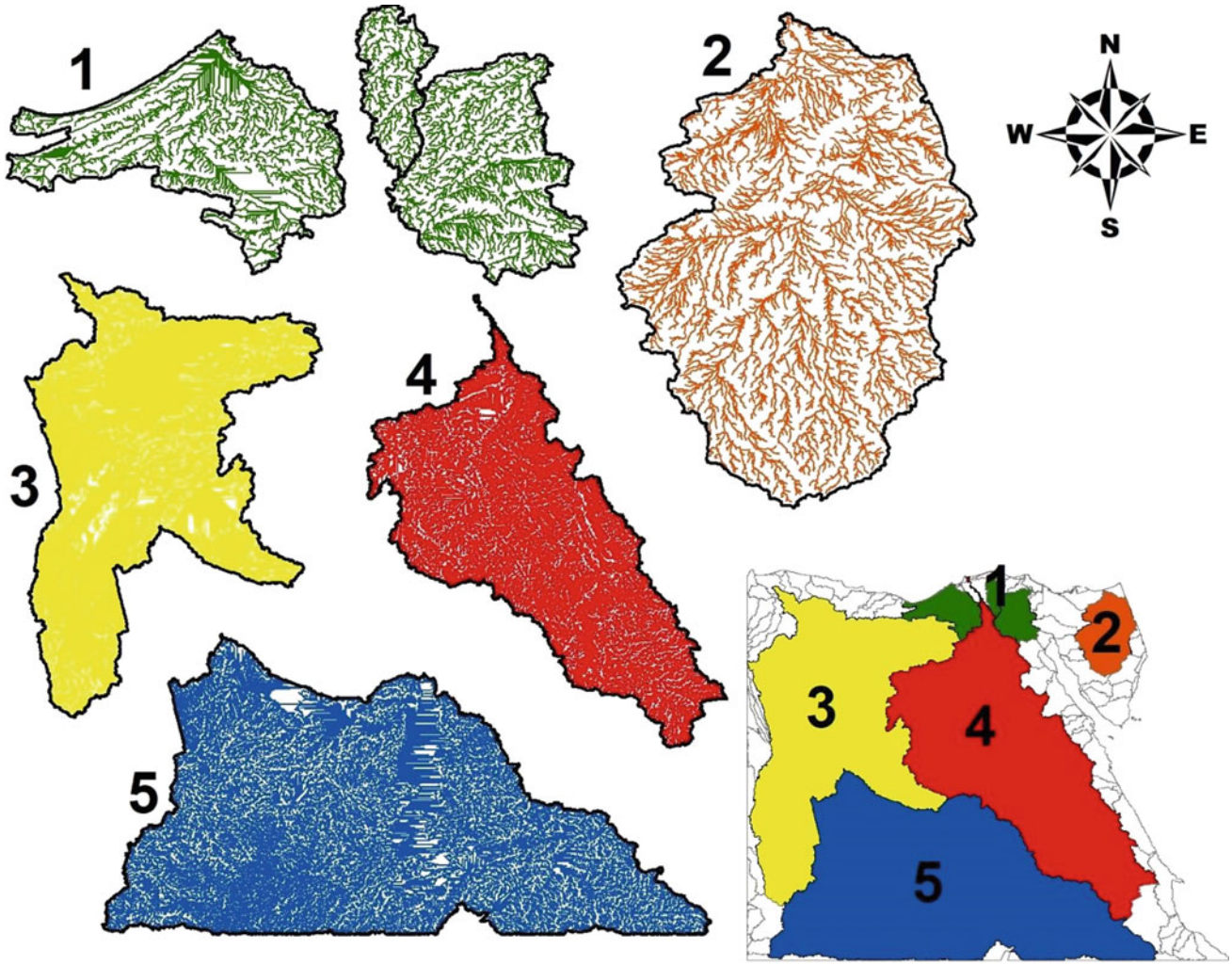

Fig. 3.12 The streams of the chosen main basins in Egypt: (1) east, west, and central Nile Debasins, (2) main basin in Sinai Peninsula, (3) western main basin, (4) eastern main basin, and (5) southern main basin in Egypt territory. Created by authors

foreigner countries (Matrouh, New Valley, Aswan, Red Sea, and North Sinai). The largest governorate in area is New Valley (42% of total Egypt's area) and only 0.25% of the Egypt total population live in, whereas around 25% of population are settled in a Great Cairo (Cairo, Giza, and Kalyoubia governorates) (Table 3.1). The lowest governorate in population is South Sinai with only 102,000 persons living in it. Based on CAPMAS (2017), the Egypt total population is 94,798,827 and the total inland area is 1,004,458 km^2 (Table 3.1).

