WATER RESOURCE MANAGEMENT IN LIBYA FROM THE FARMERS PERSPECTIVE

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I certify that in my opinion the thesis submitted by Ali Khalefa Ali YOUNES titled "WATER RESOURCE MANAGEMENT IN LIBYA FROM THE FARMERS PERSPECTIVE" is fully adequate in scope and in quality as a thesis for the degree of Master of Science.

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Ali Khalefa Ali YOUNES

ABSTRACT

M. Sc. Thesis

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Wetlands are environments that are completely or partially submerged or contain a certain proportion of water or moisture and remain in this state for the whole year or for a temporary period. Agricultural activities in Libya have different characteristics as well as wetlands are also used for agricultural purpose. Water management has different points concerning ecology, society also which is associated with the aforementioned governance conditions. These conditions affect water policy arrangement for every country. All arrangements as well as rules or decided laws about water policy require investigating situations of individuals who will implement them.

This thesis focuses on Libya's water resource features also which is associated with the aforementioned situation of individuals related to wetlands as well as agricultural lands. Thus, it was aimed to determine effective policy principles that will help to

develop water management strategies related to wetlands as well as agricultural areas in Libya with the help of social research.

This study will utilize a descriptive research methodology that is suitable for this sort of research study. Furthermore, research methods utilized in getting information for this research study. The analysis phase towards measuring also which is associated with the aforementioned analyzing the quality of the participant's responses via using Statistical Package for Social Sciences (SPSS) software tool as well as ANOVA test has applied a qualitative research method to evaluate the collected answers from the participants. The samples in this study were 412 Libyan farmers to evaluate some research factors also which is associated with the aforementioned towards enhancing wetlands treatments in Libya, for instance, Farmers' knowledge as well as perception.

Farmer' ownerships, Farmers' Barriers, also which is associated with the aforementioned towards Farmers' Trust Scales. Results indicate that the Farmer's ownership scale is valid. Reliability of Farmers' knowledge also which is associated with the aforementioned towards perception, Farmer's ownerships, Farmers' Barriers, as well as Farmers' Trust Scales has been taken into consideration as a research factor to evaluate the agricultural areas usage in Libya also which is associated with the aforementioned towards how to protect such kind of lands in Libya. All scales have reached satisfactory as well as the research results indicate that the scales can be used in the measurement of the indicated variables. Furthermore, as declared via the results of this research study a large number of farmers are falling into High School.

The results of this research study a high number of the framers in Libya are in the age between forty to forty-nine years also which is associated with the aforementioned towards the low number of farmers were between eighteen to twenty years old. As reported via the results of this research study a strong positive relationship between Farmers' ownerships as well as Farmers' knowledge also which is associated with the aforementioned towards perception. As informed via the results of this research study a strong positive correlation between Farmers' Barriers also Farmers' knowledge also which is associated with the aforementioned towards perception.

In addition, about 78.9% of farmers believe that wetland use is the main problem due to a misunderstanding of how wetlands are used also which is associated with the aforementioned towards benefited. 35.3% of farmers agreed to develop agricultural areas containing "peat" also which is associated with the aforementioned towards landing, while about 36.4% of farmers agree on little to thinking that wetland also which is associated with the aforementioned towards fertilizer recommendations have exceeded the needs of crops also which is associated with the aforementioned towards smallholders due to a misunderstanding of framers of how Fertilizer use also which is associated with the aforementioned towards wetland utilization.

Therefore, focusing on the use of wetlands in new ideas contributes to managing water also which is associated with the aforementioned towards agricultural fertilizers, as well as solving the farmers' misunderstanding of misunderstanding wetlands in terms of agriculture also which is associated with the aforementioned towards dealing with the risk of self-combustion "peat" is important. Important to move forward for optimum use of wetlands also which is associated with the aforementioned towards agriculture.

As a final point, the results of this research study have supported that there was a strong positive correlation between Farmers' Trust also which is associated with Farmers' knowledge as well as perception. Furthermore, research have supported that a significant relationship between Farmers' Trust also Farmers' knowledge also which is associated with perception. This research study can open the source of how to enhance the work of the Ministry of Environmental Preservation as well as the Ministry of Agriculture in Libya in terms of how o guidance the Libyan farmers also which is associated with shade the light of the water resources usage of agricultural areas.

Keywords : Wetlands in Libya, Agriculture, Farmers' knowledge, Farmer's perception, Farmer's ownerships, Farmers' Barriers and Farmers' Trust, wetlands treatments, Libyan farmers.

Science Code : 91438

ÖZET

Yüksek Lisans Tezi

ÇİFTÇİ PERSPEKTİFİNDEN LİBYA'DA SU KAYNAKLARI YÖNETİMİ

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Sulak alanlar, tamamen veya kısmen su altında kalan veya belirli oranda su veya nem içeren ve tüm yıl veya geçici bir süre boyunca bu durumda kalan ortamlardır. Libya'daki tarımsal faaliyetler farklı özelliklere sahip olup, sulak alanlar da tarımsal amaçlı olarak kullanılmaktadır.

Su yönetiminin ekoloji, toplum ve yönetim koşulları ile ilgili farklı noktaları vardır. Bu koşullar her ülke için su politikası düzenlemesini etkilemektedir. Su politikasıyla ilgili tüm düzenlemeler ve kurallar veya kararlaştırılmış kanunlar, bunları uygulayacak kişilerin durumlarının araştırılmasını gerektirmektedir.

Bu tez, Libya'nın su kaynakları özelliklerine ve sulak alanlar ve tarım arazileri ile ilgili bireylerin durumuna odaklanmaktadır. Böylece Libya'daki sulak alanlar ve tarım alanları ile ilgili su yönetimi stratejilerinin geliştirilmesine yardımcı olacak etkin politika ilkelerinin sosyal araştırmalar yardımıyla belirlenmesi amaçlanmıştır.

Bu çalışmada, bu tür araştırmalar için uygun olan betimsel araştırma metodolojisi kullanılacaktır. Ayrıca bu çalışma için bilgi edinmede kullanılan araştırma yöntemlerine gelinince, katılımcıların yanıtlarının niteliğinin ölçülmesine ve analiz edilmesine yönelik analiz aşamasında, Sosyal Bilimler için İstatistiksel Paket (SPSS) yazılım aracı ve ANOVA kullanılmış, katılımcılardan toplanan cevapları değerlendirmek için nitel bir araştırma yöntemi olarak T-testi uygulanmıştır. Libya'daki çiftçilerin bilgisi ve algısı, Çiftçilerin mülkiyeti, Çiftçilerin Engelleri ve Çiftçi Güven Ölçekleri gibi bazı araştırma faktörlerini değerlendirmek ve sulak alan yönetimlerini geliştirmek için çalışma örneklemini (412) Libyalı çiftçi oluşturmuştur. Sonuçlar, Çiftçilerin mülkiyet ölçeğinin geçerli olduğunu göstermektedir. Çiftçilerin bilgi ve algısı, Çiftçilerin mülkiyeti, Çiftçilerin Engelleri ve Çiftçi Güven Ölçeklerinin güvenilirliği, Libya'daki tarım alanların kullanımını ve Libya'da bu tür arazilerin nasıl korunacağını değerlendirmek için bir araştırma faktörü olarak dikkate alınmıştır. Tüm ölçekler tatmin edici seviyeye ulaşmıştır ve araştırma sonuçları, ölçeklerin belirtilen değişkenlerin ölçülmesinde kullanılabileceğini göstermektedir. Ayrıca, bu araştırma çalışmasının sonuçlarına göre çok sayıda Libyalı çiftçinin eğitim düzeyinin Lise düzeyinde olduğu ortaya çıkarılmıştır. Bu araştırma çalışmasının sonuçlarına göre, Libya'daki çok sayıda çiftçinin kırk ila kırk dokuz yaşları arasında olduğu ve az sayıdaki Libyalı çiftçinin on sekiz ila yirmi yaşları arasında olduğu bulunmuştur. Bu araştırma çalışmasının sonuçlarında bildirildiği üzere, Çiftçilerin mülkiyeti ile Çiftçilerin bilgisi ve algısı arasında güçlü bir pozitif ilişki vardır. Ayrıca, bu araştırma çalışmasının sonuçları, Çiftçilerin mülkiyeti ile Çiftçilerin bilgi ve algısı arasında anlamlı bir ilişki bulunduğunu desteklemektedir. Bu araştırma çalışmasının sonuçlarından da anlaşılacağı üzere, Çiftçilerin Engelleri ile Çiftçilerin bilgi ve algıları arasında güçlü bir pozitif ilişki vardır. Ayrıca, bu araştırma çalışmasının sonuçları, Çiftçilerin Engelleri ile Çiftçilerin bilgi ve algısı arasında anlamlı bir ilişki olduğunu desteklemektedir.

Çiftçilerin yaklaşık %78,9'u, sulak alanların nasıl kullanıldığına ve bunlardan nasıl yararlanıldığına dair yanlış fikirlere sahip olduğundan dolayı sulak alan kullanımının ana sorun olduğuna inanmaktadır. Çiftçilerin %35,3'ü "turba" ve ekim de dahil olmak üzere, tarım alanlarını geliştirmeyi kabul ederken, çiftçilerin yaklaşık %36.4'ü, gübrenin nasıl kullanıldığı noktasında ve sulak alan kullanımına ilişkin yanlış fikirlere

sahip olduğundan, sulak alan ve gübre önerilerinin, mahsullerin ve küçük çiftlik sahiplerinin ihtiyaçlarını aştığını düşünmektedir.

Bu nedenle, yeni fikirlerde sulak alanların kullanımına odaklanmak, su ve tarımsal gübrelerin yönetilmesine katkı sağlamanın yanı sıra, çiftçilerin sulak alanları tarım açısından yanlış anlamalarını ve kendi kendine yanma "turba" riski ile mücadele etmeyi de önemli hale getirmektedir. Sulak alanların ve tarımın optimum kullanımı için ilerlemek önemlidir.

Son bir nokta olarak, bu araştırma çalışmasının sonuçları, Çiftçilerin Güveni ile Çiftçilerin bilgi ve algısı arasında güçlü bir pozitif korelasyon olduğunu desteklemiştir. Ayrıca, bu araştırma çalışmasının sonuçları Çiftçilerin Güveni ile Çiftçilerin bilgi ve algısı arasında anlamlı bir ilişki olduğunu desteklemektedir. Bu araştırma çalışması, sulak alanların optimum kullanımı için Libyalı çiftçilere nasıl rehberlik edeceği bakımından Çevre Koruma Bakanlığı ve Libya Tarım Bakanlığı'nın çalışmaları için bir kaynak teşkil edecektir.

Anahtar Kelimeler : Libya'daki Sulak Alanlar, Tarım, Çiftçilerin bilgisi, Çiftçilerin algısı, Çiftçilerin mülkiyeti, Çiftçilerin Engelleri ve Çiftçilerin Güveni, sulak alanların geliştirilmesi, Libyalı çiftçiler.

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PART 1

GENERAL OVERVIEW

1.1. INTRODUCTION

Libya situated on the also which is associated with the aforementioned northwest Mediterranean coast of Africa, has a total area of around 1.76 million km2 [1]. The cultivable area remains estimated at 2 170 000 ha, which is 1.2 percent of also which remains associated with the aforementioned total area. The total population is about 6.4 million also which is associated with the aforementioned inhabitants in (2011) also which is associated with the aforementioned. The population density is 3 inhabitants/km2 also which is associated with the rural population was estimated to be only 21 percent in (2021). Agriculture contributes less than 5% although it provides employment for approximately also which is associated with the aforementioned 13% of the active population [1].

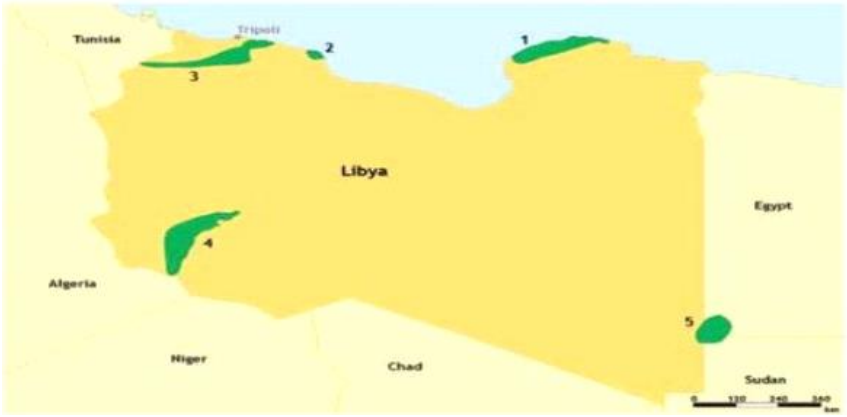

Figure 1.1. The important cultivations area in Libya.

As can be seen in Figure 1.1. The five plant areas of Libya are such as 1- Jabal Al Akhdar, 2- Sabkha Tawurgha, 3- Jabal Nafusa, 4- Jabal Al Owainat, also which is associated with 5- Jabal Misak. The most plant area in Libya is Al-Jabal Al-Akhdar

which is considered one of the largest vegetation areas as well as is located in Cyrenaica in northeastern Libya; which contains 80% of the Libyan plants (2020); also, which is associated with an exceptional center of endemism. The botanical areas also regulated climate with hot springs also which is associated with open canals of Tawurgha as well as the limestone formations in the Nafusa Mountains, which stretch 500 km from the Tunisian border strengthen to the Nagara region on the Mediterranean coast. Libya consists of three main local botanical habitats, for instance, the coastal also which is associated with the desert habitats with their crossing valleys from south to north as well as from west to east. A great number of plant species, which more than 1800 are flourishing in these habitats. These plant species form a vegetation type with variable features [2].

