Healthy Ecosystem for Rangeland Development (HERD)

Participatory Rangeland and Grassland Assessment (PRAGA)

For two HERD Project areas (El Ga'ween and Abou Mazhoud)

In Matruh (Egypt)

FINAL REPORT

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Executive Summary

In the North Western Coastal Region of Egypt (NWCR), rangelands occupy an area of 3.5 million acres and represent the major grazing lands over the entire country. The intensive grazing combined with the low precipitation rate resulted in a serous unrecoverable land degradation that threatens the ecological system. In the context of the Healthy Ecosystem for Rangeland Development (HERD) project, the Participatory Rangeland and Grassland Assessment (PRAGA) was used to assess the land degradation and natural vegetation health at the rainfed area of the NWCR of Egypt. The two project areas i.e., Al Ga'ween and Abou Mazhoud were selected for performing the assessment. Both sites are located in the North Western Coast of Egypt and occupy a total area of 3,969 Km^2 (1,386 Km^2 for El Ga'ween and 2,583 Km^2 for Abou Mazhoud). The methodology was developed by Participatory Assessment of Land Degradation and Sustainable Land Management in Grassland and Pastoral Systems", financed by FAO-GEF and executed by IUCN. The methodology aims at effeciently combining the indigenous knowledge and the scientific approaches to assess the land degradation and the natural vegetation health.

A training on PRAGA methodology was conducted in Matrouh from 28/7 to 2/8/2019 by Claire Ogali and Chris Magero, from the IUCN regional office in Nairobi, Kenya and in presence and support of the staff from IUCN regional office in Amman, Jordan. Local experts and scientists attended the training**,** and a preliminary set of priority indicators was identified.

This report presents the primarily results collected from the field with the information extracted from remote sensing imageries. The data were collected from the field during the period from September to November 2019 for the two the landscape project areas. A total of 253 points were selected for data collection in both areas considering the different land cover and soil types. A participatory community rangeland mapping exercise was conducted to define the major landmarks in the landscape project areas e.g., water resources points, roads, old grazing routes, boundaries of the rangelands. ,,,,,,etc. Primarily results were used in the DPSIR framework to explore some of the major potential drivers and potential pressures that affect the rangeland health, the framework also helps in identifying the potential impacts and potential responses and interventions.

Field data were collected from the two study sites by a teamwork includes scientists (GIS expert, Soil specialist, botanist, rangeland management specialist and a socio-economist) in addition to representives from the local related directories and some members of the local community. Data collected from each sampling site were in the context of: 1) Description of the landscape project areas 2) soil indicators 3) water indicators 4) natural vegetation indicators 5) other indicators. As a preparatory phase, some maps for the landscape project areas were prepared using GIS including:

1- **Location map** for each site identifying the area and outlying the boundaries. It is worth to mention that the boundaries of the landscape project areas were modified and adjusted to correspond the watersheds' boundaries contained in each area.
2- **Geomorphology map:** shows the major geomorphic features of the landscape of assessment.
3- **Annual rainfall map:** showing the average annual rainfall over the selected sites.
4- **Community and tribal maps:** showing the distribution of the local communities and the major tribes over the landscape project areas.
5- **land use map:** showing the dominant land use patterns in each location.
6- **Vegetation cover map:** showing plant species dominating the project areas.
7- **Water resources map:** including the watershed boundaries and the location of rainwater harvesting cisterns
8- **Slope map:** to show the slope categories of each area.
9- **Geologic map:** showing the geological features of the landscape of assessment.

Highlights from collected field data and preliminary analysis of external data include:

- **Soil erosion:** data show that almost 62% of the sites in El Ga'ween and 64% in Abou Mazhoud were affected by soil erosion i.e., sheet erosion, gully erosion or wind erosion. Water erosion is resulted from the increase in surface runoff with a decrease in the soil infiltration capacity. While wind erosion resulted from the excessive disturbance of soil by tillage for barley cultivation.
- **Organic litter:** generally high levels of organic litters were observed in the two areas. High plant litter may have resulted from the high levels of precipitation in the previous rainy season (2018/2019). Plant residues can protect the soil from erosion and improve the soil physical characteristics. High level of animal wastes was also observed in the two the landscape project areas, which is an indicator of a high grazing pressure.
- **Water resources:** There was no evidence on the impact of rangeland health on water resources in the North Coastal Zone. This because of the difficulty of monitoring the change in surface and ground water discharges, a low number of underground wells makes it difficult to monitor the recharge and the water salinity.
- **Land cover:** desert shrubs class was the most dominant land cover in the assessment landscape. Annuals disappearance can be explained by that the time of assessment was in autumn, while, they usually begin to flourish in the spring time. The local informants stated that the change of land cover (the transition from rangeland to cultivated crops or orchards) took place more than 30 years ago. This statement was in agreement with the RS analysis that shows a little change in land cover in the last 20 years. However, the fluctuation in the shrubland coverage from dense to scattered and vice versa was resulted from the temporal change of rainfall.

- **Dominant plant species:** The area is divided into 4 main sectors, which are the coastal sector, represented by rain-fed crops and horticultural trees, in addition to Rimth (*Haloxylon scoparium)* in the rocky areas. The second sector is dominated by dense growth of the Methnan (*Tymelaea hirsuta)*. The third sector, which is one of the favorite areas for grazing camels, is dominated by Ajram plants (*Anabasis articulata)* and the last sector, which is the bare lands. It has been noted the spread of some invasive species, such as Shouk El Gamal (*Echinops spinosus L.),* Kokhia (*Bassia indica*), and Australian Atriplex (*Atriplex nummularia*).
- **Vegetation cover:** the coverage of the bare ground was very low**.** The landscape of assessment was characterized by the dominance of unpalatable species ie., 74 % in El Ga'ween and 65% in Abou Mazhoud. Also the absence of the palatable annual species was recorded. Local informants revealed that most of the rangelands are deteriorated as compared to the past.
- **Biotic disturbance:** generally, many wild animals disappeared e.g. rabbits because of rangeland deterioration; these animals were using the healthy growing shrubs for hiding.

In summary, the rangelands have deteriorated in recent years because of a number of major factors, the most important of which is over grazing, improper agricultural practices, but the main reason from the point of view of the local community is the low rainfall in the region as compared to the previous years.

A primarily set of priority indicators was identified as part of the DPSIR casual framework to support evidence based decision making for sustainable land management. Potential indicators included : 1) Drivers : human population, climate change, policy and concentrated feed stuff price ; 2) Pressures : overgrazing , fire wooding, infrastructure development, crop farming and invasive plant species ; 3) State: vegetation production and species composition, soil organic carbon, land cover and soil erosion; 4) Impacts: food security, livestock production, milk production, immigration ; 5) Responses: integrated land use planning, strengthening local natural resource governance institutions, reduce the negative impact of climate change by the implementation of proper water harvesting structures (drivers); grazing management plans, control of fire wooding , control of urbanization, water point management (cisterns), invasive species control, control of the unregulated cultivation of barley (pressures); rehabilitation of the highly degraded areas to promote vegetation cover, reseeding of the endangered annual species, grazing management and protection (state); education, raising the awareness and the development of alternative income generating activities.

PRAGA approach is linking the indigenous and scientific knowledge; identify potential indicators; map additional casual pathways and suggest appropriate interventions to achieve LDN targets and promote sustainable land management.

1. Introduction and general background

The Rangelands in the world occupy almost 24% of the total land area, while the cultivated areas occupy only 11%, while thereare 31% of forests. Deserts, freezing areas, the highest tops of mountains and the civil and industrial building occupy the remaining percentage which is 34% (FAO 1995).

In most of the Arab countries, Rangelands occupy vast areas, estimated at about 468 million hectares (1,114,285 fed), equivalent to 33.3% of the total area of the Arab countries, (Arab Organization for the Agricultural Development, 2004). The importance of Rangelands lies in providing fodder and increasing the livestock production and it is considered a source of income for large numbers of the breeders who totally or partially depend on feeding their livestock, thus it determines their lifestyle. Rangelands have a great role in providing people with the livestock products all over the world. The rangelands and forests provide the largest and the least costly portion of animal fodder around the world, and play a basic role in preserving the soil from the erosion and reducing the rainfall- runoff; consequently, increasing the water infiltration in to the ground, recharging the ground water, resisting desert encroachment and raising the environmental balance in general, in addition to its role in providing other requirements for citizens such as hunting and recreation.

The Rangelands in the Arab Republic of Egypt cover about 10 million feddans, located in four main areas: the northwestern coast, the northeastern coast, Wadi El Arish and some wadis of central Sinai and the region of "Haliab and Shalateen", southern Red Sea coast. The rangelands area in the northwest coast of Egypt is about 3.5 million feddan, which represents about 50% of the total flora in the country. The grazing period in the area extends for 4 to 5 months, according to the amount of rain, which starts from the end of October, to the beginning of March. Due to the low productivity of the rangelands in the area, which brings the carrying capacity to 7.3 heads / fed, some breeders use a supplementary feeding of up to 0.5 kg/ head/day, ranging from barley to the other grains and figs and other concentrates. In the non-grazing season", which extends upto 8 months, each head needs 2.5 kg per day for concentrated feeds for sheep and 2.2 kg for goats. Livestock is considered the main source of income for the residents of the Northwestern Coast, as it represents 23% of the family's income in Ras El-Hikma, 35% in Matruh, 27% in El Negela , 45% in East Barrani and 41% in West Barrani. Livestock farming in Matruh includes breeding sheep, goats and camels. As shown in Table (1), the governorate has around 390 thousands heads of lamb representing 7.13% of the total sheep in Egypt. There are around 134 thousand heads of goats representing 3.32% of goats at the country level, while for camels the number in the governorate is around 17.8 thousand heads representing 11.6% of the camel population at the country

level. The number of cows is low in the governorate, where there are 8.7 thousand heads, representing only 0.18% of the total country heads of cows.

Table (1). Population of livestock in the administrative districts including the landscape project areas in 2015/2016 (numbers by head)

Region	Sheeps		Goats		Camels		Cows	
	No.	%	No.	%	No.	%	No.	%
Matruh and Ras al-Hikma	128824	3.1	55203	41	3835	21.6	1121	12.9
El Negela	63200	16.2	21250	15.8	4700	26.4	475	5.5
Barani and El Salom	79700	20.5	22000	16.4	4530	25.5	433	5
The total area	271724	69.7	98453	73.2	13065	73.5	2029	23.3
Total governorate	389619		134506		17785		8740	

Source: Matruh Directorate of Agriculture, Department of Statistics.

Although the importance of rangelands for Matrouh's economy as well as for the herders, insufficient information is available for decision and policy makers for developing and implementing plans. In this respect most of the available information related to rangelands and pastoralism in Matrouh is descriptive rather than numirecal that can be used in analyzing root causes affecting the well-being of pastoralism and rangelands. A big information gab exists for thematic ….. that considered especially challenging for remote and mobile populations, including education,health services representation and participation,alternative livelihood,access to development and infrastructure and livestock mobility. In addition, there is a considerable gap in the following topics: degree of land degredation, rangeland condition and productivity, pollution, disasters, displacement and landuse policy changes, land use changes and gender role in rangeland.

To implement the Healthy Ecosystems for Rangeland Development **(HERD)** project; It is highly needed to get the necessary information and data that help in achieving its goals. In general, this information and data are obtained either from the literature and remote sensing or from the data that can be obtained from the local community.

In fact, the use of one of the two approaches may have positives and negatives results. Thus, the methodology of the Participatory Rangeland and Grassland Assessment (PRAGA) was introduced as an assessment approach that combines scientific and local knowledge, So it is good to recall that the 2 methods are complementary and can provide a holistic approach for assessing RL health; 1) the participatory approache which relies on the participation of the local community in implementing, preparing and gathering information regarding the rangeland areas. 2) the approach of remote sensing, as well as scientific knowledge in obtaining information for these areas. PRAGA methodology has been developed by Food and Agriculture Organization (FAO) and the International

Union for the Conservation of Nature (IUCN) in the context of the Participatory assessment of land degradation and sustainable land management in grassland and pastoral areas project funded by the Global Environment Facility (GEF) which is used in a number of countries including Burkina Faso, Kenya, Kyrgyzstan, Niger and Uruguay.

This report presented includes primary results extracted from the data collected from the two HERD landscapes project areas (El Ga'ween ;Ras El-Hikma district) and (Abou Mazhoud; El Negela and Barrani districts). The achieved results support and strengthen the decision makers and the local to use the natural resources in a more sustainable manner resulting in high economic and environmental benefits. In this concern, data from 253 sites in both landscapes project areas were collected on the basis of specific indicators related to soil, water, plant coverage,……etc. Therefore, a multidisciplinary team from the related experts as well as represintitives from the related executive departmments and local communities were formed to perform such investigation. Landscape maps were created by the local community to identify the land use, the grazing locations, water points, settlements, infrastructure, in each of the project location. For the identification and the validation of the above-mentioned maps, satellite images (Sentinel) were used. The data were collected through 6 field missions using tablet device in addition to holding four consultation sessions with members the local community to explain the methodology. Finally the collected data were reviewed and developed further during the validation process.

2. Participatory Rangeland and Grassland Assessment (PRAGA)

This methodology is suitable for monitoring and evaluating the state of rangelands in the desert areas where the indigenous knowledge of the local Bedouins in these areas should be taken into account. When assessing the rangelands in addition to the scientific knowledge and satellite data that work together to give a clear and complete picture of the rangeland health in the target areas.

2.1. Meaning of (PRAGA)

The term stands for: **Participatory Rangeland and Grassland Assessment**. In this respect, it is possible to refer to some terms related to the participatory evaluation process, which are:

- **Evaluation:** evaluation is considered one of the most necessary steps in planning and implementing development projects, as it helps to ensure the projects' success and continuity. Evaluation process means a comparison which is made between a current situation and a targeted situation for a specific region in a specific time period, which helps in the decision-making process.

- **Monitoring:** is a repetitive process of gathering data and information in order to track changes over time. For rangelands, it is necessary to collect data and information periodically over several years.

2.2. Purpose of the assessment:

PRAGA methodology is designed to assess the current status of rangeland health according to the objectives and interests of the lands users based on a combination of scientific and local knowledge. The methodology has been developed to support management systems that assist pastoralists and landholders, also the findings of the assessment and monitoring process will identify the best land management practices that can be used to feed the policy process,

2.3. Assessment Objectives:

Generally, many objectives can be achieved from the evaluation process, which could be theoretical or applicable. In this concern, the objectives of the evaluation process in general can be presented as follows:

A. Applicable goals:

1. Identify the strengths and weaknesses in the implementation of the development programs and projects.
2. Determine the work environment for the project activities.
3. Identify the attitudes of individuals and their satisfaction towards the services provided and the practices they apply.

B. Theoretical goal: In brief, it includes how to use the evaluation process to enrich science with facts and theories about social change, its factors, obstacles, leadership and communication with individuals, groups and societies.

2.4. The goal of PRAGA methodology:

This methodology aims to provide a practical guidance on how to conduct an effective assessment for the rangelands at a lower cost, and also to combine the general descriptive approaches, remote sensing technology and the participatory approach of the local community in the process of monitoring plant cover. At the end, an acceptable methodology will be produced and can be used in the preservation and maintenance of rangelands in desert areas which can be used later in similar regions.

2.5. What is the need for this methodology?

Due to the lack of information and data on the current situation of rangelands in the area, which are necessary for the developmental planning process, it is highly required to conduct a general and comprehensive assessment for the statue of soil degradation in the

rangelands and grasslands based on the guidance of the stakeholders and the local community through:

- Bridging the knowledge gap in the process of evaluating rangelands and grasslands.
- Building the capacities of rangeland, grassland and agricultural land users and developing their skills and indigenous knowledge with regard to the rangelands.
- Evaluating the severity of soil degradation in the rangelands and building the necessary evidence to support sustainable management.

2.6. Steps and stages of the PRAGA Methodology

The evaluation process goes through many stages and steps, the most important of which is defining the goal of the evaluation process, and identifying the necessary needs for improving the current situation, and finally and most importantly, identifying the approaches used in the evaluation process. According to PRAGA methodology, it consists of 6 phases with nine steps, which are shown in Figure (1).

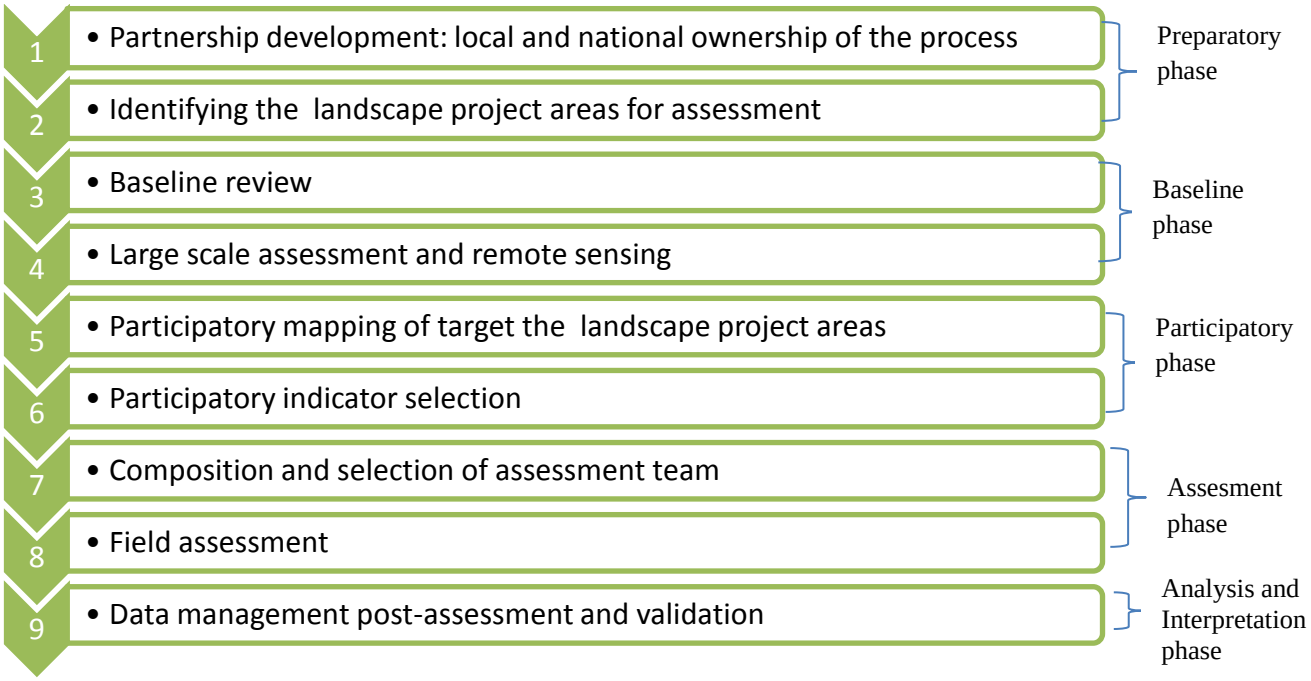


Figure (1). Summary of PRAGA methodology steps (FAO and IUCN Draft methodology)

Step 1: **Partnership Development** with the goal of engaging concerned parties (such as public institutes, communities, and other relevant parties) to encourage taking over the methodology and lead the implementation process.

Step 2: the landscape project areas for assessment which aims at the agreement on an area for assessment that has an appropriate geographical or administrative scope, and targets homogenous ecosystems and land use and any other practicality for application of the methodology.

Step 3: Baseline review which aims to collect the available relevant data from secondary sources and local informants to provide the context of the assessment the landscape project areas, in addition to the available environmental and socio-economic data.

Step 4: **Landscape scale assessment and remote sensing:** It considers one of the scientific methods to provide the landscape project areas scale overview of the target areas and to monitor land degradation.

Step 5: **Participatory mapping of target the landscape project areas**: It aims at the participation of the local community and stakeholders in mapping the target landscape to identify distinct zones for assessment.

Step 6: **Participatory indicator selection**: It is the second stage of the participatory phase, where participate in the mapping workshop agree on the feasible and adequite indicators for the assessment of rangeland status.

Step 7: **Composition and selection of assessment team**: selecting the assessment team that owns the necessary skills to conduct the assessment.

Step 8: **Field assessment**: the agreed indicators are measured in the target areas .

Step 9: **Data management, post-assessment and validation**: at this stage, it must be ensured that the data are properly collected, stored, and are easy to restore and also analyze the obtained data, and write the report at the end.

3. The basic phases of the assessment process according to PRAGA methodology:

The following is the detailed explanation of each phase:

3.1. First Phase: The preparatory phase:

This stage begins before the assessment process, and is considered one of the most important stages, through which the rest of the stages are processed and prepared, responsibilities are identified and partnerships are established with officials through holding several introductory meetings and field visits. This stage has two steps, the first step is to develop partnership and identify responsibilities at the local or national levels toward the assessment process. While, the second step involves identifying the landscape project areas for assessment.

3.1.1. Step (1): Partnership development:

Its aim is to engage key stakeholders such as research inistitutes and, communities, and other relevant parties to enhance methodological ownership and leadership of implementation. Accordingly, a workshop for stakeholders analysis was held on April 23, 2019 under the patronage of the Center for Environment and Development in Arab Region and Europe (CEDARE) and the Desert Research Center, at the Directorate of Agriculture in Matrouh. The workshop was attended by 18 participants from various entities and institutions concerned with rangeland (Figure 2), such as the Desert Research Center, Matrouh Agricultural Directorate, Irrigation and Water Resources Directorate in Matrouh, Barki breeders cooperative, and El Rams association for rangeland development and environment, Directorate of Veterinary Medicine in Matrouh, in order to analyze the stakeholders and identify the partners involved in the rangelands at the local and national levels, and to determine their role in the management of rangelands. Accordingly, the stakeholders were divided into four levels: central government, local government, civil society, and international organizations.

Several sessions were held at the Center for Sustainable Development of Matruh Resources of the Desert Research Center with breeders and local leaders where a full explanation of the workshop objectives has been introduced with providing all the necessary information regarding the workshop topic, stakeholders were identified including: Ministry of Agriculture and land reclamation represented by the Desert Research Center, the Agricultural Directorate and the Veterinary Directorate, herders, El Rams Association for the Development of rangeland and envronment, Civil Society, Ministry of Water Resources and Irrigation, Matruh Governorate represented bu the village development department. (a detailed stakeholders report is attached). Table (2) shows the analysis of Stakeholders and their respective responsibilities.

Figure (2). Identifying stakeholders and developing partnerships

Table (2). Stakeholders and their responsibilities in rangeland development

Organization /entities	The Nature of the Role		Resposibilties	Obstacles
	Primary/Direct	Secondary/ indirect		
Ministries (central level)				
Ministry of irrigation and Water Resources	√			
Ministry of Environment		√		
Ministry of Agriculture	√			
Ministry of Tourism		√		
Ministry of Social Solidarity		√		
Ministry of Investment and International Cooperation	√			
Governorate level				
Agriculture Directorate	√		• Providing the technical staff • Selection and preparing the sites • Monitoring, evaluation and management • Logistic support	Lack of fund
Desert Research Center	√		• Providing research staff • Providing technical studies • Logistic support • Providing seeds and seedlings • Providing labs and analyses	Lack of fund
General Secretary of Matrouh Governorate	√		• Provide the official cover for the project activities	Lack of fund
Northwest Coast reconstruction authority		√	• Peroviding pasture areas maps in the governorate	Difficult to apply
Geneal Directorate of Administration of Groundwater	√		• Contributing in storing works	Lack of fund
Livestock Development Association	√		• Providing work areas • Coordination between families	Lack of fund
*Sustainable Development Center of Matrouh Resources	√		• Preparation and spread knowledge • Field training	
Irriagtion Directorate	√		• Contribution in wells making and storage places	
*Village Development department	√		• Awareness raising of the handy crafts, milk production and micro projects	
*Technical Support Centers	√		• Applying the activities of the sustaible development	
Vetrinary Medicine Directorate			• Proving vetrinary care	
Council of mayors and sheikhs		√	• Contribution in providing feeder and tools • Solving border disputes	
Environment Management	√		• Facilitate the role of different organizations	
Cooperatives				
*El Rams association for rangeland development and envronment	√		• Work as a mediator between the local community and the donors	
Sheep breeders Cooperative	√		• Breeders Data	
Breeders	√		• The target segment	
Herders	√		• The target segment	
*Locals	√		• Mediator between the government and the neficiaries	
MADAD association	√		• Marketing	

*Women participation

3.1.2. Step (2): Identifying the landscape 2 project areas for assessment

This stage aims to identify the areas for assessment, and to outline the adminstrative and geographic borders,. A detailed study has been done by a team of experts from Desert Research Center, and the Center for Environment and Developmenmt in Arab Region and Europe (CEDARE) and a team of specialists from IUCN during December 2016. Accordingly, lot of field visits to Matrouh governorate and discussions with the local community, breeders, organizations, adminstrations which are in charge of rangeland management in the Northwest coast, to define the boundaries of the project areas and the locations with highest for the assessment (Figure 3).

Figure (3). Showing the proposed landscape project areas for the assessment to the local community and the executive partners

Two areas with 253 sites were chosen for the assessment (Figure 4); (1) El Gaw'een, which is located in the domain of Ras El-Hikma village, east of Matruh; it extends 42 km along the Mediterranea coast, between longtudes "27° 17` 48.63‟ and 27° 53` 21.34‟ E , and latitudes 30° 53` 27.47‟ and 31° 13` 29.78 N. (2) Abou Mazhoud which is located in the domain of Sidi Barrani city, west of Matruh, and extends 61 km along the Mediterranea coast between longtudes 26° 48` 29.81‟ and 26° 01` 0.65 ‟ E, and latitudes 31° 34` 50.29‟ and 31° 05` 48.41‟ N. The assessment process covered a total area of 944,653 feddans, distributed as 329,938 feddans in the area of El Ga'ween and 614,715 feddans in Abou Mazhoud area (Figure 4). It has been considered that two

areas were representative of typical rangeland in the northwest coast of Egypt, **the assessment the landscape project areas were selected based on**:

1. Pressure and threats facing the rangelands in the area.

2. Presence of rangelands governance challenges in the area.

3. The heterogeneity of the landscape of the two areas in terms of land use, soil, topography and the composition of plant populations to be representatives for the rangelands of the northwest coast.

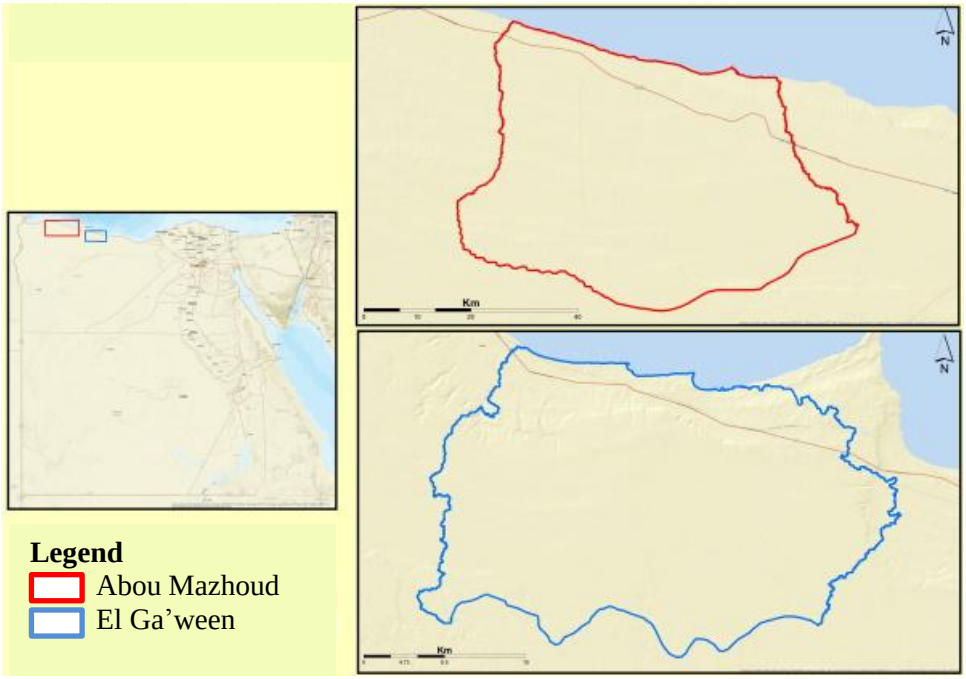


Figure (4). Location of the two the landscape project areas for assessment (Al Ga'ween – Abou Mazhoud).

3.1.2.1. Characterization of the landscape project areas for assessment:

The two areas for assessment are located in the domain of Matrouh governorate, which is located in the northwestern coast of Egypt, and extends from km 61 west of Alexandria to the Egyptian-Libyan border along 450 km on the Mediterranean coast, extending to the south with a depth of about 400 km south of the Siwa Oasis. The governorate is bordered from the eastern side by Alexandria and El Behera governorates, and is bordered from the southeast by Giza and from the south by the New Wadi Governorate. The total population of Matrouh Governorate is about 474,475, representing 0.47% of the total population of Egypt, according to the 2019 census; males represent about 52.4% of the total population, while the female ratio is about 47.6% of the total population. Livestock including sheeps, goats and camels is the main source of income for 80% of Matrouh's population, in addition to some other commercial activities, the agriculture activities include the cultivation of wadis with horticultural crops such as figs and olives.

El Ga'ween is located within Marsa Martuh city district mostly in the region of Ras El-Hikma, including the villages of Sedi Henesh, El-Dakhla, El Garwala, El-Zayat, Atnoh, El-Kwasem, Kshok Emera, Abou Markek (Figure 5).

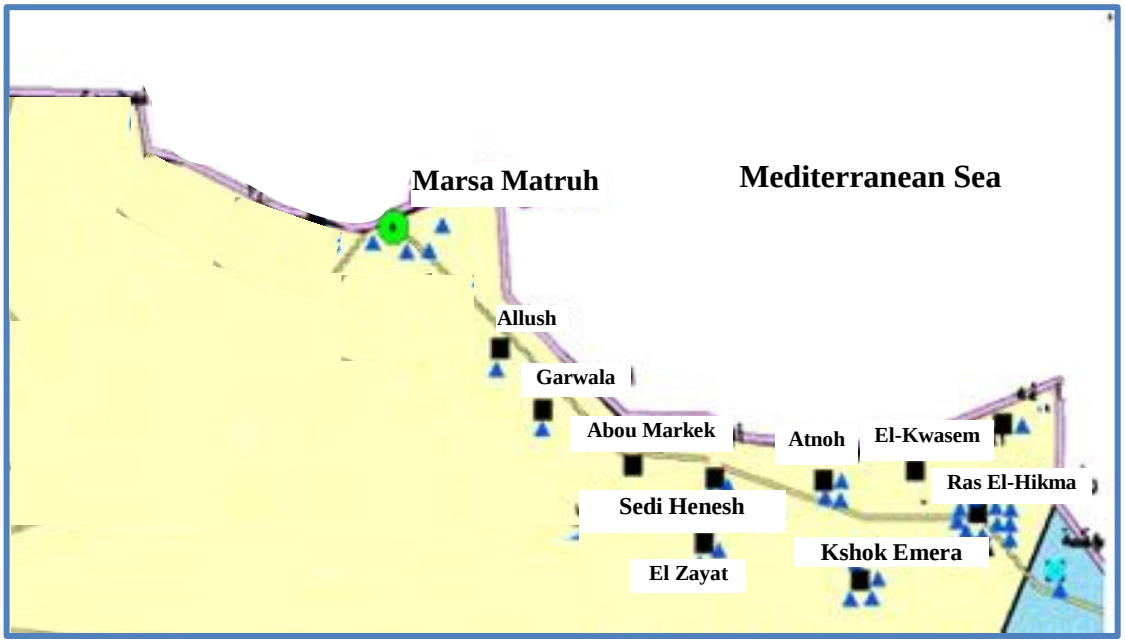


Figure (5). The Administrative areas in El Gw'een

The area includes about 82 subvillages, with a total population of approximately 28,617 people, including 15,124 of males, and 13,493 of females (Table 3).