Those governorates are administratively divided into 364 districts. The Capital "Cairo" involves the highest number of districts of 43 (Table 3.1). Based on the general infrastructure of Egypt (Fig. 3.15), within the 27 governorates, there are around 24 main cities, 122 towns, and 117 villages. There are huge road networks that connect all these cities, towns, and villages together. The estimated total length of these networks is around 27,300 km^2, ranged from highways to smaller width roads between villages (Fig. 3.14) (FAO-Stat 2017) (Fig. 3.15).

Agricultural sector in Egypt is the main source of income to around 60% of Egyptians (Fig. 3.16), as it supports the livelihood to around two-thirds of the Egyptians (ICARDA 2013). Within the last five decades (1960–2016), the population in the rural areas sharply decreased from 62% (during 1960s) to around 56% (during 1975). Recently, the rural population represents around 58% of Egyptian total population (Fig. 3.16). The rural population growth was less than the national population growth by around 1% between 1960 and 1980, whereas after 1980 till now the rural population growth is higher than the national population growth especially after 2010 based on the presented data shown in Fig. 3.16.

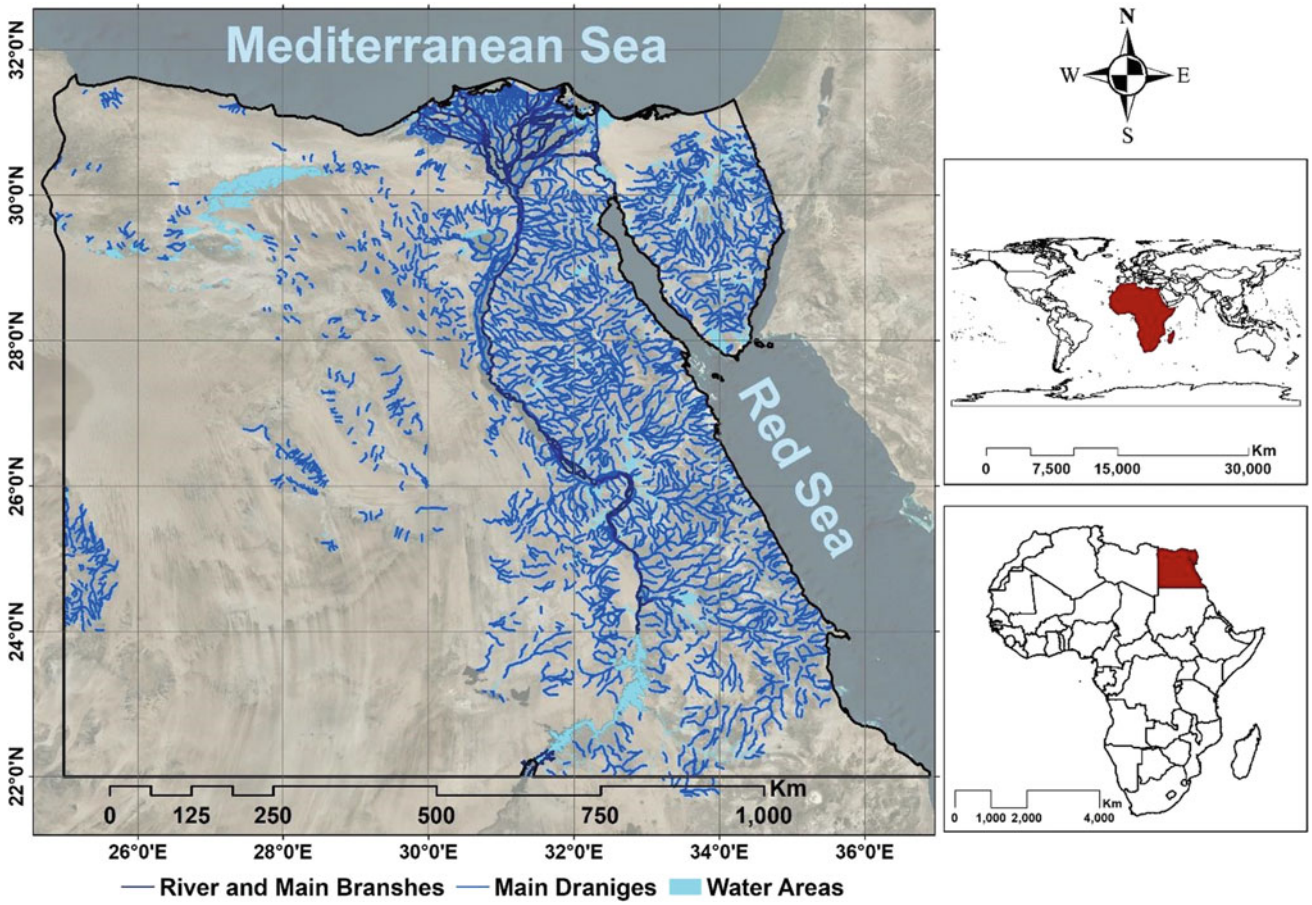

Fig. 3.13 The main drainage network in Egypt. Created by authors

The employment in agricultural sector is decreased dramatically from 55 to 40% between 1970 and 1980, respectively. With continuous decrease in employment in agricultural sector, the most recent value is less than 25% (Fig. 3.17). With these deductions in agricultural employment, the agricultural sector participation in the total gross domestic product (GDP) reduced, respectively, from around 30% to around 10% over the last 55 years (1960–2016) as shown in Fig. 3.17.