Wastewater has to be treated, the reflection on the supply side will also need a water balance also which is associated with an examination of all available water streams beginning at the source [1- 10]. Furthermore, to optimize the reutilize potential it might be useful towards segregate such streams as well as treat them separately [11]. Moreover, lead to scale considerations towards find the best size of collection, treatment which is associated with distribution frameworks for a reutilize option [12]. In the same way, this might result in frameworks of very diverse scale [13]. Consequently. water supply scheme for a metropolitan area, domestic which is associated with manufacturing wastewater treatments of various sizes from municipal towards one production process down towards greywater [11], for instance, all the wastewater except those from toilets [12]; treatment for one building producing service water for toilet flushing, garden irrigation as well as even laundry in that same building [1-10]. Therefore, the water Supply which remains associated with Sanitation Collaborative Council postulated in 2000 at its Bellagio meeting that the household is the basic unit at which towards [11] start examining water issues, with solving every issue at the smallest possible scale [14], from household towards entire country, optimizing the possible solutions in repeated cycles [13].

Treatment wetlands are either natural or constructed systems managed in a specific manner for the treatment of wastewaters [14]. Although traditionally applied for the treatment of domestic also which is associated with municipal sewage from both

separate also combined sewerage, treatment agricultural areas have been applied globally since the late 1980s to treat various types of wastewaters, including agricultural wastewaters, for instance, cattle, swine, poultry as well as dairy mine drainage, food processing wastewaters (winery, abattoir, fish, potato, vegetable, meat, cheese, milk, sugar production) [15,16], heavy industry wastewaters, for instance, polymer's, fertilizers, chemicals, oil refineries, pulp, also which is associated with landfill leachate as well as runoff H_2O [16]. In wetlands treatment, wastewater, usually pretreated to a rather high degree in the case of natural agricultural areas, remains allowed to flow, very slowly, through the agricultural area's framework [14]. Bacteria, fungi, also which is associated with many other types of organisms inhabit the aqueous medium also which is associated with utilization pollutants contained in the wastewater for food [14]. Wetland's systems are usually no more than two feet deep, in order to enable photosynthesis as well as diffusion from the air to maintain aerobic conditions. Area loading rates must be managed so as to avoid the development of anaerobic zones [11,13]. Flow-through them is very slow, so that hydraulic retention times are very long, due to the lack of input of energy of the types used with mechanical treatment systems [17]. Among the treatment agricultural areas, horizontal subsurface flow constructed agricultural areas are a widely applied design [14]. Treatment is achieved via a variety of physical, chemical also which is associated with biological processes, such as sedimentation, filtration, precipitation, sorption, plant uptake, microbial decomposition as well as nitrogen transformations [16].

1.2. WETLANDS

Natural agricultural areas have served as a receiving body for wastewater disposal for as long as wastewater has been collected, which date back to the beginning of the 20th century [18]. Research insights gained from several studies on natural agricultural areas also which is associated with implementation considerations of constructed agricultural areas for wastewater treatment happened during the 1980s as well as 1990s in Canada treatment agricultural areas systems used for municipal wastewater treatment across Canada, which included treatment of wastewater from agricultural practices, storm water treatment as well as mining acid drainage treatment [14,15].

Furthermore, whether soils are saturated via either surface water or ground water for long periods or for much of the growing season, for instance, presence of water table at or less than 30 cm of the surface for a period of 14 consecutive days during normal years), specific vegetation types, called hydrophilic plants are grown [11,15,19]. Moreover, these plants have specific structures, able towards transporting atmospheric gases, including oxygen, through their leaves also which is associated with stems to their roots for respiration [14]. These same structures also transport respiratory via - products as well as other gases generated in the soil back up the roots, stem also which is associated with leaves for release to the atmosphere, thereby reducing the potentially harmful accumulation of gases in the region of the growing roots [14]. Emergent plants obtain phosphorus primarily from soil, floating plants directly from the water, as well as rooted submerged plants from both soils also which is associated with water. In the second step, when soils become water-saturated, microbial communities promoting biochemical reactions consume oxygen changing soil conditions into anaerobic conditions. Furthermore, these conditions cause many elements also which is associated with compounds to occur in reduced forms creating characteristic colors, textures also compositions typical of hydric soils. In addition, they influence nutrient cycling, pH change, sediment also which is associated with organic matter accumulation, decomposition, as well as metal concentrations in the sediment also which is associated with water [14].

1.3. THE RESEARCH AIM AS WELL AS OBJECTIVES

- To show the impact of agricultural areas treatments in Libya in general condition.
- Explain what brought about via increasing the agricultural areas treatments resulting in climate change in Libya.
- Identify the challenges that face the world in general also which is associated with Libya in specific towards reducing global warming also which is associated with reducing the impact of agricultural areas treatments on climate change.
- Vision of the future of Libya as well as technological solutions towards reducing global warming also which is associated with what remains the role

of governments as well as individuals also which is associated with our responsibility towards confront global warming.

- To identify aspects of the agricultural area's treatments design process in Libya.
- To improve agricultural areas treatments according towards Libya which will reduce the financial risk of investment as well as the cost of capital investment.
- To develop an integrated agricultural area in Libya as well as decision support framework guidance of existing buildings.

1.4. CLIMATE CONDITIONS IN LIBYA

That the three primary kinds of climatic sorts are available in Libya: the Mediterranean atmosphere along the waterfront region of Cyrenaica, trailed via a belt of (fifty towards one-hundred) km of steppe environment also which is associated with the aforementioned which overwhelms the beachfront zone of Libya, at also which is associated with the aforementioned that point a greater part of the nation which also which is associated with the aforementioned remains desert, coming in direct contact with the Mediterranean water at the Gulf of Sirte [20]. In waterfront territories can most recent five days however only here which is associated with these persevere for multiple.

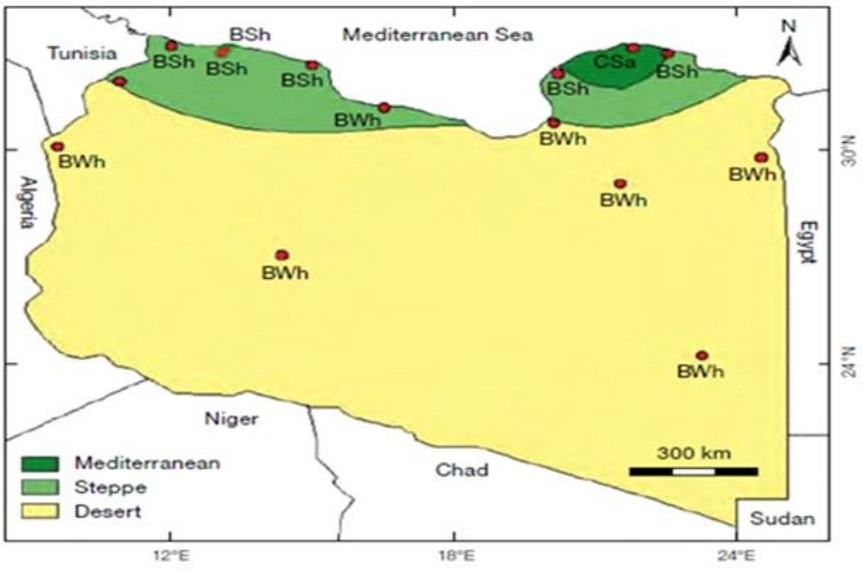

Figure 1.2. The climate types in Libya [20].

Urban architectural design involves place-making the formation of a setting that gives a feeling of spot towards a zone. This procedure is accomplished via building up recognizable neighborhoods, one of a kind engineering, stylishly satisfying open spots which is associated with vistas, recognizable tourist spots as well as central focuses, which is associated with a human component built up via perfect sizes of advancement as well as continuous open stewardship [21]. Other key components of place making incorporate exuberant business habitats, blended utilize advancement with ground-floor retail utilizes, human-scale which is associated with setting touchy structure; sheltered as well as appealing open territories; picture making; also, which is associated with enhancing components in the open domain. Open spaces or avenues to neighborhoods, city-wide frameworks or entire locales [15].

That adaptation remains increasingly being presented as a necessary response tool in respect of climate change effects. Furthermore, the adaptation still continues towards lag behind mitigation in the climate change discourse [15]. However, this situation looks likely towards changing during the recent time for the reason that of an increasing scientific acceptance that certain climate change effects are now inevitable.

1.5. THE RESEARCH IMPORTANCE DESIGN ASPECTS

This research study is important which can evaluate the farmers perceptions and barriers about agricultural areas in Libya. A major challenge that agricultural areas still need towards pass through the framework without causing severe damage. Two typical strategies remain bypasses as well as redundant structures: overflows within pump sumps or agricultural areas beds could be one way, or planning several treatment lines in parallel so that if one remains offline, the waste water can still be treated via the other lines. In addition, risk considerations when there remains not only a treatment, on the other hand, a supply commitment, either in terms of quantity, quality, both, that must be complied with.

1.6. RESEARCH QUESTIONS

RQ_1: What's the Farmers' knowledge and perception about agricultural areas treatment in Libya based on climate change?

RQ_2: What's the farmers barriers to eliminate the risk of some agricultural areas in Libya?

RQ_3: What's the Farmers trust of reducing agricultural areas costs in Libya?

RQ_4: What's the Farmers trust and ownerships development of reducing agricultural areas costs in Libya?

1.7. THE RESEARCH PURPOSE

The purpose of the study is towards describe some research factors that influence countries; nowadays, some countries are seeking towards formulate guidelines for high quality of agricultural areas retrofits. Consequently, the main concepts of this research study is towards detecting the impact of climate change on agricultural areas in Libya which remains associated with towards investigate the possibility of reducing operation as well as maintenance operation also which is associated with agricultural areas costs in Libya. Therefore, this research study reflects the signification importance that can be obtained from the investigation of the impact of climate change which remains associated with agricultural areas treatments also operation as well as maintenance operation as well as agricultural areas costs in Libya, therefore, towards minimizing waste as well as reduce the current expenses for cost as well as human renounces consumption of agricultural areas all around the world.

1.8. LIMITATIONS OF THE RESEARCH

They can be clarified as follows:

- This study has focused on describe the aspects related towards regional development status requirements for low capital also which is associated with operational costs.

- A limited financial resource, a treatment costs are small, that the implementation of the treatment frameworks becomes viable.
- To evaluate antecedents of farmers' knowledge as well as perception of agricultural areas ' habitats also which is associated with agriculture.
- To evaluate the Farmers' knowledge also which is associated with perception about agricultural areas treatment in Libya based on climate change.
- To evaluate the farmers barriers to eliminate the risk of wastewater in Libya.
- To evaluate the Farmers trust of reducing operation as well as agricultural areas costs in Libya.
- To evaluate the Farmers, trust as well as ownerships development of reducing operation also which is associated with agricultural areas costs in Libya.
- To evaluate the operation as well as agricultural areas costs in Libya.
- Operation also which is associated with agricultural areas costs are taken over via the operator which remains concerned with service provider.
- A good functioning of the plant treatment.
- To show lack of skilled manpower for undertaking even basic operation as well as agricultural areas.

1.9. THE RESEARCH CONTRIBUTION

The contribution of our study is as follows:

- This study will observe the electronic database towards reviewing which remains associated with the evaluation the impact of climate change on wetland treatments in Libya also which is associated with towards investigate the possibility of maintained as well as operations design in Libya.
- The outcome of this research study will be a powerful guideline also which is associated with a reference for next researchers who interested on studying such important subject after evaluating the main affecting factors which remains associated with elements that can affect which remains associated with has impacted climate change on wetland treatments design frameworks in Libya.

- The results of this study will be an important issue which remains associated with great participations for Libyan wetland treatments as well as economical domain towards avoids economical risk also which is associated with crises in future.

PART 2

LITERATURE REVIEW BASED ON AGRICULTURAL AREAS IN LIBYA

2.1. INTRODUCTION

Agricultural areas are in effect, multi-functional natural reservoirs, as well as whole communities are dependent upon their productivity also which is associated with the aforementioned also which is associated with hydrological benefits [37,41]. The wetland benefits are especially important in the dry parts of developing countries where the strategic importance of Agricultural also which is associated with the aforementioned areas for rural livelihoods is enormous [31,32,42]. where also which is associated with the aforementioned land shortage is a continuously growing problem due to increased population pressure [33, 36]. adapted to the local market [20,47, 50].

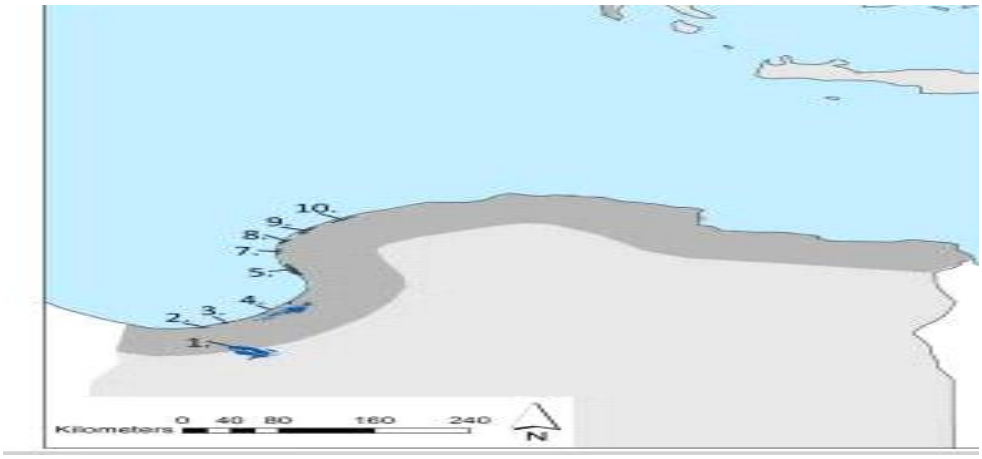

Figure 2.1. The wetlands are in Libya: (1) Sabkha Al Kabirah; (2) Sebkha Bishr; (3) Sebkha Hafiroun & Brega; (4) Sebkha Ajdabiya & Al Brayqah; (5-6) Sekbha Karkurah; (7) Sebkha Ghemines (8) Sebkha Gandoufa; (9) Sebkha El Thama & Esselawi; (10) Sebkha Al Kuz [42].