Table (3). Villages, affiliated sub-villages and their population in El Gw'een area

Village Name	Subvillages No.	Males	Females	Total
Ras El Hikma	10	4563	3792	8355
El Zayat	10	852	834	1686
Abou Markek	10	2019	1834	3853
Sedi Henesh	9	1062	917	1979
El-Dakhla	6	564	535	1099
Atnoh	7	1049	1006	2055
Garwala	7	1268	1125	2393
El-Kwasem	8	618	555	1173
Kshok Emera	5	1110	1061	2171
Allush	2	879	846	1725
Total	74	13984	12505	26489

While, Abou Mazhoud is adminstravily located between sidi Barrani city in the west and El Mathany east of El Neguilla city, the area includes villages of Abou Steel, Abou Marzouk, Abou Mazhoud, El Zafer, El Fakhry, El Katrany, Shamas (Figure 6), Barani and El Negela areas have 245 subvillages with a total population of 90370 people, including 47428 males and 42942 females (Table 4).

Figure (6). The adminstrative areas in Abou Mazhoud

Table (4). Villages, affiliated subvillages and their population in Abou Mazhoud area

The Local Unit	Subvillages No.	Males	Females	Total
Sedi Barani City	65	18129	16641	34770
Abou Steel	14	6412	4405	10817
Abou Marzouk	12	1191	1194	2385
Abou Mazhoud	6	325	380	705
El Zweda	14	1395	1394	2789
El zafer	7	1113	963	20076
El fakhry	9	1106	1135	2241
El Katrany	11	184	155	339
Shamas	15	2016	1863	3879
Total	153	31871	28130	60001

3.1.2.2. Tribal and community composition:

According to (Daoud 2015), before about 300 years, “Awlad Ali” tribes started to migrate to the Northwestern coast of Egypt due to the war in Libya at that time., the area was inhabited by Jumiat tribe before the arrival of Awlad Ali tribes. It was agreed to divide the northwestern coastal region from El Salumm to Al-Behera governorate, allocating two thirds of the area to the tribes of Awlad Ali and the third to the tribe of Jumiat.Until the beginning of the twentieth century, there were no borders between the lands of Awlad Ali tribes, as they were free for going everywhere. Due to the increasing of population density and the migration of some other tribes to the northwestern coastal region, demarcation of the lands of the tribes of Awlad Ali was set. Awlad Ali tribes

consist of 6 main tribes who are Awlad Kharouf, Senkor (also called Ali Abiad), Ali Ahmer, Qotan, Jumiat and Senena.

Each major tribe consists of a number of sub-tribes, and each sub-tribe has a number of families (house). In general, there are the Senena tribe in the southern area, which is the area of rangelands and camel breeding. But the Northern part is inhabited by tribe of Ali Ahmar that are concerned with raising goats and sheep.

Matruh Resource Management Project, funded by the World Bank during the period from 1994 to 2002, divided the Northwest Coast region into a number of homogeneous local communities based on the tribal structures and the agricultural activities. There are number of delegates for each community who are chosen by the local community aiming at engaging the local community in the development and plans related to the region. In this concern, the different communities as well as the tribal distribution for each of the two the landscape project areas are as follows:

El-Ga'ween area: includes seven communities located within Ras El-Hikma region (Figure 7); as well as both the first and the tenth communities in the region of Marsa Matruh city. The tribal system prevails in the area, where it is noted that most of its inhabitants are from the tribes of Awlad Kharouf and the tribes of the Senena and the Sengor, in addition to some other tribes (Figure 8).

Abou Mazhoud area: includes the local communities affiliated to El-Negela starting from the first community to the sixth community, as well as the communities numbers 1, 2, 3, 5, 15 of Barani which is also located within the area. The second community in El-Negela covers the largest part of the landscape project areas (Figure 8). As for the distribution of tribes in Abou Mazhuod area, It is clear that the majority of the area is inhabited by the families of Jumiat, Qotan and Sengor tribes. The families of Jumiat tribe are concentrated in the southern region (pasture areas) includes the families of El Mahafez and El Gerara (Figure 10).

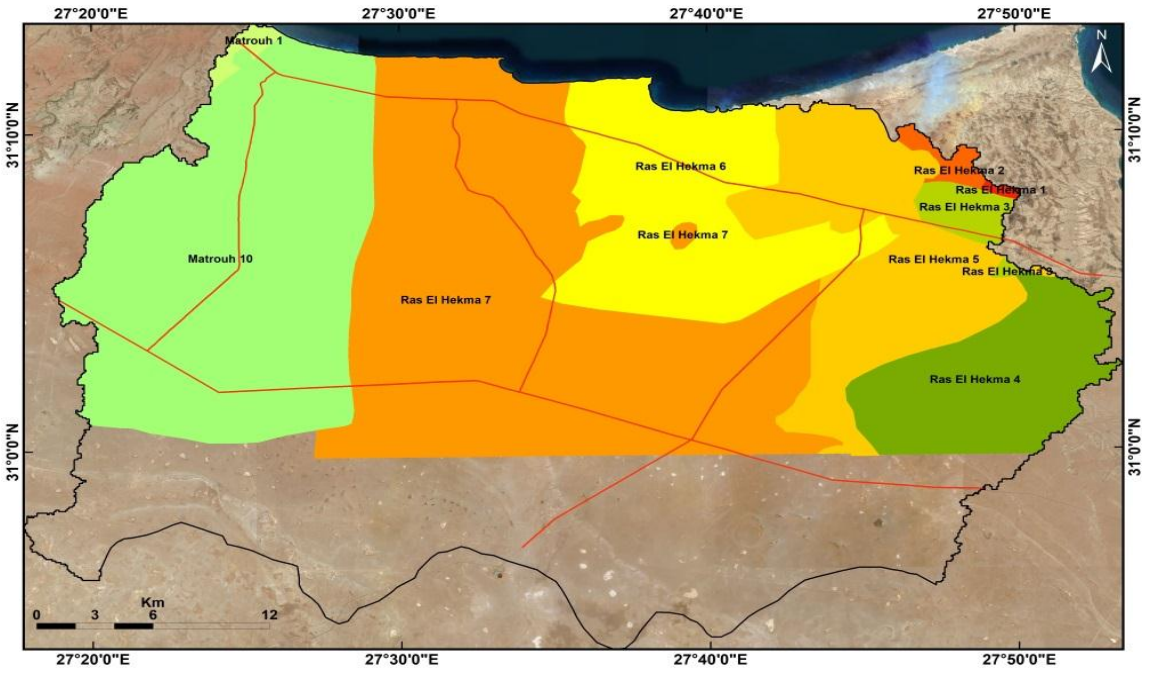


Figure (7). Distribution of the local communities in El-Ga'ween area

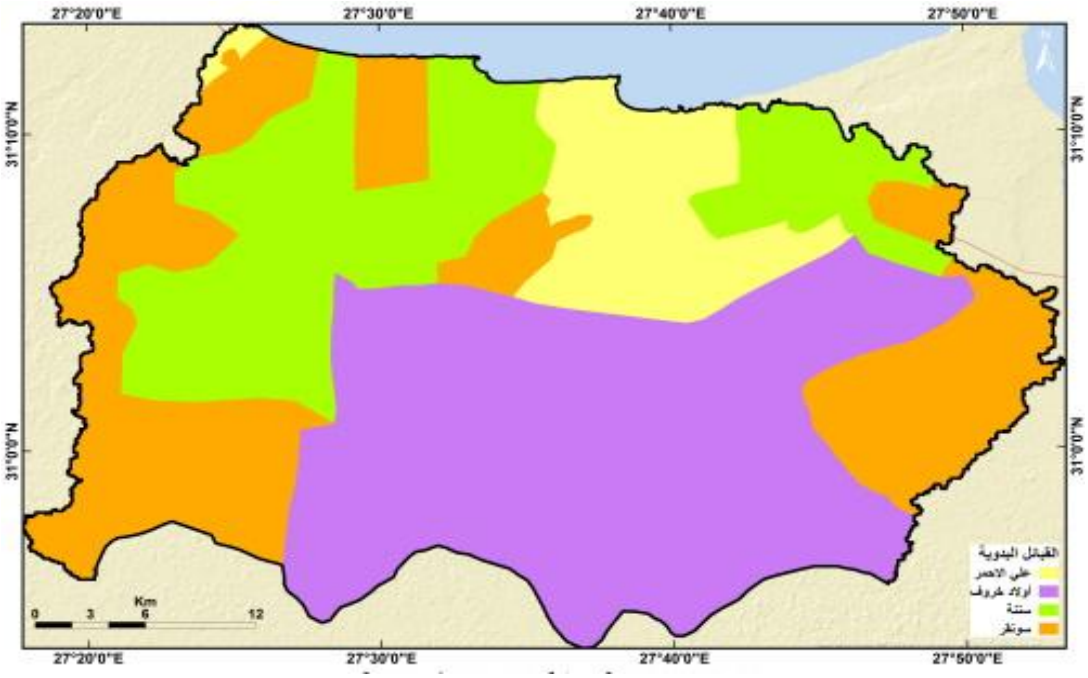


Figure (8). Distribution of tribes in El- Ga'ween area

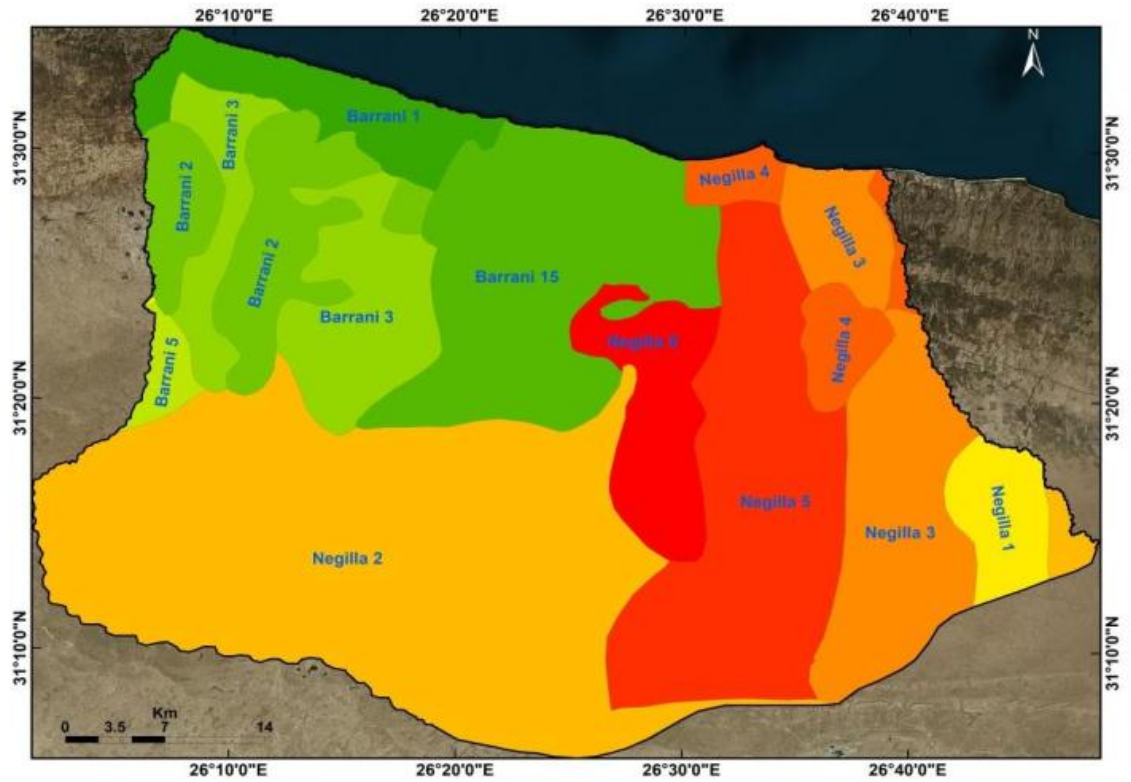


Figure (9). Distribution of communities in Abou Mazhoud area

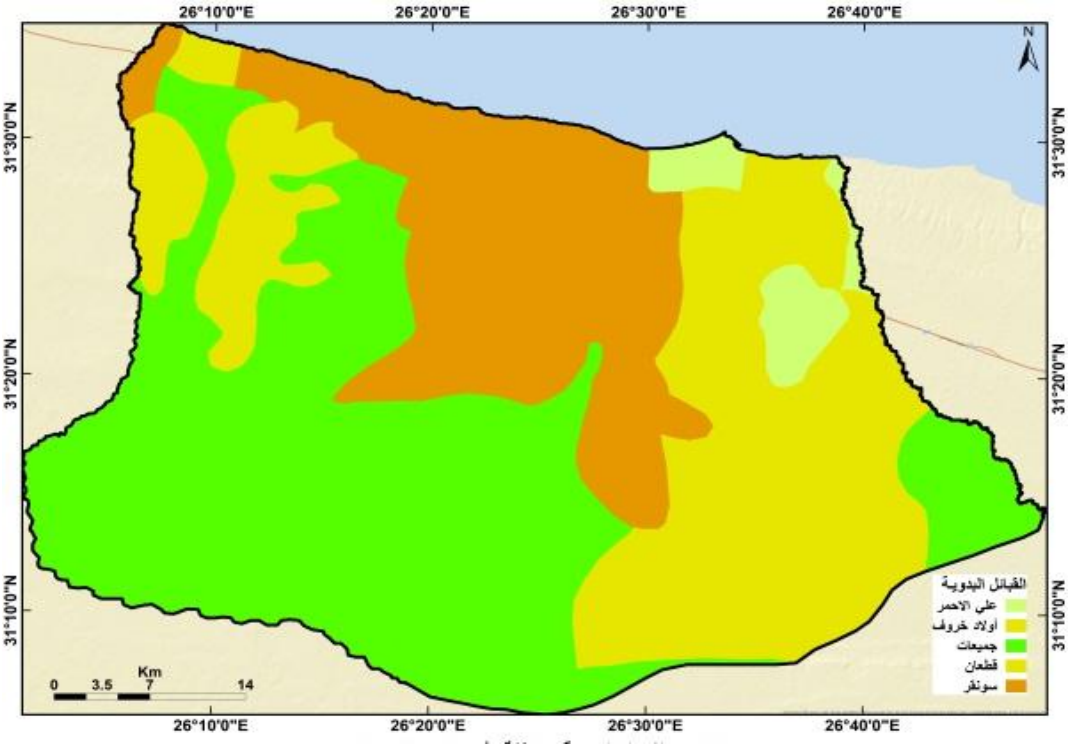


Figure (10). Distribution of tribes in Abou-Mazhoud area

3.2. The second phase: the baseline phase

According to BRAGA methodology, this stage aims at the collection of available data for the landscape area that will be assessed, and providing a general overview of the area. In this phase, previous studies conducted in th area as well as the data from the official authorities are used . These data include information about topography, climate, water resources, soil combined with data from satellite images. At this stage, participants from local community, stakeholders and executive partners should be informed of the results of that stage until such results become trusted. So, this stage includes two steps the first is the baseline study, which aims to collect available and relevant data for the landscape of assessment from secondary sources and local informants. The second step is to use the remote sensing data in a relevant spatial and temporal resolution to monitor the degradation of rangelands.

3.2.1. Step(3): Baseline review

In this step, the report addresses the main characteristics of the landscape project areas for assesment in terms of climate, geomorphology, geology, water resources, land use, soil properties, and natural vegetation. The results achieved can be presented as follows:

3.2.1.1. Climate:

The two the landscape project areas are characterized by a typical Mediterranean climate, which is hot, dry in the summer and warm, rainy in the winter. The average annual rainfall in the Northwest Coast of Egypt is 140 mm, and the rainy season extends from October to March peaking in December and January. Due to the lack of meteorological stations in the area, only one climate station in Marsa Matruh city is available, which make it unreliable to use its data to calculate the average annual rainfall for each of the two areas of study. Therefore, the freely available online data was used , in our case we used the data from The National Center for Environmental Prediction; Climate Forecast System Reanalysis (NCEP / CFSR)

The annual average rainfall rate for each area was calculated using daily data for 35 years from 1997 until 2014; each project area is divided into three zones according to the mean annual rainfall, which are less than 100 mm, 100-125 mm, and more than 125mm. This can be summarized as follows:

El-Ga'ween: Figure (11) indicates that the annual average rainfall in El-Ga'ween area ranges from 86 to 125 mm, which increases relatively close to the sea and its decline as we have headed to the south. The majority of the assessment project area is recieving between 86-100 mm of rain, which is the southern portion that contains most of the rangelands. As for the northern portion with rainfall amount > 100 mm, it is assigned to horticultural crops and croplands.

As for the other climate parameters, the average maximum temperature is 23 ° C, with the highest value of 28.5 ° C recorded in August. While, the average annual minimum temperature is 16.4 ° C , and the lowest value of 10.2 ° C is recorded in January. The annual relative humidity value ranges between 60-80%, and rises in the summer season compared to winter. The average wind speed in the area is 19.3 km/hr with the maximum value recorded during the winter months starting from December to March.

Abou Mazhoud: Figure (12) indicates that the average annual rainfall in the area ranges between 90-160 mm. It is also noticed that the rainfall amount increases north as we get close to the sea. Most of the landscape project areas is located in the zone receiving more than 125 mm. Rangelands in the area are to the south where the annual rainfall ranges between 100-125 mm.

The average maximum temperature in the area is 23.8 ° C with the highest value of 29 ° C recorded in August a, while the average annual minimum temperature is 15 ° C and its lowest value of 8.4 ° C is recorded in January. The annual average relative humidity in the area is 67% and it increases in the summer and reaches its highest value during July and August. The average wind speed is 18.0 km/hr, with the maximum value recorded during the winter months, starting from December to March.

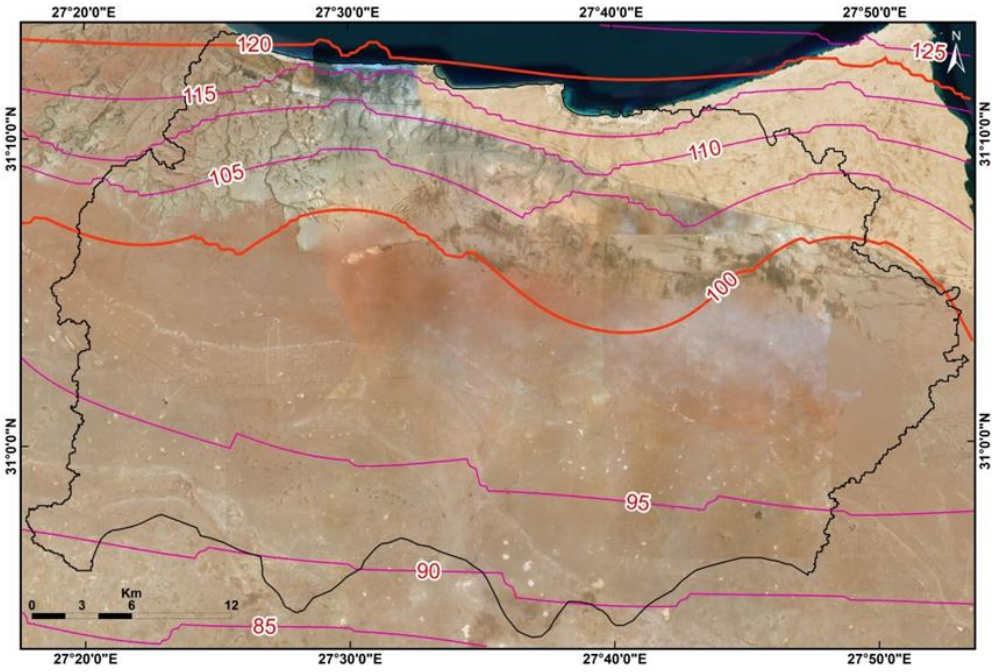


Figure (11). Rainfall Distribution in El Ga'ween area

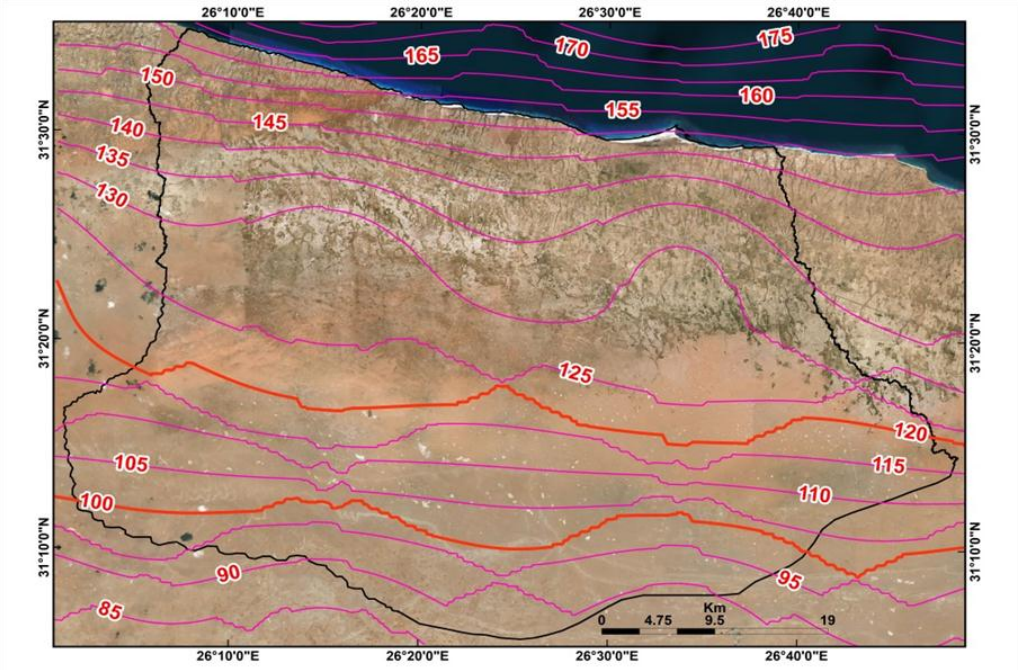


Figure (12) Rainfall Distribution in Abou-Mazhoud area

3.2.1.2. Geomorphological characteristics:

Based on the topographic maps for the two the landscape project areas, with a scale of 1: 25000 in addition to the Digital Elevation Model (DEM) and previous studies, three Geomorphological units were distinguished in each area as follows, (Figures 13 and 14).

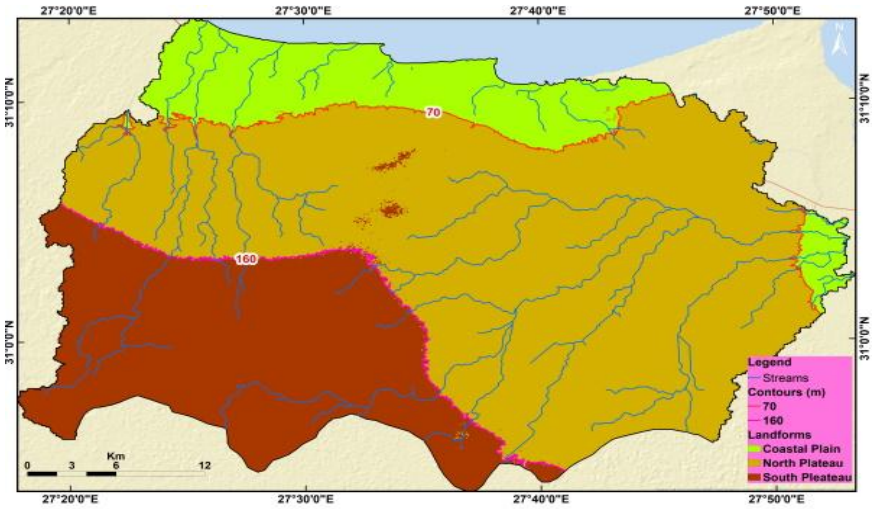


Figure (13) Geomorphological sectors in El Ga'ween area

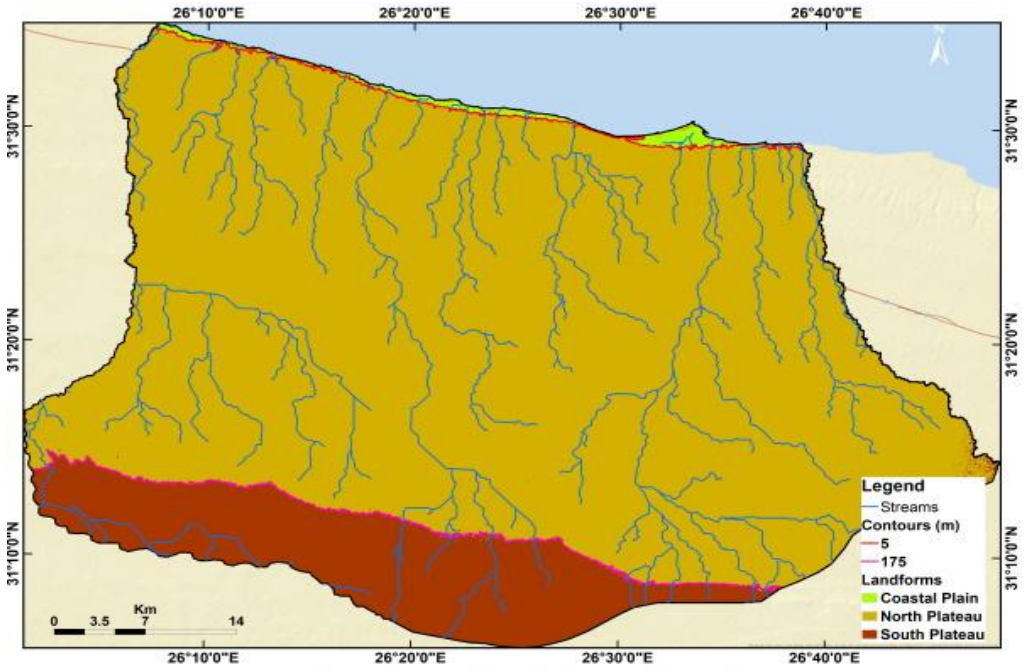


Figure (14) Geomorphological sectors in Abou-Mazhoud area

A- The Coastal Zone

The two the landscape project areas (El-Ga'ween and Abou- Mazhoud) differ from each other in the coastal zone in terms of its width and height above the sea level, as well as the intensity of the slope. In "El-Ga'ween" area, the coastal zone extends to approximately 1 to 8 km from the shoreline; while in "Abou Mazhoud" area it extends from 200 m to 2 km from the shoreline where the side of the hill approaches the coastline. Concerning the height in "El-Ga'ween area, it ranges from 0 to 70 meters above sea level, while in "Abou Mazhuod" area it ranges from 0 to 5 meters above sea level. The slope in the coastal sector of "El-Ga'ween ranges from zero to 31.7 %, while in "Abou Mazhoud" it ranges from zero to 4.4 % (Figures 15 and 16).

The coastal zone in " El-Ga'ween" area is different than that in "Abou Mazhuod'' area, as it contains the coastal plain and the piedmont plain, where the latter disappears completely in "Abou Mazhuod" area. In general, the coastal zone consists of several geomorphic features, including "active sand dunes" which consist of "white Oolitic sand" with some depressions and small flood plains among these sand dunes. There is also a high series of the old Oolitic dunes and an elevated series of Oolitic limestone used in constructions (Figure 13). Depressions consist of saline soils with a soil texture ranges from fine sand to clay. These depressions are dominated by halophytes, and wet and dry Hummocks. Flood plains that exist between the sand dunes are formed mostly from fine particles. Sometimes, there are gravels or rocks transferred by flood water from the northern plateau Through the streams.

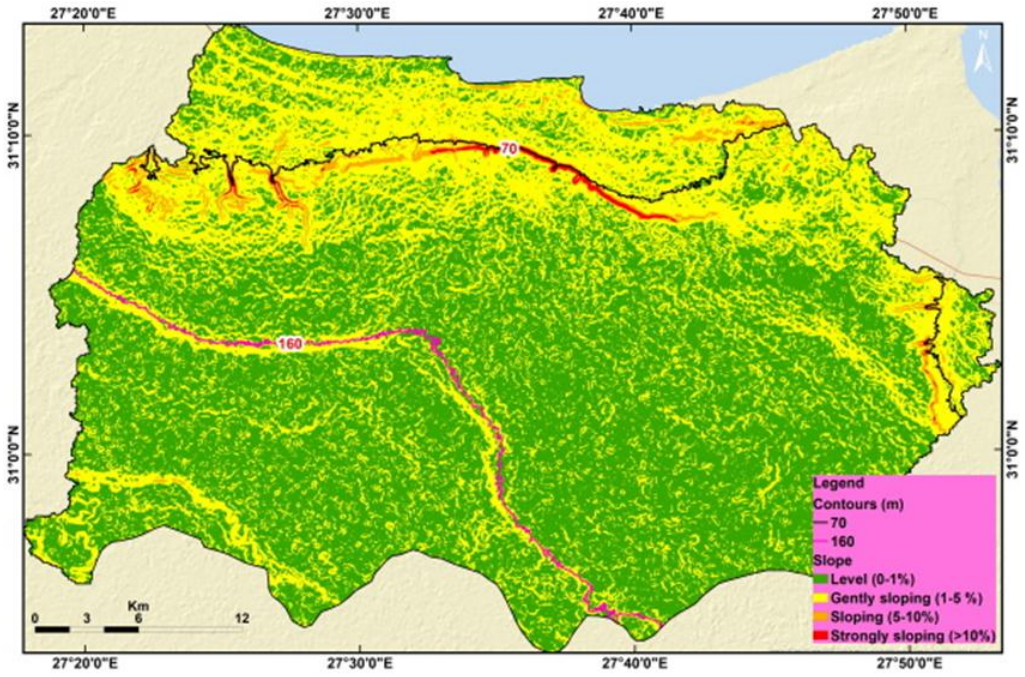


Figure (15) Main sloopings classes in El Ga'ween area

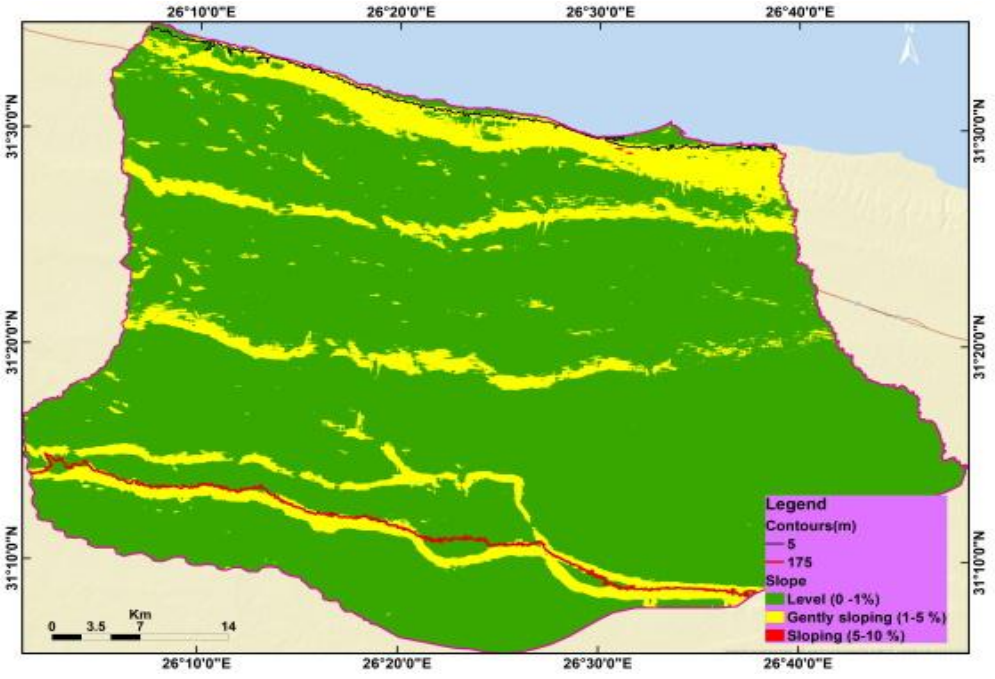


Figure (16) Main sloopings classes in Abou Mazhoud area

The coastal zone of “El-Ga’ween" area is characterized by the presence of the “Piedmont plain”, starting from the base of the northern plateau edge to the boundaries of the coastal plain and it may reaches the sea in some spots. The soils of the piedmont plain are mainly formed from the flood depositions during the successive cycles of floods resulted from rain falling on the northern plateau as it transfers the soft soil paticles i.e., sand - silt- clay and coarse soil particles i.e.,gravel- rocks - boulder. The Piedmont plain has an economic importance for the inhabitants of El Ga’ween area, because it is usually used for cultivating orchard trees in the Wadi bottom, Delta, and alluvial fans ; it is also used for cultivating field crops such as barely and wheat on the wide terraces and in delta with flat topography. This zone is crossing the international road of Alexandria/El Saloum, from the east to the west, as it starts from Ras El Hikma city to El Kesaba (El Grawla) in the north of El Ga’ween area.