3.3 The Geological Features and Soil Map of Egypt

Different land uses of soil are closely related to the geological characteristics and soil properties of the earth surface. Several attempts have been achieved to map the geological features and Egypt soils based on their characteristics. The oldest geological features in Egypt are dated to Precambrian Era where the Archaen rocks cover mainly in Red Sea Mountains, South Sinai Mountains, and Uweinat Mountain (on Gulf Kabir Plateau, southwestern corner) and represent around 10% of Egypt area (Zahran and Willis 2009; Hammad 1975). Then, within the Mesozoic era, the Cretaceous period formation (e.g., Nubian Sandstone) occurred mainly in south Egypt and north Sinai covered around 40% of Egypt surface (Zahran and Willis 2009). The Cenozoic era involving Paleogene (Paleocene, Eocene, and Oligocene), Neogene (Miocene and Pliocene), and the Quaternary (Pleistocene and Holocene) periods have been distributed over the rest of Egypt area in eastern and western deserts. The most recent geological features (Quaternary period) can be observed mainly in recent Nile Alluvium in the Nile Valley and Delta (Hammad 1975).

Based on those geological features, there are different soil units that occur in Egypt territory and can be observed in Fig. 3.18 and Table 3.2. There are 33 different soil units distinguished in Fig. 3.18, as the description of each unit is too long so that the abbreviation for each unit is used as suggested by authors. Table 3.2 shows the area coverage and description for each soil unit. Based on the soil map, the sand dune and sandy areas (Sa1 to Sa8) cover around 41% of Egypt land, besides 16% of shallow or stony loamy sand/sandy loam soils. The Nile alluvium represents only 2.6% of Egypt soils. This later soil type is the main and the highest fertile soils that can be used for agricultural production in Egypt.