The Al Khadra irrigation development project, started in 2002 through a joint venture between American companies also which is associated with the Libyan government with its the Great Manmade River Water Utilization Authority (GMRWUA) [43, 46]

is an example of this expanding private irrigated farming. Initiated with 1 000 ha in the Benghazi area using mobile irrigation equipment, it expanded to 10 000 ha there, as well as 5 000 ha in the Sirte area, also which is associated with 1 200 ha in Tarhona south of Tripoli [20,48-50]. It grows a wide range of crops: cereals, for instance, wheat, barley, oat, maize; fodder (alfalfa also which is associated with grass hay), fruits, for instance, grapes, peaches, pears as well as apricots; potatoes, as well as olives. Permanent pastures account for 13.3 million ha, annual crops for 1.72 million ha also which is associated with permanent crops for only 0.34 million ha in 2013. Rainfall occurs during the winter months (October-March), on the other hand, great variability is observed from place to place also from year to year. Average annual rainfall for the country as a whole is 56 mm. Temperatures vary between over 40 ° C in summer to below zero in winter [31]. Libya also has a large diversity of habitats also which is associated with ecosystems such as sea as well as beaches, forests, mountains, steppes, grasslands, a variety of agricultural areas land also which is associated with desert. The diversity of wetlands in Libya as written below [51]:

- Salt marshes (Sabkhas), such as Sultan, Abo Kamash also which is associated with the aforementioned towards Benghazi sabkha.
- Coastal lagoons, such as Al-Ghazala also which is associated with Azizi.
- Water springs, such as Tawurgha also which is associated with Ain Kaam.
- Desert oases, such as Gaberoun, Bzima Oasis.
- Dams, such as Almjenin dam Wadi Attot.
- Artificial reservoirs, such as Made River reservoirs.
- Water treatment plants.

These ecosystems have a great economic importance, they are also sheltering for many species. So, any disturbance, threats or destructing of these habitats will negatively affect the components of biodiversity of these areas. Furthermore, they have a great value as touristic also which is associated with recreational zones. They also have a crucial role in the purification of contaminated water [51].

Wetlands are complex, highly sensitive ecosystems that are prone to change dramatically due to natural also human factors [37, 41]. Such susceptibility to change

prompted many countries to implement laws, regulations, also which is associated with standards aimed at protecting agricultural areas, as well as policies for their management as well as restoration [52]. However, in the case of Libya, nature conservation efforts, which started as early as the 1970's, tended to focus mainly on the protection of limited forest also which is associated with wildlife areas in small designated national parks in the Jabal al-Akhdar as well as few other locations in the west of the country [53, 64].

2.2. WATER CONDITION IN LIBYA

Water that falls has humble utilization of yield plants on the grounds that the amount is too little to even think about entering the dirt adequately, otherwise it might invade a permeable soil too quickly [1], otherwise it might run-off quick. Well Project (Water also which is associated with Energy for Life in Libya, 2014) demonstrated that few levels of dryness should be unsurprising. The first remains the place where the dry environment remains modified via customary stormy seasons. In such locale it very well may be conceivable towards delivering a wide scope of yearly yield during the short blustery season, enough to continue towards going creatures also which remains associated with feed humanity [1]. The subsequent condition remains an all-year aridity, here also there adjusted via light or sporadic downpours, which may make creation of harvest unimaginable. The third circumstance is the place where water is got from wells, trenches or diverse methods with the goal that customary agribusiness can endure, in spite of the aridity of the climate.

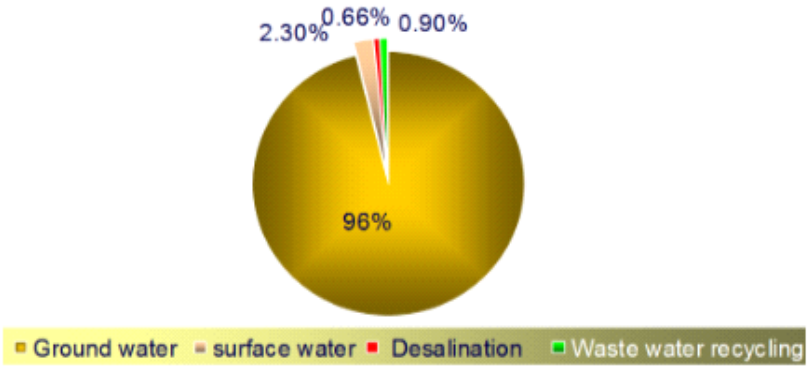

Figure 2.2. Water resources in Libya.

Libya is considered to stand within the third situation, where water in agriculture is entirely necessary for all plant also which is associated with animal life. Plants have to grow, that are able for living as well as reproducing in semi-arid, arid, also which is associated with even desert regions. However, the problem in this case is as aridity increases, fewer also less species is modified, also which is associated with the prospective biomass are reduced. Water from wells as well as lakes in Libya as in arid regions face problems of quality, especially the presence of excess minerals. The depth of the well necessary to obtain water may vary a few to hundreds of meters. Water from wells is either fossil (stored in aquifers for thousands of years), or from soil stored water from rain, in any case it is stored rainwater. Both sources are limited also which is associated with can be exhausted [2].

2.3. WATER AS WELL AS HANDINESS

Water resources in the country which were originated from seawater desalination, wastewater, surface which associated with water also which is associated with groundwater. Furthermore, the existing desalination plant produced seventy million m3 in (2012), exclusively for municipal as well as industrial purposes [70]. What's more, the present capacity of wastewater treatment remains estimated at 74 million m3 per year, with treated effluent primary targeted towards agricultural purposes. Moreover, surface water, originating mainly from rainfall, represents approximately 170 million m^3 per year, contributing less than 3% of the total water utilization [53]. What's more, sixteen dams also which remains associated with several reservoirs have been created towards managing surface H_2O resources. Moreover, groundwater, both shallow also which is associated with fossil aquifers, represent the main source of water supply in the country. Both shallow (Jabal Nafusah, Jifarah, Jabal al Akhdar, as well as which remains associated with Murzuk) correspondingly, also which remains associated with fossil groundwater (Kufra) as presented in Figure 2.3 are recharged via rainfall at a rate of approximately 650 million m^3 in (2021) [4].

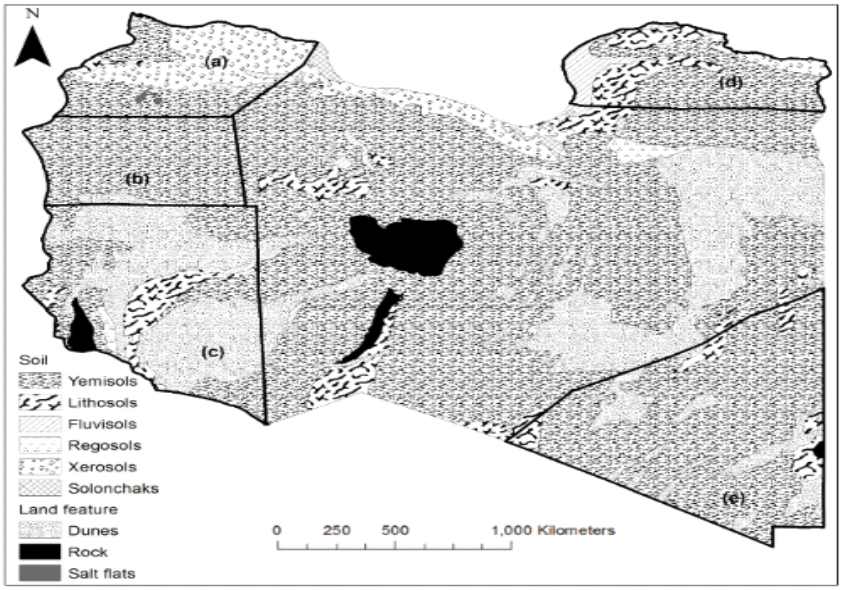

Figure 2.3. Soil classification as well as land features, also which remains associated with the major groundwater basins (a: Jifarah, b: Jabal Nafusah, also which remains associated with c: Murzuk, d: Jabal al Akhdar, as well as e: Kufra) in Libya.

Groundwater resources almost unusable for the reason that of their high salinity. From (1950 to 1990), the seawater interface advanced based on (1- 2) km inland, also which remains associated with salinity increasing significantly from 150 ppm towards approximately 1,000 ppm in the coastal aquifers [60].

Table 2.1. The characteristics of the shallow also which is associated with fossil basins based on Libya.

Basins	**Area (Km^2)**	**Total dissolved salts (mg/l)**	**Present also which is associated with probable pollution Sources**	**Effect of exploitation**	**Authors also years**

Jabal ala Akhdar	145	1000–5000	Sea water intrusion also which is associated with waste disposal	Water level decline also which is associated with sea water intrusion	[53]
Kufra	760	200–2000	Humans as well as fertilizers	Water level decline as well as local contaminations	[53,68]
Jifarah	20000	500–4500	Sea water intrusion, fertilizers as well as waste disposal	Water level decline as well as sea water intrusion	[53,68]
Jabal Nafusah	215	1000–5000	No pollution	Water level decline	[53]
Murzuk	350	500–1,500	Humans also which is associated with fertilizers	Water level decline as well as local contaminations	[53, 68]

Table 2.2. Overview of the medium also which is associated with large size desalination plants.

Location	Kind of plants	Design capacity	No of units	Operation year	Year of installation	Existing capacity
Benghazi	EDR	19200	16	1969	1967	Out of order
Zuara	MSF	13500+4500	3+1	1974–1979	1972–1977	Out of order
Derna	MSF	9000	2	1975	1973	4000
Al-Brega	MSF	7200	3	1975	1973	Out of order
Benghazi	MSF	24000+24000	4+4	1976+1978	1974+1976	10000
Sirt	MSF	9000	2	1976	1974	Out of order
Zilitn	MSF	13500+4500	3+1	1975–1978	1974–1976	Out of order
Tripoli-west	MSF	23000	2	1976	1974	4600
Tobruk	MSF	24000	4	1977	1975	8000
Sousa	MSF	13500	3	1977	1975	2500
Zuitina	MSF	5500	2	1977	1975	Out of order
Benjwad	MSF	6000	2	1978	1976	Out of order
Homes	MSF	40000	4	1980	1977	25000
Ras-Inof	MSF	24000	3	1983	1979	Out of order
Sirt	MSF	9000	2	1982	1979	Out of order
Al-Brega	MSF	4800	2	1982	1980	Out of order
Zuitina	MSF	30000	3	1983	1981	Out of order
Ras-lanof	MSF	8400	1	1984	1982	Out of order
Misrata	MSF	30000	3	1987	1982	25000
Bomba	MSF	30000	3	1988	1984	18000
Sirt	MSF	10000	1	1986	1985	9000
Zilitn	MSF	30000	3	1992	1989	20000
Tobruk	RO	6000	2	1979	1977	Out of order
Benwlid	RO	7000	1+1	1982–1983	1980–1981	Out of order
Tajoura	RO	10000	2	1984	1981	One unit
Misrata	RO	10000	5	1984	1984	Out of order
Zuara	RO	30000	6			
Tobruk	MED	40000	3			Under construction
Sousa	MED	10000	2			Under construction
Tripoli	MED	10000	2			Under construction
Derna	MED	5000	1			Under construction

Ecosystem services (ESs) are increasingly being utilized via many countries throughout the world as a framework to address the UN SDGs [33, 36]. The usability of Libyan soil databases ESs also which is associated with SDGs is the first of its kind for North Africa, as well as is based on a literature review also which is associated with available geospatial layers.

2.4. LIBYAN SOILS

Libyan soils are slightly or moderately weathered soils typical of arid areas. Figure 2.4 also which is associated with Table 2.3 show the major soil classes of Libya according to the FAO Soil Classification System as well as Table 2.4. Typical soil properties from the soil databases of Libya. The most arable land in Libya occurs at two locations: Al-Jabal al Akhdar in the northeast region, also which is associated with Al Jifarah Plain in the northwest region. Almost all of the country is a desert (95%) with 1.2% (2.2 million ha) being cultivated [69,72, 76]. Yermosols as well as Xerosols are the major soil orders in the region. Soils in Libya are typically shallow, sandy in

texture, low in organic matter content also which is associated with water holding capacity [79].