B- The Northern Plateau Zone

The height of the northern plateau in El Ga’ween area ranges from 70 to 160 meters above sea level, while in "Abou Mazhoud" area it ranges from 5 to 175 m above sea level. The width of the northern plateau in El Ga’ween area ranges from 9 to 16 km, while in "Abou Mazhoud" area it ranges from 37 to 39 km. The slope of the northern plateau in El Ga’ween area ranges from zero to 34 %, while in "Abou Mazhdoud" area it ranges from zero to 5.4 % (Figures 15 and 16). The northern plateau in both areas is characterized by the formation of wadi catchment and its main tributaries. These tributaries are used for cultivating orchards, such as olive, fig, and some pomegranate and almond trees, in addition to the rain-fed watermelon. The cliffs on both sides of the streams are used for grazing sheep and goats.

The local farmers are using the extended areas of the northern plateau in both areas to grow field crops such as barley (on a large scale) and wheat where it predominates in “Al-Araq” in Abou Mazhoud area. It was noticed that the cultivated area of field crops in "Abou Mazhoud” is larger than that of the" El Ga’ween area. Shallow and deep soils prevail in many areas of the northern plateau in the region of "Abou Mazhoud" (Figure 14) as compared to "El Ga’ween" in which rock exposures and stone lands prevail. There are some shallow depressions, which are called "Hettyia", in the northern plateau, that are often used in cultivating Rain-fed watermelon and barley. The composition of “Marmarica” (fossil limestone) covers most of the plateau lands, then the formation of “El Hagif” (limestone), while the flood deposits cover the waterways, the depressions, and some flood plains on the surface of the plateau.

The northern plateau has the largest proportion of the vegetation cover, and it is considered as the main grazing area for sheep and camels. The vegetation cover ranges from scattered to dense as it is shown in the land cover map. There are some landforms that are present in the plateau, such as Shateeb (the beginning of the Wadi tributaries) ,

Ghout (areas with a wide space, flat, shallow to medium deep soils with a dense vegetation cover in which Hummocks are prevalent) and Hettyia (small area consist of very hard limestone or sandy loam soils used in agriculture. Goora (vast areas with a level surface , a very high content of calcium carbonate , completely free from natural vegetation and not used in agriculture) and Aeolian sand, desert Hummocks and quartz sand dunes are of low altitudes. The Alexandria / Salloum International Road cross this sector from east to west, from where it starts at the village of Al-Mathani in the east to the village of Al-Muqattala in the west.

C- The Southern Plateau Zone

The height of the southern plateau in El Ga'ween area ranges from 160 to 209 meters above sea level, while its height in "Abou Mazhoud" area ranges from 175 to 214 meters above the sea level. The slope of the plateau surface ranges from zero to 7.2 % and from zero to 5.1 % in El Ga'ween and Abo Mazhoud, respectively (Figures 15 and 16). Streams in this plateau cannot be distinguished in site, because the surface appears completely flat except for the slopes separating the terraces of this plateau. In general, the Marmarica formation (fossil limestone) predominates this plateau except for very limited locations; especially in the area of "El G a'ween in which Hagif formation (limestone) is found. The scattered vegetation cover prevails in this zone combined with bare soil in the form of rock exposures in the far south of El G a'ween, or as wind and/or water sandy deposits, in the southern part of "Abu Mazhoud". The plateau contains some of the landforms that exist in the northern plateau, such as Hettyia, Ghout, Aeolian deposits, but other landforms such as Shateeb and Goora are absent in this zone.

3.2.1.3. Geological properties

The geologic properities of each geomorphologic unit (zone) are presented as follow (Figures 17 and 18):

A. **The coastal zone:** consists mainly of active coastal dunes, and its sand is distinguished by its white colour, well sorted loose to semi-consolidated limestone. In some places, these dunes are covered by a thin crust of limestone and are followed by a group of interdunal depressions and plains higher the sea level. It consists mainly from clayey and sandy loamy soils with a high salinity as it is affected by seawater. Then it is followed by a series of consolidated ridges of ancient sand dunes, with a color ranging from pink to white, which is the Oolitic limestone and the lower layers of this composition are overlapping layers of clay

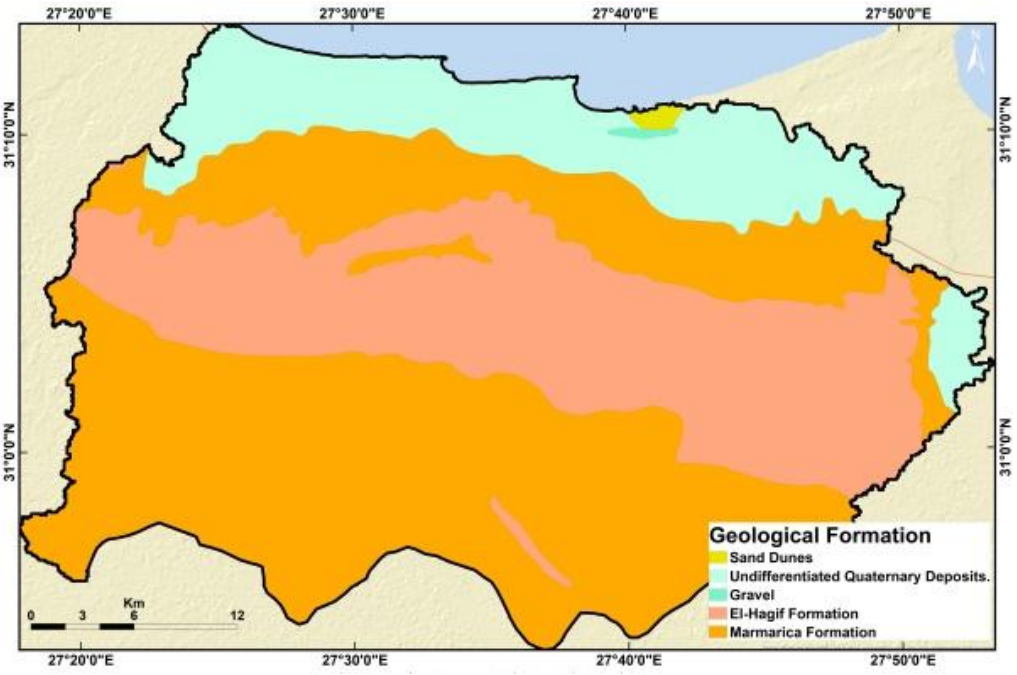


Figure (17). Geological Formation in El Ga'ween area

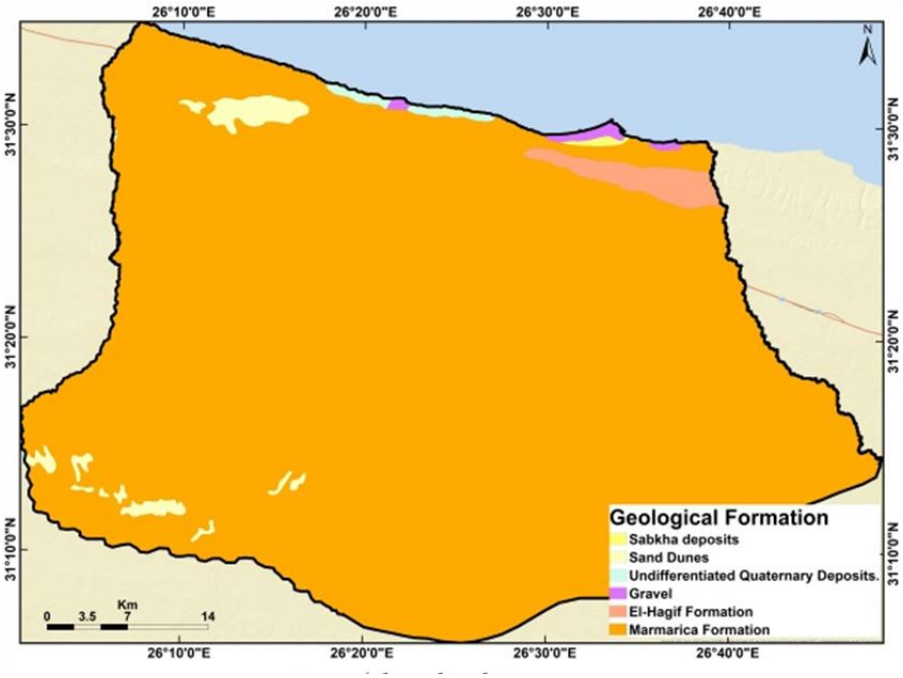


Figure (18). Geological Formation in Abou Mazhoud area

and sandstone. Then there are alluvial plains with a soil depth up to 2 m. These alluvial plains consist of deposits ranging in size from clay to gravel. The coastal plain in El Ga'ween area is different as it is wider and overlapped with the Piedmont plain as compared to the area of Abou Mazhoud. The Piedmont plain in El Ga'ween area is characterised by the presence of distinct Alluvial fans and Deltas.

B. **The Northern plateau zone**: includes the escarpment and the surface of the northern plateau. The escarpment is composed of permeable limestone that sometimes extends to the sea, especially in Abou Mazhoud area and is distinguished by a large number of Wadis that cross the escarpment and form the floors of the wadis, which have a thick layer of alluvial soils at the pedimont of the escarpment. The slopes of the escarpment consists mainly from red sandy limestone and are exposed to the wind and water erosions. The northern plateau consists of two basic formations i.e., El Hagif and Marmarica. El Hagif formation represents the rocks of the Pliocene era and consists mainly of limestone interspersed with layers of marl and clay. While Marmarica formation represents the mid-Myosin era, and it consists of cracked limestone rocks containing holes and fossils. Sometimes Dolomite represents the limestone rocks intertwined with the clay and marl. Hammad, 1972 divided the rocks of the middle Miocene era into two layers, the first layer is characterized by the fossil sandy limestone, the marley and the chalky, while; the second layer consists of shale, and clay blocks overlapping with the limestone which has the same properties as in the first zone.
C. **The southern plateau zone**: consists of limestone of the Marmarica formation.

3.2.1.4. Water Resources

Rain is the main source of water in the northwest coast, which is mostly used for agricultural purposes, especially in the Wadi areas as well as for human and animal consumption. There are some other sources for freshwater, such as desalination of sea water and the water transported by Alexandria-Matrouh pipline which are used only for drinking, because of its high costs. For rainwater conservation, there are different types of dykes, which are considered the main systems for rainwater harvesting used in the NWC region. Such dykes are concrete, earthy or stone and are being built along the wadi's mainstream and the sub-streams. The application of this system aims to reserve and store the rainwater in the soil profile, which is then planted with fig, olive and grape trees.

The size of the dykes and the distance between them vary according to several factors, including the specifications of the wadi's channel course in terms of width, slope, depth of the rock layer,... etc. This system is characterized by that the plants don't need to be fertilized as the suspended sediments of runoff are rich in nutritional elements. There is another type of dykes called stone dykes that is built in the delta of the Wadis in order to reduce the velocity of the surface runoff. These types of dykes are common in the two

the landscape project areas. As the region is totally dependent on rainwater, the report, in this part, is showing water resources related to rain in both areas in reference to the geomorphological features:

A. **The coastal zone**: This zone has the Delta of the Wadis, however no records for the wadis discharges are available due to the lack of devices for measuring surface runoff. There are an average number of cisterns and reservoirs for surface runoff collection, mostly in the rocky areas, due to the high population density in this region.
B. **The northern plateau zone**: it includes a network of wadi channels in both the landscape project areas of Ga'ween and Abou Mazhoud (Table 5 and Figures 19 and 20). Surface runoff rates decrease in flat areas of the plateau, which represents most of the Wadis catchment areas. With increasing slopping at the edges of the Wadis small tributaries and the presence of a shallow soil layer, the rate of runoff increases, which causes the flooding of Wadis bottoms with rain water. This zone is characterized by an increase in the number of cisterns, due to the presence of the rocky layer needed for such structure.
C. **The southern plateau zone**: characterized by its relatively flat terrian. The runoff flow rate is low, and the infiltration rate in the soil profile is high, except for some areas that have gullies resulted from the increased surface runoff concentrations. Shallow depression areas allow accumulation of the runoff water in the plants root zone due to the presence of a deep soil profile, these shallow depressions are often cultivated with figs, olives, melons or grapes. In general, the southern plateau is characterized by a low number of cisterns due to the low rainfall rates and the low population density. The distribution of cisterns in the two project areas is shown in Figures 21 and 22)

In the recent years, different development activities were caeeied out by various national and international organizations. El Ga'ween zone has 23 wadis and their tributaries that have been developed and reclaimed by constructing 415 dykes for the purpose of reserving rain water. while for Abou Mazhoud, 15 Wadis and their tributiries were developed and reclaimed, with a total number of 229 cement dykes.

Table (5). The Main wadis that crossing the two the landscape project areas and their Characteristics (FAO 1970)

	Wadi Name	Area (km^2)	Length (km)
El Ga'ween	El-Grawla Wadi	77.8	22
	El- Zarka Wadi	125.88	20.7
	El-Harega Wadi	101.72	21
	El- Kesaba Wadi	87.61	20.3
	EL- Rathm Wadi	28	10.25
	El-Ghandora Wadi	11.74	9.02
	EL-Zayat Wadi	49.21	7.55
	El-Alam Wadi	16.10	10.50
	Sakhr Wadi	13.65	7.48
	Zablah Wadi	12.58	7.58
	Minshawy Wadi	9.12	6.96
	Abu-Grouf Wadi	13.59	6.94
	Hashim Wadi	4.19	5.68
	Karim Wadi	6.42	5.15
	El-Slofa Wadi	19.7	8.25
	Smeet Wadi	61.83	16
	Haron Wadi	31.54	8.8
	Mador Wadi	37.34	20.8
Abou Mazhoud	El-Terfaya Wadi	6.25	8
	El-Zaybak Wadi	28.54	16.4
	Sodra Wadi	5.82	6
	Shamas Wadi	44.46	15.8
	Abu Marzok Wadi	36.37	15.8
	Abu El Amrya Wadi	10.00	21
	El-Shera Wadi	52.86	23
	El-Hoyra Wadi	37.96	23
	Heda Wadi	22.06	23.5
	Gharnak Wadi	1.36	2.5
	Abu Hesha Wadi	34.17	23.6
	Halpeda Wadi	53.36	24.1
	El-Tawela Wadi	34.62	24.5
	Shbety Wadi	21.04	24.2
	El-Nthely Wadi	51.42	25.00
	Zahery Wadi	3.19	4.5
	Abu Snfek Wadi	10.21	11.00
	Kwal Wadi	17.71	23.00
	Zynab Wadi	29.52	23.7

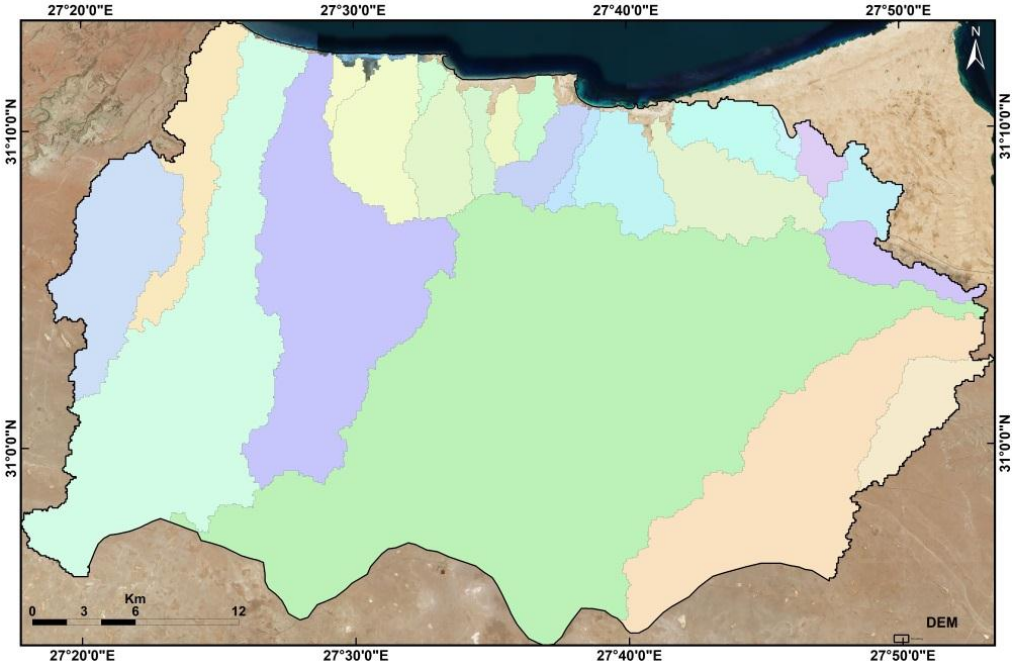


Figure (19). Main watersheds in El Ga'ween area

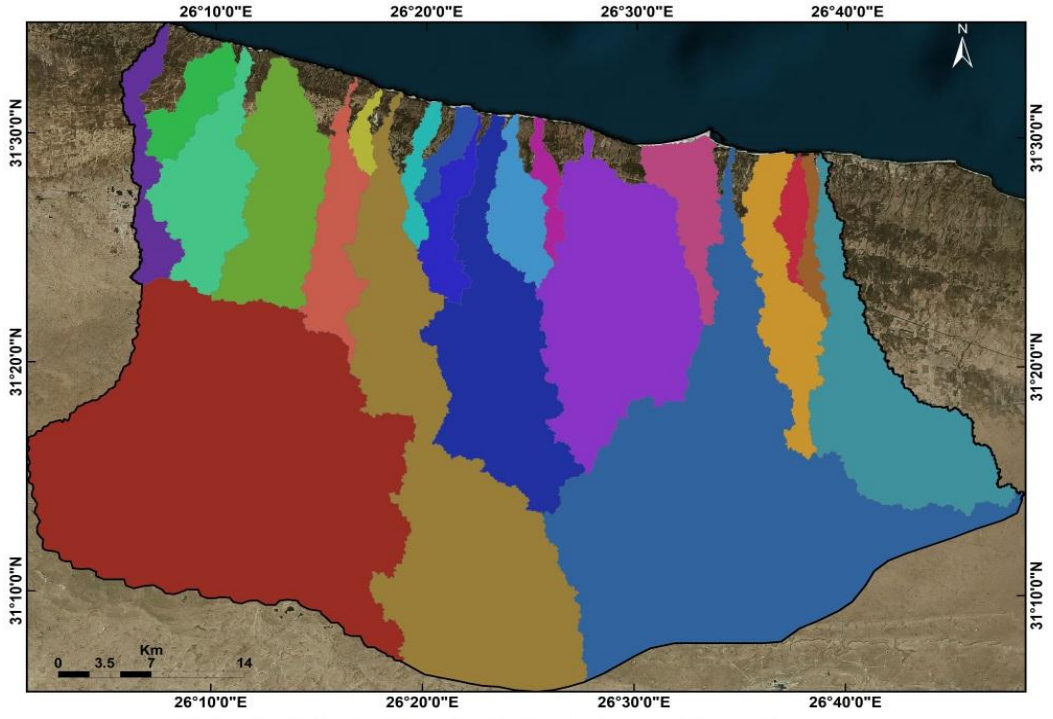


Figure (20). Main watersheds in Abou Mazhoud area

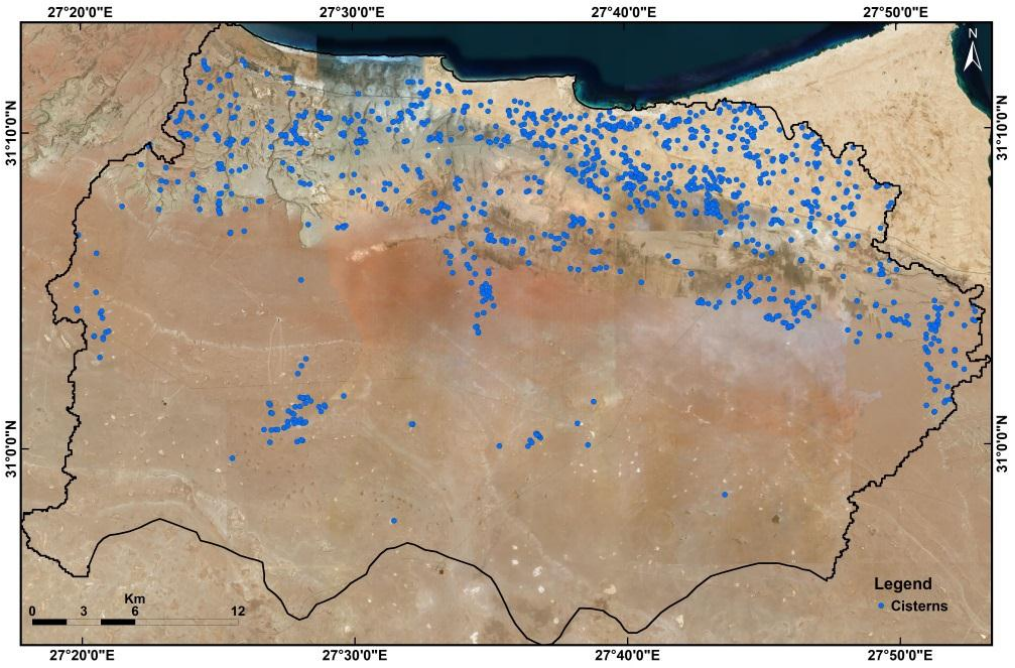


Figure (21). Distribution of cisterns in El Ga'ween area

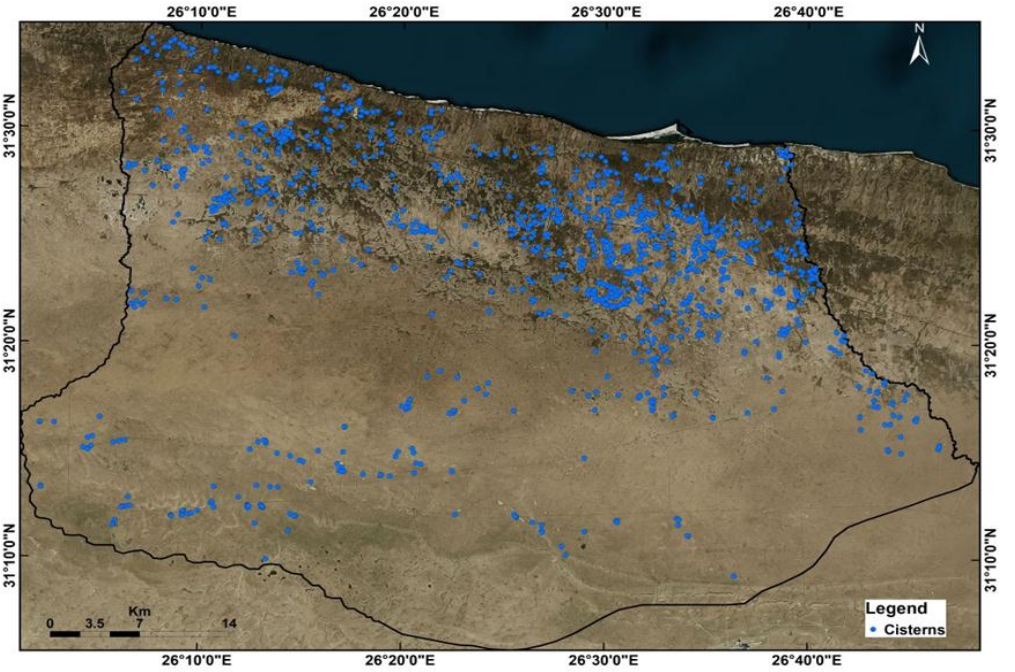


Figure (22). Distribution of cisterns in Abou Mazhoud area

3.2.1.5. Soil Properties

The landscape project areas are occupying about 944,653 feddans. The main geomorphic units and the sub-units were defined as follows:

- The recent coastal plain.
  Foreshore Strip
- The old coastal plain.
  1. Silica sand dunes
  2. Coastal ridges
  3- Depressions
  4- Alluvial fan that exists only in El Ga'ween area.
- Plateau.
- Barren rocks.

Soil evaluation in the two areas of El Ga'ween and Abou Mazhoud:

Based on the Morphopedologic, physical and chemical properties, the soils have been evaluated and classified according to capability for agricultural potentiality to the following classes (Table 6) and Figures (23 and 24).

- Class II: which occupies an area of about 7071.4 feddans in El Ga'ween, and it is represented by the alluvial fans soils.
- Class III: which occupies an area of about 14785.8 feddans; about 12,023.8 in El Ga'ween and 92,762 feddan in Abou Mazhoud. This class is represented by the soils of the old coastal plain depressions, the silica sand dunes soils, soils of the undulating surfaces and solution sinkhole on the plateau surface.
- Class V: which occupies an area of about 55,452.4 feddans; about 35452.4 fed in El Ga'ween, and 20,000 fed in Abou Mazhoud. This class is represented by the soils of the coastal ridges and the foreshore stripe.
- Class VII: which occupies an area of about 777343.4 fed; 275390.4 fed in El Ga'ween, and 501953 fed in Abou Mazhoud. This class is represented by the soils of the plateau and the barren rocks.

Table (6). Land capability classification in El Ga'ween and Abou Mazhoud areas

Soil capability classes	Area (fed)		Total
	El Ga'ween	Abou Mazhoud	
Class(II)	7071.4	----------	7071.4
Class (III)	12023.8	92762	104785.8
Class (V)	35452.4	20000	55452.4
Class (VII) Plateau Baaren Rocks	275390.4	501953	777343.4
Total	329938	614715	944653

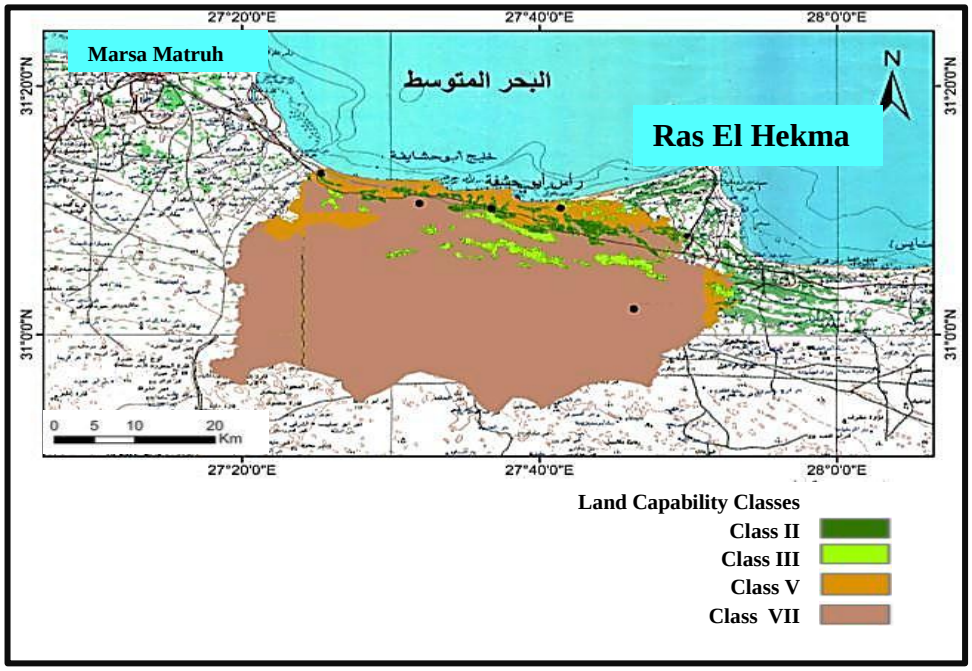


Figure (23). Land capability classes in El Ga'ween area

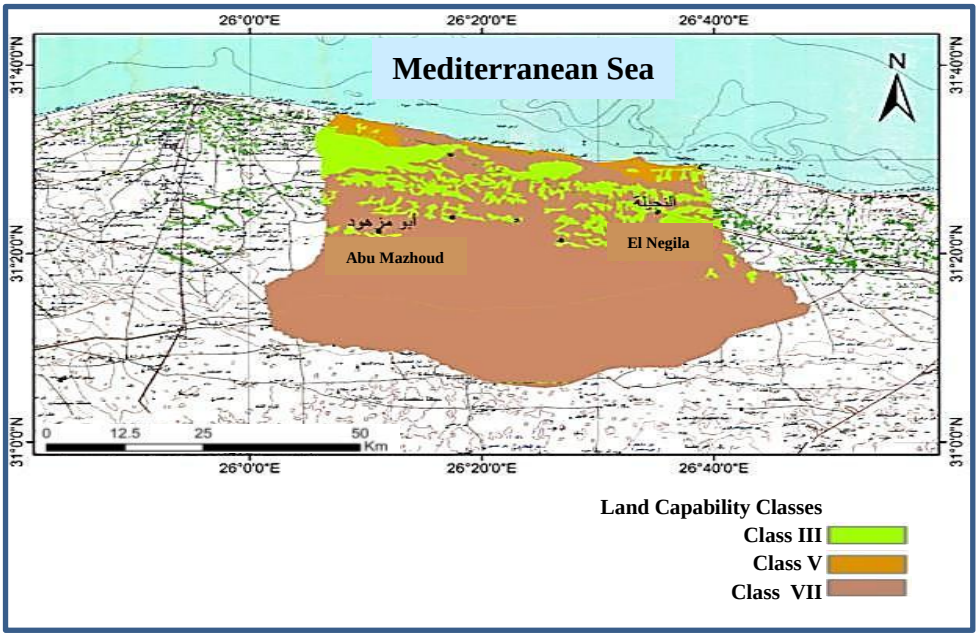


Figure (24). Land capability classes in Abou Mazhoud area

The soil properties of in each land capability class in the two the landscape project areas are summarized as follows (Table 7)

A. Land cpability Class II:

Its area is about 7071, 4 fed in El Ga'ween, and it is represented by alluvial fan soil. There are two types of the alluvial fan soils, which are different in their characteristics as follows:

The first type: the soil is generally deep (> 100 cm) and ground water appears in some areas at a depth of 120 cm, and the surface topography ranges from flat to gently undulating (0,5-5%). The soil texture ranges from medium to moderatly fine (loam, silty loam); the structure of the soil is massive, soft or hard. The soil lime content ranges from moderatly to high, as of the calcium carbonate content ranges from: 3.3 to 19.1%. It is also slightly to moderately saline (<4-8 dS/m). The soil reaction ranges from slightly alkaline to moderatly alkaline (pH =7.6 – 8.2) and the soil drainage is moderate (2.3-8.2cm/hour).