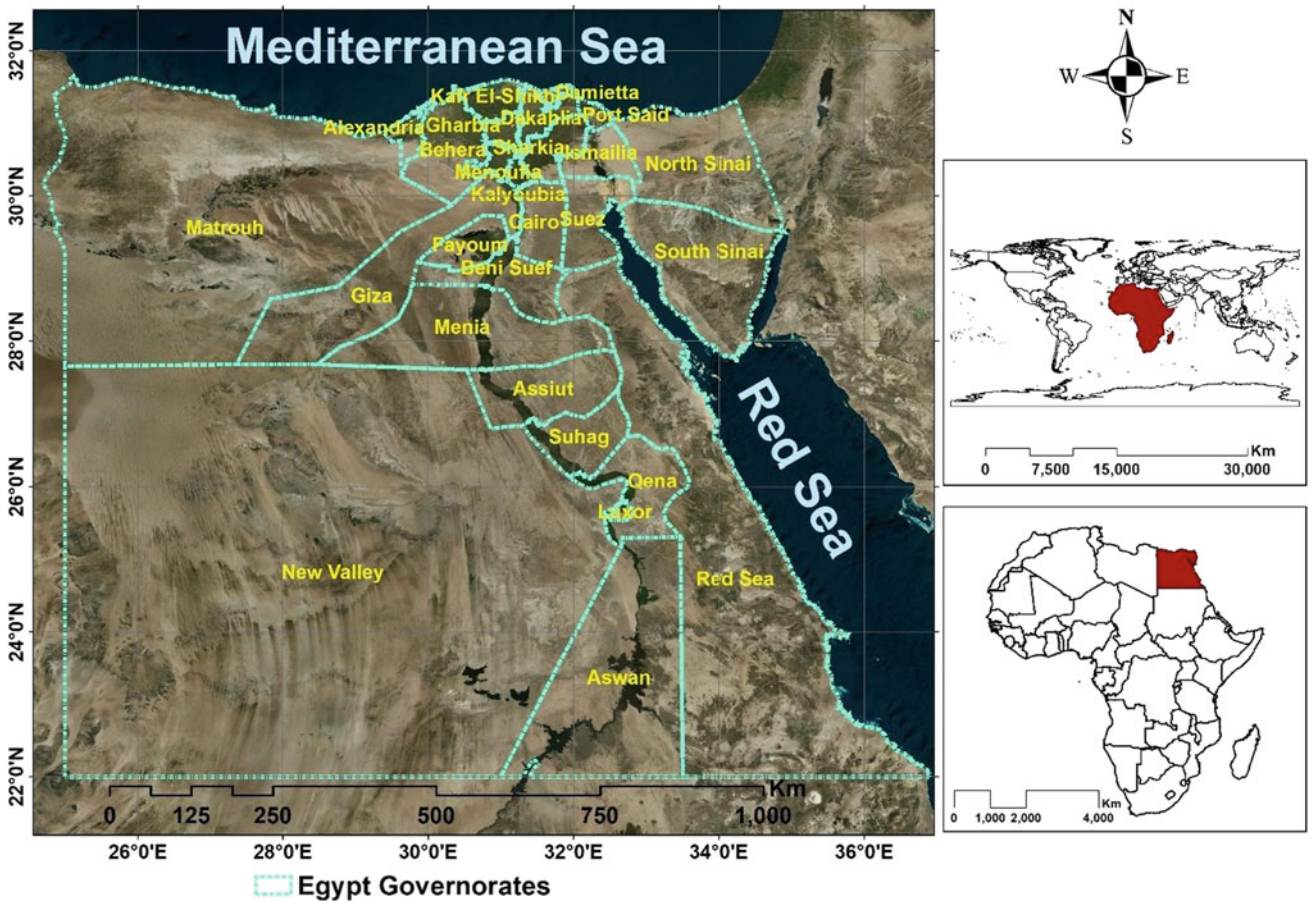

Fig. 3.14 The main Egypt's governorates. Created by authors based on CAMPAS 2017 database

Table 3.1 The area and total population of the Egyptian governorates

No.	Governorates	Number of districts	Area (km^2)	(%)	Total population* (×1000) (%)	
1	New Valley	4	424,073.75	42.22	241.25	0.25
2	Matrouh	8	162,437.75	16.17	425.62	0.45
3	Red Sea	8	121,043.78	12.05	359.89	0.38
4	Aswan	10	68,967.82	6.87	1473.98	1.56
5	Menia	13	32,768.72	3.26	5497.10	5.80
6	South Sinai	8	30,143.55	3.00	102.02	0.11
7	Giza	21	29,245.34	2.91	8632.02	9.11
8	North Sinai	11	27,376.59	2.73	450.33	0.48
9	Qena	14	13,546.84	1.35	3164.28	3.34
10	Assiut	15	12,084.22	1.20	4383.29	4.62
11	Sohag	20	11,021.28	1.10	4967.41	5.24
12	Beni Suef	10	10,752.35	1.07	3154.10	3.33
13	Beheira	19	10,328.80	1.03	6171.61	6.51
14	Suez	6	9198.54	0.92	728.18	0.77
15	Cairo†	43	7773.36	0.77	9539.67	10.06
16	Fayoum	9	6444.09	0.64	3596.95	3.79
17	Ismailia	8	5043.19	0.50	1303.99	1.38
18	Sharqia	22	4497.17	0.45	7163.82	7.56
19	Dakahlia	21	3906.17	0.39	6492.38	6.85
20	Kafr El Shiekh	12	3820.62	0.38	3362.19	3.55
21	Monofiya	12	2440.39	0.24	4301.60	4.54
22	Gharbia	12	1996.20	0.20	4999.63	5.27
23	Alexandria	18	1697.88	0.17	5163.75	5.45
24	Port Said	12	1458.27	0.15	749.37	0.79
25	Kalyoubia	15	1264.76	0.13	5627.42	5.94
26	Damietta	9	862.76	0.09	1496.77	1.58
27	Luxor	4	263.64	0.03	1250.21	1.32
Total		364	1,004,457.81	100	94798.88	100