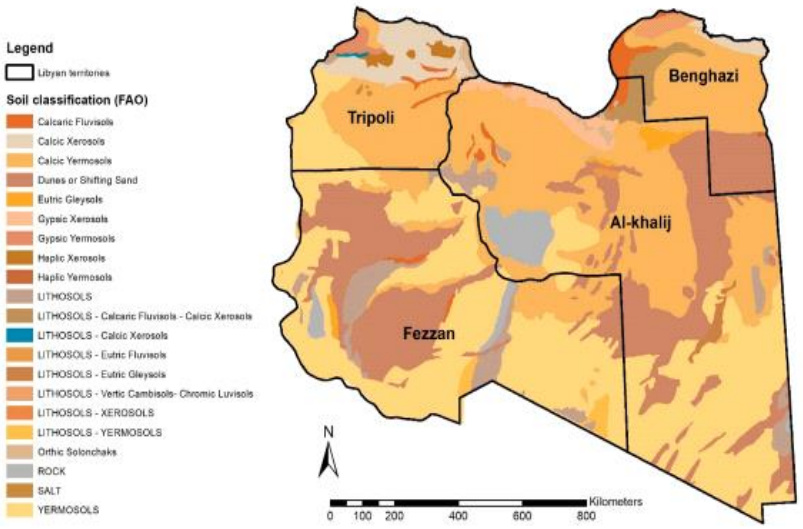

Figure 2.4. Soil map of Libya adapted from [68].

Table 2.3. Soils of Libyan territories based on the Food also which is associated with Agriculture Organization (FAO) of the (UN) soil classification system [68].

Tripoli	Al-Khalij	Benghazi	Fezzan
Calcaric Fluvisols	Calcaric Fluvisols	Calcaric Fluvisols	Calcaric Fluvisols
Calcic Yermosols	Calcic Yermosols	Calcic Yermosols	Calcic Yermosols
Orthic Solonchaks	Orthic Solonchaks	Orthic Solonchaks	Orthic Solonchaks
Calcic Xerosols	Calcic Xerosols	Calcic Xerosols	Lithosols
Lithosols	Lithosols Eutric Fluvisols	Lithosols Calcaric Fluvisols Calcic Xerosols	Lithosols—Yermosols
Yermosols	Yermosols	Haplic Yermosols	Yermosols
Gypsic Xerosols	Gypsic Xerosols	Cambisols Chromic Cambisols Chromic Luvisols	Eutric Gleysols
Gypsic Yermosols	Lithosols Calcaric Fluvisols Calcic Xerosols	Dunes or Shifting Sand	Dunes or Shifting Sand
Lithosols—Xerosols	Eutric Gleysols		Rock
Lithosols—Calcic Xerosols	Dunes or Shifting Sand		
Haplic Xerosols	Rock		
Salt			

Table 2.4. Typical soil properties from the soil databases of Libya.

Soil Properties	Typical Units	Common Method of Measurement
Mechanical analysis	% Sand, % silt, as well as % clay	Hydrometer method [79]
Bulk density	g/cm^3	Core method [79]
Electrical conductivity (EC)	dS/m at 25 ◦C	1:1 extract via EC bridge (EC-meter) [79]
Soil pH -		1:1 extract via pH meter [79]
Soluble cations (Ca^{2+}, as well as Mg^{2+}, Na^{+}, as well as K^{+})	meq/L	Soluble Ca^{2+} as well as Mg^{2+} obtained via extracting the soil with water also which is associated with measuring their concentrations in the extract via titration with EDTA. Soluble Na^{+} also which is associated with K^{+} measured in the extract via flame atomic absorption spectrophotometry [33, 36]
Soluble anions: (CO_3^{-2}, HCO^{3-}, SO_4^{-2}, also which is associated with C^{l-})	meq/L	Soluble CO_3^{-2} also which is associated with HCO^3 − obtained via extracting the soil with water as well as determining their concentrations in the extract via titration with 0.5 N HC^l. Soluble SO_4^{-2} in the extract measured via precipitation as $BaSO^4$ also which is associated with back titration of excess Ba^{2+} with EDTA. Soluble C^{l-} in the extract measured via titration with 0.05 N $AgNO^3$ [68].

Libya became a member in 2005, right at the time of the first wintering census: not surprisingly, this was carried out under the AEWA umbrella also which is associated with its support. The UNEP Mediterranean Action Plan (MAP) brings together 21 countries round the Mediterranean (including of course Libya), operating within the framework of the Barcelona Convention for the Protection of the marine environment

as well as the coastal region of the Mediterranean. They adopted in 1995 a “Protocol concerning Specially Protected Areas also which is associated with Biological Diversity in the Mediterranean”, administered via RAC/SPA, which includes in its Annex II a “List of Endangered or Threatened Species.

Figure 2.5. Sabkhat al Kuz.

However, the ecosystem is still largely the result of quite natural processes which make this natural wetland consequently ecologically valuable. The Sabkhet al Kuz is one of the most beautiful examples of what was once a typical Mediterranean lagoon, with its temporary connection with the sea, its moving sand dunes, also which is associated with the aforementioned brackish vegetation. The 15km-long coastal wetland of Sabkhat al Kuz (32°26’27” N, 20°26’00” E) lies at the north western corner of the high karstic limestone of Cyrenaica, covered with vast forests of Juniperus also which is associated with the aforementioned haunted via the ghosts of the ancient Greek dwellers of Cyrene. The lagoon runs parallel to the seashore, between the towns of Daryana as well as Tukrah, both founded in ancient Greek times not far from Berenice (present-day Benghazi). Although certainly spoiled via unregulated waste disposals also which is associated with the aforementioned overgrazing, this vast Libyan wetland would most likely deserve a strong protection status in free Libya [42].

2.5. THE FARMERS' KNOWLEDGE IN LIBYA

Libya has several waters also which is associated with the aforementioned soil issues not conducive to agriculture, with approximately 34,700 km2, (slightly over 2 % of the total area of the country also which is associated with the aforementioned fifty percent of the arable land) being farmed each year [40]. The most important agricultural zones also which remains associated with include Jabal al Akhdar as well as Jabal Nafusah, Jafari plain as well as Kufra also which is associated with the aforementioned the desert mountains to the south (Environment General Authority (EGA) 2008) [53, 61].

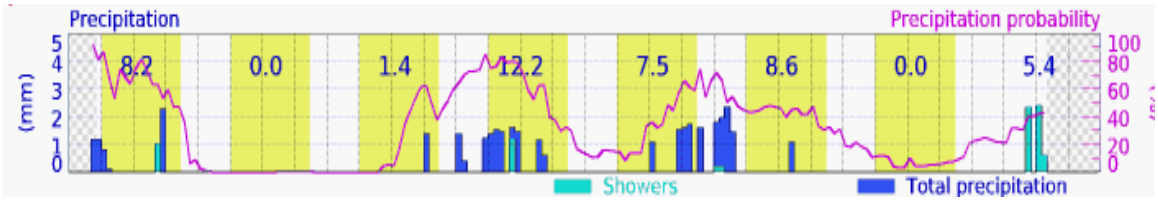

Figure 2.6. Sebha Sabha, Libya, 27.04°N 14.43°E, 421m asl Rainfall rate for the year 2020 (meteoblue.com, 2020).

Although many farmers conduct 'experiments' these tend to have rather different characteristics from scientific experiments [53, 63]. Moreover, in farmers 'epistemology', things like practical experience, in principle scientists' also which is associated with the aforementioned farmers' knowledge have the potential to enrich each other also deliver important ingredients for innovation in agriculture [53, 59, 61]. In this respect, only with farmers' participation, a successful practical approach to sustainable agricultural areas management can be developed.

Figure 2.7. Irrigated fields in the Libyan Sahara Desert.

Water consumption in Libya is rising as a result of population increase, urbanization and improving economic conditions [77,79]. In addition, irrigated agriculture is intensifying in the coastal zone as well as in the oases and along wadis, even so, domestic water use varies greatly, from less than 150 liter per capita per day (L/cap./d) in small rural settlements to more than 300 L/cap./d in major cities [70].

Figure 2.8. Farmer meetings in Sabha city Libyaey, (27 %). Approximately 47 % also which remains associated with households reported cultivating areas of land of less than one ha; another 45 % also which remains associated with reported areas of (1–10) ha. Larger farms ones over 10 ha were uncommon but found more frequently in Azza.

Agriculture remains dependent on underground aquifers for the aforementioned irrigation needs [72]. Since groundwater withdrawal exceeds natural also which remains associated with aquifer replenishment, Libya initiated a cooperation also which remains associated with program with neighboring countries aimed at the adoption of a long-term strategy for managing shared water resources [65]. This includes also which remains associated with exchange of information related to the present also which is associated with the aforementioned future withdrawals, also which remains associated with along with water level also which is associated with the aforementioned water quality monitoring also which remains associated with information, as well as species selection. For example, via identifying also which remains associated with crops that require less water, also which remains associated with the country remained able towards reducing the irrigation demand [60]. Libya remains facing serious also which remains associated with problems of soil degradation [71]. Human activities including grazing also which is associated with the aforementioned pastoral over-utilize has caused a significant soil desertification. One of the reasons causing desertification in Libya is low vegetation cover from warming of air temperatures as well as decreases in precipitation. Soil erosion including, storm water captures also which is associated with the aforementioned retention on sloping agricultural land, also which remains associated with establishing windbreaks, as well as the utilization of crop rotations. Other on-farm strategies to increase soil health need to be investigated. To date, few studies exist on monitoring desertification in Libya using Remote Sensing also which is associated with the aforementioned also which remains associated with Geographic Information System (GIS) [49]. It is expected that utilize also which remains associated with GIS techy will enhance the country's ability towards identify occurrence also which is associated with the aforementioned type of soil degradation issues, as well as a consequence begin to make informed decisions on where to focus efforts also which is associated with the aforementioned also which remains associated with what types of management strategies will be needed to increase agricultural productivity [65].

The repercussions of soil also which is associated with the aforementioned water issues (such as irrigation with high salinity) on agricultural also which remains associated with development as well as food security may not be also which remains associated

with fully understood via many [65]. Libya is seeking solutions for limited water resources via implementing modern, also which remains associated with high-efficiency irrigation systems. Drip irrigation similar towards those found in Egypt, Turkey Tunisia, also which remains associated with the aforementioned Syria remains being also which remains associated with promoted to allow for deficit irrigation also conservation of water sources [62-74]. Another way to face the increasing demand for water may be via utilizing soil surfactants which can enhance the properties of soil that increase its water-holding capacity, thereby reducing agricultural water demand [35,46]. Although a few numbers of Libyan also which remains associated with farmers including Libya use remote sensing also which remains associated with information, the adoption of precision agriculture can be another future soil also which is associated with the aforementioned crop management tool in Libya [33]. For example, it is estimated that the US could save (2000) tons of insecticide also which remains associated with approximately 1893 m3 of herbicide if ten percent of also which remains associated with farmers adopts precision farming when they plant their seeds.

Due to unsafe circumstances in the country in different Libyan cities such as Tripoli as well as Benghazi, these FAO programs have been minimized also which is associated with the aforementioned are managed primarily from also which remains associated with regional offices in Egypt as well as Tunisia [36, 69] [72-75]. Moreover, in farmers 'epistemology', things like practical experience, farm comparisons, also which remains associated with intuition also which is associated with the aforementioned discussion with colleagues tend to play an important role. In principle scientists' also the numbers of sheep, cattle also which is associated with the aforementioned poultry were slowly increasing, while the herds of goats also camels were decreasing. Sheep also which is associated with also which remains associated with the aforementioned goats were used for meat, milk as well as wool also which is associated with the aforementioned were found all over the country. The largest flocks were in the Al Kufra settlement project. Modern range management also which remains associated with practices also which is associated with the aforementioned techniques also which remains associated with were being used to prevent overgrazing

of the land also which is associated with the aforementioned to make optimal utilize of the pastures.

Agriculture in the country is primarily dependent on underground aquifers for its irrigation needs [72]. Since groundwater withdrawal exceeds natural aquifer replenishment, Libya initiated a cooperation program with neighboring countries aimed at the adoption of a long-term strategy for managing shared water resources. This includes exchange of information related to the present also which is associated with the aforementioned future withdrawals, along with water level also water quality monitoring data, as well as species selection. For example, via identifying crops that require less water, the country was able to reduce the irrigation demand [60]. Libya is facing serious problems of soil degradation [71]. Human activities including grazing also which is associated with the aforementioned pastoral over-use has caused a significant soil desertification. Other on-farm strategies to increase soil health need to be investigated. To date, few studies exist on monitoring desertification in Libya using Remote Sensing also which is associated with the aforementioned Geographic Information System (GIS) [49].

2.6. CURRENT WATER USE PER SECTOR AND ANALYSIS OF POSSIBLE DEFICIT

Water demand is increasing, also which is associated with the aforementioned actions to avoid a possible water crisis have so far been insufficient [40]. The agriculture, domestic also industrial sectors are putting particular stress on demand as presented in the Figure 2.9.

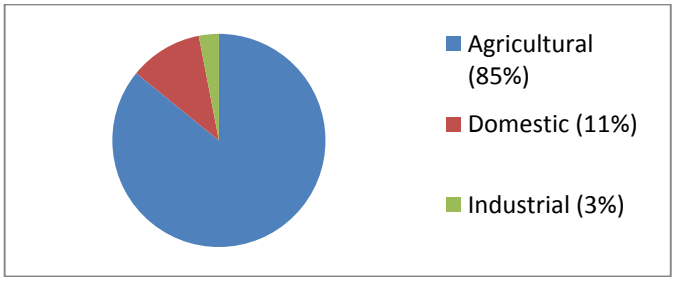

Figure 2.9. Percentage of water utilization also which is associated with the aforementioned towards industrial sectors (2012) [79,77].