Table (7). Soil types in El Ga'ween and Abou Mazhoud areas

Geomorphologic Units	Soil Units
The recent coastal plain Fore shore strip	Deep or shallow soil – coarse texture with rock outcrops
The old coastal plain Silica dunes	-Deep to shallow soil with coarse texture.
Coastal ridges	-Shallow to moderatley deep soil with moderately coarse to medium texture
Depressions	-Moderatley deep soil to deep with moderately fine or coarse texture -Deep soil with medium texture
Alluvial fans	Deep soil with coarse to moderately coarse texture and sometimes with finer substratum.
Plateau The undulating surfaces and solution sinkholes	-Deep or moderatley deep soil with moderately coarse to moderately fine textures
The bare rocks	Rocky lands

The second type: the depth of the soil ranges from moderatley deep to deep (90 or > 100 cm), and surface topography changes from flat to slightly undulating (0.5 – 5%) and the surface is covered with varisized shell fragments and desert shrups with varying density. The soil texture ranges from coarse to modertaelty coarse with finer interclation, it ranges from sandy to loamy sand and loamy or silty loam. Soil structure is massive or sub-angular blocky, and the content of lime in the soil ranges from very low to moderate as the percentage of calcium carbonate ranges from 8.0 -9.6% and rarely reaches up to > 25%. Soils are free to slightly saline EC values are <4 dS/m and rarely rises from 8-16 dS/m. Soil reaction ranges from moderately alkaline to alkaline (PH = 7.4 – 8.2); Drainage is rapid (17.2 cm/ hr) or moderate speed (11.6 cm/ h).

B. Land capability Class III:

The area is approximately 104,785.8 fed, about 12023.8 feddans in El Ga'ween area and about 92762 feddans in Abou Mazhoud area, represented by Silica sand dunes soil and the soils of the old coastal plain depression and the soils of solution sinkholes above the plateau. The following is a summary of the three soil types properties:

- **Silica sand dune soils:** the depth of the soil ranges from moderately deep to deep (50 or > 100 cm).The surface topography is undulating (5-10%), and covered with desert shrubs different height. The texture of the soil is coarse sand, and the structure is loose single grains. The content of soil lime is ranging from very low to high, as (the percentage of Calcium carbonates is varying from <2 -20%. It is very slightly affected by salts (<4 dS/m) and the soil reaction ranges from the moderate alkaline to strongly alkaline (pH ranges from 8.0 -8.5) with moderate to very rapid drainage (11.6- 35.4 cm/hr).
- **Soil of the old coastal plain depression:** the depth of the soil ranges from moderately deep to deep (50 to > 100 cm) and the surface topography changes from flat to undulating (0.5 -10%). The surface is covered with varisized rock fragments in varying quantities and shell fragments. There are also few desert shrubs and some fig and olive trees. The texture of the soil is moderately fine, which ranges from sandy clay loam to silty clay loam. The soil structure is massive or sub-angular blocky with varying consistence. The lime content ranges from high to very high, (the percentage of calcium carbonate is ranging from 21-57%), The soils are slightly to moderately affected by salts, (<4 - 8 dS/m) and rarely rises to reach 8 to 16 decimeters / m), and the reaction of the soil ranges from slightly alkaline to alkaline (PH ranges from 7.6-8.2) and the drainage is slow or medium speed (2.3 – 7.6 cm/ h).

Solution sinkholes above the plateau: soil is moderately deep (50- >100 cm). The surface topography is flat (0.5- 2%), and it is covered with the rock fragments in medium quantities and with sand sheet. There are also many desert shrubs. The texture of the soil ranges from modertaely coarse to modertaely fine (loamy sand, loam, silt loam), and the

structure is maasive which is soft or compacted. The content of the soil's lime ranges from moderate to high, where the percentage of the soil calcium carbonate ranges from 13.2- 16.8% and it is rarely very high and reaches 61.0%. The soil is slightly to moderately aftected by salts (<4-8 dS/m), rarely highly saline (> 32 dS/m) and soil reaction is neutral (pH 7.4); sometimes moderatly alkaline (8.0-8.2), and the drainage is moderate (2.3 -6.12 cm/h).

C. Land capability Class V:

Its area is approximately 55452.4 fed, about 35452.4 fed in El Ga'ween area and around 20,000 feddan in Abou Mazhoud area, represented by foreshore strip soils and coastal ridges soils. The following is the soil properties of both soils:-

Forshore strip soils: generally soil is shallow and rarely deep (30- <50 cm or >100 cm). . The surface topography ranges from slightly undulating to undulating (2-10%) and covered by some natural plants.

The Soil texture is mostly coarse and ranges from coarse sand to Oolitic sand, and it is single grains loose. This soil is characterized by very high content of lime as the Calcium carbonate percentage varies from 69- 94%. The soil is affected by salt in varying degrees of vulnerability (16-32 dS/m). The soil is alkaline with pH> 8.4, and its drainage varies from slow rapid to rapid (3-15 cm/hr)

The Coastal ridges soils: its depth varies from shallow to moderately deep (30-50 cm) and the topography of this unit is characterized by flat surface and in few cases, it is undulating (0.5-10%). The surface is covered by rock fragments, which exist in varying amount. The soil texture varies from coarse to meduim (sandy loam – loam), and its structure loose or hard. Its lime content is varying from high to very high as the percentage of the calcium carbonates ranges from 25-37%; the soil is slightly saline and sometimes moderately affected and rarely highly saline (<4-8 dS/m). Soil reaction varies from slightly to moderate alkaline (PH 7.5- 7.8); the drainage is slow (0.35-0.9 cm/hr).

D. Class 7 land capability:

The area is approximately 77,7343.4 fed, about 275390.4 fed in El Ga'ween area, and about 501953 fed in Abou Mazhoud. The area is represented by the Plateau and the bare rocks.

3.2.1.6. The land Covers and Uses

The land cover and uses vary in the area due to its variable economic activities. The images of Satellites "Sentinel" have been used to create the land use map for the two the landscape project areas using the NDVI. Each area was divided into 8 classes (Table 8) according to the land use such as limestone and sand dunes, resedential areas, orchard trees, rainfed barely, rocky lands, dense desert shrubs, scattered desert shrubs, and bare soils. The following table indicates the different land uses in the two areas of El Ga'ween and Abou Mazhoud, and the percentage of each land use.

Table (8). Distribution of lands covers and uses on the landscape project areas

Percentage of land use (%)		
Lands Uses	**El Ga'ween**	**Abou Mazhoud**
Limestone and sand dunes	3.34	1.65
Residential areas	1.02	----------
Orchard trees	2.45	1.24
Rainfed barely	4.20	19.05
Rocky surface	23.05	15.17
Dense desert shrubs	38.80	23.14
Scattered desert shrubs	19.70	29.94
Bare soils	7.45	9.82

Table (8) and Figure (25) indicate that the dense desert shrubs class represents the predominant land use in El Ga'ween (38.8%), but in Abou Mazhoud, the predominant land use is the scattered desert shrubs which respresents 29.94% (Table 8 and Figure 26). The cultivated area of barely is higher in Abou Mazhoud as compared to El Ga'ween.

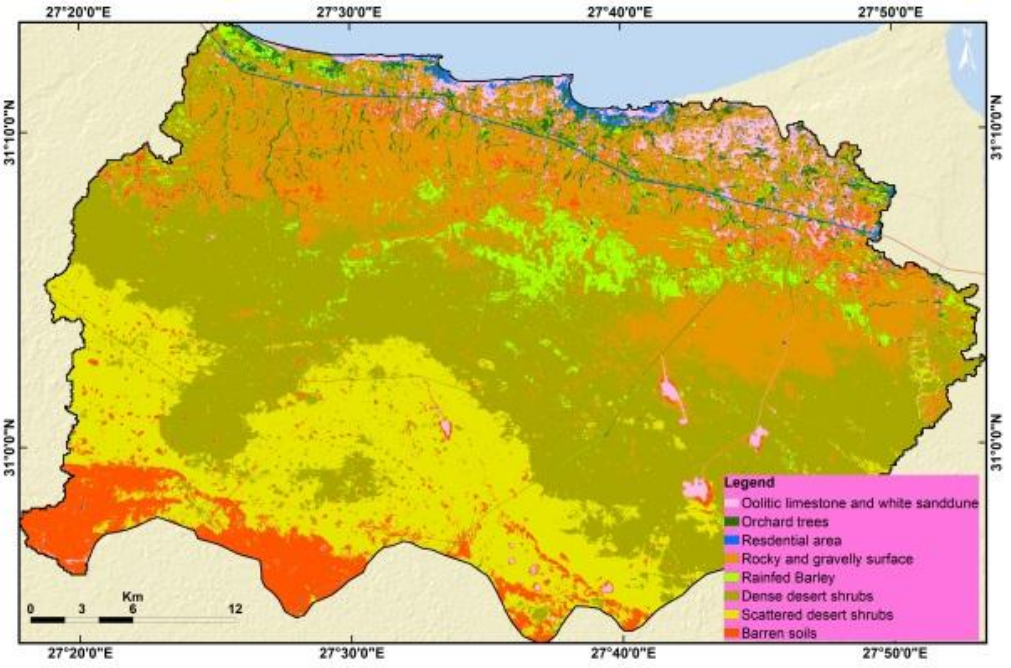


Figure (25). Land cover and uses of El Ga'ween area

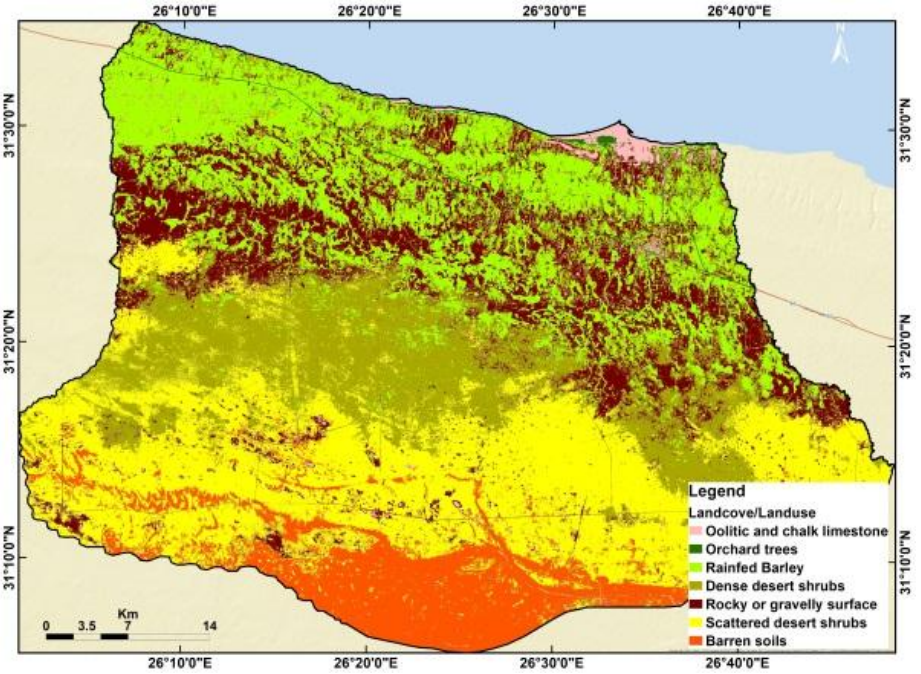


Figure (26). Lands covers and uses in Abou Mazhoud area

3.2.1.7. The Natural Vegetation

The Northern coast of Egypt is divided into three main zones; the first one is the eastern coast, the second is the Delta, the third is the Western coast. The Northwest coast extends about 500 km, west of Alexandria to El Saloum plateau, while its width is about

30 km. The coastal part of the Western desert is considered one of the richest geographical regions in Egypt as regard the density and the diversity of the natural vegetation, which represents about 50% of the Egyptian flora, thus it is considered one of the most crucial regions for the development programs and settlement in the Egyptian deserts.

The NWC includes 1033 types of flowering and vascular plants (Boulos, 2009 &Täckholm1974); such types are distributed all over 6 eco systems: sandy dunes (131 types) the swamps and salt marshes (155 types), the non-saline depressions (224 types), the rocky exposures (206 types), the interior plateau (139 types) Wadis (178 types) (Fakhry 1994). This plant diversity is due to the spatial distribution of annual rainfall which is about 180 mm in Alexandria, reducing to140 mm in Matruh, to reach 114 mm in El Saloum. In terms of vegetation composition in the two the landscape project areas, it's shown as the following:

I- El Ga'ween area (Ras Hikma)

In view of the field visit, the map of El Ga'ween includes 5 main zones according to the variability in both the density and the diversity of plants varieties starting from the coast towards the inland (Figure 27). In this area , 53 species have been observed, including 16 annual types and 37 perennial types. The palatability degree was recorded for each variety and almost 25% (17 types) of the varieties were unpalatable. While 36 types were palatable in variable degrees, including 18 of high palatability, and 10 moderate palatable varieties, in addition to 8 low palatable varieties, which the animals graze only in times of feed shortage and in the dry seasons (Table 9). It is worth noting that the vegetation diversity reduces in both of the first and fourth zones, and totally disappears in the fifth zone. While it increases in the second and third zones; due to the intensive human activity in the first zone where the population exists, in addition to that the main habitats in the first zone consist basically from salt marshes and sandy which support the growth of limited number of plant varieties. But for the fourth zone which is the last one, it is the furthest zone from the coast, and thus the growth of the plant varieties' is highly affected by the low amount of rain. The following is a detailed presentation of the vegetation structure of each zone.

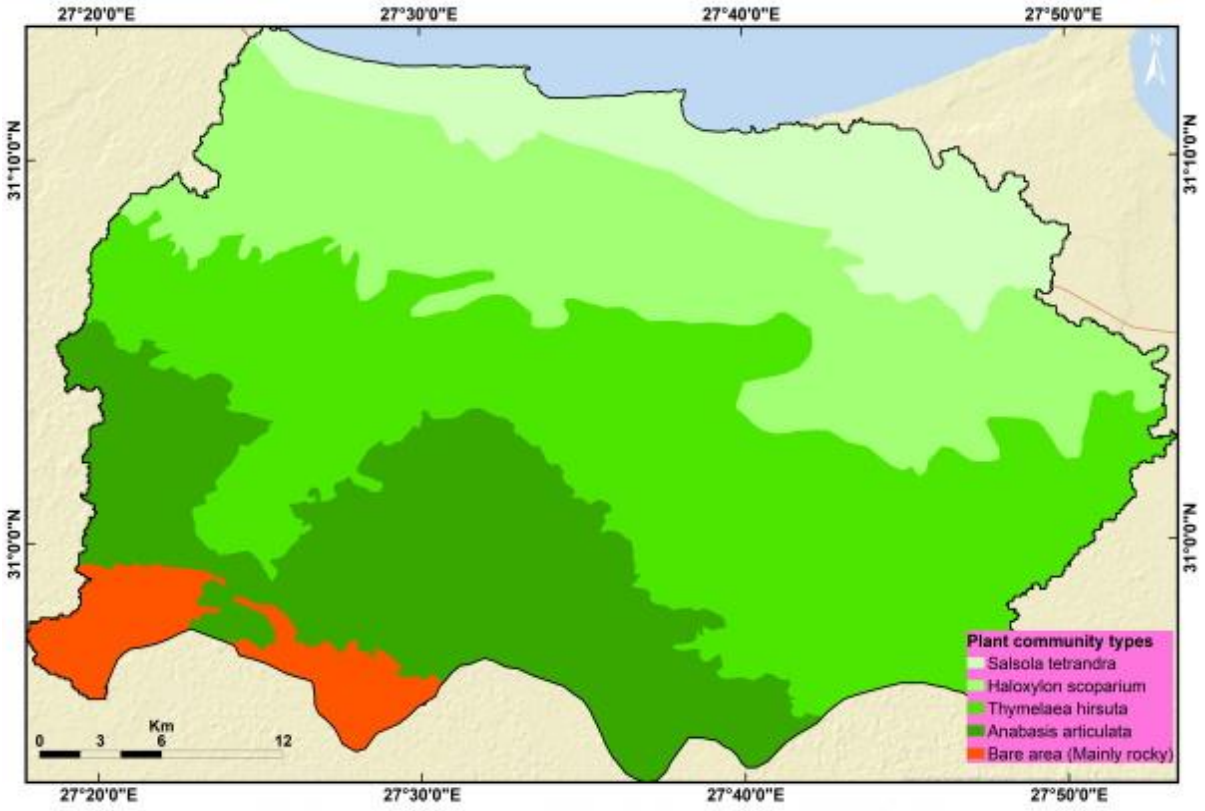


Figure (27). The main plant community types in El Ga'ween area

Table (9). Vegetation species in El Ga'ween area representing the life cycle, palatability, the community type, and the common name

Sections	Life duration	Platability	I	II	III	IV	Arabic name
Species			Community type				
			Salsola tetrandra	*Haloxylon scoparium*	*Thymelaea hirsuta*	*Anabasis articulata*	
Ammophila arenaria (L.)	p	Unpalatable	2	0	0	0	قصب الرمال
Anabasis articulata (Forssk.) Moq.	P	High	1	1	1	4	عجرم
Anacyclus monanthos (L.)Thell.	A	High	1	2	1	0	سره الكبش
Arthrocnemum macrostachyum (Moric).	P	Unpalatable	3	0	0	0	شنان
Asphodelus aestivus Bort.	P	Low	0	3	2	1	بصل العنصل
Astragalus trigonus DC.	P	High	0	1	1	0	اصابع العروس
Astragalus spinosus (Forssk).	P	High	0	1	1	0	قداد
Atractylis carduus (Forssk.) C.Chr.	P	Unpalatable	0	1	1	1	شوك الجمل
Atriplex halimus L.	P	Medium	3	2	1	1	قطف
Bassia indica (Wight) A.J.Scott.	A	Low	0	1	0	0	كوخيا
Carrichtera annua (L.) DC.	A	High	0	3	1	0	قليقله
Centaurea calcitrapa L.	A	Unpalatable	0	3	1	0	مرار
Citrullus colocynthis (L.) Schrad.	P	Unpalatable	0	0	1	0	حنظل
Cynodon dactylon (L.) Pres.	P	High	0	2	0	0	نجيل
Dactyloctenium aegyptium (L.)	A	Medium	0	1	0	0	رجل الحربايه
Deverra tortuosa (Desf.) DC.	P	High	0	2	1	1	قزاح

Echinops spinosus L.	P	Medium	1	1	1	1	شوك الجمل
Eryngium campestre L.	A	Unpalatable	0	2	1	0	شقاقيل
Fagonia cretica L.	P	Unpalatable	0	1	0	0	شوكه
Filago desertorum Pomel.	A	Medium	0	1	2	0	فلاجو
Globularia arabica Jaub.& Spach	P	High	1	1	1	0	حندقوق
Gymnocarpos decandrus Forssk.	P	High	1	1	1	0	جرد
Halocnemum strobilaceum (Pall).	P	Unpalatable	3	0	0	0	حطب احمر
Haloxylon scoparium Pomel	P	Medium	1	4	2	1	رمث
Haplophyllum tuberculatum (Forssk.).	P	Unpalatable	1	1	0	0	شجره الريح
Hyoscyamus muticus L.	P	Unpalatable	0	0	0	1	سكران
Helianthemum lippii (L.) Dum. Cours.	P	Low	0	1	1	1	رعل
Lepidium draba L.	A	High	0	3	1	0	لسلس
Lycium europaeum L.	P	Medium	0	1	1	1	عوسج
Marrubium alysson L.	A	Unpalatable	0	1	0	1	فراسيون
Mesembryanthemum crystallinum L.	A	Unpalatable	0	2	0	0	غسول
Moricandia nitens (Viv.) Durand & Barratte.	P	Medium	0	1	0	0	فجيله
Nitraria retusa (Forssk.) Asch.	P	Low	1	0	0	0	غرقد
Noaea mucronata (Forssk.) Asch. & Schweinf.	P	Medium	0	2	1	0	شوك الحنش
Ononis vaginalis Vahl.	P	High	2	0	0	0	حطيبه
Onopordum alexandrinum	A	High	1	2	1	0	خرشوف

Boiss							
Peganum harmala L.	A	Unpalatable	1	1	0	0	حرمل
Plantago ovata Forssk.	A	High	0	2	3	2	لقمة النعجة
Salsola imbricata Forssk.	P	Unpalatable	0	0	1	2	خريط
Salsola tetragona Delile	P	Medium	0	1	1	2	ضمران
Salsola tetrandra	P	High	4	1	1	2	ضمران
Salvia aegyptiaca L.	P	Medium	0	1	0	0	رعلة
Salvia lanigera Poir	P	High	0	1	1	1	شجرة الجمل
Schismus barbatus (L.) Thell.	A	Low	0	1	1	0	بهمة
Scorzonera undulata Vahl.	P	High	0	1	2	1	دباح
Seriphidium herba-album (Asso) Sojak.	P	High	0	1	0	0	شيح
Stipa capensis Thunb.	A	Low	0	1	1	0	سفسوف
Suaeda vera Forssk.	P	Unpalatable	0	0	0	2	سبطه
Thymelaea hirsuta (L.) Endl.	P	Unpalatable	0	2	4	2	مثنان
Traganum nudatum	P	Low	0	0	1	0	ضمران
Verbascum letourneuxii Asch.	A	Low	0	1	1	0	خرماع
Zilla spinosa subsp. biparmata Maire	P	High	0	0	1	1	سله
Zygophyllum aegyptium Hosny.	P	Unpalatable	2	0	0	0	رطريط

The distribution of vegetation species based on the land uses classes :

The first zone (coastal zone):

This zone extents along the coast; it is located to the north of the international coastal road; its width is about 5 km, where *Salsola tetrandra* prevails with other 16 different species in three different habitats as follows:

A- **The coastal sanddunes**, which are Oolitic sand dunes, consisting mainly from Calcium carbonates, in which both of *Ammophila arenaria* and *Ononis vaginalis*, grow. (Figure 28); such species are unpalatable and common in the environment of the sandy dunes.

Figure (28). A general view of *Ononis vaginalis* located in the coastal sand dunes in El Ga'ween area.

B- Salt marshes (Sabkha) are low areas that are affected by the sea water reflected in a high soil salinity. There are two types of salt marshes, the dry one, in which *Atriplex halimaus* and *Arthrocnemum macrostachyum* dominate, and wet one, in which *Halocnemum strobilaceum* and *Zygophyllum aegyptium* prevail (Figure 29).

C- The coastal rock exposures, in which the following plants exist: (*Globularia Arabica*) and (*Gymnocarpos decandrus*) and rarely *Anabasis articulate*, (*Haloxylon scoparium*), (*Anacyclus monanthos*), (*Haplophyllum tuberculatum*) species are found.

Figure (29). A General view of a salt marsh where the plant of *Halocnemum strobilaceum* (Pall) prevails in the "depressions" and *Atriplex halimus* L. grow on the edges and in the high, dry areas – El Ga'ween area

The Second zone (*Haloxylon scoparium*):

This zone extends to the south of the international coastal road, where the plant of *Haloxylon scoparium* prevails; This area is distinguished by the existence of the orchard trees such as olives- figs and Almond, and field crops as Barely which supports the growth of a large number of plant species, estimated by 41 species. The main plants that accompany (*Haloxylon scoparium*) are: (*Asphodelus aestivus*,*Lepidium draba*, *Carrichtera annua*), as most common plants. While, *Plantago ovate* (Figure 30), *Onopordum alexandrinum*, *Mesembryanthemum crystallinum*, *Thymelaea hirsute*, are common species.

On the other hand, *Astragalus spinosus*, *Globularia Arabica*, and *Gymnocarpos decandrus* were monitored as of the most palatable species, but rarely appear.

Figure (30). *plantago ovate* Forssk.- Main annual palatable species in El Ga'ween area

The third zone (*Thymelaea hirsute*):

This zone is considered the largest in El Ga'ween area and is more homogenous, as a dense vegetation of *Thymelaea hirsute* bushes prevails, in addition of 33 other different species. "*Thymelaea hirsute*" is considered of the unpalatable plants as it contains strong fibers that are hard to digest, and may be this is the reason for the high coverage of such shrub in the area.

The main accompanying range plant species are *Plantago ovate*, *Deverra tortuosa*, *Scorzonera undulate (Figure 31)*, in addition to *Anacyclus monanthos*, *Haloxylon scoparium*, *Salsola tetragona*, *Gymnocarpos decandrus*, (*zilla spinosa* subsp. Biparmata) in less degree.

Figure (31). *Scorzonera undulate* plants and *Vahl Plantago* ovate Forssk in El Ga'ween area.

The Fourth zone (*Anabasis articulate)***:**

It is the last zone in which the natural vegetation exists; it consists basically from *Anabasis articulata*. It's one of main zones for camels grazing. It also contains some of the mostly known unpalatable species as (*Salsola imbricate*) and (*Suaeda vera*). On the other hand, some palatable species are monitored, as (*Plantago ovate*), (*Salvia lanigera*, *Scorzonera undulata*, and *Lycium europaeum*) (Figure 32).

The Fifth zone (The inland zone**):**

It is the last zone and the furthest from the coast, it lacks vegetation cover except in rain catchment ponds, where few scattered plants of Hyoscyamus muticus L. and Salsola imbricata Forssk exisit. Such plants are unpalatable.

Conclusion

From the above, it is indicated that there is signs of overgrazing in El Ga'ween area, as it was difficult to monitor the palatable species, especially the annuals, except in in the wadis floors, on the plateau surface and in the rainfed farming areas. Some introduced and invasive species were frequently monitored such as: Centa urea calcitrapa and Bassia indica, which in trun replaced the highly palatable species such as

Gymnocarpos decandrus and globularia arabica; that indicate the deterioration extent of the rangelands in this area.

Figure (32). *Lycium eurpaeum L.* – *The Fourth zone* in El Ga'ween area.

B- Abou Mazhoud area

The natural vegetation in Abou Mazhoud (Figure 33) can be divided into 4 main groups: the first zone or the coastal zone , the Methnan zone (*Thymelaea hirsute* L) Agram Zone (*Anabasis articulate* Forssk); and finally the fourth zone, which lacks the natural vegetation (Figure 33). Abou Mazhoud area is a largely flat area with homogenous natural characteristics; that might be one of the direct reasons of the high productivity of the rainfed crops, particularly barley and wheat, in addition to some of the horticulture crops located in the water catchment areas and in the Wadi floors. It's worth mentioning also that the barley cultivated areas have increased widely, leading to a decrease in the area of *Thymelaea hirsute* zone. Fifty-six plant species were recorded in the first three zones, including 25 annual species (40%), 40 perennial species (60%). Not all such species are unpalatable, there are only 13 unpalatable species (20%), 24 highly palatable species (25%), and 11 average palatability species (17%), in addition to 16 low palatable species representing 25 out of the total recorded species in the area (Table 10).

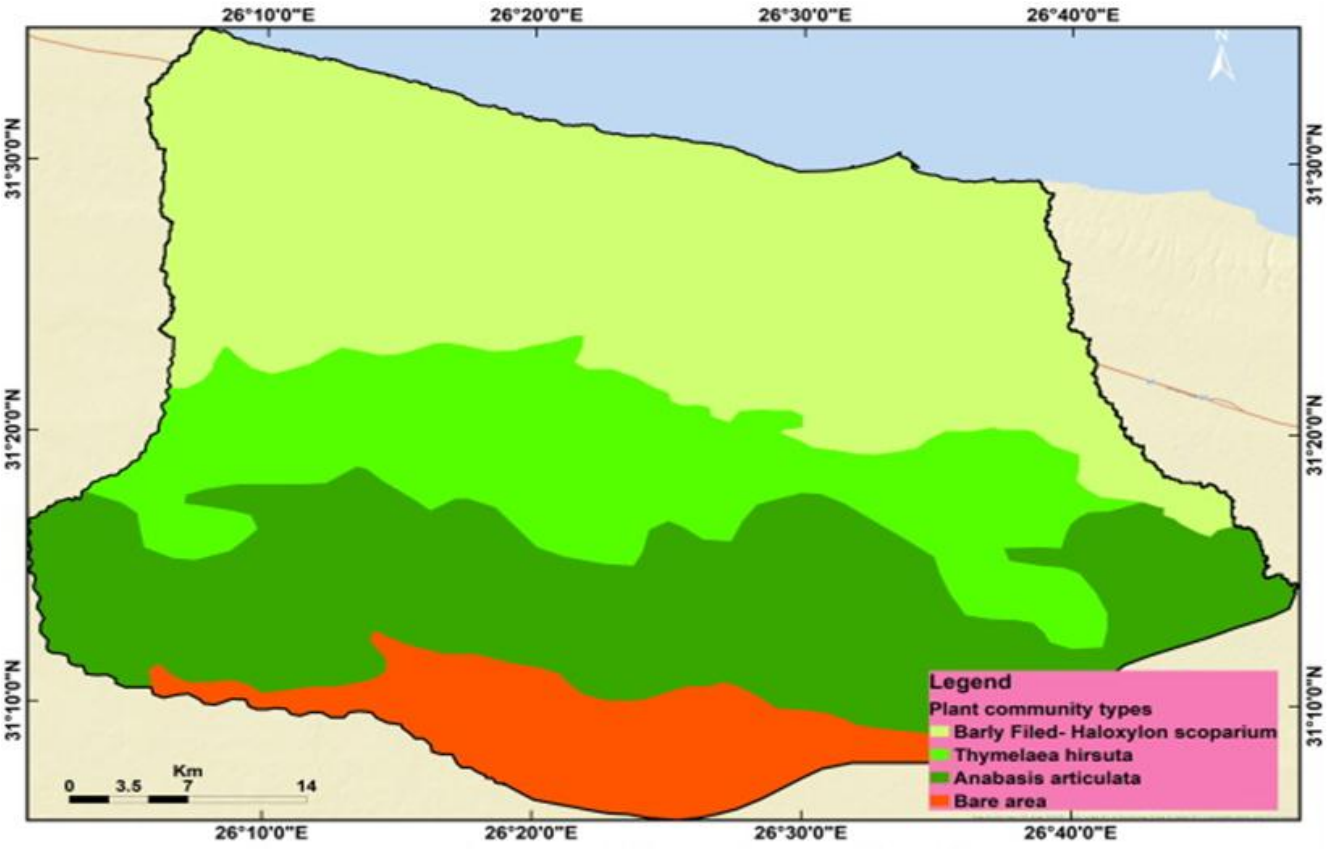


Figure (33). The main plant community types in Abou Mazhoud area

Table (10). The plant species in Abou Mazoud area representing the life cycle, palatability, community types, and the common name

Species	Life Duration	Platabilit y	Section/ Community types			Arabic name
			Barly Filed- Haloxylon scoparium	***Thymelaea hirsuta***	***Anabasis articulata***	
Achillea santolina L.	A	Un palatable	1	0	0	بعيثران
Aegilops ventricosa Tausch.	A	Low	1	0	0	شعير الفار
Allium ampeloprasum L.	P	Un palatable	1	1	0	بصل العفريت
Anabasis articulata (Forssk.) Moq.	P	High	1	2	4	عجرم
Anagallis arvensis L.	A	Low	1	0	0	عين الجمل
Anacyclus monanthos (L.)Thell.	A	High	1	2	1	سره الكبش
Anthemis pseudocotula Boiss.	A	Low	1	0	0	اربيان
Ashodelus aestivus Bort.	P	Low	3	2	2	بصل العنصل
Astragalus trigonus DC.	P	High	1	1	0	اصابع العروس
Astragalus spinosus (Forssk).	P	High	1	0	1	قداد
Atractylis carduus (Forssk.) C.Chr.	P	Medium	0	1	1	شوك الجمل
Atriplex halimus L.	P	Medium	2	1	1	قطف
Bassia indica (Wight) A.J.Scott.	A	Low	1	0	0	كوخيا
Bromus madritensis L.	A	Low	1	1	0	ديل الثعلب
Carduncellus mareoticus (Delile).	P	Un palatable	2	1	0	شوك الجمل
Capparis spinosa var. inermis Turra.	P	Un palatable	1	0	0	كبار
Carrichtera annua (L.) DC.	A	High	3	1	1	قليقله
Chenopodium murale L.	A	Un palatable	1	0	0	زربيح
Cichorium endivia L.	A	Low	1	0	0	شيكوريا
Convolvulus althaeoides L	P	Un palatable	1	1	0	عليق
Cynodon dactylon (L.) Pres.	P	High	2	1	0	نجيل
Deverra tortuosa (Desf.) DC.	P	High	1	3	2	قزاح

Echiochilon fruticosum Desf.	P	High	1	0	1	جرشة
Echinops spinosus L.	P	Medium	1	1	0	شوك الجمل
Emex spinosa (L.)	A	Low	1	0	0	ضرس العجوز
Enarthrocarpus strangulatus Boiss.	A	Un palatable	1	0	0	شلطام
Fagonia cretica L.	P	Un palatable	0	1	1	شوكه
Farsetia aegyptia Turra.	P	High	0	1	1	جريبى
Filago desertorum Pomel.	A	Medium	0	1	1	فلاجو
Globularia arabica Jaub.& Spach	P	High	1	1	0	حندقوق
Gymnocarpos decandrus Forssk.	P	High	1	1	1	جرد
Haloxylon scoparium Pomel	P	Medium	4	3	2	رمث
Helianthemum lippii (L.) Dum. Cours.	P	Medium	0	1	1	رعل
Hippocrepis cyclocarpa Murb.	A	Low	1	0	0	ضريس
Ifloga labillardierei (Pamp.)	A	Medium	0	1	1	كريشه الجدى
Lappula spinocarpos (Forssk.)	A	High	0	1	1	قلية الراعى
Lepidium draba L.	A	High	3	1	0	لسلس
Lolium perenne L	A	High	1	0	1	حشيش الفرس
Lycium europaeum L.	P	Medium	1	3	1	عوسج
Lygeum spartum Loefl.	P	Low	1	0	0	حلفا
Marrubium vulgare L.	P	Un palatable	0	1	0	روبيه
Medicago intertexta Var. ciliaris	A	High	1	1	1	خاصج
Mesembryanthemum crystallinum L.	A	Un palatable	1	0	1	غاسول
Moricandia nitens (Viv.) Durand & Barratte.	P	Medium	1	0	0	فجيلة
Noaea mucronata (Forssk.) Asch. & Schweinf.	P	Medium	2	1	2	شوك الحنش
Onopordum alexandrinum Boiss	P	High	2	1	0	خرشوف
Periploca angustifolia Labill.	P	High	0	1	2	حلاب
Plantago albicans L.	P	High	1	0	0	ينم
Plantago ovata Forssk.	A	High	3	1	2	لقمة النعجة
Pseudorlaya pumila (L.)	A	Low	1	0	1	شمر الجبل
Rumex vasicarius L.	A	Low	0	1	0	حماض

Salsola tetrandra Forssk.	P	High	1	2	3	ضمران
Salvia aegyptiaca L.	P	Medium	1	1	1	رعلة
Salvia lanigera Poir	P	High	1	0	1	شجره الجمل
Schismus barbatus (L.) Thell.	P	Low	1	0	1	بهمه
Scorzonera undulata Vahl.	A	High	0	1	2	دباح
Seriphidium herba-album (Asso) Sojak.	P	High	0	1	1	شيح
Stipa capensis Thunb.	P	High	0	1	1	سفسوف
Suaeda vera Forssk.	P	Un palatable	0	1	2	سبطه
Teucrium polium L.	P	Low	0	1	1	جعده
Thymelaea hirsuta	P	Un palatable	1	4	2	مثنان
Trifolium resupinatum L.	A	Low	1	0	0	قرط
Trigonelaa stellata Forssk.	A	Low	1	0	1	دراهمية
Xanthium spinosum L.	A	Un palatable	1	0	0	شبيط
Zilla spinosa subsp. biparmata Maire	P	High	0	1	1	سله

The first zone (rainfed area):

This zone covers a large area of Barani as it extends parallel to the coast; its width is about 10 km. This zone is distinguished by the existence of the rainfed agriculture activities, particularly barley and wheat in the leveled areas in addition to the fruit trees in the Wadis floors and rain catchment areas; but (*Haloxylon scoparium*) and (*Ashodelus aestivus*) grow widely on the lands edges and rocky areas. In this zone about 40 plant species have been found. Plants of (*Atriplex halimus*, *Plantago ovate*, *Lepidium draba*, and *carrichtera annua* are the most common and companying plants, while plants of *Onoporadum alexandrinum*, *Cynodon dactylon*, *noaea mucronata* have been recorded as examples of the common palatable species. On the other hand, some rare and palatable species have been monitored, such as *Deverra tortuosa*, *Gymnocarpos decandrus* (Figure 34), and *Salvia lanigera*).