*Data updated from CAPMAS 2017a, b, †The Egypt Capital

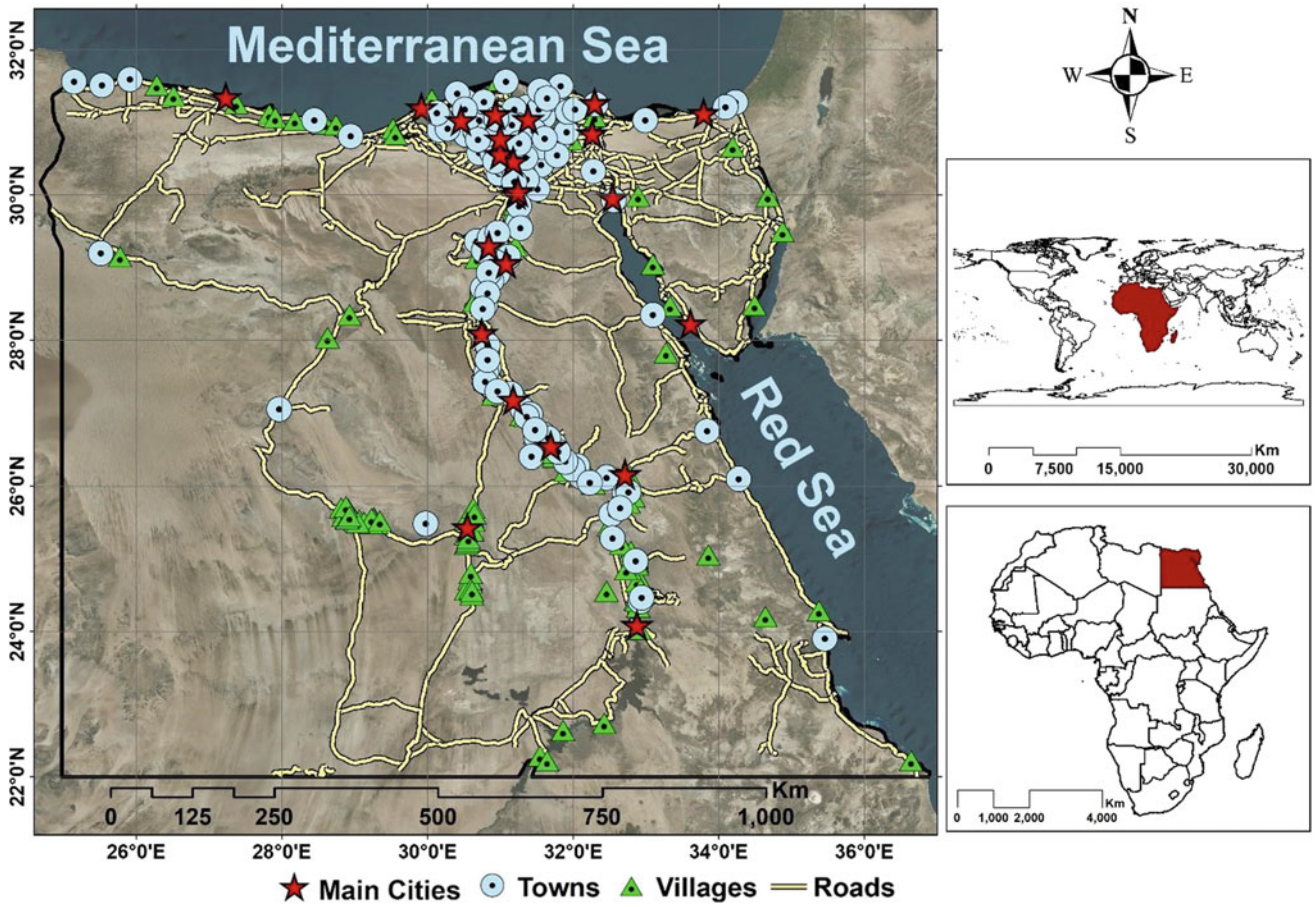

Fig. 3.15 The main infrastructure of Egypt. Created based on FAOStat 2017

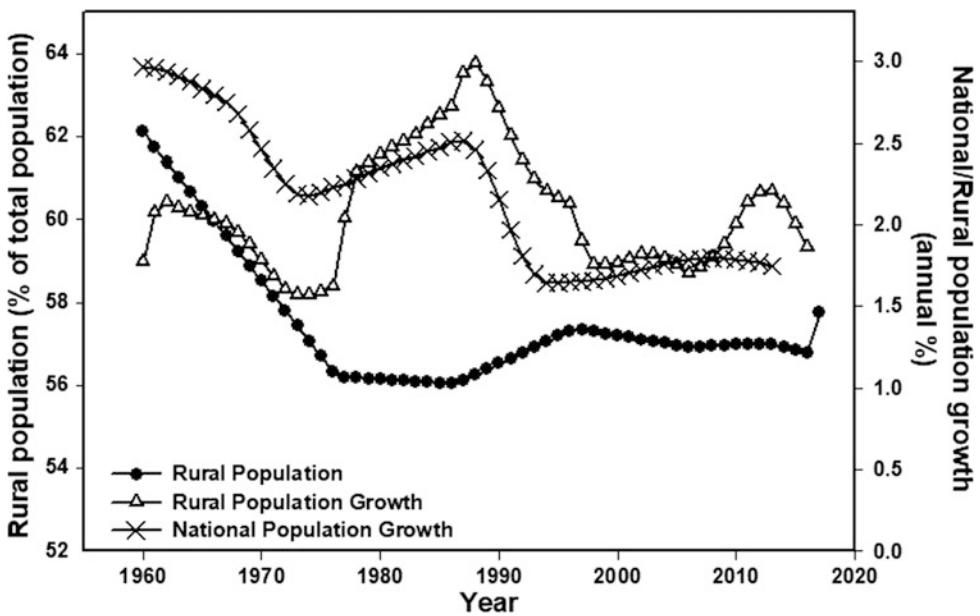

Fig. 3.16 The rural population as a percentage of total population and the rural population growth comparing with the national population growth. Created based on World Bank, World Urbanization Prospect and CAPMAS (2017a, b) database