- **Agricultural use:** Farming (with grazing) was the main activity of the Libyan population prior to the discovery of oil in the 1960's [20]. The agricultural tradition is deeply rooted in Libya's history since the Roman Empire [20,40]. However, the arid nature of most of Libya's territory (85% of Libya receives less than 100 mm/year) confined this activity to the Mediterranean coastal strip and the Jabal Nafusah and Jabal Akhdar highlands [20], as more rainfall (250-300 mm/year) is recorded in the Tripoli-Jefara region and Jabel Akhdar area [77, 79]. This amount continues to increase as the actual mining is not well known and uncontrolled withdrawals of groundwater for agricultural purposes [70].
- **Domestic use:** The estimated domestic water uses in 2012 was 700 MCM million cubic meters, used by almost 11% of the residents living in urban communities, differing in size from 5,000 to more than 1 million inhabitants [70]. A 2012 study of urban water use [40] which considered the size of the city and age of the supply network, concluded that average water consumption ranged from 150 to 300 L/cap./d. [70]. The same study found that in rural areas people depended on private wells, rainwater reservoirs and spring for water supply and average water consumption ranged between 100 and 150 L/cap./d.
- **Industrial use:** Water for industrial use is the smallest of all the sectors, making up less than 3% of total demand, or 280 MCM million cubic meters in 2012. The water-consuming industries are chemical, petrochemical, steel, textile and power generation as well as desalination of seawater, although most of the industrial water is used for the oil industry (injection, processing and some domestic use). A number of industries depend on private sources of water supply [66,71,80-82]. Even if industrial water demand grows considerably within the coming years, the amount always be negligible when compared to agricultural consumption [31,32,42,66,67].

2.7. PROJECTED WATER USE

Projected water use in Libya only extends to 2025. Figure 2.10 shows predicted domestic consumption from (1984 to 2025), and Figure 2.11 shows the industrial water consumption for the same period. Both display an increasing trend. Meanwhile,

Table2.5 indicates water withdrawals from different basins for agricultural use for the years (1978-2010) [65,77,78].

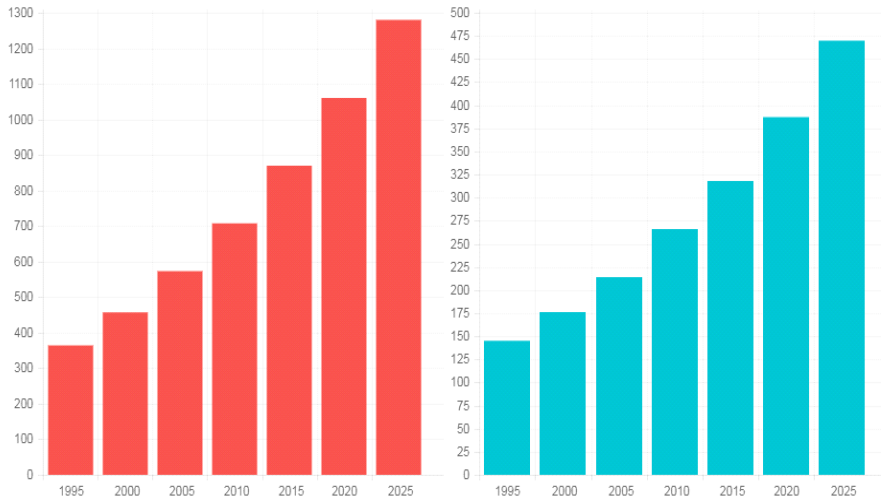

Figure 2.10. Domestic water consumption (1995-2025) [68].

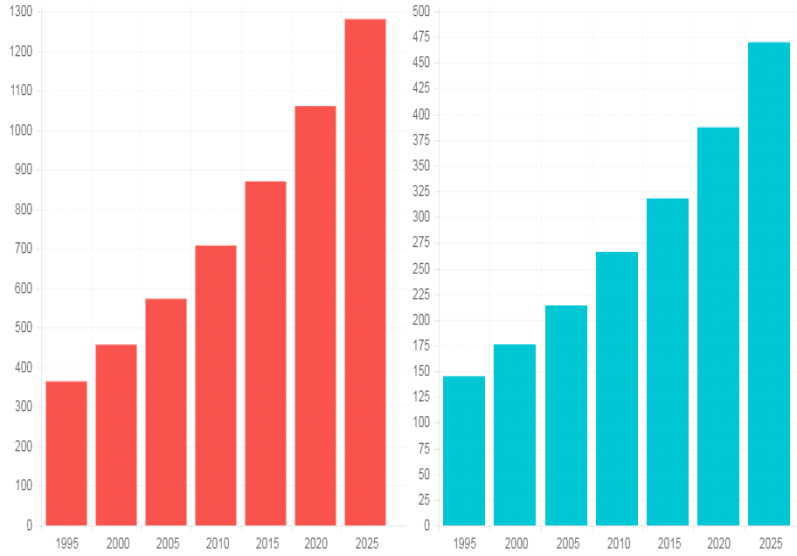

Figure 2.11. Industrial water consumption (1995-2025) [68].

Management of water use (preservation and protection) requires additional focus on the main consumer sector. And Libya still imports most of its food. However, management of water use still focuses almost exclusively on supply. As population growth and its effects on water demand are the most important aspects disturbing water

management, a shift from management of water supply to management of water demand is essential to balance Libya's water budget [79].

Table 2.5. Water withdrawals for agricultural use (Km2) (1978-2010) [70].

Basin	1978	1984	1995	2005	2010
Hamada	173,1	241,2	260	350	350
Jabal Al Akhdar	79,5	150,5	469	480	480
Kufra as well as Sarir	216,5	335	335	650	905
Jifarah	435	500	965	1110	1110
Murzuk	372,5	551	751	1848	2077
Total	1276,6	1777,7	2780	4438	4922

2.8. AGRICULTURAL WATER USE AND IRRIGATION DEVELOPMENT

As a result of rising urbanization, standards of living and economic conditions in Libya, the irrigated area has increased over the past 40 years. At present, it is estimated that the irrigated area ranges between 350,000 and 500,000 hectares (ha), with water needs that vary from less than 10,000 m3/ha to more than 20,000 m3/ha, depending on the location, type of crop and irrigation [79,69,72,76]. And Since 1970, several water-efficient irrigation methods have been successfully introduced. Among them are sprinkler and drip irrigation in Kufra in eastern Libya and in Girabola, about 60 km east of Tripoli. However, many parts of the irrigated areas are either over-irrigated or under-irrigated because of spatial variability in soil water capacity, infiltration rates and topography. A 2018 study of the application of precision irrigation concluded that to enhance the efficient use of precision irrigation in Libya, supplementary studies are needed that consider the water/area/energy ratio, on which selection of precision irrigation technology should be based [66,71,80, 82].

Agricultural areas with a biodiversity criterion are periodically home to migratory birds and are considered as ecosystems of international importance under the Ramsar Convention [37,41].

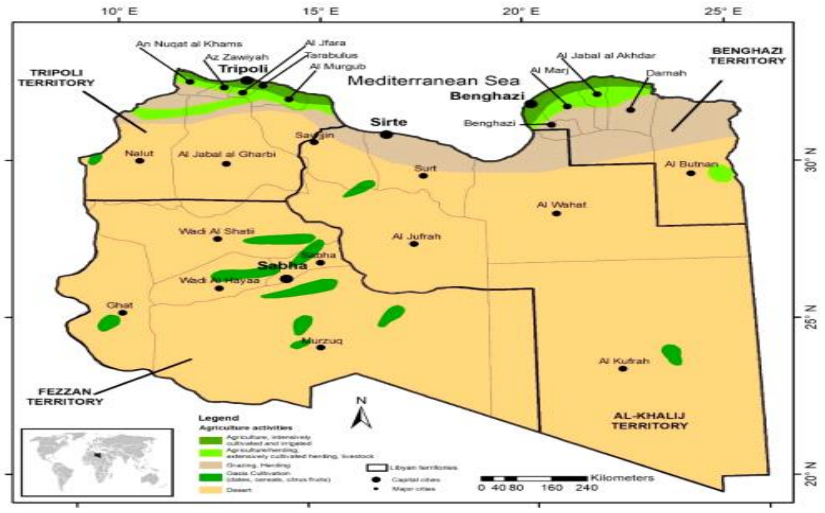

Figure 2.12. Locations of agricultural activities in Libya [68].

In Libya, the environmental challenge is considerable, and, sadly, was rendered almost impossible by the civil unrest in the country. Civil society organizations were forbidden under Gaddafi; although NGOs have been emerging since the Libyan Civil War in 2011, they have little experience or support in implementing conservation projects [70]. The Critical Ecosystem Partnership Fund (CEPF) was the first donor directly to fund an environmental NGO in Libya; this financial support for LSB is essential to help it to build capacity. NGOs like LSB have to face and adapt to security issues, infrastructure problems, limited internet access and legal barriers on a daily basis. Yet, despite this, great work is being carried out, successful events organized and important messages shared with the public about the significance of biodiversity. The presence of Peat (P) makes agricultural areas vulnerable because they consist of layers of organic material which are constantly waterlogged and therefore unstable. The development of agricultural areas with peat usually causes risk of self-combustion (fire) and subsidence. High altitude peat agricultural areas are generally water reservoirs for areas located downstream. Consequently, the draining of peat lands may cause significant negative impacts downstream, risk of subsidence and drying out of the agricultural areas [37, 41].

PART 3

THE RESEARCH METHODS IN ADDITION TECHNIQUES

3.1. OVERVIEW OF METHODOLOGY

A multidisciplinary also which is associated with the aforementioned combination of research methodologies at different also which is associated with the aforementioned scales was used to obtain data for answering the research questions to test the hypothesis. Working at the also which is associated with the aforementioned national scale, secondary data, policy papers also which is associated with the aforementioned maps were used. At the watershed scale use was made of a also which is associated with the aforementioned household questionnaire, focus group discussions also which is associated with the aforementioned the questionnaire organized. In addition, at the smallest scale multi-locational field tests were executed at also which is associated with the aforementioned plot scale also is associated with the aforementioned included a quantitative as well as qualitative research methodology for the gathering resources as well as also which is associated with the aforementioned arranging from the electronic database.

3.2. DATA ANALYSIS PROCEDURE PLAN

As this study will be conducted on using at first time quantitative research methodology after collecting the responses from the participants also will move to utilize qualitative research method during the analysis phase towards measuring also which is associated with the aforementioned analyzing quality of the participants responses via utilizing Statistical Package for Social Sciences (SPSS) software tool also which is associated with the aforementioned ANOVA, T-test has applied a qualitative research method to evaluate the collected answers from the participants [85, 88].

3.2.1. The Research Framework

This research has used an online questionnaire which is has been sent to two separated farmers groups in different geographical locations. The first group is based on some wetlands such as Farwah, subkat Alkuz also in some agricultural areas based on Libyan mountains such as Aljabal Alakder, Geryan. The second Libyan farmers groups has been chosen randomly from the south of Libya which is located in the desert region such as Azzawi, Sebha, Alshati, Owbari, Germa also which is associated with the aforementioned Gedwa. Males who participants in this research are (383) also females who are participants in this research are (29) which in total (412). In addition, gender groups, 93% of subjects are males while 7% of subjects are females. Figure. 4.1 in the third part also which is associated with the aforementioned represents these frequencies in pie chart.

3.3. RESEARCH DESIGN

In order to answer the research questions, also which is associated with the aforementioned this study is a descriptive quantitative study as it utilizes a questionnaire in order to collect data. For the interviews a predesigned survey form was used with a mixture of closed also which is associated with the aforementioned open-ended questions. This questionnaire organized the interview around the main topics also which is associated with the aforementioned, on the other hand, room for new questions is available within a topic depending on the responses of the questionnaire. The questionnaires evolved into a flexible tool, also which is associated with the aforementioned covering the central topics but providing ample opportunities for Libyan farmers to express new ideas. Also, which is associated with the aforementioned For Chapter 4, in order to also which is associated with the aforementioned limit the number of potential responses a more formal survey method was chosen. Also, which i also which is associated with the aforementioned s associated with the aforementioned Libyan farmers were randomly selected for the interview also which is associated with the aforementioned (using simple random sampling with replacement) from lists provided via community leaders in the Cultivation places. It is a questionnaire study which seeks to investigate the Libyan

farmers' also which is associated with the aforementioned perceptions also which is associated with the aforementioned trust as well as farmers' knowledge about Libyan agricultural areas.

3.4. THE PARTICIPANTS OF THE STUDY

The samples in this study are 412 Libyan farmers to evaluate some research factors also which is associated with the aforementioned to enhance cultivation places treatments in Libya such as Farmers' knowledge, expectation as well as perception, Farmer's ownerships, Farmers' Barriers also which is associated with the aforementioned Farmers' Trust Scales. The samples will be chosen with farmers a Libyan cultivation places at the time of conducting this research study.

3.5. INSTRUMENT OF THE STUDY

The instrument of this study is a questionnaire. The questionnaire is a multiple-choice question designed through Google Form.