Figure (34). Overgrazed *Gymnocarpos decandrus plant* in Abou Mazhoud area

The second zone (Thymelaea hirsute):

In this zone, *Thymelaea hirsute* shrubs are abundant in a high density; the plant is unpalatable, which explains why such plant exists in great number inside this zone. The most important accompanying species in terms of abundance are (*Deverra tortuosa*, *Haloxylon ascoprium*, *Lycium europaeum*, then *Anabasis articulate*, *Ashodelus aestivus*, *Anacyclus monanthos*, and *Salsola tetrandra*. On another hand, few plants were monitored from *Periploca angustifolia* (figure 35), *Zilla spinosa* subsp. *biparmata Maire*, *Gymnocarpos decandrus Scorzonera undulate*, *Seriphidium herba-album*, *Salvia lanigera*, (figure 36), and others which are characterized by their high palatability and rare appearance. (Table10)

Figure (35) *Periploca angustifolia*plant Sp. in Abou Mazhoud area

Figure (36). *Salvia lanigera S*p. in Abou Mazhoud area

The Third zone (Anabasis articulate):

The third zone is characterized by the prevalence of *Anabasis articulate* (Forssk.) Moq.; and is considered the main area for camel grazing (figure 37) as the plant is unpalatable for goat and sheep; furthermore, this zone is far from the populated areas. On another hand, 36 accompanying species have been monitored, mainly *Salsola tetrandra* plants, it's also one of the favorite species for camels, *Plantago ovate*, *Periploca angustifolia*, *Noaea mucronata*, *Deverra tortuosa*, *Haloxylon scoparium*, *Zilla spinosa* subsp. *biparmata Maire Salsola*, *Seriphidium herba-album*, *Gymnocarpos decandrus*, *Farsetia aegyptia*, *and Salsola tetrandra* . Figure (38) shows the main palatable and rare species in this area such as *Salsola tetrandra*.

Figure (37). ***Anabasis articulata (Forssk.) Moq.*** **in Abou Mazhoud area**

Figure (38). ***Salsola tetrandra Sp.*** **in Abou Mazhoud area**

The Fourth zone (the Inland zone):

The fourth zone is the inland of the landscape project area, which lacks vegetation appearance except for few unpalatable plants such as *Hyoscyamus muticus* and *Salsola imbricate*.

Conclusion

Quantitative and descriptive studies of the natural vegetation were conducted in Abu Mazhoud area for identifying the palatability degree for each plant variety; 65 plant species were monitored, including 80% of the palatable species in variable degrees. The area was divided into 4 main zones, which are: the coastal zone that is presented by rainfed cultivation and fruit trees in addition to *Haloxylon scoparium* in the rocky areas. The second zone is dominated by highly dense (*Thymelaea hirsute*) shrubs. The third zone is represented by (*Anabasis articulata (Forssk.)Moq.*), which is the favorite area for camel grazing. The last zone is the bare soil zone. It was noticed that there were some invasive species such as *Carduncellus mareoticus, Bassia indica, Atriplex nummularia* which vary in their palatability, including unpalatable species such as *Carduncellus mareoticus*, moderately palatable as *Bassia indica*, and highly palatable as *Atriplex nummularia*. It has been noticed signs of overgrazing in the area revealed by the poor growth of the palatable species. Species palatability seems to be an important indicator to assess RL health, so it is highly recommended to protect and rehabilitate the deteriorated plant species in the area.

3.2.2. Landscape scale assesment and remote sensing:

PRAGA mechanism depends as previously mentioned, on combining the scientific knowledge with the local indigenous knowledge. In this stage, Satellite data combined with the acquired field data were used for increasing the verification of knowledge and the understanding of the rangeland's health and the land deterioration extent in both project areas. Consequently, this part of the report shows the land cover changes in the two project areas and the vegetation production according to remote sensing data

3.2.2.1. Land cover change

"Land cover change" is one of the main indicators, which reveals the lands deterioration, especially in the rangelands. According to the framework of the Land Degradation Neutrality (LDN), the conversion of land from natural productive (rangelands in our case) to less productive land (bare soil, urban land, barren soil) is an indicator of land degredation. In the dryland areas land degredation affects negatively the biodiversity, livestock production and food supply as well as the resilience of the socio-economic systems.

For detecting such change which occurred in the area, Landsat 8 Satellite images were used for the two the landscape project areas "El Ga'ween and Abou Mahoud" to create the land cover maps. Land cover maps were created at intervals of 5 years i.e.,1999, 2004, 2009, 2014, 2019, with spatial resolution of 30 m. The land cover units were classified to 4 classes, including cultivated soil, bare soil, dense desert shrubs, and scattered desert shrubs.

As shown in Figures 39 and 40 no remarkable landcover changes were detected in the last 20 years, this finding agrees with the information provided by the local community. They concluded that the great change that converted the rangelands to horticulture and rainfed crops was recorded more than thirty years ago. However, the noticable change in the density of the desert shrubs, as some densely vegetated areas converted to areas with scattered vegetation, and vice versa, was resulted from the fluctuation of annual rainfall from year to year.

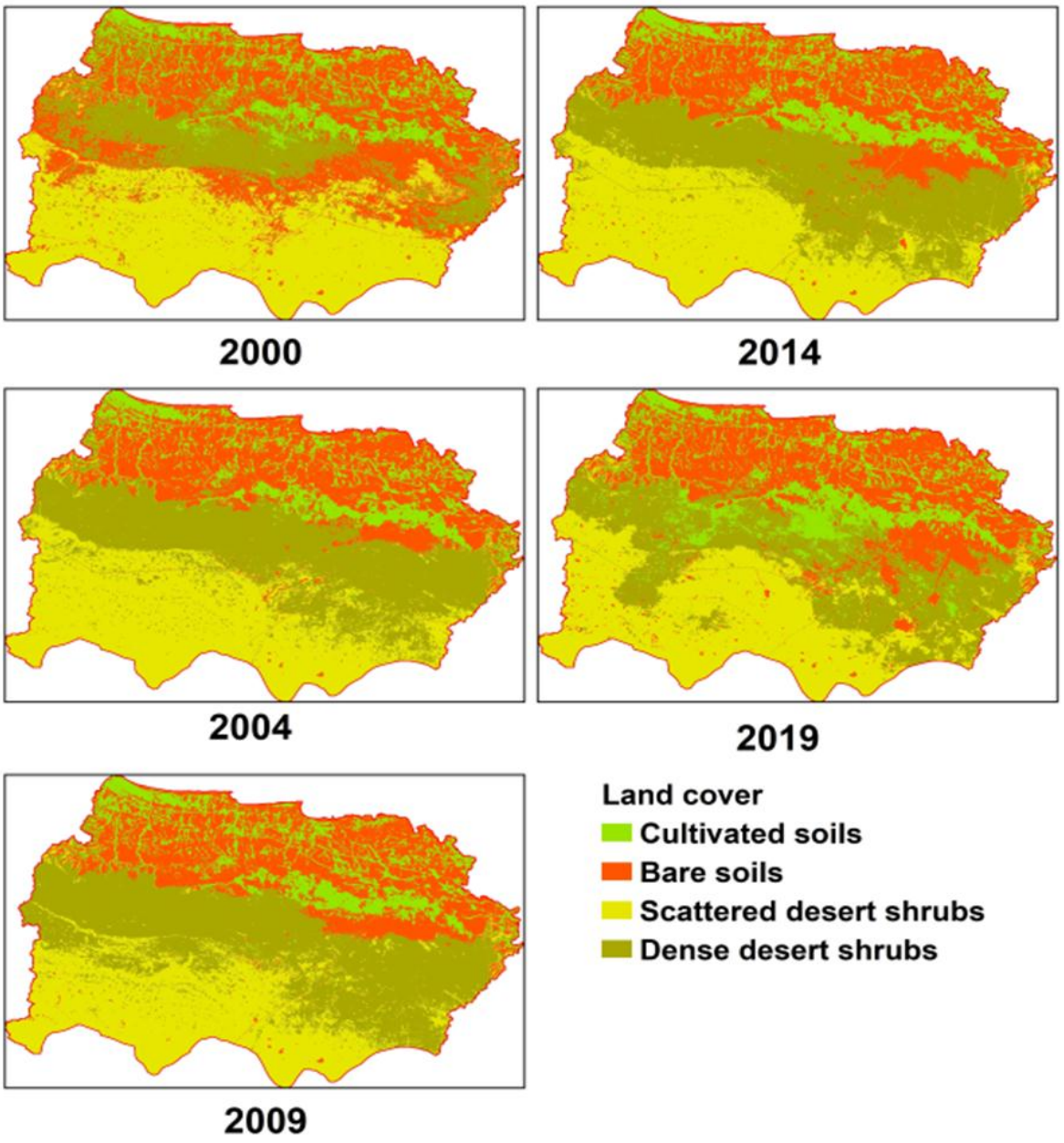


Figure (39). Land cover maps in the last 20 years at El Ga'ween area

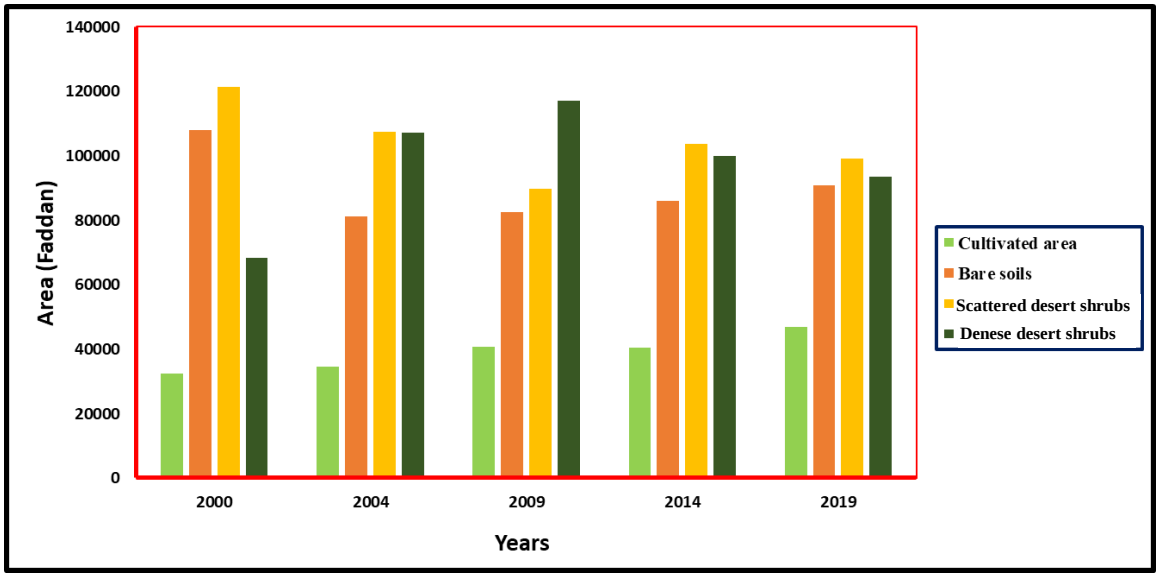


Figure (40). The monitored land cover changes (by feddan) every five years in El Ga'ween area

Figures 41 and 42 show that the land cover witnessed the land cover witnessed no remarkable change over the last 20 years in Abou Mazhoud area; that also agrees with the information provided by the locals., They revealed that the significant change in the land cover from natural rangelands to cultivated lands already occurred more than 30 years ago. Generally, the area with low dense desert shrubs was greater as compared to area of the highly dense desert shrubs, except for the two years of 2004 and 2009, were almost they were equivalent. It is also shown that there was a slight decline in the area of the bare soil, demonstrating the increase of the cultivated lands in limited spots.

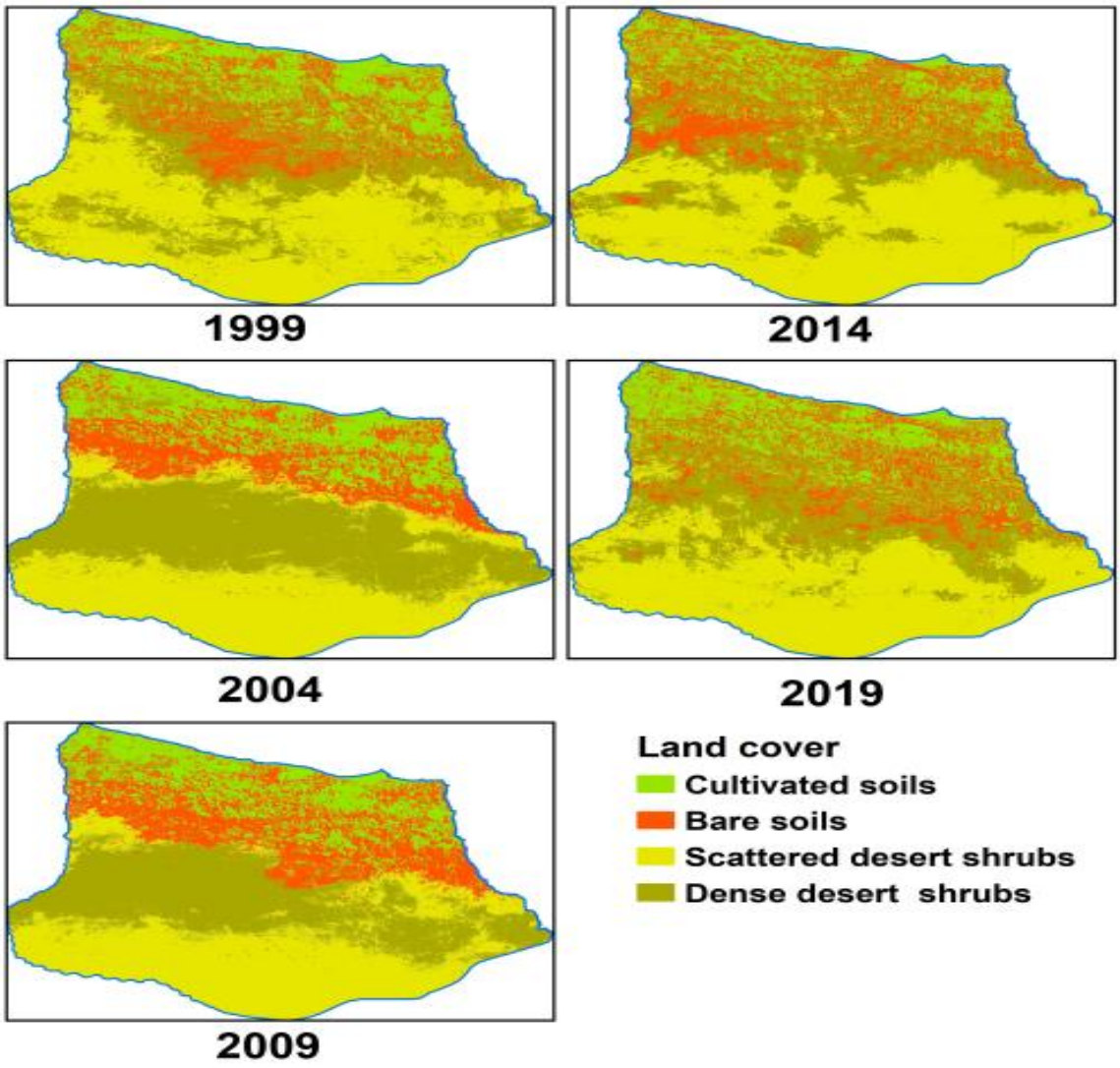


Figure (41). Land cover change in the last 20 years at Abou Mazhoud area

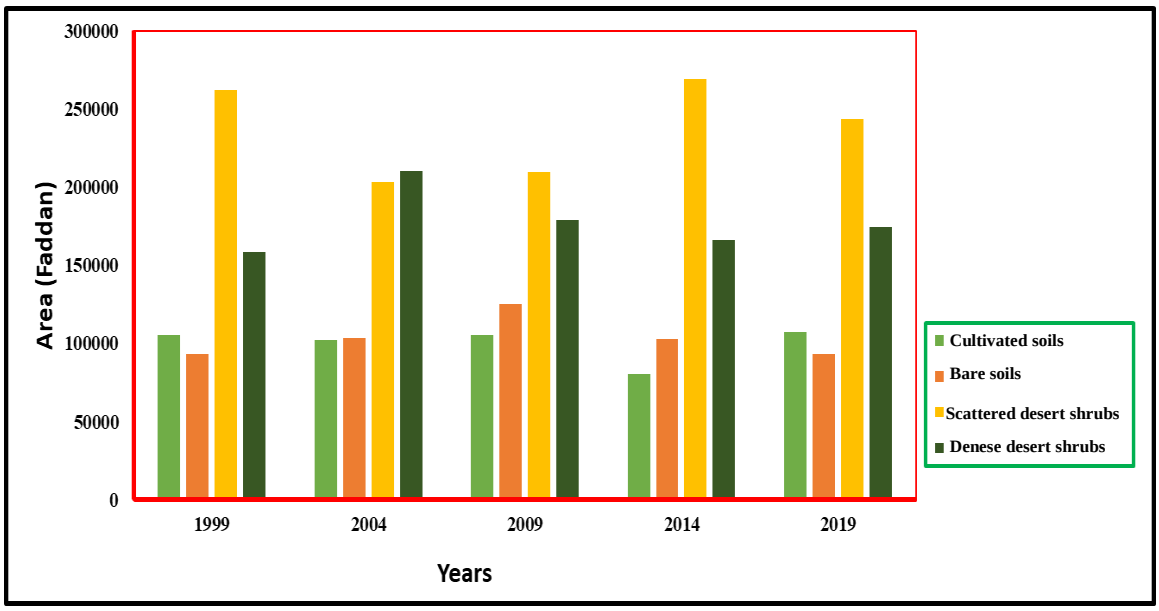


Figure (42). The monitored land cover changes (by feddan) every five years in Abou Mazhoud area

3.2.2.2. Vegetation production

In the baseline study of the HERD project conducted by the Arab Organization for Agriculture Development (AOAD, 2020). The Normalized Difference Vegetation Index (NDVI) was used to detect the vegetation production change within the same year and from year to year. Images from Sentinel-2 sattelite were used to produce the NDVIs every three months starting from August 2015 to November 2019. The obtained NDVI values revealed that the maximum vegetation production is obtained in March every year, while the minimum production is recorded in November in both project areas (Figures 43 and 44). The landscape project areas depend mainly on rainfall which usually starts in November and ends in March , and this is maybe the reason for the high vegetation production in March (end of the rainy season) as compared to November (end of the dry season)

In figures 43 and 44 The two project areas folow the same trend in the annual NDVI. However, it shows that the vegetation production and density are higher in Abou Mazhoud area as compared to El Ga'ween , and that is caused by the higher mean annual rainfall in Barrani area as compared to Matrouh and Ras El Hekma. In areas, the rainy seasons of 2015/2016 and 2018/2019 produced higher vegetation yield as compared to 2016/2017 and 2017/2018 rainy seasons , and this is also due to the higher total rainfall in 2015/2016 and 2018/2019 seasons.

Figure (43). Average NDVI time series in El Ga'ween area

Figure (44). Average NDVI time series in Abou Mazhoud area

3.3. The third phase: participatory phase:

This phase aims at involving the local stakeholders in the evaluation process, and in the initial landscape mapping, Meetings were conducted with the local community, local officials and local experts in El Ga'ween and Abou Mazhoud areas before starting the field data collection sessions in the two the landscape project areas. These group meetings included presentations about the project objectives, and a detailed discussion about the landscape of interest, land use patterns and local knowledge . As part of the discussion, the local community described their cultural landscape, land use patterns and natural resources including soil, water and vegetation. It has been taken into account in this stage to involve the largest number of the local community members along with the good geographic representation and involving the females considering representing all the aging stages of the local community members, focusing on the old aged and the herders.This phase includes two steps: the first is participatory landscape mapping, and the second is the participatory indicator selection

3.3.1. Step 5, Participatory mapping of the landscape project areas

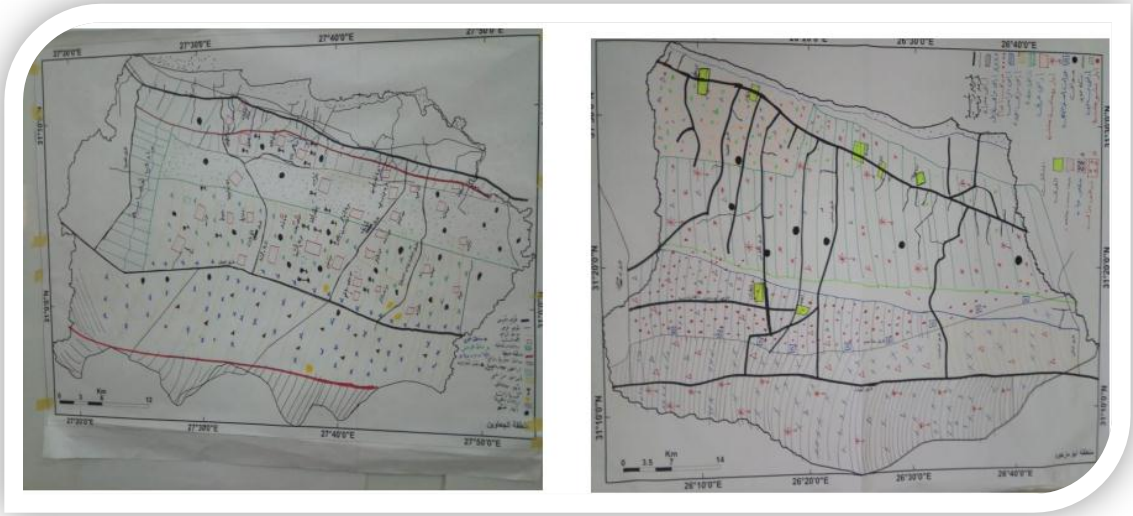
At this stage the community members were asked to transfer their local knowledge and expertise into a map. Participatory mapping was done in two groups (Figures 45 and 46) of the community members for El Ga'ween and Abou Mazhoud. The landscape mapse included information about water points (cisterns, ground wells), grazing areas, roads, species of the vegetation, grazing animal types in each area, old grazing routes, and land use patterns as well as the spatial resolution and temporal dynamic of the land cover change and deterioration. Sampling points were identiefied collaborativelly based on the variability in the landscape mainly in soil and land use types.

The local communities classify the landscape project areas according to the physical attributes and land use patterns. The landscape in the two project areas was divided to three zones from the sea to inland based on the land cover i.e., horticultural cultivation area, barley cultivation area and the natrural rangelands area . The latter is then divided to two sub-zones, sheep grazing area and camel grazing area. Participants indicated that Abou Mazhoud area is characterised by a higher amount of annual rainfall and better soil quality espacially in El Erq site (see results section for definition) which is more suitable for wheat cultivation.

In both the landscape project areas, community members detailed the landforms (10 landforms: results section) and the different soil types (4 types : results section) using the local terms of the bedouins. Each landform and soil type has its soil and vegetative characteristics . Sampling points were identified based on landscape variability in land use, land form and soil types. To describe the degree of degredation and the factors

influencing it, a scale of highl, meduim and low degredaded areas was used during sampling.

Figure (45). The local community members during the participatory landscape mapping



El Ga'ween **Abou Mazhoud**

Figure (46). The participatory maps of El Ga'ween and Abou Mazhoud

3.3.2. Step 6, Participatory indicators selection for landscap project areas

During the participatory mapping workshop, local community members, experts and all the concerned parties a greed on adequate and feasible number of indicators for field assessment.. Such indicators should be well- known and accepted by the local community members and should be scientifically robust. During selecting such indicators, the financail cost should be taken into account for gathering and analyzing the data and time allocated for conducting the assessment.

3.3.2.1. Stages of selecting the indicators

According to PRAGA methodology which maximizes the role of the local community in every step of the assessment process including the indicators selection. Based on such framework, a training workshop was conducted during 28/8- 2/9/2019 by Claire Ogali and Chris Magero , from the IUCN regional office in Nairobi, Kenya and in presence and support of the staff from IUCN regional office in Amman, Jordan. The training was attended by local experts and scientists, and a preliminary set of priority indicators was identified. The training included a field visit to collect field data from sample points representing all the agro- ecological zones of El Ga'ween landscape project area. The IUCN staff members from Kenya and Jordan provided the support to the project team in collecting the field data and evaluating the assessment datasheet.. During the training, datasheet used for rangeland assessment in Kenya was presented, and some indicators were eliminated and others were added based on the disscussion of the local stakeholders. some socio-economic indicators were suggested. Also a modified electronoc datasheet was created to facilitate the field data collection.

3.3.2.2. Soil indicators:

Soil is an important determant for land degredation, therfore information on the following soil indicators were collected:

* **Landforms:** Indicates the vegetation changes according to the landform characteristics. Table (11) provides a complete description for all the landforms and their characteristics in the landscape project areas.

*** Soil type:** Soil type affects the vegetation type and it is a key indicator of grazing potential . Table (12) gives a complete description of all the soil types which exist in the assessment the landscape project areas.

* **Soil texture**: Gives an idea about the soil water conservation capacity and the soil fertility degree in its relevance for different plant types.

* **Soil structure:** Indicates the cohesion of of the soil practicles and its different physical characteristics.

Table (11). The local termes of the land forms used in the assessment of the landscape project areas

Landscape	Characteristics	Plant cover	Photo
1- Shateeb	• A narrow strip of a shallow soil acts as a waterway during rain • Surrounded by rocky soil • A very fertile soil and easily cultivated	The land cover is dominated by Mithinan *Thymelaea hirsuta*	
2- Ghout	• An extended area of a very fertile soil ,lower in elevation as compared to the surrounded areas • Not less than 50 Feddan in area • The soil is mainly loose and easy to plow	The area is mostly dominated by Mithinan *Thymelaea hirsuta*	
3- Hettia	• Low-concave terrain • Water and sediment collection areas • Different types of soil ranges from good soil suitable for agriculture to very compacted soil with a high content of calcium carbonate • From 1-5 feddan in area • Similar to the bowl in shape	Can be cultivated with all types of crops, especially watermelon, but in case that the soil is very compacted, it is used as a drinking spot for camels	
4- Alawy	• High lands as compared to surrounding lands • Convex in shape • Rocky land often covered with rock fragments ranging in size from gravel to boulder	Thyme and Artimisia are found in these lands	

5- Araqeeb	Flat areas with rocky shallow depth covered with rock fragments of different sizes	Not suitable for cultivation and is mostly dominated by scattered desert shrubs	
6- Kezan	Lime sand dunes located along the sea	Trees and shrubs mainly used for sand dune fixation	
7- Sabkhat (salt marshes)	Flat land along the sea with a lower level than the sea, dominated by hummocks characterized by a high content of dissolved salts	Mainly halophytes	
8- Groove (Gully erosion)	Grooves from water runoff that cuts the areas with fragile soils	Natural plants	

9- Erq land	Sand ripple lands - with a wavy surface, deep and retain moisture for long periods	Rich in natural plants - suitable for growing various field crops, horticulture, watermelon	
10- Goora	Flat areas with a very high calcium carbonate content - no rocks	Land that cannot be cultivated and has no vegetation	

Table (12). The local terms of the soil types as used in the assesment of the landscape project areas

Soil type	Characteristics	Plant cover	Photo
1- Noos	Loose, fertile, sandy to silty soils, water retained, low salinity, low calcium carbonate	Barley cultivation lands and horticultural lands in some bottoms and delta of wadis	
2- Galda	Lands with a high content of calcium carbonate - cracks on the surface - highly compacted difficult to plow soil - low leaching rate because of the high contents of fine particles and calcium carbonate	It can be reclaimed and cultivated with different crops	

3-Snake soil	Alkaline saline soils - loose and soft soil	Dominated by halophytes	
4-Safy Remal (sand deposits)	Aerated deposits of fine and coarse sand grains	Dominated by natural plants	

Soil depth: Indicates the soil suitability for the cultivation of different plant species more than others(discriptive from previous study) .