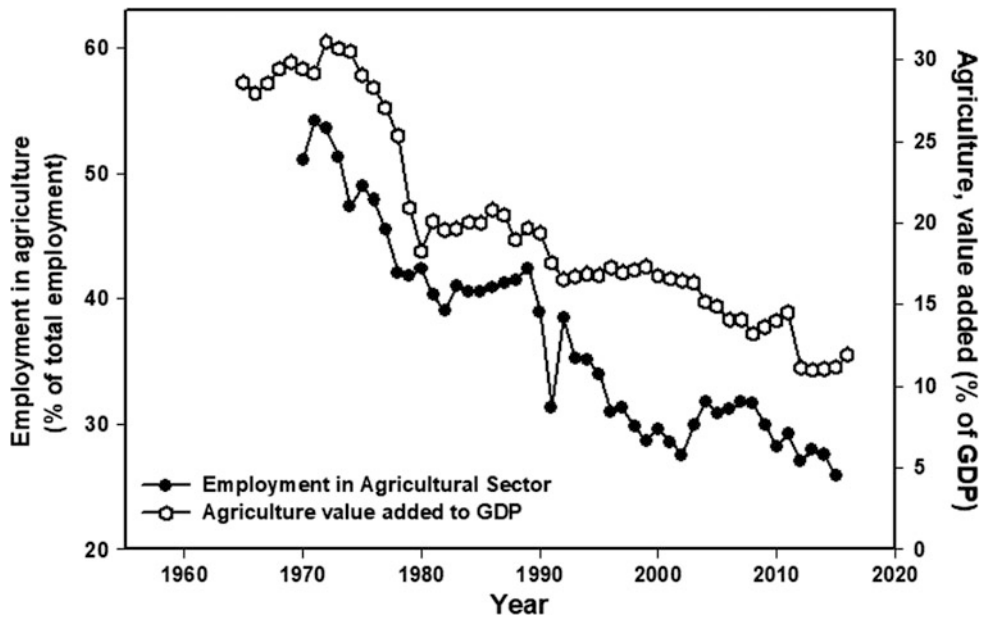

Fig. 3.17 The percentage of employment in agricultural sector compared with the Egypt's total employment and the participation percentage of agricultural sector in gross domestic product (GDP). Created based on World Bank, World Urbanization Prospect and CAPMAS (2017a, b) database