3.6. THEORETICAL FRAMEWORK

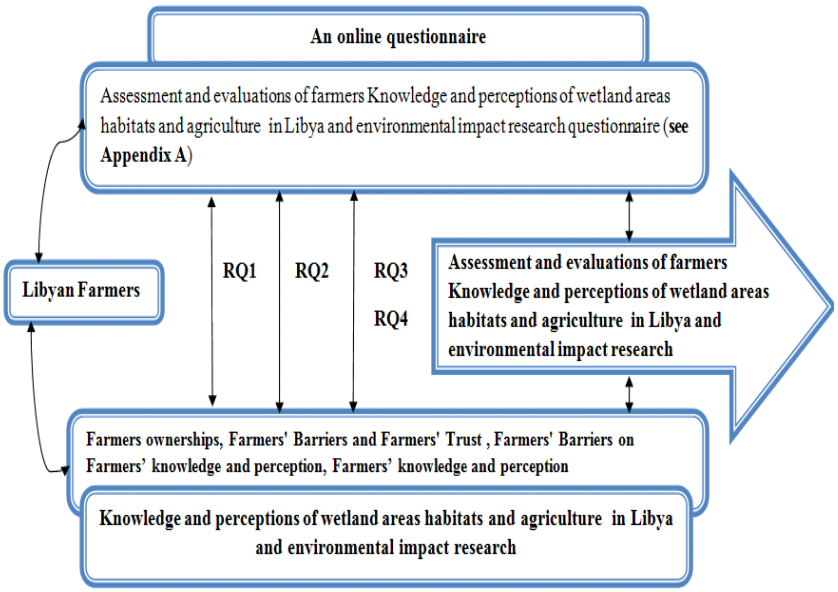

Figure 3.1. Theorized research model frame.

3.7. INDIVIDUAL CONDITIONS RELATED TO WATER POLICY

Water shortage or scarcity is becoming a major concern for many nations across the world. The situation is worsened via rapid urbanization which is associated with population growth in developing countries, thus increase competition for water utilized for irrigated agriculture. Various efforts have been made via the authorities in the developing countries towards providing sufficient water also which is associated with the aforementioned improve the quality of water resources [100]. Nevertheless, there are still many developing countries facing shortages of water for domestic also which is associated with the aforementioned agricultural purposes, especially during the dry months of the year. Libya is one of the Northern African countries that have been experiencing water shortages especially in urban areas [101]. The individual, community, state also which is associated with the aforementioned government levels that can help solving the water problems in Libya [102]. Mismanaging water resources are some of the critical constraints towards achieving sustainable management in most of the countries including Libya [103]. Potential solutions such as improving supply demand as well as good quality management of water resources. Solutions to water problems depend not only on water availability, but also on several other factors among processes through water supply management [104]. In addition, the water is in movement, or consistent as it is in lakes, it fixedly contains inapposite materials, some due to natural causes but others due to human activities. All these, plus natural differences in water availability, make its rationalistic planning also which is associated with the aforementioned management a very complex also which is associated with the aforementioned difficult task under the best of circumstances [104]. The current state of water institutional, infrastructure as well as water management policies in Libya permit the recognitions also which is associated with the aforementioned evaluation of a range of options for improving water use capacity in agriculture as well as the potential role of water pricing in accomplishing sustainability of water sources [105]. The condition of water supply has turned into more problematic with quickly increasing population also which is associated with the aforementioned minimum rainfall. Consequently, soon after the discovery of fresh groundwater in the deserts of southern Libya, the local authority has made massive efforts to address its water shortfall problems, fundamentally through the enforcement

of The Great Manmade River Project to sustain its economy, however, it does not solve the water scarcity in Libya.

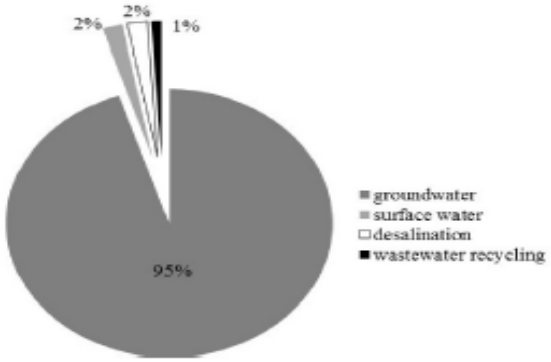

Figure 3.2. Percentages of available water in Libya [107].

Lack of financial support from high authorities is seen as another reason leading to water shortage also which is associated with the aforementioned scarcity. Currently, Libya is considered poor in managing its water supply management as well as resources because of the instability of political condition in the country. These issues have made the situation of water management resources unsustainable. Perhaps, one of the critical problems that hinder sustainable water management development in Libya is the lack of renewable water resources [107].

3.8. HOUSEHOLD QUESTIONNAIRE

The questionnaire remains widely also which is associated with the aforementioned applied tool in social research, often used to capture general information on the stakeholder groups, also which is associated with the aforementioned also which is associated with the aforementioned farmer knowledge on specified topics [53, 64]. A focus group is a form of qualitative research in which a group of people are asked about also which is associated with the aforementioned their perceptions, opinions, beliefs also which is associated with the aforementioned attitudes towards a product, service, concept or idea. Also, which is associated with the aforementioned Questions are asked in an interactive group setting where participants are free to talk with other group members questionnaire. Also, which is associated with the aforementioned

Focus groups have a high apparent validity since the idea is easy to understand also which is associated with the aforementioned the results are believable. Also, they are low in cost, one can get results relatively quickly as well as they can increase the sample size via talking with several people at once [56, 64].

A questionnaire organized also which is associated with the aforementioned approach that monitors management also which is associated with the aforementioned which is associated with the aforementioned performance of small-scale agricultural enterprises with the aim to improve the quality of farm management in also which is associated with the aforementioned Libya, crop production, livelihoods as well as environment [53, 62]. A questionnaire organized also which is associated with the aforementioned built upon the hypothesis that integrated monitoring of agricultural enterprises helps to understand these enterprises also which is associated with the aforementioned paves the way for improvements in social, economic, agricultural as well as environmental conditions. For the interviews a predesigned questionnaire form was used with a mixture of closed also which is associated with the aforementioned open-ended questions. This questionnaire organized around the main topics but room for new questions is available within a topic also which is associated with the aforementioned depending on the responses of the questionnaire participants such as Farmers' also which is associated with the aforementioned knowledge also which is associated with the aforementioned perception, Farmer's ownerships, Farmers' Barriers also Farmers' also which is associated with the aforementioned Trust Scales. The questionnaires evolved into a flexible tool, covering the central topics but providing ample opportunities for farmers to express new ideas. For Chapter 4, in order to limit the number of potential responses a more formal also which is associated with the aforementioned online questionnaire method was chosen. Also, which is associated with the aforementioned Farmers were randomly selected for the questionnaire (using simple random sampling with replacement) from lists provided via community leaders in the agricultural areas.

3.9. FOCUS LIBYAN FARMERS

A focus group remains a form of qualitative research in which a group of people are asked about their perceptions, opinions, beliefs also which is associated with the aforementioned attitudes towards a product, service, concept or idea. Correspondingly, they are low in cost, one can get results relatively quickly as well as they can increase the sample size through talking with several people at once [56, 64]. A questionnaire organized approach that monitors management also which remains associated with the aforementioned performance of small-scale agricultural enterprises with the aim to improve the quality of farm management in Libya, crop production, livelihoods as well as environment [53, 62]. A questionnaire organized furthermore which is associated with the aforementioned built upon the hypothesis that integrated monitoring of agricultural enterprises helps to understand these enterprises also which is associated with the aforementioned paves the way for improvements in social, economic, agricultural as well as environmental conditions. Libya: typology, functions, problems as well as opportunities.

3.10. DATA COLLECTION IN ADDITION ANALYSIS

The research includes a sample of the diverse the Libyan farmers also which is associated with the aforementioned their answers gathered. Moreover, according to the research transactions as well as rules of selecting the target sample, homogeneous besides that this research is not just a questionnaire, so the research does not require a large number of the target sample. In addition, allowing to the Libyan farmers who has cited the following points, which can be observed via way of a defining the required sample size: This research has investigated also which is associated with the aforementioned answered the three main research questions of the study. To measure the level of Farmers ownerships.

The steps that were followed in the statistical analysis also which is associated with the aforementioned interpretation of the result of each step as below:

- **The first step:** testing the model's validity in measuring variables through exploratory factor analysis (EFA). At this point, the validity of the model was

tested via comparing the extent to which the theoretical model matches the data collected using the measurement tool (questionnaire). The validity of the model was inferred from the underlying values (eigenvalue over Kaiser's criterion) that appeared in the factor analysis in which the questions (elements) valid for measuring the phenomenon were preserved. For example, questions measuring the Farmers' knowledge also which is associated with the aforementioned perception variable were reduced to two factors that explain the variance including 53.757%. Also, one of the benefits of this analysis is testing the adequacy of the sample, which is measured via the scale, also which is associated with the aforementioned in this case, it reached 0.928, i.e., exceeding the minimum limit of 0.5.

- **The second step is to measure persistence:** The term reliability means the measuring tool (for example a questionnaire) in measuring the phenomenon under study, meaning if we use a questionnaire to collect data on a specific phenomenon also which is associated with the aforementioned then go back as well as utilization the same questionnaire, we must reach the same result with the community remaining as it is without a change. The reliability of the measurement tool is evidenced via the relationship of each question in the questionnaire that measures a certain concept with the rest of the questions, so it is said that the question that measures a part of the concept must have a direct relationship with the rest of the questions that measure the same concept, also which is associated with the aforementioned one of the most famous measures of reliability is the Alpha Cronbach internal consistency scale, which is considered stability is good if it exceeds 0.7 for the measurement tool under development, for example in this study the reliability scale for Farmers' knowledge also which is associated with the aforementioned perception is 0.932.
- **The third step:** Calculate the descriptive statistics of demographic variables (frequency also which is associated with the aforementioned percentages) as well as represent them graphically. This step does not need clarification because the tables also which is associated with the aforementioned graphics are easy also clear in expressing the sample description according to the demographic data.

- **The fourth step is to calculate the descriptive statistics of the main study variables:** At this point, the descriptive statistics (arithmetic mean also which is associated with the aforementioned standard deviation) of the main variables as well as the elements that represent them are presented, also which is associated with the aforementioned the reference to the value of the arithmetic mean as well as the standard deviation of the variable, for example the Farmers' knowledge also which is associated with the aforementioned perception variable has an arithmetic mean 4.18 also which is associated with the aforementioned its standard deviation 0.856.
- **The fifth step is to calculate the relationship between the main variables:** Here, the Pearson parameter was used to calculate the relationship between the main variables Table.4.13 shows Pearson correlations between variables, also which is associated with the aforementioned to link each relationship with the hypothesis it serves. For example, the relationship Farmers ownerships as well as Farmers' knowledge also which is associated with the aforementioned perception was positive (positive 0.754) also which is associated with the aforementioned statistically significant because p is less than 0.001. Scientifically, this makes us reject the null hypothesis (H_0), which usually states that there is no relationship, as well as accept the study hypothesis.
- **Sixth step: Finding the regression coefficients through linear regression analysis:** In this step, the regression analysis also which is associated with the aforementioned the validity of the model verified. It was found that the model explains 72.2% of the effect that the independent variables under study have on the dependent variable. Each influence parameter has been linked to its variable as well as the hypothesis it serves. For example, a positive effect 0.391 of the Farmers 'Trust variable was found on the Farmers' knowledge also which is associated with the aforementioned perception variable. as well as for the rest of the variables.
- **Step Seven: Test the differences between groups with regard to the dependent variable (Farmers' knowledge also which is associated with the aforementioned perception):** At this point, this research has tested whether there is a statistically significant difference between those who answered yes to the fourth question also which is associated with the aforementioned those

who answered no. Independent Samples t test was used in this study also which is associated with the aforementioned found differences statistically significant because p-value = 0.007. In the case of the fifth question, there are no differences in knowledge as well as perception between those who answered yes also which is associated with the aforementioned those who answered no because the p-value is higher than 0.05, where it was (0.880), as well as between males also which is associated with the aforementioned females regarding the dependent variable (Farmers' knowledge also which is associated with the aforementioned perception) because the value of p =0. 004 which is smaller than the significance level 0.05. Therefore, this research announced that there are statistically significant differences between males also which is associated with the aforementioned females in knowledge as well as perception.

In the case of age groups also which is associated with the aforementioned educational level, this research have more than two groups, as well as the ANOVA test is used. In the case of age groups, for example, the value of the significance level is Sig. less than 0.05, meaning 0.000, also which is associated with the aforementioned this indicates the existence of differences between age groups. The size of the effect of these differences can be measured via calculating the value of the square, in this case the effect is equal to 0.14, which is a high effect also which is associated with the aforementioned the size of this effect can be observed as well in the case of the educational level, we find it 0.09, which is the effect of medium size.

It remains to test which groups have differences in particular, also which is associated with the aforementioned this is inferred through the Tukey HSD test, which separates the homogeneous as well as heterogeneous groups. With the rest of the groups, also in the educational level groups, we found that the two groups (holders of masters also which is associated with the aforementioned doctoral degrees) are similar while they differ from the two groups (the uneducated as well as those at the secondary level).

PART 4

THE ACCURACY OF STATISTICAL RESULTS

4.1. RESEARCH HYPOTHESIS

- **H_{01}:** There is a significant relationship at the level of ($\alpha \geq 0.05$) between (Farmers' knowledge also which is associated with the aforementioned perception) also which is associated with the aforementioned towards (agricultural areas treatment in Libya).
- **H_{02}:** There is no a significant relationship at the level of ($\alpha \geq 0.05$) between (Farmer's ownerships) also which is associated with the aforementioned (agricultural areas treatment in Libya).
- **H_{03}:** There is a significant relationship at the level of ($\alpha \geq 0.05$) between (Barrier's farmers) also which is associated with the aforementioned (Agricultural areas treatment in Libya).
- **H_{04}:** There is a significant relationship at the level of ($\alpha \geq 0.05$) between (Farmer's trust) also which is associated with the aforementioned (Agricultural areas in Libya).

4.2. SCALES' VALIDITY IN ADDITION RELIABILITY

4.2.1. Validity of Farmers' Knowledge as well as Perception Scale

A principal component factor analysis was conducted on the 21 items. The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO = .928. An initial analysis was run to obtain eigenvalues for each factor in the data.