* **Natural soil disturbance** (Soil and wind erosion): It is an important indicator for land degredation that is affected by vegetation cover, topography, soil structural characteristics and the different agricultural management practices.

* **Artificial soil disturbance:** Indicates the human impact on land degredation through the wrong practices, the signs of "artificial disturbance" are the existance of Crushers, roads, lighting posts..

*** Soil Salinization:** Soil salinity is a major indicator for land degredation , but in the two the landscape project areas, the only lands affected by salinity exist close to the sea (salt marches) ; thus, the human has no role in soil salinization in the area.

*** Organic litter:** Plant organic litters have a great role in protecting the soil from erosion, increasing the water retention, and preserving the soil temperature. The existence of the plant dead materials is considered a good indicator of the intensity of grazing process, as the plant wastes increase with the reduction of the animal grazing rate.

3.3.2.3. Water indicators:

Water is considered the main factor for the rangeland health in the area, and determines the land usages (horticulture or field crops or rangelands). The rainfall rates are considered a good indicator of the rangeland productivity for obtaining a good production during this year and also maintaining the fullnes of the rainwater collection cisterns which are used as sources of drinking water for animals. Information on the following water indicators were collected: :

* **Rainfall amount:** Rain is the main factor which identifies the health of the rangelands, as the seasons of high rain are characterized by a high vegetation density and production, unlike the seasons of low rains.

*** The groundwater wells:** The rainfall amounts affects the salt concentrates in the groundwater which is used in the variable agricultural activities.

* **Cisterns** which are underground structures used to store rain water, and they are the main sources of water supply for animals and humans in such areas . Amount of the stored water stored in these cisterns depends mainly on the amount of the rain water.

***Dykes:** Includes earth, cemented, and stony structures which are used in retaining the rain water in the soil profile and for reducing the velocity of the runoff water which accordingly reduces the process of the soil erosion,

3.3.2.4. Vegetation indicators:

Vegetation indicators are considered direct indicators to measue the land degredation of the indicators included the following:

- **The vegetation type:** Reveals the existance and condition of the vegetation types as compared to the past.
- **The vegetation cover:** Which is the percentage of the bare ground which determines the amount of forage production per unit area.
- **Percentage of natural vegetation cover in past and present:** is an indicator that has been used for sites dominated by the natural vegetation and aims to measure the extent of the deterioration of the current vegetation as compared to the past. This indicator is used to express the reduction of vegetative production as well as the extinction of some plant species.
- **Plant life cycle and degree of palatability:** annuals and perennials differ in their growth as well as the degree of palatability, and through this indicator, the proportion of palatable and unpalatable species was determined in the assessment landscape.
- **Plant species in terms of their abundance and degree of change:** This indicator lists the highest plants concerning their abundance (to indicate the extent of

rangeland degradation in case of the spread of the unpalatable species) and compare them to their state in the previous time.

- **Rangeland use**: This indicator aims at measuring the extent of the use of the reangeland as well as the degree of grazing pressure (high, medium or low).
- **Grazing system**: This indicator was used to identify the prevailing grazing system in the region, which is also used to measure the degree of grazing pressure rangeland.
- **Grazing seasons**: This indicator was used to identify the periods during which grazing is taking place. Grazing season usually begins in the spring after the rain, but due to the lack of alternative sources for fodder, rangelands in the area are also used during the summer and autumn periods using residues of barley plants and some parts of shrubs.

3.3.2.5. Other indicators:

- **The presence or absence of wild animals**: an indication of the density of the vegetation cover where some wild animals prefer to be in places of dense vegetation cover.
- **Pollution Manifestations**: Some wastes, such as plastic bags, are dangerous to sheep when feeding on them, which leads to medical complications for animals and consequently their death.

Finally, after completing this stage, a data collection tool was prepared and the abovementioned indicators were formulated to measure and to monitor the land degredation in the assessment landscape.

3.4. Fourth phase, Assessment phase:

This stage aims to build the capacity of the assessment team, which will collect the information from the field of assessment. Experts from IUCN, carried out a training workshop for training the assessment team on how to use the methodology in the assessment process and transferred the knowledge from other countries' experiences, which have used the same methodology. This phase contains two steps, the first is the composition and selection of assessment team, and the assessment process itself.

3.4.1. Step 7, Composition and selection of the assessment team:

The assessment team was formulated from local experts, scientists, community leaders, herders and the local community members to conduct the assessment process. It was taken into consideration that the assessment team includes all specializations related to the rangelands with all representation of the concerned authorities that are related to the rangeland management in the area (Table 13 and Figure 47). The concerned authorities included: the Desert Research Center, the Sustainable Development Center of Matruh Resources, Matroh Governorate,Directorate of Agriculture, technical support

NGOs interested in rangelands. For scientists,, it was taken into consideration that the assessment team includes different disciplens e.g. plant ecology, rangelands management, soil science, GIS, Socio-economy, and Field crops. Selected team was highly knowledgable about the rangelands and participatory approaches for rangeland management and evaluation.

Table (13). Names and specialties of the assessment team

No.	Names	Discipline	Authority
1	Prof.Dr. Mohammed Yehia Draz	Ecology and dryland agriculture expert	Head of research group
2	Asmaa A. Shata	Soil science expert	Desert Research Center
3	Abd El Samad Abd El Satar	GIS and RS expert	Desert Research Center
4	Ashraf Nour Elsadek	Field Crops expert	Desert Research Center
5	Mahmoud El Sayed Ali	Plant ecologist	Desert Research Center
6	Mohamme Abu El Maged El Shesheny	Rangelands specialist	Desert Research Center
7	Emad Gamal Rashed Awad	Social science expert	Desert Research Center
8	Abd El Hameed Israfel	Rangeland and local expert	Sustainable Development Center of Matruh Resources
9	Rabee Fazee	Head of El Neguilla Technical support unit	Sustainable Development Center of Matruh Resources
10	Mardy Saad Haron	Head of Barrani Technical support unit	Sustainable Development Center of Matruh Resources
11	Ahmed Israfel Kasem	Head of Ras El Hekma Technical support unit	Sustainable Development Center of Matruh Resources
12	Hussen El Seneny	Head of the village development department	Matrouh Governorate
13	Mohammed Abu El Dahab	Agriculture extension	Agrigultural Directorate in Matruh
14	Mostafa Rasheed	local community	Head of Rangelands cooperative in Matruh

Figure (47). Assessment team members

3.4.2. Step 8, Field assessment

This step aims at collecting the field data according to the indicators which was previouly detected,. In this step all the local experts and scientists with the local community member work together to understand and verify conditions on the ground during the assessment. The field assessment process started with defining the data sources, selecting the tool of the data , testing and validating the tool and finally recording the field data. All these steps were performed in corporation with the local community , the executive partners and the assessment team . The following is a simplified explanation for such steps.

3.4.2.1. Data collection resources

The data presented in this report were collected from two sources. The first is the collected data from the sampling points in the assessment the landscape project areas. The second source is the data collected from the information center and the decision making support deparments in the governorate of Matrouh and the monitoring and evaluation unit at the sustainable development center of Matruh resources .

3.4.2.2. Data Collection tools:

The assessment team ensured that the indicators are realistic and understandable by the local community. Thus local terms were used, for example, to define the landforms, soil types and the natural plants. The datasheet contains a general description of the selected points e.g. picture, coordinates, land tenure, proximity to service centers,……. Moreover,

the datasheet has the three main indicators of: 1) soil indicators 2) water indicators 3) vegetation indicators.

3.4.2.3. Validation of the tool:

A preliminary copy of the data sheet was prepared collaboratively with the local community, in order to ensure that the indicators are realistic, used terms are understandable and the mapping is effective . To test the tool, a field mission was conducted targeting 10 selected points (Figure 48). The tool was re-formulated which resulted in the current data sheet. After the validity of the tool, the datasheet was converted from a hard version (paper) to the electronic version for easy collecting, processing , retriving, and analyzing the data. The electronic version made it also easy to attach the picture of the sampling location during the data collection.

Figure (48). The assessment team in participation with the experts of IUCN during the process of evaluating the indicators

3.4.2.4. Field data collection

This stage took almost 4 months through 6 field trips, in which field data were collected from 253 selected sampling sites covering the two areas of the project (120 sites in El Ga'ween and 133 sites in Abou Mazhoud; Figure 49).

Figure (49). The assessment team during the data collection

3.5. Fifth phase, Analyses and interpretation phase

3.5.1. Step 9,Data management post-assessment and validation:

The assessment team was keen on a daily review of the data collected from the field in order to ensure that all the required information in the datasheet were complete. The coordinates of the sampling points were checked on a daily basis, and all the missing data if any were completed, while maintaining a photocopy of the datasheet.

Data management: All the data sheets collected by the team were revised and stored to be easiy retrievable. Under HERD project a central database will be established and will be accessable by the project partners.

Tabulation of data: After revising and storing the data , the assessment team grouped the data in simple tables containing the arithmetic mean, frequency distribution, and percentages.

Data analysis: The tabulated data were analyzed using SPSS program version 19. Qualitative data were converted to its quantitative form for the analysis. Results of the analysis were then interpreted and presented in tables and figures

Data interpretation: The data was interpreted according to the observations of the assessment team during the field work. Additional analysis has been done using DPSIR

(Drivers-Pressure-State-Impact-Response) casual framework to describe the interaction between society and the environment.

4. Results

Results were set in the form of tables and graphics for easy displaying, They are presented according to the 4 main components a) landscape context b) soil indicators c) water indicators and d) vegetation indicators. Here we present the primarly results for data collected .from 253 sites in both the landscape project areas

4.1. Landscape context:

This section presents the basic information about the landscape such as number of sampling sites, slope, landform, land use right and land use , land cover and proximity to major services.

Number of sampling sites

The total number of the sampling sites in the two the landscape project areas is 253 sites, including 12 sites in El Ga'ween representing 47.4% out of the total sites, and 133 sites in Abou Mazhoud representing 52.6% (Figure 50). (Figures 51, 52) show the number and distribution of sampling sites in each area.

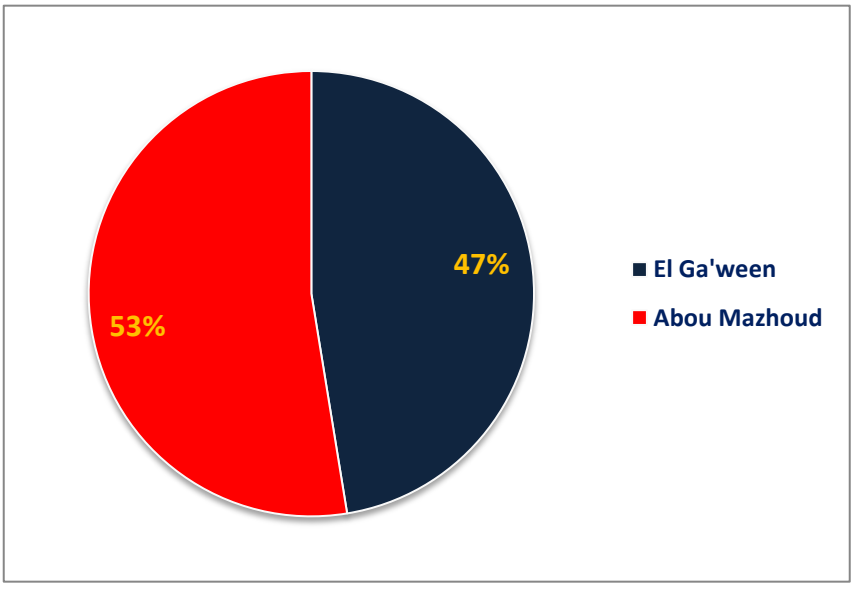


Figure (50). Percentages of sampling sites in the landscape project areas

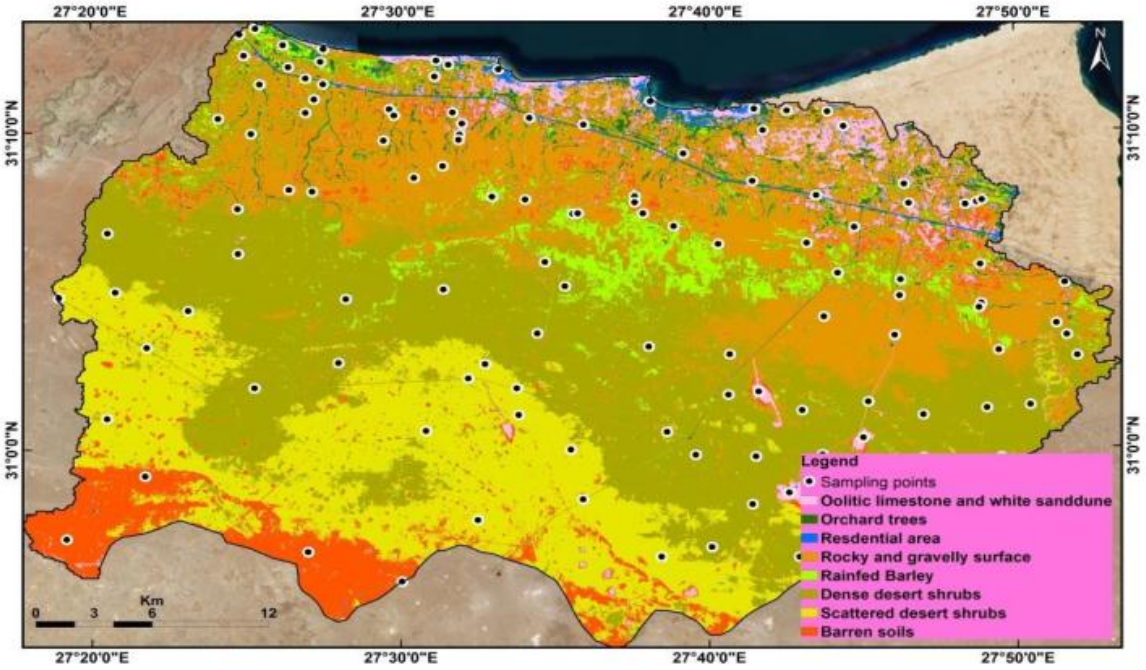


Figure (51). Locations of the sampling sites in El Ga'ween area

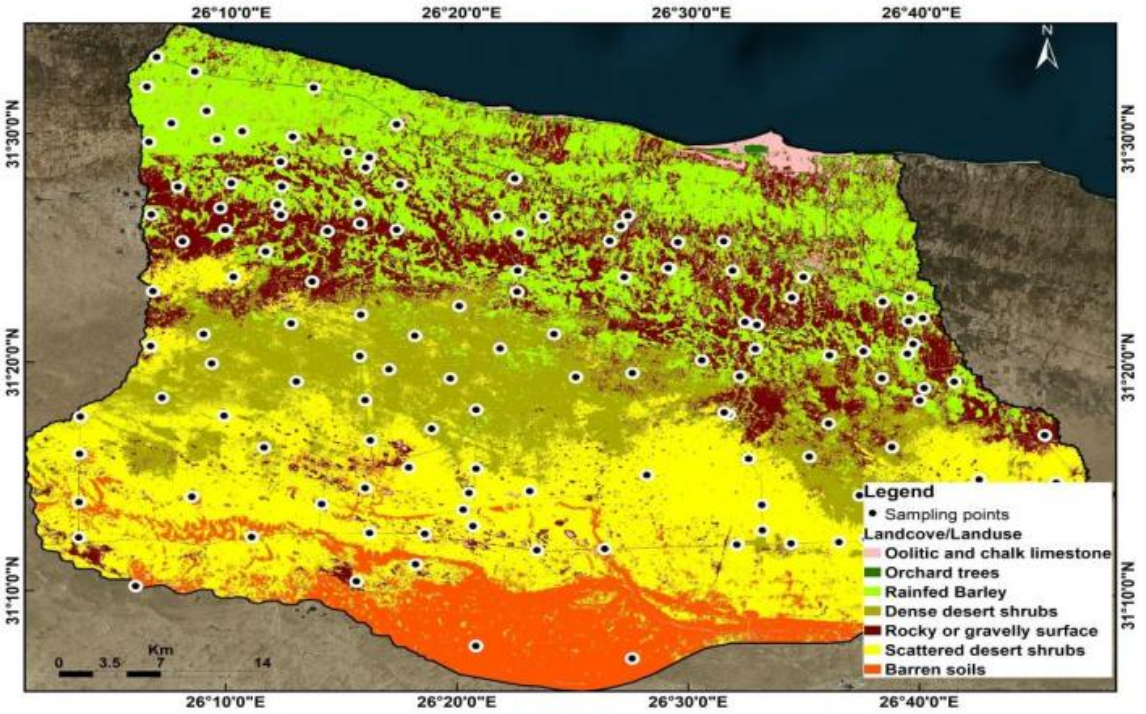


Figure (52). Location of the sampling sites in Abou Mazhoud area

Slope

The proportion of sampling sites in each of slope classes (flat,gentle,meduim and steep) is presented in figure 53 . In El Ga;ween aream there are 66 sites located on a flat slope representing 55% of the total sites, 41.7 % (50 sites) on a gentle slope and 3.3% (4 sites) on a meduim slope. While for Abou Mazhoud, most of the sampling sites (121 sites) representing 91% of the total sites were located on a flat slope , 9% (12 sites) on a gentle slope , and there were no sampling sites were located on a meduim or a steep slopes.

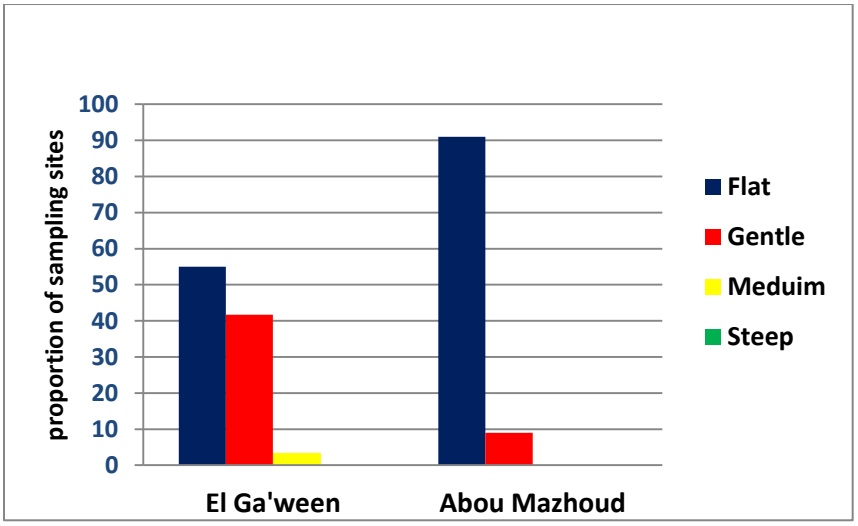


Figure (53). Slope classes of the landscape project areas

Land surface shapes

The results of the shapes in El Ga'ween area indicate that there are 14.2% of the sites (17) on convex shape, 5.8% (7 sites) on concave shape while most of the sites (99) are on a flat shape representing 80% of the total sampling sites. The results also showed that there were no sites on a complex shape. In Abou Muzhoud, the results indicated that there are 14 sites (10.5%) on a convex slope shape, two sites (1.5%) on a concave shape, while most of the sampling sites are on flat slope shape representig 84.2% of the total sampling sites. Only 5 sites repesenting 3.8 % are on a complex slope shape. These results concluded that the shape of the slope in the lansscape project areas is mostly flat. (Figure 54).

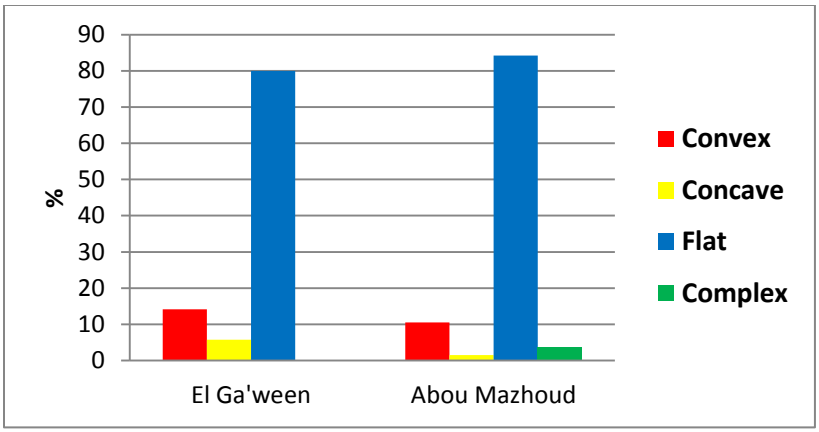


Figure (54). Land surface shape in the landscape project areas

Land use right

The results of the study regarding the land use right indicate that most of the lands are public, which are lands entitled to be used by all the tribe members. Here we found that most of the rangelands are limited to the "public and communal" land use rights; "communal lands" is a term which means the lands managed by the family, and are used by all the family members. It is rarely found that grazing lands be managed by a single person (private land). The results for the El Ga'ween area indicated that the public lands amounted 62.5% of the sampled sites (75 sites), while the private lands in this area are estimated to be 26.7% (32 sites) , most of them are cultivated with orchards. As for the communal lands, they numbered about 13 sites with a percentage of 10.8% of the sampling sites in El Ga'ween. Data also indicated that in the Abou Mazhoud, 56.4% (75 sites) of its lands is classified as public land. While the private lands represent 27.8%. (37 sites) . The total number of sites that was marked as communal lands" is 21 sites representing 15.8% from the total sampled sites. **(Figure 55).**

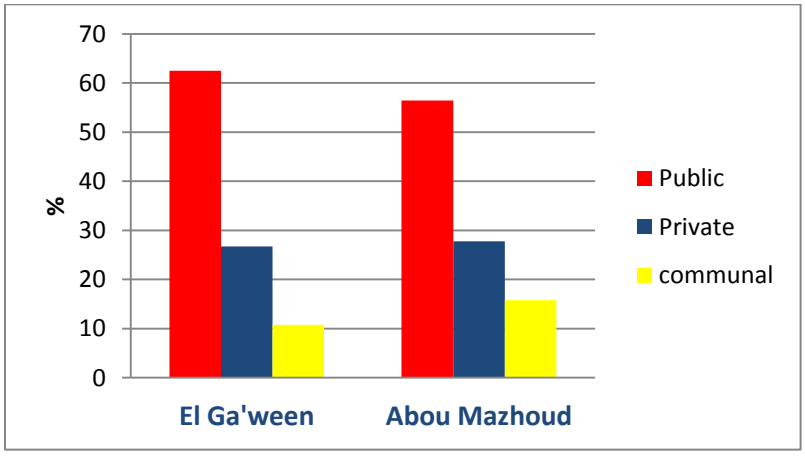


Figure (55). Land ownership in the project areas

Land uses land and vegetaion cover classes

The dominant land use in the North Western Coast of Egypt is a mixture of rangelands, croplands and horticulture. The results of land use patterns in El Ga'ween area indicated that the rangelands represents 51.7% (62 sites). While the sites that were used for the horticulture representing represents10.8% (13). Only 14 sites which represent11.7% of the sampling field sites were occupied by barely and wheat, while the number of sampled resedential sites during the assessment was sampled 3 sites representing 2.5%. There were also 12.5% of the sampling sites(15) were bare rocky lands,while salt marches were found in only 4 sites (3.3%), and the crushers and limestone lands were about 9 sites (7.5%). The reasults related to the land use in Abou Mazhoud revealed that rangelands was the dominant land use as it represents 54.9% of the sampling sites(73), while the crop land was at 33 sites representing 24.8%, 5.3 % for orchard trees(7sites) ; 15.0% (20 sites) of bare soil. The results revealed that there were no salt marshes or crushers in Abou Mazhoud area (Figure 56).

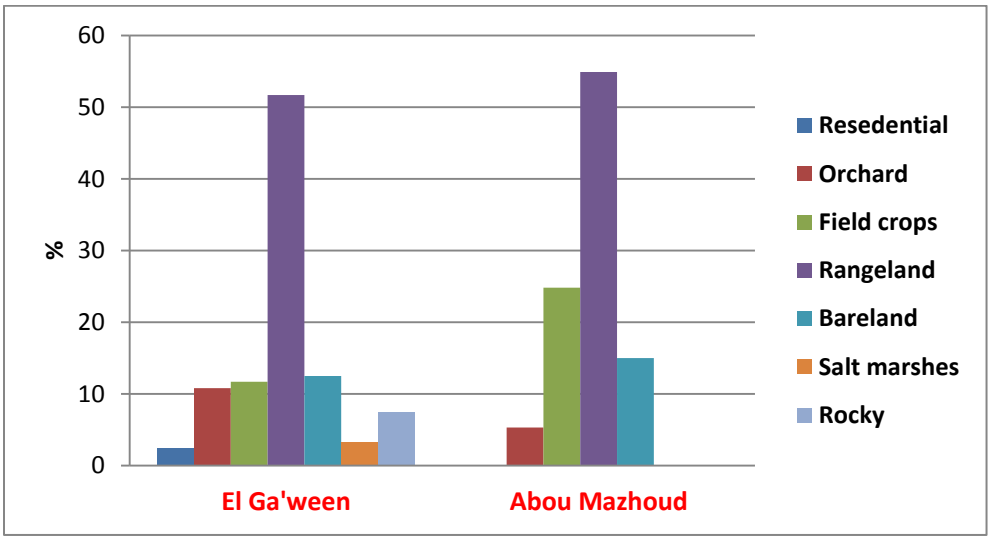


Figure (56). Land use classes in the landscape project areas

Proximity to main services

The results indicate that there is a high variability in the proximity of the sampling sites to the main services. Sites are either distant, average close or so close from the services. The results of the assessment indicated that El Ga'ween area has 44 sites at (36.7 %) are close to the main services in a range of less than 10 km; 25 sites (20.8 %) were average close to major services. While, the remaining sites (15) representing 42.5 % are more than 10-40 km away from the main services. With regard to the area of Abou Mazoud, the largest portion of the sampled sites (75) representing 56% were far from services for a distance of more than 10 km. While, the sites which were in average

proximity, within 10 km from the services were 38 sites (28.6%). There are 20 sites with a percentage of 15.0% that were close to the main services (Figure 57).

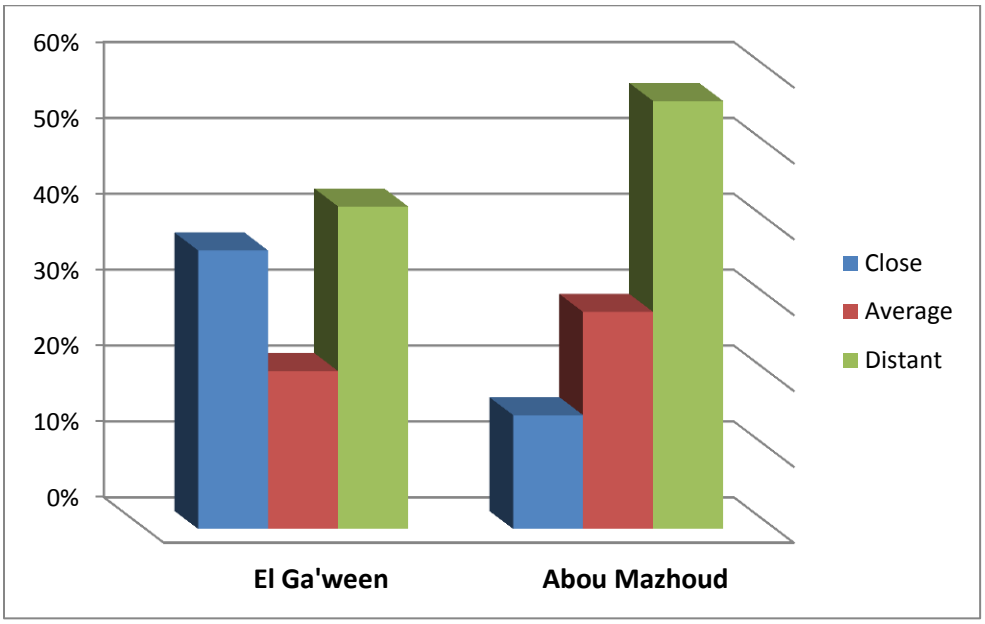


Figure (57). Proximity to main services in the landscape project areas

4.2. Soil indicators

This section of results highlights the information captured about the soil characteristics including landforms, soil types , soil texture, soil color, soil structure, soil depth , soil disturbance (natural or artificial), soil salinity and organic wastes. The results are sammurised as follow:

Landforms:

Local terms, which are used originally by the local bedouin, were used for describing the different landforms. As previously mentioned, table 11 indicates definitions for each of the landforms type , their main characteristics, and the prevailing vegetation species.

The results, related to the different landforms in the assessment the landscape project areas, indicate that the landforms in the El Ga'ween area were dominated by El-Ghout at 36.7% (44 sites) followed by Araqeeb landforms representing 34.2% (41 sites) followed by Alawy landforms at 14.2% (17 sites) . The number of Goora sites were 6 representing 5.0% , while Shateeb landforms have occured only in 5 sites with the percentage of 4.2%, Sabkhat landform were in 4 sites (3.3%) and finally Kezan landform were in 2 sites (1.7%). The results of Abou Mazhoud area revealed that most of its lands were Araqeeb at 61 sites (45.9 %), Ghout lands at 48 sites (36.1%), Alawy lands at 16

sites (12.5%), Hettia land form in 5 sites (3.8%) and Shateeb in 2 sites (at 1.5% (Figure 58). The results revealed that the area of Abou Mazhoud didn't have any saltmarshes and Kezan landforms which are usually found along the coast.We excluded the coastal strip from the assessment as these lands are already assigned for commercial purposes.

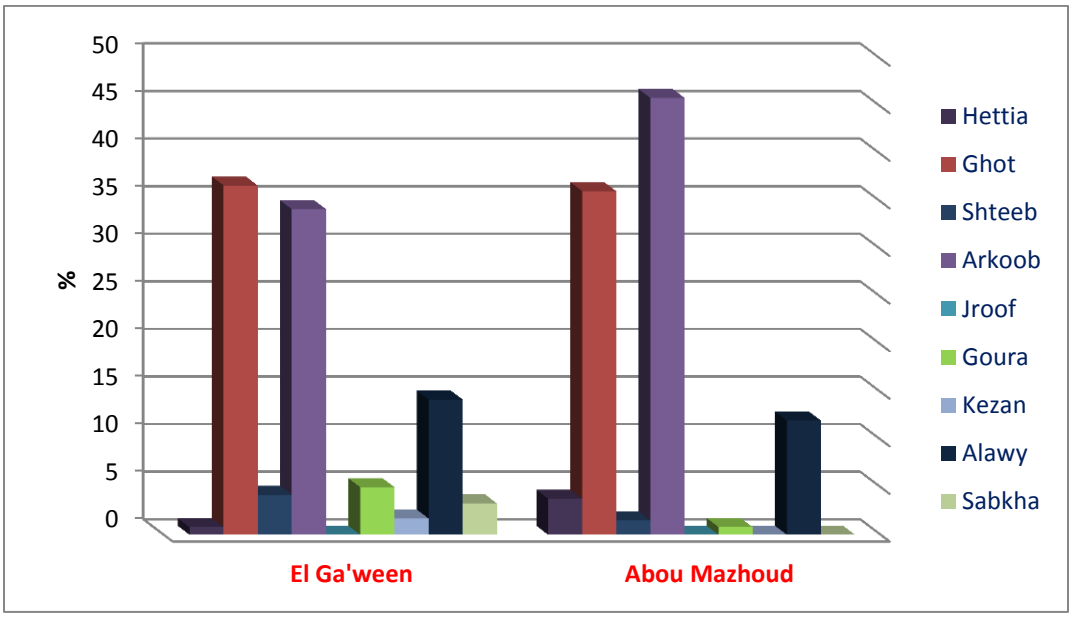


Figure (58). Landforms in the landscape project areas

Soil Types:

Local terms were also used for describing the soil types in order to be easly identified by the local community, and they are presented in Table 12:

In El Ga'ween area, results reveaed that most of the sampling sites (56) representing (46.7%) have gravelly soils, 32 sites (26.7%). were Galda soils, 18 sites (15.0%). were Noos soils, 10 sites (8.3%) were safy and finally, 4 sampling sites at (3.35%) were Snake soil. In sum, most of El Ga'ween soils are "gravelly and galda" (Figure 59).