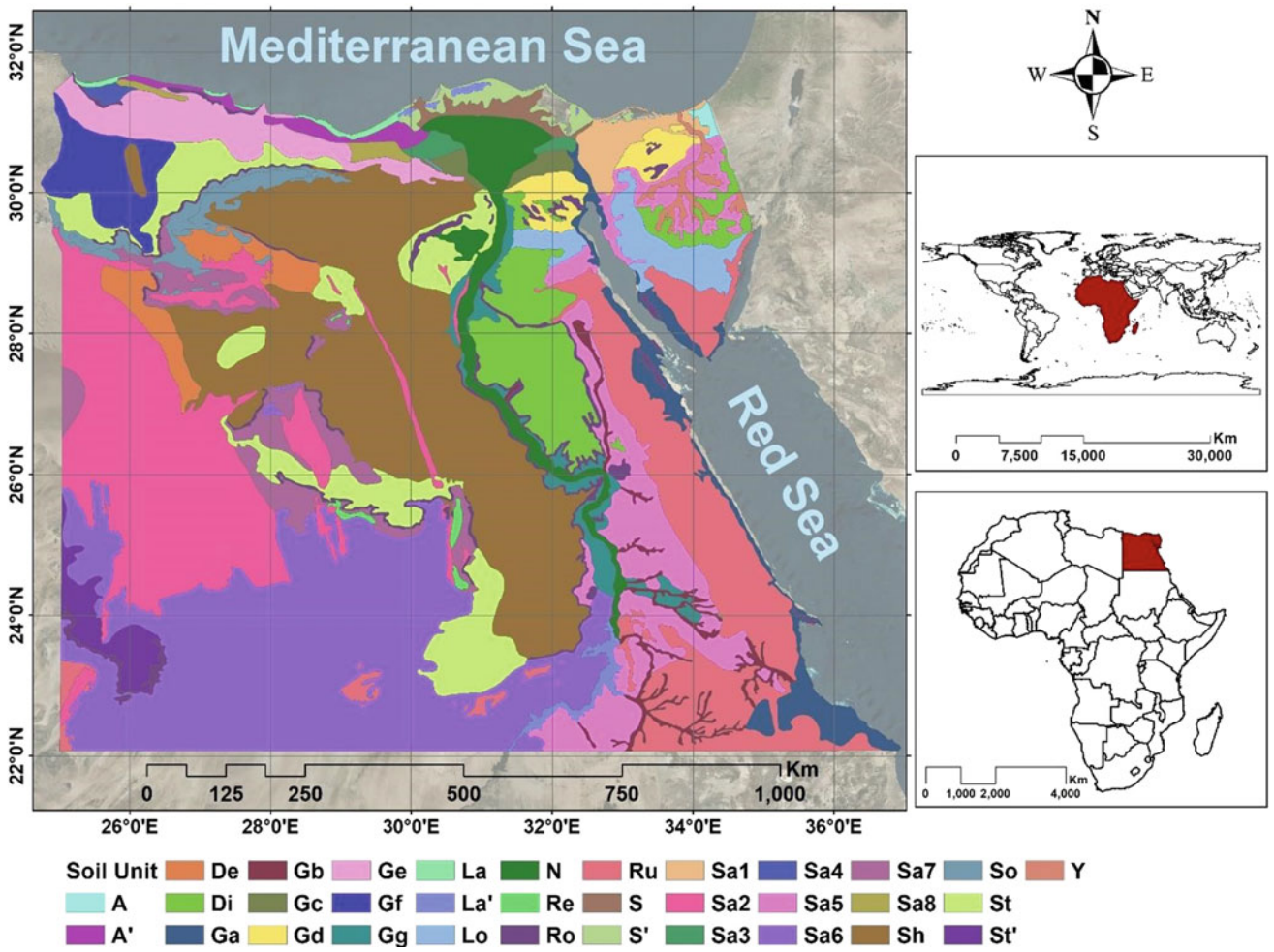

Fig. 3.18 The soil map of Egypt. Created by authors based on http://www.un-spider.org/ and confirmed by Hammad (1975) https://esdac.jrc.ec.europa.eu/images/Eudasm/Africa/images/maps/download/afr_egsma2.jpg

Table 3.2 Egypt soil units based on the legend of Fig. 3.18

ID	Soil unit description	Area (%)
I. Soils developed mainly from limestones		
St	Stoney and loamy sand Lithosols on rough to undulating denuded terrain	5.95
Sh	Shallow or stoney loamy sand - sandy loam soils of Peneplains with	16.01
Gf	Gravelly sand to gravelly loamy sand Lithosols with scattered Solonchaks	1.92
Sa7	Sandy soils with stoney hill remnants of the Piedmont plains	2.99
Ge	Gravelly sand Lithosols with brown loamy soils in scattered patches of the desert plains	2.58
A′	Arid brown loamy soils with remnants of rocky ridges of the coastal plains	0.57
Sa4	Sandy and loamy sand soils with remnants of rocky ridges of the coastal plains	0.14
II. Soils developed mainly from sandstones		
Sa5	Sandy soils and gravelly Lithosols of the desert plains with rocky hills	5.99
A	Arid brown soils with sand dunes	0.09
Sa6	Sandy soils of the Nubia sandstone plains with stoney hill remnants	18.04
St’	Stoney sand Lithosols on rough terrain with rock lands	1.19
Sa8	Sandy to loamy sand soils with Lithosols	0.29
III. Soils developed mainly from a variety of rocks		
Lo	Loamy sand to sandy loam soils with Lithosols	1.56
Gg	Gravels and gravelly sand soils of the alluvial fans, outwash plains, Nile terraces and Piedmont plains	1.33
Gd	Gravelly sand and gravels of a denuded rock land with sand dunes	1.05
IV. Soils Derived Mainly from Shales		
Re	Reddish brown calcareous clayey soils of the desert oases	0.19
V. Solonchaks and Salt-Affected Soil		
So	Solonchaks with rocky hill remnants	0.71
So	Solonchaks with rocky hill remnants	0.70
S	Salt-affected soils of the lower Nile delta areas	0.51
VI. Saltwater marshes		
S′	Salt marshes of the lower delta plain	0.57
La	Lagoons–coastal limestone ridges combinations	0.20
VII. Alluvial soils and alluvial lacustrine complexes		
N	Nile alluvium	2.58
Gb	Gravelly loamy sands of the drainage channels	1.15
Sa3	Sands, clay loams with calcareous crusts and sand dunes of the delta lacustrine complex	0.31
Gc	Gravels and gravelly sand soils of deltaic phase with sand dunes	0.44
Y	Yellowish brown soils of Wadi El-Arish	0.48
VIII. Regosols		
Ga	Gravelly and gravelly sand beaches, sometimes with rock outcrops	2.32
Sa2	Sand dunes and sand sheets of the Western Desert	11.92
Sa1	Sand dunes and sand sheets of the Northern Sinai	0.87
Ru	Rugged rock land mainly of the basement complex	8.94
Ro	Rocky escarpments of different country rocks	2.08
De	Denuded rock land with few sand dunes	1.64
Di	Dissected limestone plateau with lithosols	4.18
La′	Lakes	0.49