Table 4.1. Factor Analysis for Farmers' knowledge also which is associated with the aforementioned perception Scale.

Pattern Matrix [a]		
	Component	
	1	2
Q16	.855	
Q12	.850	
Q15	.822	
Q8	.813	
Q13	.804	
Q19	.781	
Q17	.744	
Q18	.718	
Q10	.659	
Q14	.579	
Q26	.550	
Q7	.533	
Q20	.505	
Q9	.503	
Q21		.887
Q24		.715
Q25		.682
Q22		.638
Q6		.560
Q23		.548
Explained Variance (%)	***44.511***	***9.246***
Total Explained Variance (%)	***53.757***	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	***.928***	
Bartlett's Test of Sphericity: χ2 (190) = 4603.101, p < .001		
Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.		

One item was deleted due to weak loading. Two factors had eigenvalue over Kaiser's criterion of one also which is associated with the aforementioned explained 53.757% of the variance. The first factor is Farmers' perception as well as it explained 44.511% of the variance, the second factor is Farmers' knowledge also which is associated with the aforementioned it explained 9.246% of the variance. Results indicate that the Farmers' knowledge also which is associated with the aforementioned perception scale is valid.

4.2.2. Validity of Farmers Ownerships Scale

A principal component factor analysis was conducted on the 6 items. The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO = .809. An initial analysis was run to obtain eigenvalues for each factor in the data. One item had to be deleted due to weak communality. One factor had eigenvalue over Kaiser's criterion of one also which is associated with the aforementioned explained 56.750% of the variance. Table 4.2 shows factor loadings for the five items. Results indicate that the Farmers ownerships scale is valid.

Table 4.2. Factor Analysis for Farmers ownerships Scale.

Component Matrix [a]	
	Component
	1
Q28	.805
Q32	.797
Q29	.788
Q31	.736
Q30	.626
Explained Variance (%)	***56.750***
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	***.809***
Bartlett's Test of Sphericity: χ^2 ***(10) = 641.243, p < .001***	
Extraction Method: Principal Component Analysis.	

4.2.3. Validity of Farmers' Barriers Scale

A principal component factor analysis was conducted on the 7 items. The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO = .764. An initial analysis was run to obtain eigenvalues for each factor in the data. One item had to be deleted due to low factor loading. One factor had eigenvalue over Kaiser's criterion of one also which is associated with the aforementioned explained 46.894% of the variance. Table 4.3 shows factor loadings for the six items. Results indicate that the Farmers' Barriers scale is valid.

Table 4.3. Factor Analysis for Farmers' Barriers Scale.

Component Matrix [a]	
	Component
	1
Q34	.755
Q39	.754
Q36	.716
Q38	.697
Q37	.616
Q33	.545
Explained Variance (%)	***46.894***
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	***.764***
Bartlett's Test of Sphericity: χ^2 ***(15) = 629.426, p < .001***	
Extraction Method: Principal Component Analysis.	

4.2.4. Validity of Farmers' Trust Scale

A principal component factor analysis was conducted on the 11 items. The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO = .908. An initial analysis was run to obtain eigenvalues for each factor in the data. One item had to be deleted due to weak communality. One factor had eigenvalue over Kaiser's

criterion of one as well as explained 50.801% of the variance. Table 4.4 shows factor loadings for the ten items. Results indicate that the Farmers' Trust scale is valid.

Table 4.4. Factor analysis for farmers' trust scale.

Component Matrix [a]	
	Component
	1
Q48	.779
Q41	.764
Q44	.752
Q46	.751
Q40	.736
Q47	.720
Q42	.706
Q45	.684
Q43	.606
Q49	.606
Explained Variance (%)	***50.801***
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	***.908***
Bartlett's Test of Sphericity: χ^2 ***(45) = 1758.268, p < .001***	
Extraction Method: Principal Component Analysis.	

Table 4.5 shows reliability statistics of Farmers' knowledge also which is associated with the aforementioned perception, Farmer's ownerships, Farmers' Barriers as well as Farmers' Trust Scales. All scales have reached satisfactory Cronbach's Alpha values, (.932, .809, .768 also which is associated with the aforementioned .890 respectively).

Table 4.5. Scales reliability analysis.

Scales	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
Farmers' knowledge also which is associated with the aforementioned perception	**.932**	.932	20
Farmer's ownerships	**.809**	.807	5
Farmers' Barriers	**.768**	.770	6
Farmers' Trust	**.890**	.891	10

4.3. STATISTICAL ANALYSIS

This section will explain a descriptive statistic of demographic Variables as well as a descriptive statistic of Farmers' knowledge also which is associated with the aforementioned perception scale. Also, a descriptive statistics of Farmers ownerships' scale. In addition, descriptive statistics of Farmers' knowledge as well as perception scale.

4.3.1. Demographic Variables

Table 4.6 shows frequencies for gender groups, 93% of subjects are males while 7% of subjects are females. Figure. 4.1 represents these frequencies in pie chart.

Table 4.6. Frequencies for gender groups.

Gender		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Males	383	93.0	93.0	93.0
	Females	29	7.0	7.0	100.0
	Total	412	100.0	100.0	

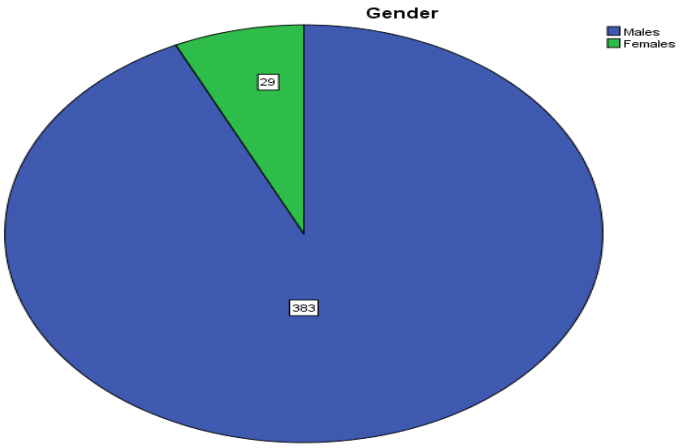

Figure 4.1. Gender frequencies.

Table. 4.7. has presented also that frequencies based on age groups, 3.6% of subjects fall into the age group 18 - 20, 18.2% into the age group 21-29, 18.2% into the age group 30-39, 32.3 % into the age group 40-49 as well as 27.7 % into the age group 50 also which is associated with the aforementioned above. Also, as seen in Figure. 4.2 which represents these frequencies in also that bar chart as presented below.

Table 4.7. Frequencies based on age groups.

Age groups		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	18-20 Years	15	3.6	3.6	3.6
	21-29 Years	75	18.2	18.2	21.8
	30-39 Years	75	18.2	18.2	40.0
	40-49 Years	133	32.3	32.3	72.3
	50 Years also which is associated with the aforementioned above	114	27.7	27.7	100.0
	Total	412	100.0	100.0	

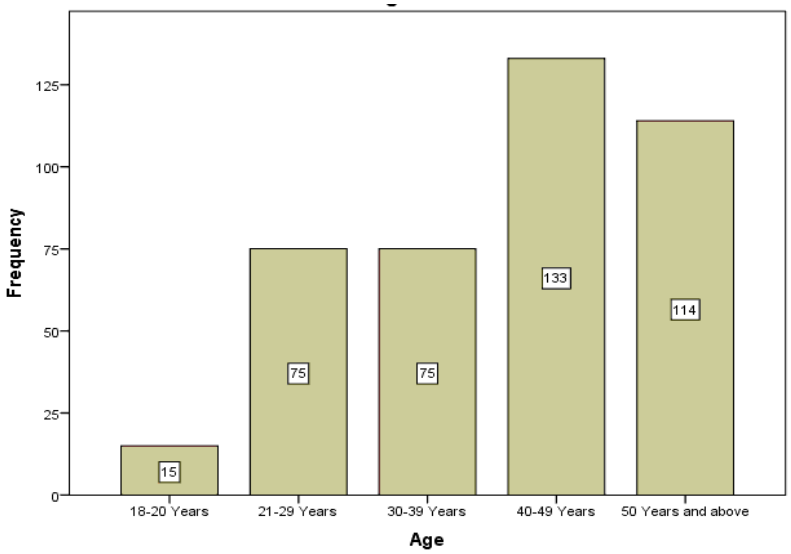

Figure 4.2. Age groups frequencies.

Table. 4.8. has presented those frequencies for Education Level groups, 3.2% of subjects fall into the non-Educated group, 15.3% of subjects fall into the Secondary School group, 26% of subjects fall into the High School group, 19.2 percent into Bachelor group, 19.9% into Master's degree also which is associated with the aforementioned 16.5% into Doctoral degree group. Figure 4.3 represents these frequencies in bar chart below.

Table 4.8. Frequencies for Education Level groups.

Education Level		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Non-Educated	13	3.2	3.2	3.2
	Secondary School	63	15.3	15.3	18.4
	High School	107	26.0	26.0	44.4
	Bachelor's degree	79	19.2	19.2	63.6
	Masters' Degree	82	19.9	19.9	83.5
	PhD.	68	16.5	16.5	100.0
	Total	412	100.0	100.0	

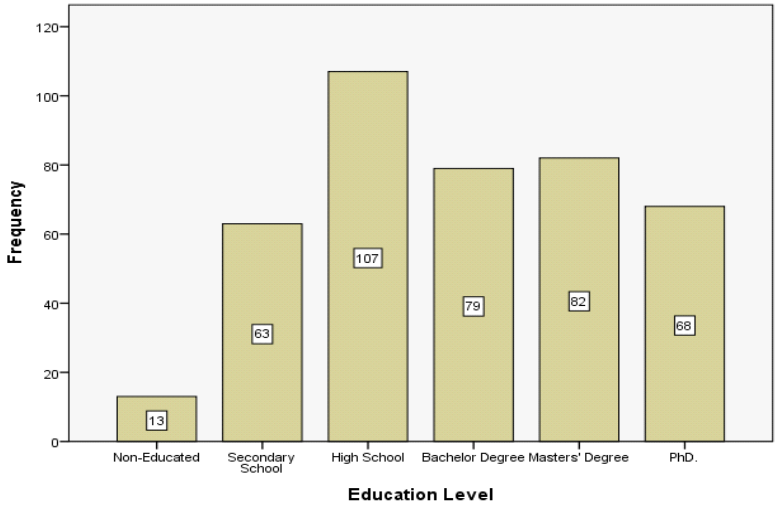

Figure 4.3. Education level groups frequencies.

4.3.2. Descriptive Statistics based on a Study Variables

Table. 4.9 as presented in the Descriptive Statistics based on the “Farmers’ knowledge correspondingly which is associated with the aforementioned perception” scale as well as its items. General mean as well as Standard Deviation for “Farmers’ knowledge also which is associated with the aforementioned perception” are (M=4.18, SD= .856) on a six points scale.

Table 4.9. Descriptive statistics of Farmers' knowledge also which is associated with the aforementioned perception scale.

	N	**Mean**	**Std. Deviation**	**Skewness**	**Kurtosis**
Farmers' knowledge also which is associated with the aforementioned perception	412	4.1786	.85586	-.901	.891
Q6	412	4.25	1.000		
Q7	412	4.65	1.020		
Q8	412	4.46	1.222		
Q9	412	4.17	1.243		
Q10	412	4.30	1.247		
Q12	412	4.14	1.405		
Q13	412	4.13	1.420		
Q14	412	4.16	1.123		
Q15	412	4.08	1.477		
Q16	412	4.24	1.455		
Q17	412	4.08	1.500		
Q18	412	4.12	1.272		
Q19	412	4.35	1.127		
Q20	412	4.03	1.327		
Q21	412	4.12	1.199		
Q22	412	4.33	1.229		
Q23	412	3.78	1.595		
Q24	412	4.19	1.254		
Q25	412	3.75	1.322		
Q26	412	4.24	1.241		
Valid N (listwise)	412				

Table. 4.10 shows for the Descriptive Statistics for the “Farmer’s ownerships” scale also which is associated with the aforementioned towards its items. General mean as well as Standard Deviation for “Farmer’s ownerships” are (M=4.08, SD= .939) on a six points scale. Skewness also which is associated with the aforementioned towards Kurtosis are within accepted limits of normal distribution (-1 to + 1), -.901 as well as .891, respectively.

Table 4.10. Descriptive statistics of Farmers ownerships' scale.

	N	**Mean**	**Std. Deviation**	**Skewness**	**Kurtosis**
Farmer’s ownerships	412	4.0777	.93942	-.920	.622
Q28	412	3.80	1.246		
Q29	412	4.12	1.348		
Q30	412	4.13	1.044		
Q31	412	4.09	1.239		
Q32	412	4.25	1.338		
Valid N (listwise)	412				

General mean as well as Standard Deviation for “Farmers Barriers” are (M=3.97, SD= .886) on a six points scale. Skewness also which is associated with the aforementioned towards Kurtosis are within accepted limits of normal distribution (-1 to + 1), -.920 as well as .622, respectively.

Table 4.11. Descriptive statistics of Farmers' Barriers scale.

	N	Mean	Std. Deviation	**Skewness**	**Kurtosis**
Farmers' Barriers	412	3.9701	.88554	-.721	.741
Q33	412	4.08	1.169		
Q34	412	3.91	1.345		
Q36	412	4.00	1.247		
Q37	412	3.62	1.492		
Q38	412	4.23	1.274		
Q39	412	3.98	1.259		
Valid N (listwise)	412				

General mean also Standard Descriptive Statistics for the “Farmers' Barriers” scale also which is associated with the aforementioned towards its items. General mean as well as Standard Deviation for “Farmers Barriers” are (M=3.97, SD= .886) on a six points scale.