Concerning the soils of Abou Mazhoud, results revealed that most of the soils are gravelly which recorded in 72 sampling sites (54.1%), Noos soil in 31 sampling sites (23.3%), Safy in 16 sites (12.0%) and finally Galda soils in14 sites (10.5%). Results revealed that Snake soil types wasn't recorded in Abou Mazhoud area as no sites from the coastal area were sampled.

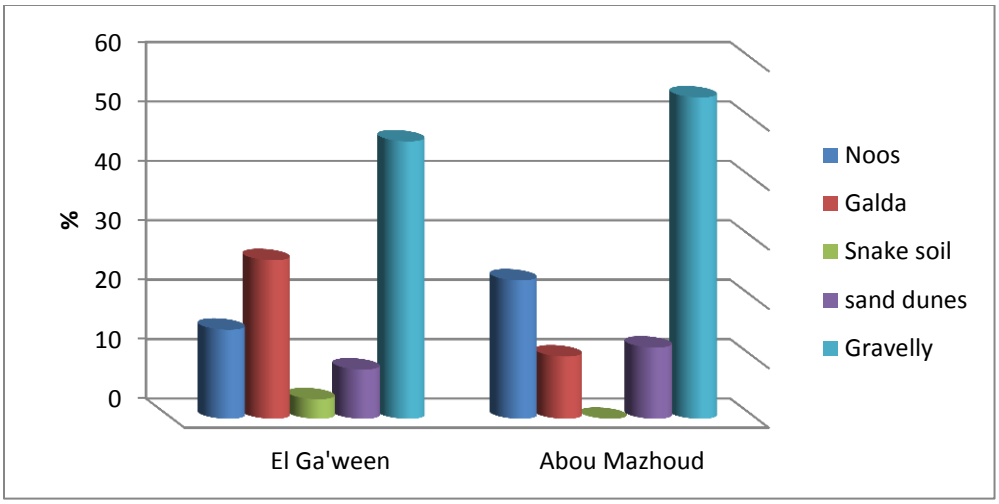


Figure (59). soil types in the landscape project areas

Soil Texture

Results related to the soil texture in El Ga'ween area revealed that 45.8% of the sampling sites were rocky soil (56 sites), 30 % moderatly coarse, 20.8% coarse (25 sites), and only 4 sampling sites (3.4 %) were meduim in texture. There were no sampling sites located in fine or moderatly Fine soils.

In Abou Mazhoud area, results revealed that most of the soils were "rocky" which marked in 71 sampling sites at 53.4%, followed by moderatly coarse soils (23.3%), coarse soils in 25 sites (18.8%), medium soils in 6 sites respectivly 4.5%. There were neither fine nor moderatly fine textured soils in the sampled sites of Abou Mazhoud area. It is indicated that there is no great difference between the two areas in terms of the soil texture. (Figure 60).

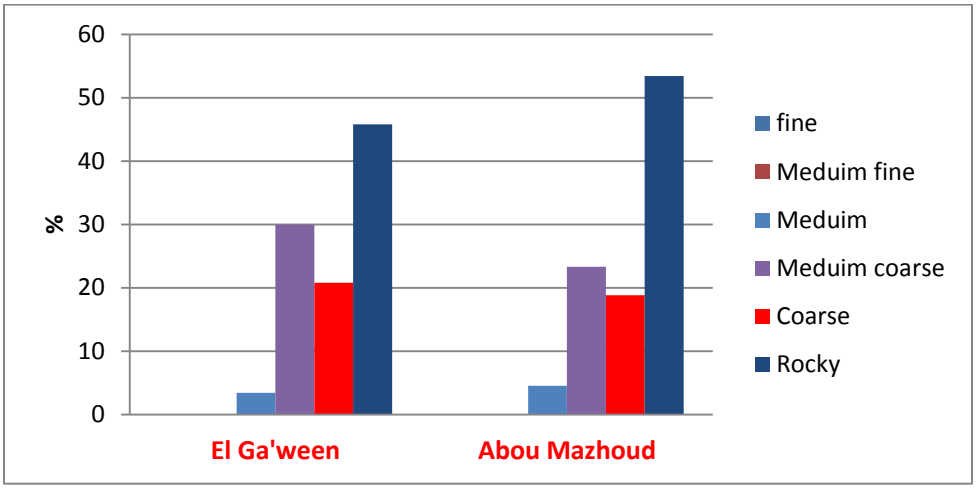


Figure (60). Soil texture in the landscape project areas

Soil color

The apparent description of the soil color in El Ga'ween area revealed that most of the soil colors were Ashhab (pale) which was recorded in 46 sites (53.3%) followed by white soil in 26 sites (21.7%) and the red soil in 16 sites (13.3%). The brown soils were in 14 sites (11.7%). Also in Abou Mazhoud area most of the soil's color was Ashhab (pale) which was recorded in 102 sites (76.7%), brown soil in 17 sites (12.8%), red soil in 9 sites (6.7%) and finally white soils in 5 sites respectivly 3.8% (Figure 61). Soil color description was based on the local terms used by the local community members.

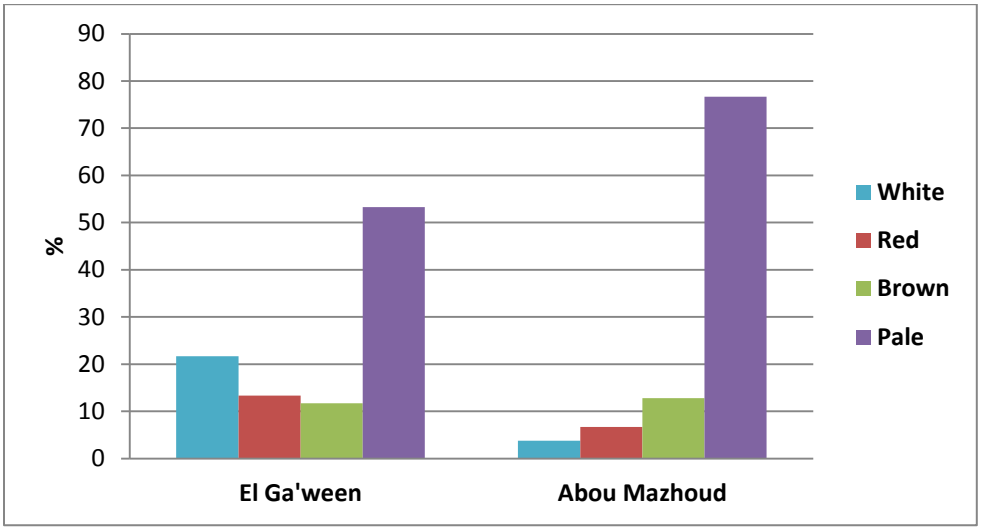


Figure (61). Soil color in the landscape project areas

Soil Structure

In El Ga'ween area, results revealed that most of the soils are "structureless", as which was recorded in 102 sites (82.6%), followed by angular blocky soils in 11 sites (10.3%), "Sub angular blocky soils in 7 sites (7.1%). As well as in Abou Mazhoud , again most of the lands were "structureless" found in 107 sampling sites representing 80.5% then "Sub angular blocky" soils in 19 points (14.3%) and then finally, "angular blocky" soils in 7 sites (5.3%). It could be concluded that most of the soils in the landscape project areas were structureless (Figure 62)

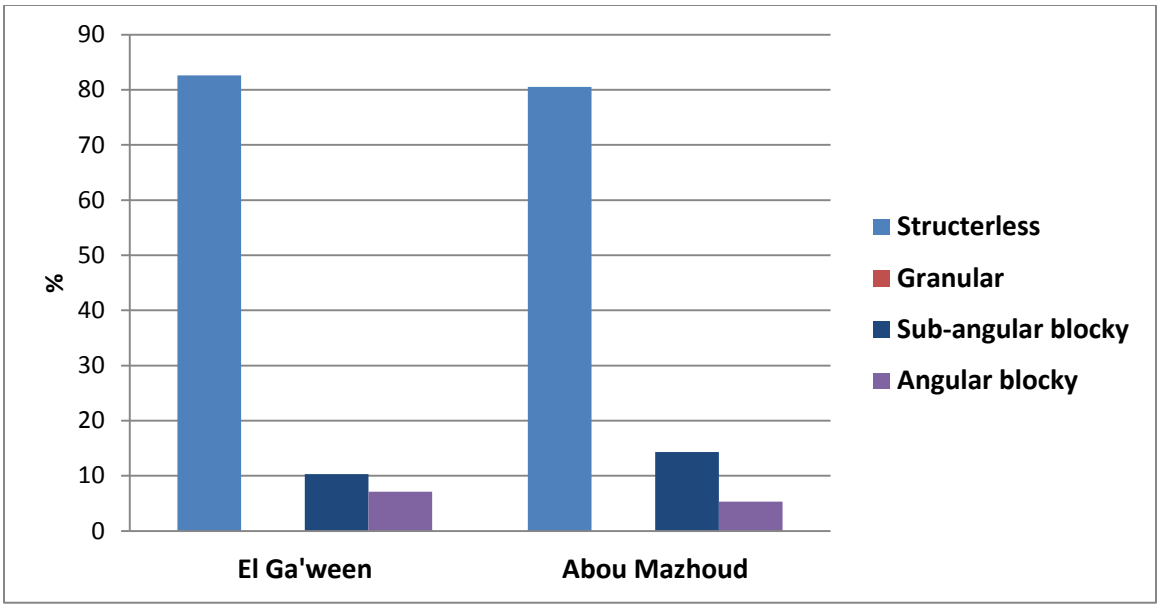


Figure (62) Soil structure in the landscape project areas

Soil Depth

Results revealed that most of the soil in El Ga'ween area is "very shallow" at 54 sample sites (45.0%), followed by deep soils in 31 sites (25.8%) and the "shallow soils" in 22 sites (18.3%). The "moderatly deep" soils only were recorded in in 13 sample sites (10.8%). Following the same pattern, most of the soil in Abou Mazhoud were "very shallow recorded in 72 sites at 45.1%, followed by shallow and moderatly deep soils in 22 sites (16.5%) each. The "deep" soils were only captured in 17 sites representing 12.8% (Figure 63)

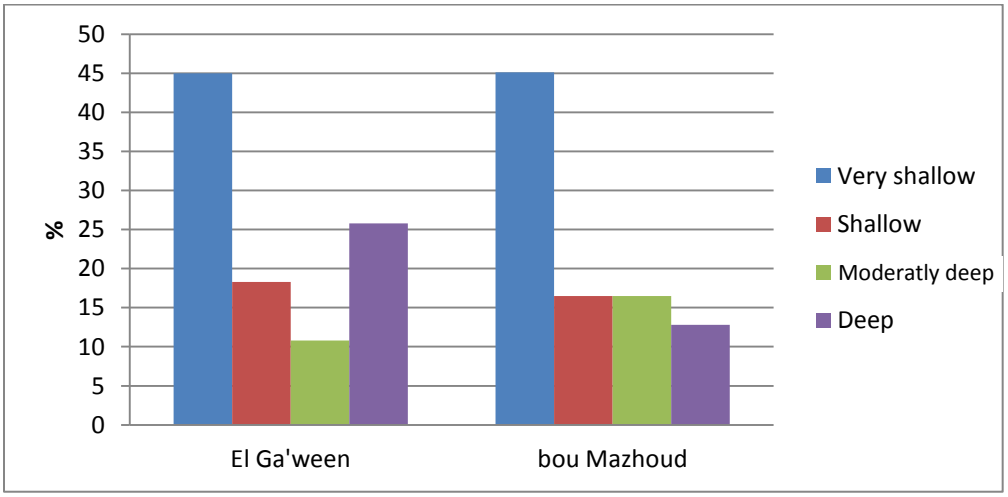


Figure (63). Soil depth in the landscape project areas

Soil Disturbance

Soil disturbance can be natural or human-induced, and it is the main cause of soil erosion and consequently land degredation. Results concerning the soil disturbance in the area of El Ga'ween revealed that the natural disturbance of the soil (gully, sheet and wind erosion) was recorded in 75 sampling sites representing 62.5%, while 'artificial disturbance" was found in 71 sites (59.2%). Some sampling sites showed the two soil disturbance patterns. The "natural disturbance" was marked in Abou Mazhoud area in 86 sites representing 64.7%, and the "artificial disturbance" in 92 sites (69.2%) (Figure 64)

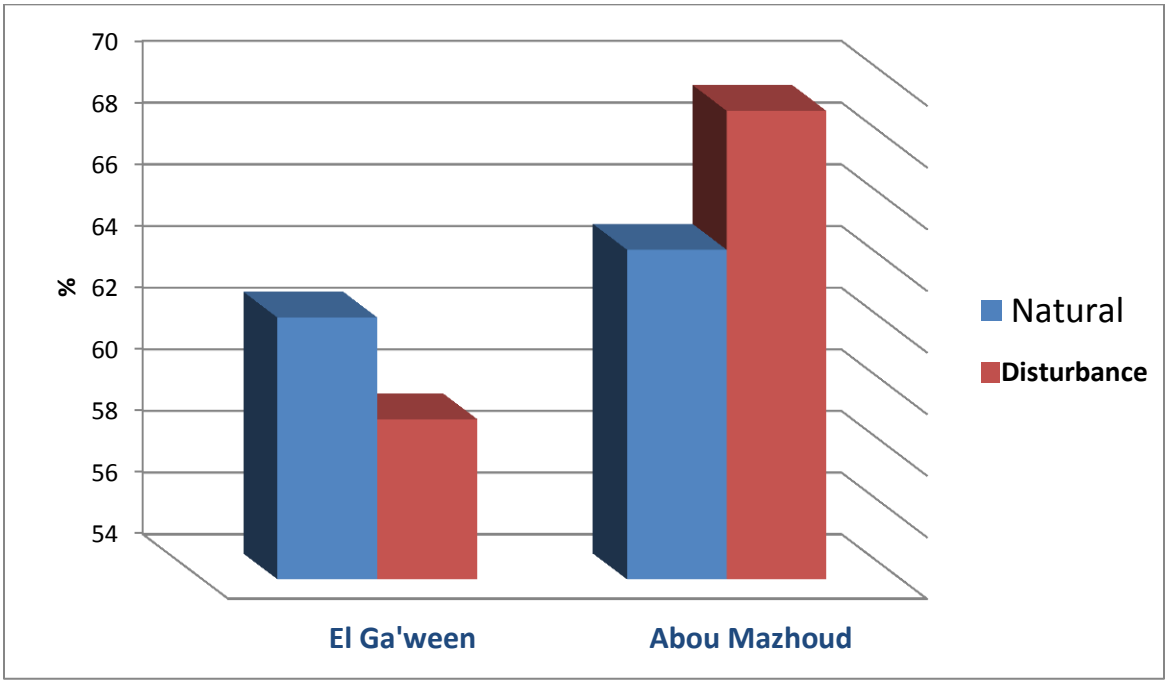


Figure (64). Soil disturbance in the landscape project areas

Soil salinity

Soil salinization is a naturaly occuring process mainly in areas close to the sea. However, ranglands in the southern part of the landscape project areas showed no observable signs of salinity. The collected data for the soils observable salinity in El Ga'ween area, revealed that there were 40 sampling sites representing 33.3% had singns of low to moderatly saline, or high salinity levels. While the remaining sites (80) showed no signs of salinization. From the 40 saline sites, the number of the sites with "low salinity" were 31 (77.5 %) there were only 5 sites with "moderatly saline soils salinity" (12.5%) and 4 sites of "high saline" (10%). Data also revealed that soils's observable salinity in "Abou Mazhoud" area was recorded only in 13 sites (9.8%) from the total sampling sites (133) . From these 13 sites, low saline soils were in 12 sites (92.30%), and moderatly saline soils was in one site representing 7.7% (Figure 65).

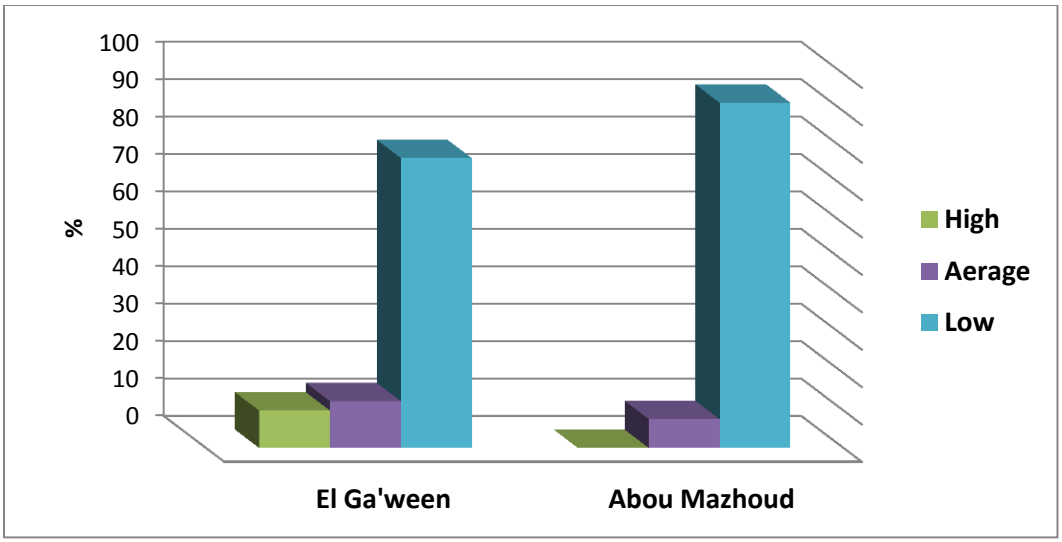


Figure (65). Soil salinity in the landscape project areas

Organic wastes

The organic wastes were expressed as relative ammounts occurred in the selected sites(High–medium–low).The results of El Ga'ween area reavealed that the organic litters appeared in 100 sites (83.3%), but no organic wastes were recorded in the remaining 20 sites (16.7%). Most of the sites contained the plant wastes which were recorded in 58 sites (58%), then the plant and animal litters were in 41 sites (41%), finally, there was only one site contained animal wastes. Data also revealed that the organic wastes were existed in Abou Mazhoud area, in 109 sites (82%) and there were 24 sites representing 18.0% didn't contain any type of organic litters. Out of the 109 sits, 33 % (36 sites) contained plant wastes, 66 % (72 sites) contained both plant and animal wastes and only one site (0.9%) contained the animal wastes (Figure 66).

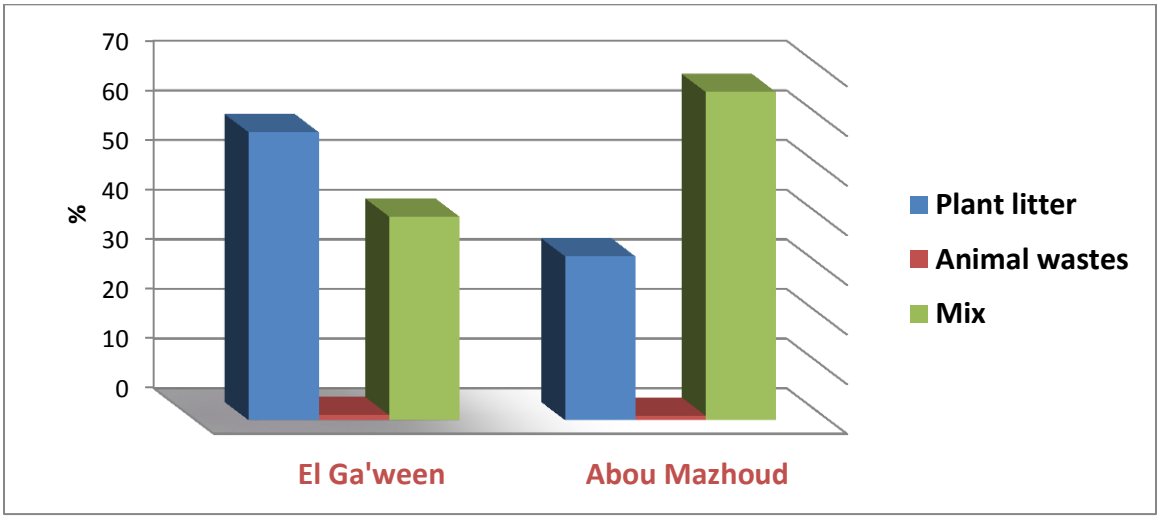


Figure (66). Types of organic wastes in the landscape project areas

4.3. Water Indicators

The water resources indicators reflect the potentiality of water and soil conservations that posetively affect the land cover including the rangeland.The area depends mainly on the seasonal rainfall, which determines the land use pattern. Rainfall amount and distribution influence the vegetation production and grazing pattern. In this section ,the data related to the water indicators are presented, which includes the amount of rainfall, number of cisterns and groundwater wells in the landscape project areas as follows.

Rainfall amount

The collected data revealed that the rainfall in El Ga'ween area ranges between average to low and can be sammurised as follow: the number of sampling sites with low rainfall (less than 100 mm) were 61 representing 50.8%, the sampling sites with average rainfall (100-120 mm) were 57 representing 47.5% and the sampling sites receiving more thn 120 mm were 2 (1.7%). It can be concluded that 98.3% of the total sampling sites in the area were recieving annual rainfall less than 120 mm. Data also revealed that the amount of the rainfall in Abou Mazhoud area is higher than El Ga'ween area, where the No. of sites with rainfall amount more than 120 mm were 92 (69.2%). There were 36 sites receiving annual rainfall of (100-120 mm), while only 5 sites were monitored with low rainfall (less than 100 mm) at 3.8% of the sampling sites (Figure 67).

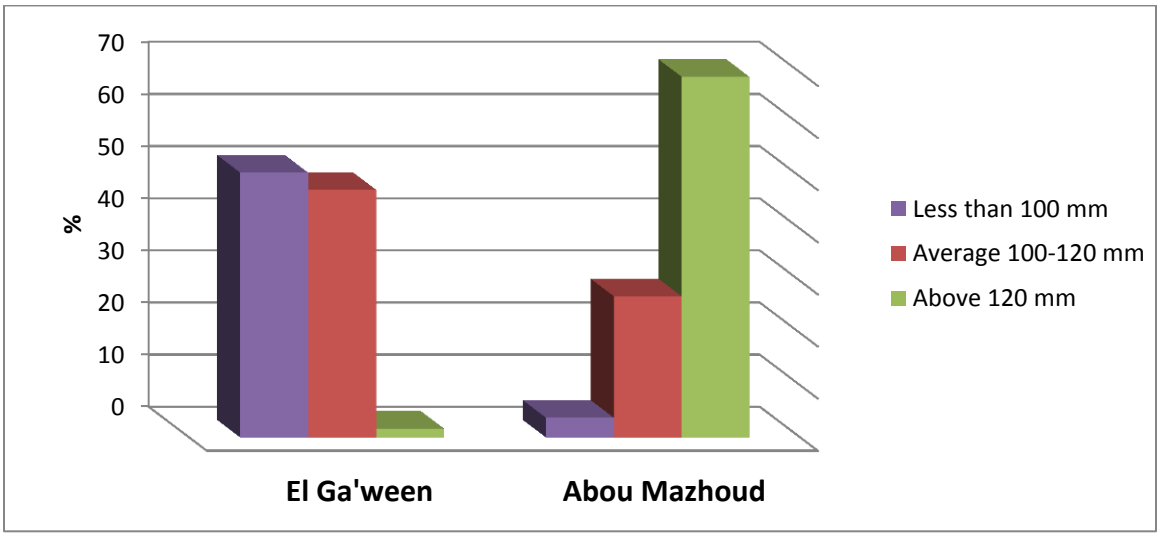


Figure (67). Rainfall amount in the landscape project areas

Groundwater wells

Ground water is used for the supplemental irrigation of the olive trees in limited area, and is characterised by its high salinity. Collected data revealed that there were only few groundwater wells in the project area .Only in 5 % (6 sites) of the sampling sites, groundwater wells were presented in El Ga'ween. However in Abou Mazhoud area, there

were also 6 sampling sites having groundwater wells representing 4.5%. of the total sampling sites. These wells are absent in the rangeland areas. (Figure 68)

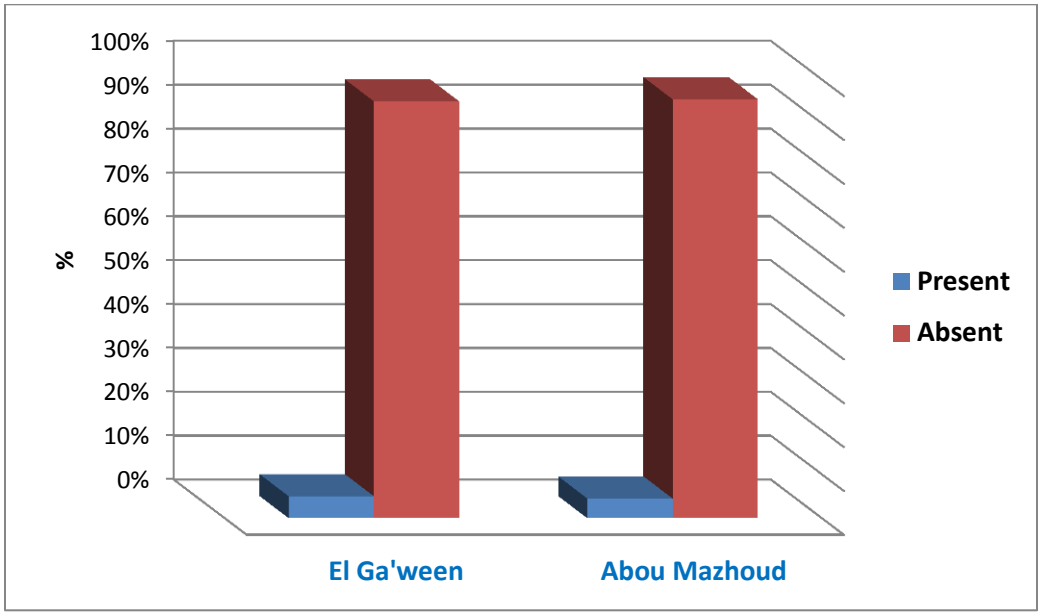


Figure (68). Groundwater wells in the landscape project areas

Cisterns

Cisterns are very important as they are the only source of drinking for people and animal in the rangeland area of the NWC of Egypt. Data concerning the presence and absence of cisterns revealed that such structures in El Ga'ween area existed in 32 sites (26.7%) while in 88 sites (73.3%) no cisterns were existed. While, Abou Mazhoud area included 19 sites (14.3%) with cisterns, while there were 114 representing 85.7 % sites without such cisterns. The capacity of the cisterns ranges from 80-120 m^3 and they are mostly exist in the resedential areas and close to the wadis.These cisterns are rarely found in the rangeland areas (Figure 69).

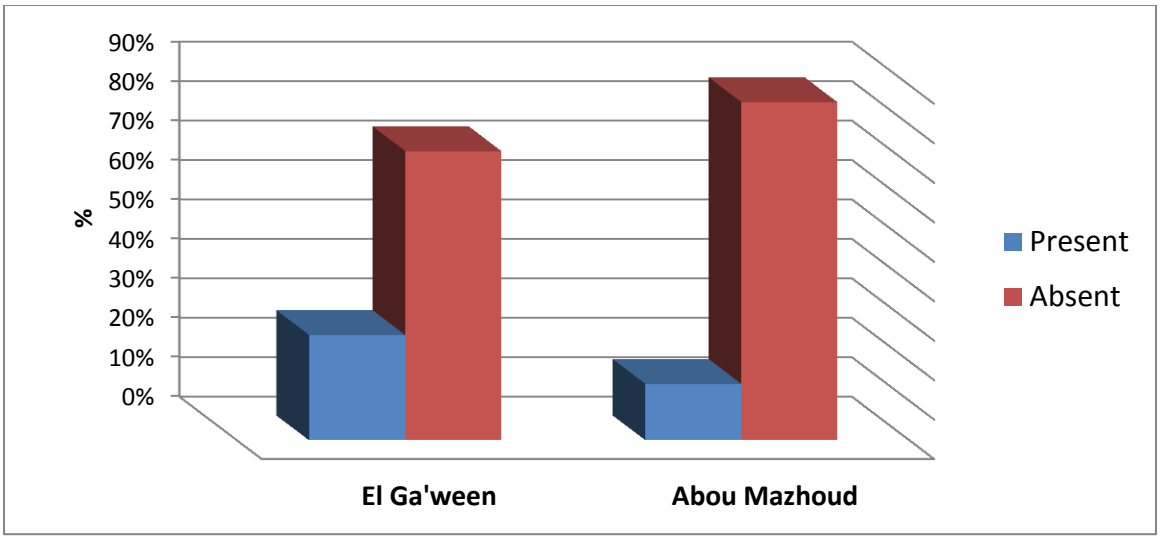


Figure (69). Rainwater harvesting cisterns in the landscape project areas

Dykes

Results related to the dykes in the landscape revealed that the area of Ga'ween has 22 sites (18.3%) have dykes, while 98 sites representing (81.7 %) do not have any types of dykes. Only 15 sites (11.3%) of the sampling sites in Abou Mazhoud had dykes and 118 sampling sites (88.7%) with no dykes (Figure 70).

It is obvious that the dykes are limited in these sampling sites, because dykes with their different types as (Cemented – earthen- stoney) are usually constructed in the Wadi main stream, its tributaries and delta for rainfall water storage.

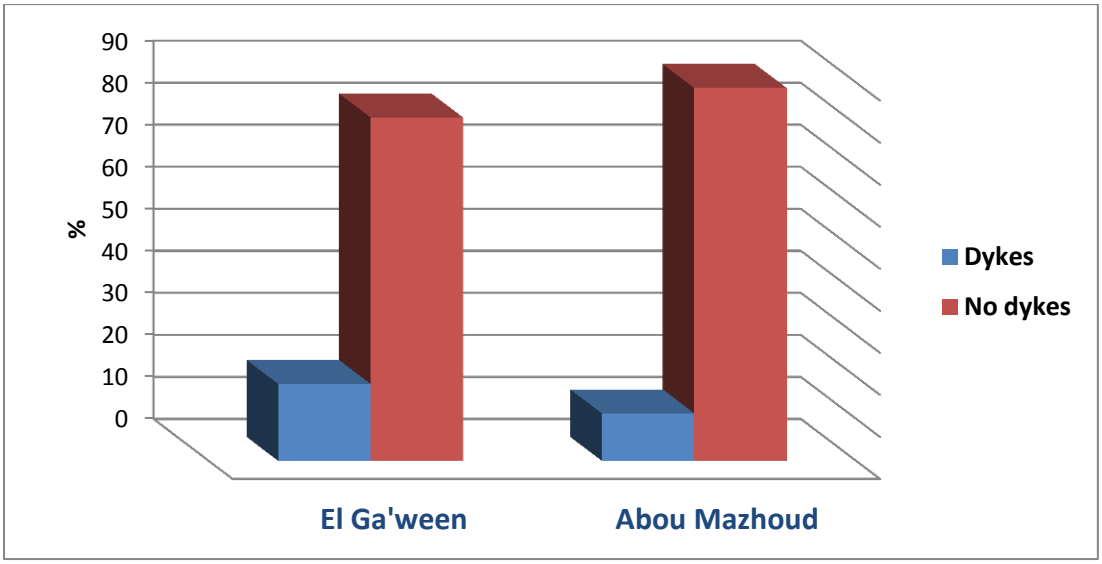


Figure (70). Presence of dykes in the landscape project areas

4.4. The vegetation indicators

Extend of vegetation cover in the landscape project areas

Data related to the percentage of vegetation cover of the two the landscape project areas, revealed that 90% of the sampling sites (108) in El Ga'ween were covered by vegetation (orchards, crops, natural vegetation). There was a high variation in the vegetation coverge in the vegetated sites; there were 51 sites (representing 42.5%) with a vegetation cover less than 25%. The relative coverage of 25-50% was recorded in 40% (48 sites) of the sampling sites, while Only 9 sites representing 7.5% have a vegetation coverage with more than 50% relative to the bare ground.