3.4 Conclusion

The earth surface and its use are highly dynamic and affected by the soil characteristics as well as the environmental circumstance of every geographical region. Egypt characterizes by several and unique natural features and resources, so this chapter provides an overview of the main natural resources in Egypt, mainly land and water resources as well as related socioeconomic features. The main geographical regions discussed were western desert, eastern desert, Sinai Peninsula, and Nile Valley and Delta. For each region, the general characteristics and landforms were described. Additionally, as the natural drainage network and basin are highly influenced by the geological structure, topology, and relief of the earth surface, the digital elevation model was used to extract the streams and natural basin in Egypt. Besides, human resources and socioeconomic features were generally presented with the main focus on agricultural sector as a key of socioeconomic sector in Egypt and support the livelihood for more than two-thirds of Egyptian population. Based on the most recent population census in 2017, the total population in Egypt is around 95 million who unevenly distributed over 27 governorates. Furthermore, the soil map of Egypt was provided in the last section of this chapter as an introduction to the detailed soil-related studies in the following chapters of this book.

References

Ali H, Mahmoud M (2004) Management of Egypt crop pattern according to reservoir water storage. In: Second regional conference on Arab water: action plans for integrated development, Cairo

Bakr N, Weindorf DC, Bahnassy MH, Marei SM, El-Badawi MM (2010) Monitoring land cover changes in a newly reclaimed area of Egypt using multitemporal Landsat data. Appl Geogr 30(4): 592–605

CAPMAS (2016) Central Agency for Public Mobilization and Statistics. Statistical yearbook. Cairo. Ref. No. 71-01111-2016. http://www.capmas.gov.eg

CAPMAS (2017a) The population of Egypt in 2017. Arabic reference, http://www.capmas.gov.eg/party/party.html

CAPMAS (2017b) Geographical Egypt Data. Arabic Reference. http://geoportal.capmas.gov.eg/arcgis/apps/webappviewer/index.html?id=67fdd9906ae6a7be42bf70dc&locale=ar

Elbana TA, Bakr N, Elbana M (2017) Reuse of treated wastewater in Egypt: challenges and opportunities. In: Negm AM (ed) Unconventional water resources and agriculture in Egypt: The handbook of environmental chemistry. Springer, Berlin, Heidelberg. https://doi.org/10.1007/698_2017_46

Embabi NS (2018) Landscapes and landforms of Egypt: landforms and evolution. In: Migoń P, Wroclaw P (eds) World geomorphological landscapes. Springer, Switzerland

FAOStat (2017) Egypt: country indicators. http://www.fao.org/faostat/en/#country/59

Hamdi H, Abdelhafez S (2001) Agriculture and soil survey in Egypt. In: Zdruli P, Steduto P, Lacirignola C, Montanarella L (eds) Soil resources of Southern and Eastern Mediterranean countries. http://om.ciheam.org/om/pdf/b34/01002089.pdf

Hammad MA (1975) Geological map of Egypt. Appendix 1. Soil Survey Papers no. 11

ICARDA (2013) Water and agriculture in Egypt. Technical paper based on the Egypt. Australia ICARDA Workshop on on-farm water-use efficiency

MALR (2009) Egypt sustainable agricultural development strategy towards 2030. Egyptian Ministry of Agriculture and Land Reclamation, Cairo

MWRI (2014) Water scarcity in Egypt: the urgent need for regional cooperation among the Nile Basin Countries. Egyptian Ministry of Water Resources and Irrigation, Cairo

Meguid AM (2017) Key features of the Egypt's water and agricultural resources. In: Negm AM (ed) Conventional water resources and agriculture in Egypt: The handbook of environmental chemistry. Springer, Berlin, Heidelberg. https://doi.org/10.1007/698_2017_41

Negm AM, Saavedra O, El-Adawy A (2017) Nile Delta biography: challenges and opportunities In: Negm AM (ed),The Nile Delta, Barceló D, Kostianoy AG (Series eds) The Handbook of environmental chemistry 55, pp 3–18

Omran ESE (2017) Land and groundwater assessment for agricultural development in the Sinai Peninsula, Egypt. In: Negm AM (ed) The handbook of environmental chemistry. Springer, Berlin, Heidelberg. https://doi.org/10.1007/698_2017_43

Stanley DJ, Warne AG (1993) Nile Delta: recent geological evolution and human impact. Science 5108(628):634–7046. https://doi.org/10.1126/science.260.5108.628

U.S. Geological Survey (2017) EarthExplorer. http://earthexplorer.usgs.gov/

Worldatlas (2017) https://www.worldatlas.com/webimage/countrys/africa/eg.htm

Zahran MA, Willis AJ (2009) The vegetation of Egypt. In: Werger MJA (ed) Plant and vegetation, vol 2, 2nd edn. Springer, Berlin, Heidelberg. ISBN 978-1-40208755-4