Data of Abu Mazoud area, revealed that the 88.7 % of the sampling sites (118) have a vegetation cover at different extent. In which 77 sites (57.9%) have vegetation coverage less than 25%, 17 sites (12.8%) with vegetation coverages between 25-50%, and only 24 sites (18%) have more vegetation coverage that exceeds 50% of the ground (Figure 71).

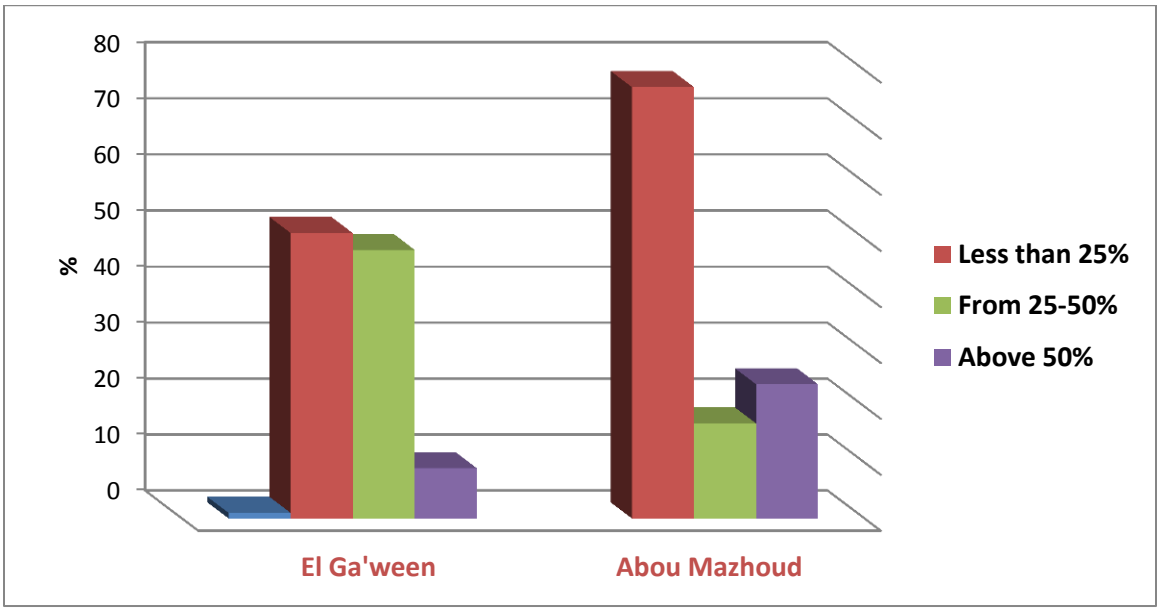


Figure (71). Extend of vegetation cover in the landscape project areas

The status of the orchards trees in the landscape project areas

EL Ga'ween area has 14 sites covered with orchard trees representing 11.6% from the sampling sites, most of which 93% are in good to moderate growth conditions. However, 7 % of the orchard trees sites are in a poor condition. All those areas were in a good growth condition in the past.

Collected data also revealed that Abou Mazhoud area had 7 sites were occupied by orchard trees representing 5.2% from the total number of sampling sites. Its growth condition varied from ranged from moderate to good and no sites were in a poor growth condition, concluding that, no orchard fields were deteriorated compared to its previous conditions. The Bedouins income depends on these long life orchard trees of figs & olives, which are often, cultivated in the wadis out of the rangeland areas (Figure 72).

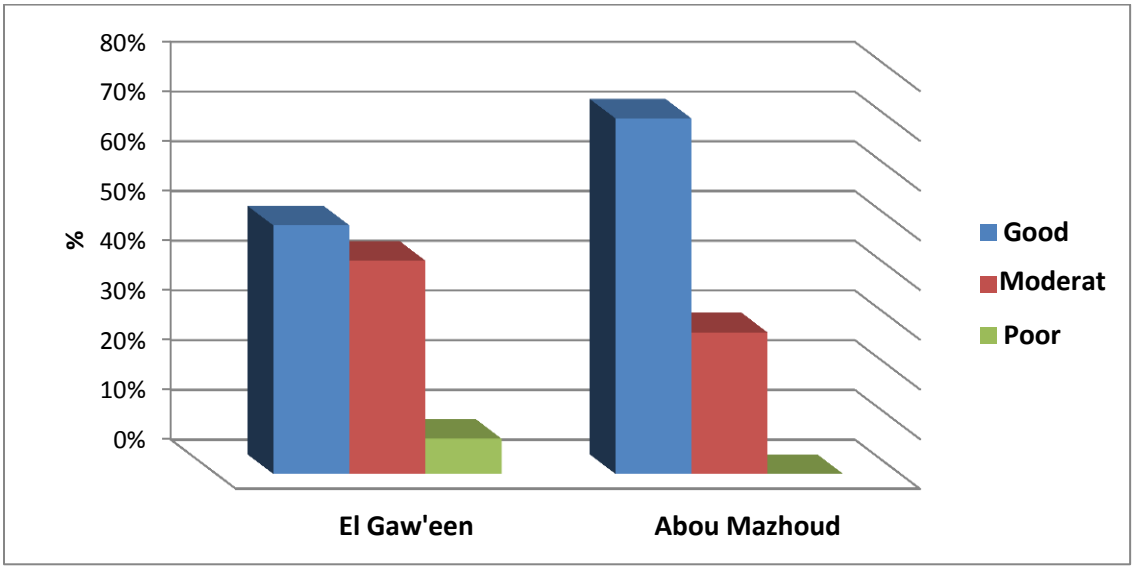


Figure (72). Growth status of the orchard trees in the landscape project areas

The status of the field crops in the landscape project areas

Results related to the status of the croplands which were monitored in the two the landscape project areas, data from El Ga'ween area revealed that 16.6% of the sampled sites (20) were cultivated with barely, including 15% in a poor growth condition and 85% in a good growth condition. By comparing these findings to the past, we found that these crop lands were deducted from the rangeland area. Seven sites out of the 20 sites were cultivated with barley twenty years ago which highlights the risk of the continuous conversion of rangelands to croplands.

On the other hand, the area of Abou Mazhoud had 36 barley sites, where 97% of these sites were in moderate to good growth condition and only 3% of the sites were in poor condition. Most of these areas in the past were rangelands indicating the expansion of barely cultivation in Abou Mazhoud in larger areas as compared to Ga'ween area which threatens the rangelands in this area (Figure 73).

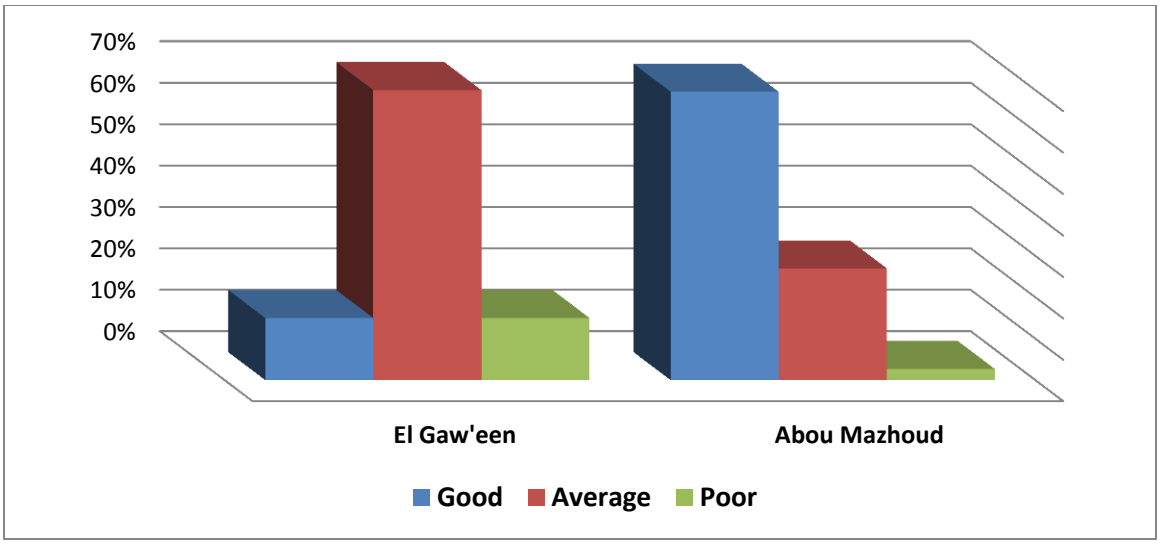


Figure (73). Growth status of field crops in the landscape project areas

The status of the rangelands in the landscape project areas

Results related to the status of the rangelands in both of the areas revealed that the number of sites at El Ga'ween area that had been marked as rangelands were 81 (67.5%) out of all the sampling sites i.e., 120. In which 57 sites (70%) were in a poor condition, 17 sites at 20.9% were in moderate condition and only 8.7 % of the sites were at good condition (Figure 74).

Collected data from the local community revealed that the rangeland condition was better in the past as compared to the present. Accordingly, 35.5% of the sites were in a good condition in the past and were deteriorated because of many reasons.

Results also revealed that in Abou Mazhoud area, 86 sites were covered by rangelands representing 64.6% of the total sampling sites i.e., 133. From which 48 sites (55.8%) were in a poor condition and 37 sites (43.1%) in a fair condition. However, there is only one site was in a good condition.

Locals and elders revealed that from the 133 sampled sites in Abou Mazhoud, 118 representing 88.7 % sites were previously occupied by range plants as compared to only 86 sites now, including only 7 sites were in a poor condition. 35 sites in average state, and the remaining 69 sites were in good conditions, and that reflects the deterioration extent that badly affected the area as that many rangelands were lost (Figure 74).

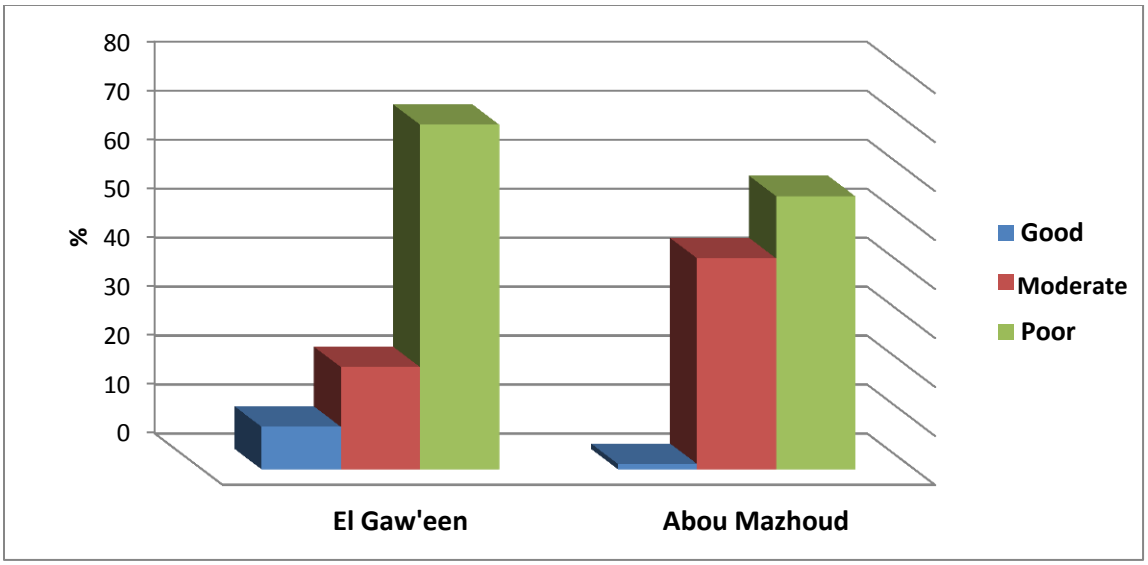


Figure (74). Rangeland status in the landscape project areas

Unpalatable species in the landscape project areas

Data revealed that most of sites in El Ga'ween and Abou Mazhoud had the unpalatable species such as "*Hyoscymus maticus* L. and *Salsola imbricate* Forssk." these shrubs are found in all the rangelands areas in the fourth zone.

Collected data also revealed that the Ga'ween area had 88 sites representing 74% had unpalatable species, representing 50-70% of the total existing species. While, 34 sites of 38.6% had a less unpalatable species with a prevalence < 25%. In contrast to the past situation, the unpalatable species were less than 25% of the total species in most of the selected sites. On the other hand, there were 86 sites (65%) were monitored in the area of Abou Mazhoud; which contains unpalatable species. 97% of these sites contained the unpalatable species in a 25-50% prevalence.

Howevere, in the past these sites had less unplatable species that didn't exceed 25% from the plant coverage, that indicates the increase of the unpalatable species replacing the palatable species (Figure 75).

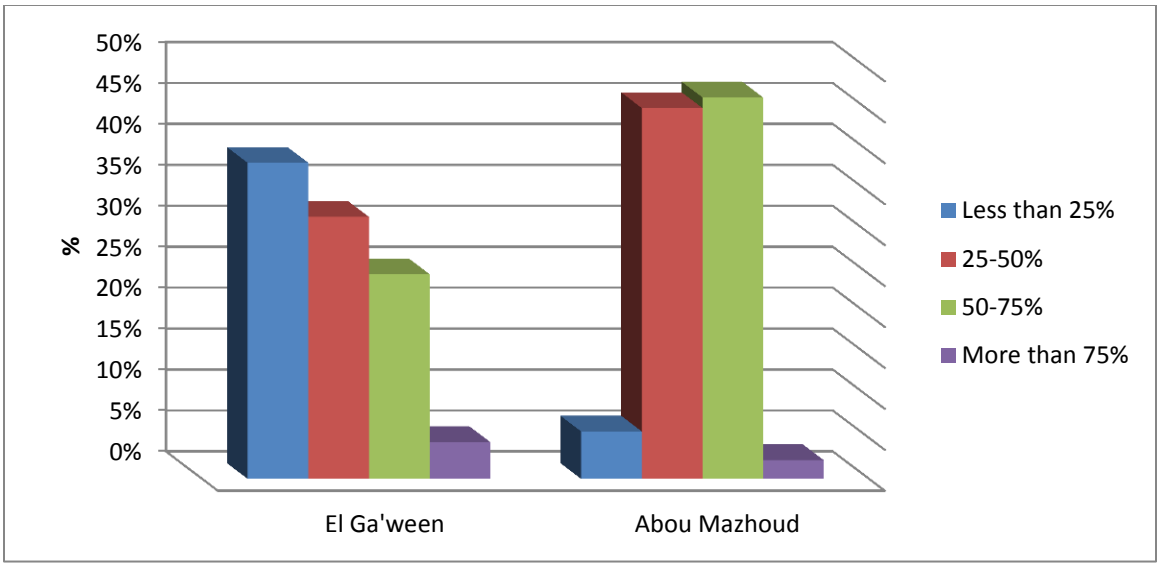


Figure (75). Unplatable species coverage in the landscape project areas

The annual plant species in the landscape project areas

Concerning the annual plant species, 81 sites were detected in the area of Ga'ween that, contain annual plants. However, they were extremely few, as from which 72 sites (88.8%) contained annual plants with a coverage less than 25%, there were only nine sites that contained annual species in a relative coverage of 25-50%, and this is the largest percentage that was detected in the sampled sites (Figure 76).

Comparing to the past as mentioned by the locales, we found that such percentages are completely different. As the percentage, of the annual species in the studied sites was high, almost 30% of the sites, had a high annual plants coverage (more than 50%), 55 sites at 45.8% had annual plants coverage with less than 25% .

In Abou Mazhoud area, the annual plants were existed in 86 sites (64.6%). From which, 47 sites at 54.6% do not contain more than 25% of its plant coverage as annual species. While the remaining had less 25-50% of such annual plants. The situation is different as compared to the past , the vegetation coverage of the annual plants was more than 50% in 55.8% of these sites. It was also indicated that 4.6% of the sites contained more than 75% of its coverage as annual species.

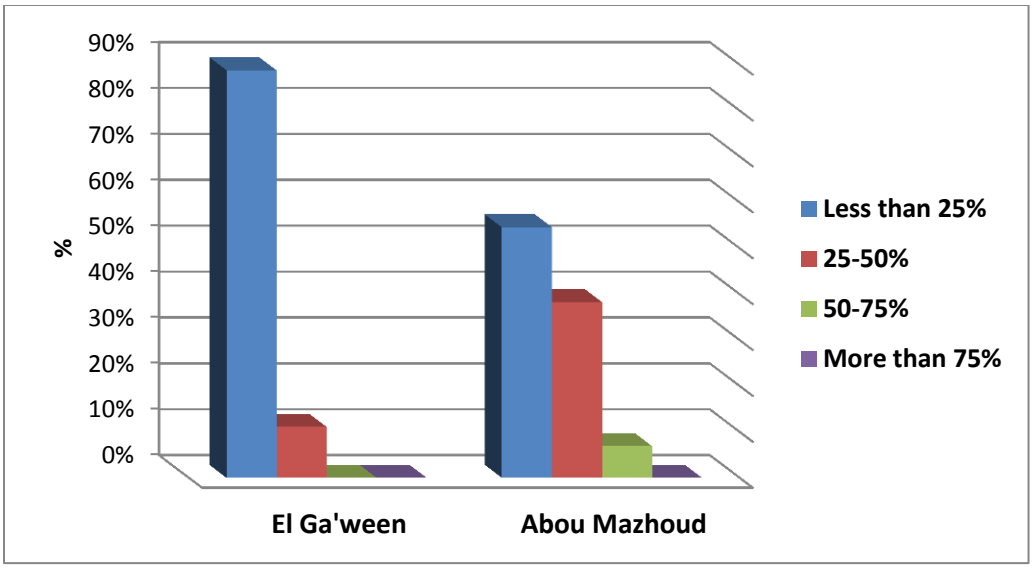


Figure (76). Annual species coverage in the landscape project areas

The palatable perennial species in the landscape project areas

Data from El Ga'ween area (Figure – 77), showed that 82 sites representing 68.3 % out of total sampling sites contain perennial shrubs mostly unplatable (95%). From which 30 sites (39.5%), 48 sites (58.5%) and 4 sites (4.8%) had a relative coverage for the perennial shrubs of less than 25%, 25-50% and more than 50% respectively. The situation was very different in the past, 5 sites had a perennial species relative coverage of less than 25%, 31 sites with 25-50 %, 42 sites with 50-75 % and 4 sites of more than 75% coverage. The platable species in the past were higher representing 89.2 % out of the total perennial species

In Abou Mazhoud area, 86 sites representing 64.6% contained unplatable perennial plants. From which 44 sites (51%), 38 sites (44.1%) and 3 sites (3.4%) had a relative coverage for the perennial shrubs of less than 25%, 25-50 % and more than 50% respectively. As mentioned by locales,the situation was very different in the past, 7 sites had a perennial species relative coverage of less than 25%, 33 sites with 25-50 %, 42 sites with 50-75 % and 4 sites with more than 75% coverage.

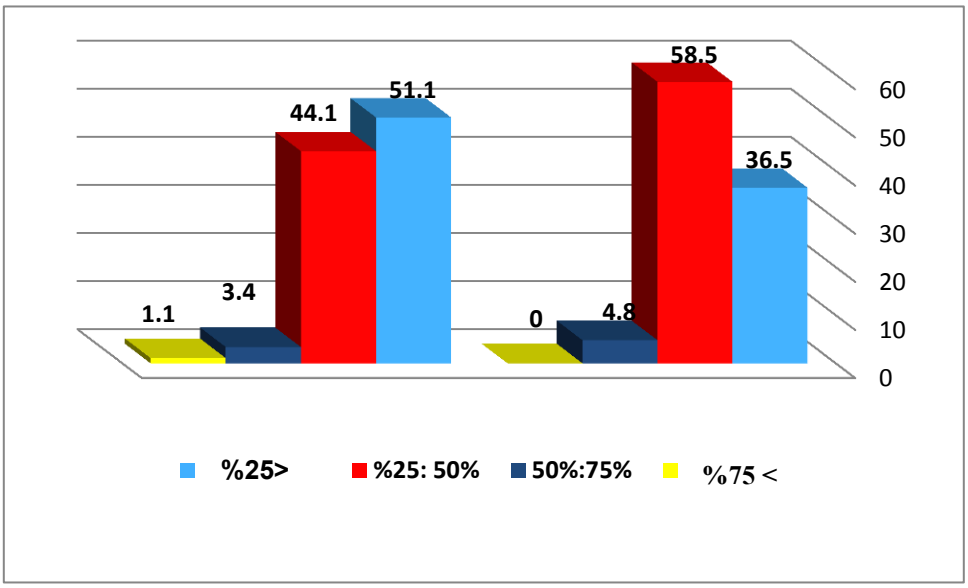


Figure (77). The palatable perennial species in the landscape project areas

5. DPSIR Analysis

DPSIR is a framework for identifying the "Drivers and Pressures" which affect the socio-ecological system and for monitoring the "State", focussing on the economic and social Impacts of change. Finally, indentifying the "Responses" and the possible essential interventions. DPSIR refers to: Drivers, Pressures, State, Impacts, Responses. The framework of DPSIR was applied in this evaluation process in order to link between the field assessment and the related survey studies. That gave a chance to the decision makers to achieve the aim of neutralize the lands dertreioration. In this report, the main drivers and pressures with direct impact on the land deterioration in the assessment landscape, will be identified. In addition to identifying the main economic and social impacts on the land derterioration aiming to find the solution for avioding such negative impacts, consequently achieving the sustainable land management.

Drivers

Over Population: Human population of Matrouh governorate has doubled between 2000 and 2020 . This rapid increase included the two project areas of assessment, especially in the cities of Ras El Hikma, Barrani and Matrouh. Such increase represents the high pressures on the limited natural resourses.

Climatic change: reports on cilmate change in the Mediterranean area, indicates that the Northern Coast of Egypt will be exposed to increase in the temperature between 1-4 °C and a decrease in the annual rainfall by 20% (**IPCC 2014**).

The absence of the organizational role: there are no specialized governmental departments responsible for the rangeland sector at the governmental level, consequently the absence of monitoring of the natural and human-induced land cover changes in the area resulting in land deterioration.

Raising prices of feed: The price of the concentrated feed-stuff reached to about 4500 LE per ton. This represents a pressure on the rangelands as an inexpensive source of livestock feed.

Pressures

Overgrazing: means increasing the number of animals over the grazing capacity. Using un-regulated continuous grazing system resulted in a poor plant growth, incomplete plant life cycle, shortage in the composition of the soil seed bank, increased number of invasive species.

Fire wooding means cutting the shrubs as fire wood for domestic uses. No data existed about the consumed amount, but it's a common phenomenon raised during the discussion with the local community and experts.

Developing the infrastructure including roads, settlements, cisterns for catching rainwater, which are mainly made by humans. Their impacts' severity relies on the closeness to the impacted areas.

Cultivating the field crops Studies and satellite images revealed the expansion of areas cultivated by field crops, especially barely which led to the reduction of the rangelands area. Field crops cultivation gives the chance for increasing and spreading of the invasive species and increasing the soil disturbance and consequently soil erosion.

The invasive plant species: Through the field assessment in the two the landscape project areas, It as shown that the most common invasive species is "*Carduncellus mareoticus*" which is highly existed in barely cultivated areas.

State:

The vegetation production: It is indicated from the collected data and the information provided by the local community, that the reduction in the vegetation production happened due to the deduction of the high palatability annual plants and overgrazing which led to the reduction of the forage shrubs over the years. NDVI values appear a change in the vegetation production and density more likely related to the fluctuation in

rainfall from year to year and within the same year, these findings agree with the opinion of the locals.

The organic carbon in the soil: No data was provided about the amount of the organic carbon of the soil in the area.

Land cover: satellite images recorded a slight changes in the land cover between 2000 and 2019 in the direction of change from dense desert shrubs to scattered desert shrubs and vice versa. This changes due to mainly the temporal variability of annual rainfall., However, It was indicated during the meetings with the local leaders, breeders and the local community, The major change of land cover from rangelands to rainfed agriculture took place more than 30 years ago.

Soil erosion the received data from the assessment indicated that 62%of the locations in El Ga'ween area and 64% of the locations in Abou Mazhoud were eroded either by water or wind.

Impacts

Food security: malnutrition in children.

Livestock: It's noticed that there was a reduction in the number heads of sheep in "Matruh, Negela, Barani" from 330.6 thousand head in 1997 to 271.7 thousand heads in 2015; the reduction rate is estimated by 17.8%. In terms of goats, the reduction was from 126.6 thousand heads in 1997 to 98.5 thousand heads in 2015; the reduction rate estimated by 22.2%. The highest decline rate was recorded in the number of goats and sheep of about 40% when comparing between 1999 and 2011 most likely due to the low rate of rainfall.

Milk production: The reduction of milk production is a result of the reduction of the animal numbers. Milk production is a main nutrition for the family and also is a main source of income after marketing or processing.

Immigration to the city Rangelands deterioration caused a shortage in providing work opportunities especially for young people, which lead to the immigration of the workers to the city to work in the tourism sector.

Responses The following is indicating some of the possible recommended responses according to each component separately.

Drivers: The proper planning of the land uses, strengthening the organizational role of natural resources management, limiting the negative impacts of climatic change by applying proper systems of rainwater harvesting.

Pressures: The proper planning for grazing, controlling the fire wooding and removing the rangelands shrubs, setting proper plans for urbanization and the infrastructure projects, managing the distribution of cisterns, controlling the expansion of the cultivated barely crop, removing the invasive species.

State: Rehabilitation of the deteriorated rangelands through the artificial revegetation of annuals, cultivation of forage shrubs and regulating the grazing system .

Impacts Raising the awareness and increasing the educational level, expanding the profitable micro projects (income generating activities).

6. Evaluating the state of the natural resources and their effect on likelihood and eco-system services

The study, focused on the assessment of the rangelands in the two project areas, revealed the condition of rangelands deterioration in the area. Such deterioration maybe partially due that the assessment process was done in September and November,and during this period that precedes the season of rainfall , most of the vegetation cover is dominated by heavily grazed shrubs,. Lack of regulations that organize the process of grazing in the area contributed negatively in this deterioration.

6.1. Evaluating land deterioration and soil erosion

It is revealed from the obtained results that 62% of the sites in El Ga'ween and 64% of the sites in Abou Mazhoud exposed to soil erosion (gully , sheet and wind erosions). The existence of the water erosion indicates the increase in the surface runoff rate, and the reduction of the soil infiltration capacity in the soil profile. The increase of the organic litter percentage, whether plant or animal wastes, indicates the great pressure on the rangelands resulted from the increased number of animals due to the existence of animal wastes. The existence of plant wastes mostly in barley fields, led to the increase of the rainfall rate in the previous year of the assessment, which explains the good growth of the plants and increasing Plant residues.

6.2. Evaluating the state of water resources and their directions

In this report, the impact of the rangelands health on the different water resources wasn't studied, this was because of the difficulty of monitoring the flow discharges at the wadis outlets, and water levels in the cisterns which reflect the state of the rangelands. It was also difficult to study the fluctuation of water level in the groundwater wells for identifying the extent of water infiltration in the soil and its impact on the salinity of ground water and identifying the pumping rate.

6.3. Evaluating the vegetation cover and biodiversity

During the assessment process, the dominant vegetation cover was shrups which are the favorite for camel grazing, but the herders indicatedthat the different annual species with high palatability rate for goats and sheep, appear in the spring season. They also admitted that there is no recent change in the vegetation cover, no transformation of the rangelands to other land uses, in the last thirty years. That was confirmed by the satellite images that there is no remarkable change in the vegetation area since 2000 until now. The two areas are distinguished with their rising number of locations in which the unpalatable species prevail dominating 74% in El Ga'ween area, and 65% in Abou Mazhoud area. It is also noticed a reduction in the palatable annual species in most of the sites in the two the landscape project areas. Results revealed also that about 35.5% of El Ga'ween rangelands and 58.8% of Abou Mazhoud's were deteriorated compared to the past. The disappearance of the wild animals, especially rabbits, was the common evidence of the rangelands deterioration as the strong shrubs were used as hidden places. In brief, the rangelands were deteriorated in the last years due to many main factors, such as overgrazing , irregular grazing and the wrong agricultural practices, but the major reason, from the locals point of view, is the decline of the annual rainfall as compared to the previous condition.

7. Conclusion and recommendations

This report shows the participatory approach in assessing the rangeland and identifying its condition. Two areas in the Northern west coast of Egypt were selected i.e., El Ga'ween and Abou Mazhoud, to conduct the assessment process. The assessment depended on the data obtained from the local community members, experts, and the rangeland scientists. The report showed the steps of the assessment process and the main results which then were connectedwith the remote sensing data. DPSIR framework was used to analyze the results and potential interventions for evidence based decision making and policy support. This section outlines the main findings, lessons learned, gaps, and recommendations .

One of the basic steps of PARAGA methodology is using the participatory landscape mapping, which rely on the information obtained from the local community and herders; such maps include the roads, vegetation cover, rangeland areas, soil, and the main landmarks of the assessment landscape. The local community divided the landscape project areas, according to the vegetation type, to saltmarshes, orchards, barley lands, rangelands. They also divided the area, according to the grazing animal types, to sheep and camel grazing lands. The main learned lessons from the participatory mapping are:

- Identifying the different land uses of the landscape and its soil and climatic characteristics and the grazing areas for different animals.

- The participatory mapoing gave an idea about the tribal composition in each of the landscape project areas, consequently identifying the persons who have to be joined to the work team and who will help in any interventions for the rangelands improving. Also defining the conflict areas to be avoided for any possible interventions.
- In the group meetings, the main changes have been identified in the areas concerning the land cover and also the main plant species , their distribution and the extinct species were defined.
- It is revealed from the results in the two the landscape project areas that the rangeland has been deteriorated greatly, and the absence of the palatable plant species and the invasion of the unpalatable shrubs were the main indicators of that deterioration, taking into account that the previous condition was in contrary to the current one. The prevalence of some of the invasive species such as *Atractylis carduus* (Forssk) is also one of the indicators of the rangeland deterioration. The existence of soil erosion is an evidence of the vegetation deterioration. The absence of the organizational role in managing the grazing process , maintaining the rangelands and limiting the transformation of the rangelands to other land uses were revealed clearly. It was important to use the remote sensing to verify the information collected from the field assessment. The remote sensing data were used in this report to monitor the land uses and the land cover change detection, and to estimate the vegetation production. However, Data were not available for identifying the spatial distribution of the degraded areas. It was noticed that there were a slight change in the land cover during the last 20 years; such change was clear in the dense desert shrubs and scattered desert shrubs land cover types due to the rainfall amount change during the periods of the satellite recording. The satellite images were from 2000, as there were some distortions in the used images; better results will be obtained if images from more precise sources are available. A set of priority indicators was identified as part of DPSIR framework to support important evidence-based decision-making for sustainable management, potential indicators include:

1. **Drivers: such as** the over-population increase, the climate change, policies, and prices of the concentrated feed.
2. **Pressures:** such as overgrazing, firewooding, infrastructure, cultivating the crops, invasive species.
3. **State:** such as the vegetation production, plant species, the organic carbon in the soil, land cover, and soil erosion.
4. **Impacts:** food security, animal production, milk production, immigration.
5. **Responses:** the integrated planning for land uses, building the capacity of the organization of the local natural resources management, combating the negative impacts of the climate change through excuting different structures for rainwater harvesting (drivers); grazing management plans, combating the process of firewooding, controling urban expansion, management of water points (cisterns),

removing the invasive species, monitoring the irregular barely cultivation (pressures), rehabilitation of the most deteriorated areas for flourishing the vegetation condition and re-seeding the annual plants threatened with extinction, rangeland management and protection (State), education, raising awareness for the alternative profitable activities.

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