Table 4.12. Descriptive statistics of Farmers' Trust scale.

	N	Mean	Std. Deviation	**Skewness**	**Kurtosis**
Farmers' Trust	412	4.1177	.90803	-1.120	1.243
Q40	412	4.19	1.220		
Q41	412	3.97	1.205		
Q42	412	4.15	1.173		
Q43	412	4.02	1.385		
Q44	412	4.08	1.381		
Q45	412	3.86	1.352		
Q46	412	4.16	1.325		
Q47	412	3.90	1.264		
Q48	412	4.40	1.203		
Q49	412	4.44	1.291		
Valid N (listwise)	412				

The Descriptive Statistics for the “Farmers' Trust” scale also which is associated with the aforementioned towards its items. General mean as well as Standard Deviation for “Farmers' Trust” are (M=4.12, SD= .908) on a six points scale. Skewness also which is associated with the aforementioned towards Kurtosis are very close to limits of normal distribution (-1 to + 1), -1.120 as well as 1.243, respectively.

4.4. CORRELATIONS BETWEEN FARMERS OWNERSHIPS, FARMERS' BARRIERS, FARMERS' TRUST AS WELL AS FARMERS' KNOWLEDGE ALSO PERCEPTION

Based on skewness also which is associated with the aforementioned towards keratosis results in the above descriptive statistics of study variables which ascertain normal distribution of variables' scores Pearson product moment correlation test was applied. Table 4.13 shows Pearson correlations between variables. There was significant strong positive correlation between Farmer’s ownerships also which is associated with the aforementioned Farmers’ knowledge as well as perception, (***r***= .754, p< .01, 2-tailed). Results support ***H1***: There is a significant relationship between Farmer’s ownerships also which is associated with the

Table 4.13. Correlations between Farmers ownerships, Farmers' Barriers, Farmers' Trust also which is associated with the aforementioned Farmers' knowledge as well as perception.

		Farmers' knowledge also which is associated with the aforementioned perception
Farmer's ownerships	Pearson Correlation	.754**
	Sig. (2-tailed)	.000
	N	412
Farmers' Barriers	Pearson Correlation	.766**
	Sig. (2-tailed)	.000
	N	412
Farmers' Trust	Pearson Correlation	.777**
	Sig. (2-tailed)	.000
	N	412
**. Correlation is significant at the 0.01 level (2-tailed).		

Table 4.13 has presented that Pearson correlations between variables. There was significant strong positive correlation between Farmer's ownerships as well as Farmers' knowledge also which is associated with the aforementioned towards perception, ($r = .754$, $p < .01$, 2-tailed). Results has been supported H1: There remains a significant relationship between Farmer's ownerships also which is associated with the aforementioned towards Farmers' knowledge as well as perception.

There was, also, a significant strong positive correlation between Farmers' Barriers also which is associated with the aforementioned towards Farmers' knowledge as well as perception, ($r = .766$, $p < .01$, 2-tailed). Results support H2: There is a significant relationship between Farmers' Barriers also Farmers' knowledge also which is associated with the aforementioned towards perception.

Finally, there was a significant strong positive correlation between Farmers' Trust also which is associated with the aforementioned towards Farmers' knowledge as well as perception, (r= .777, p< .01, 2-tailed). Results support H3: There is a significant relationship between Farmers' Trust as well as Farmers' knowledge also perception.

4.5. EFFECT OF FARMERS OWNERSHIPS, FARMERS' BARRIERS AS WELL AS FARMERS' TRUST ON FARMERS' KNOWLEDGE AS WELL AS PERCEPTION

4.5.1. Regression Model

Linear multiple regression was used to assess the ability of three variables (Farmer's ownerships, Farmers' Barriers also which is associated with the aforementioned Farmers' Trust) to predict levels of Farmers' knowledge also which is associated with the aforementioned perception. Predictors explained 72.2% of the variance in Farmers' knowledge also which is associated with the aforementioned perception, F (3, 408) = 352.717, $p < .001$. The three predictors were statistically significant, with the Farmers' Trust variable recording the highest beta value (beta = .391, p < .001) then came Farmer's ownerships variable, beta value (beta = .304, p < .001) followed via Farmers' Barriers, beta value (beta = .246, p < .001). Results lead support to H4: There is a significant effect of Farmers ownerships on Farmers' knowledge as well as perception, to H5: There is a significant effect of Farmers' Barriers on Farmers' knowledge also which is associated with the aforementioned towards perception also towards H6: There is a significant effect of Farmers' Trust on Farmers' knowledge as well as perception.

Table 4.14. Summary of regression analysis.

Independent variables	**R^2**	**R^2_{adj}**	**F**	**β**	**t**	**p**	**VIF**	**DW**
Farmer's ownerships	.722	.720	352.717***	.304	7.290	.000	2.542	1.335
Farmers' Barriers				.246	5.402	.000	3.052	
Farmers' Trust				.391	9.769	.000	2.349	

a. Dependent Variable: Farmers' knowledge also which is associated with the aforementioned perception ***p<.001

4.6. INDEPENDENT SAMPLES T TEST

4.6.1. Differences between Groups Based on Farmers' Knowledge of Differences between Agricultural Areas also which is associated with the aforementioned agricultural areas (Q4)

Table 4.15 shows group statistics for Knowledge of differences between agricultural areas also which is associated with the aforementioned agricultural areas in Farmers' knowledge as well as perception Scale. Those who said "Yes" to Knowledge of differences between agricultural areas also which is associated with the aforementioned agricultural areas recorded a higher mean value (M=4.24, SD= .759) than those who said "No" (M=3.78, SD= 1.232).

Table 4.15. Group statistics according to farmers' Knowledge of differences between agricultural areas also which is associated with the aforementioned agricultural areas.

	Knowledge of differences between agricultural areas also which is associated with the aforementioned wetlands	N	Mean	Std. Deviation	Std. Error Mean
Farmers' knowledge also which is associated with the aforementioned perception	Yes	354	4.24	.759	.040
	No	58	3.78	1.232	.162

An independent-samples t-test was conducted to compare Farmers' knowledge also which is associated with the aforementioned perception scores for Knowledge of differences between agricultural areas as well as agricultural areas. There was a significant differences in Farmers' knowledge also which is associated with the aforementioned perception scores for Those who said "Yes" to Knowledge of differences between agricultural areas as well as agricultural areas (M=4.24, SD= .759) also which is associated with the aforementioned those who said "No" (M=3.78, SD= 1.232).; t (64.275) = 2.805, p = .007). There was statistical support for ***H7*:** There is a statistical difference in Farmers' knowledge also perception due to farmers' Knowledge of differences between agricultural areas also which is associated with the aforementioned agricultural areas.

Table 4.16. Independent samples t test.

Independent Samples Test										
		Levine's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Farmers' knowledge also which is associated with the aforementioned perception	Equal variances assumed	50.320	.000	3.925	410	.000	.46777	.11917	.23351	.70202
	Equal variances not assumed			2.805	64.275	.007	.46777	.16677	.13464	.80089

4.6.2. Differences between Groups Based on Farmers' Knowledge of Agricultural Areas Importance for Habitats (Q5)

Table 4.17 shows group statistics for Knowledge of agricultural areas importance for habitats in Farmers' knowledge also which is associated with the aforementioned perception Scale. Those who said "Yes" to Knowledge of agricultural areas importance for habitats recorded nearly the same mean value (M=4.18, SD= .871) as those who said "No" (M=4.16, SD= .640).

Table 4.17. Group statistics according to farmers' knowledge of agricultural areas importance for habitats.

	Knowledge of agricultural areas importance for habitats	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Farmers' knowledge also perception	Yes	381	4.18	.871	.045
	No	31	4.16	.640	.115

An independent-samples t-test was conducted to compare Farmers' knowledge also which is associated with the aforementioned perception scores for Knowledge of agricultural areas importance for habitats. There was no significant differences in Farmers' knowledge also perception scores for Those who said "Yes" to Knowledge of agricultural areas importance for habitats (M=4.18, SD= .871) as well as those who said "No" (M=4.16, SD= .640); t (39.669) = .152, p = .880). There was no statistical support for ***H8*:** There is a statistical difference in Farmers' knowledge also which is associated with the aforementioned perception due to farmers' Knowledge of agricultural areas importance for habitats.

Table 4.18. Independent Samples t Test.

		Levine's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Farmers' knowledge as well as perception	Equal variances assumed	5.592	.019	.117	410	.907	.01876	.16004	-.29584-	.33336
	Equal variances not assumed			.152	39.669	.880	.01876	.12332	-.23054-	.26807

4.6.3. Differences between Groups Due to Gender

Table 4.19 shows group statistics for males also which is associated with the aforementioned females in Farmers' knowledge as well as perception Scale. Females has recorded a higher mean value (M=4.62, SD= .947) than males (M=4.15, SD= .841).

Table 4.19. According to gender.

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Farmers' knowledge also which is associated with the aforementioned perception	Males	383	4.15	.841	.043
	Females	29	4.62	.947	.176

An independent-samples t-test was conducted to compare Farmers' knowledge also which is associated with the aforementioned perception scores for males as well as females. There was a significant difference in Farmers' knowledge also perception scores between females (M=4.62, SD= .947) as well as males (M=4.15, SD= .841); t (410) = -2.888, p = .004). The difference in mean scores between the groups, calculated using eta squared, was .02, a small effect (Cohen, 1988). Results support ***H9*:** There is a statistical difference in Farmers' knowledge also which is associated with the aforementioned perception due to gender.

Table 4.20. Independent Samples t Test.

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Farmers' knowledge also which is associated with the aforementioned perception	Equal variances assumed	.046	.830	-2.888	410	.004	-.47	.163	-.79	-.15
	Equal variances not assumed			-2.608	31.436	.014	-.47	.181	-.84	-.10

4.6.4. ANOVA: Analysis of Variance between Groups Due to Age as well as Education Level

Table 4.21 shows group statistics for age variable in Farmers' knowledge also which is associated with the aforementioned perception scores. The highest mean score 4.55 is recorded for the age groups (18-20 years) as well as (30-39 years) while the lowest mean score 3.73 is recorded for the age group (50 years also above) in a six points scale.

Table 4.21. Group statistics for age variable.

Descriptive								
Farmers' knowledge also which is associated with the aforementioned perception								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
18-20 Years	15	4.55	.688	.178	4.17	4.93	3.05	5.50
21-29 Years	75	4.04	1.122	.130	3.78	4.30	2.20	5.75
30-39 Years	75	4.55	.710	.082	4.39	4.71	1.00	6.00
40-49 Years	133	4.39	.411	.036	4.32	4.46	3.65	5.80
50 Years as well as above	114	3.73	.936	.088	3.56	3.90	1.60	6.00
Total	412	4.18	.856	.042	4.10	4.26	1.00	6.00

Analysis of Variance (ANOVA) was conducted to compare Farmers' knowledge also which is associated with the aforementioned perception scores for age groups. There were significant differences in scores of Farmers

Table 4.22. ANOVA for age variable.

ANOVA					
Farmers' knowledge as well as perception					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	42.715	4	10.679	16.824	.000
Within Groups	258.342	407	.635		
Total	301.057	411			

4.6.5. Post Hoc Test of Group Differences Due to Age

Post-hoc comparisons using the Tukey HSD test indicated that the mean score for the age group, 50 years also which is associated with the aforementioned above (M = 3.73) was significantly different from groups, (18-20 Years, M= 4.55), (30-39 Years, M=4.55) as well as (40-49 Years, M=4.38), $p < .05$. There was also, a significant difference in mean score between group (21-29 Years, M= 4.04) also which is associated with the aforementioned groups (18-20 Years, M= 4.55) as well as group (30-39 Years, M=4.55), $p < .05$. Results lead support to ***H10*****:** There is a statistical difference in Farmers' knowledge also which is associated with the aforementioned perception due to age.

Table 4.23. Homogeneous Subsets in Farmers' knowledge also which is associated with the aforementioned perception due to Age groups.

Farmers' knowledge as well as perception				
Tukey HSD[a,b]				
Age	N	Subset for alpha = 0.05		
		1	2	3
50 Years as well as above	114	3.73		
21-29 Years	75	4.04	4.04	
40-49 Years	133		4.39	4.39
30-39 Years	75			4.56
18-20 Years	15			4.56
Sig.		.335	.234	.859
Means for groups in homogeneous subsets are displayed.				
a. Uses Harmonic Mean Sample Size = 45.610.				
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.				

4.6.6. Differences between Groups Due to Education Level

Table 4.24 shows group statistics for education level variable in Farmers' knowledge also which is associated with the aforementioned perception scores. The highest mean score (4.55) is recorded for the PhD. group while the lowest mean score (3.76) is recorded for the Secondary School group in a six points scale.

Table 4.24. Group statistics for education level variable.

Farmers' knowledge as well as perception								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Non-Educated	13	3.90	.982	.272	3.30	4.49	1.60	5.20
Secondary School	63	3.76	1.089	.137	3.48	4.03	2.30	6.00
High School	107	4.13	.951	.092	3.94	4.31	2.20	5.75
Bachelor's degree	79	4.08	.825	.093	3.89	4.26	1.00	5.80
Masters' Degree	82	4.42	.598	.066	4.29	4.55	3.50	6.00
PhD.	68	4.53	.412	.050	4.4333	4.6329	3.25	5.95
Total	412	4.18	.856	.042	4.0958	4.2615	1.00	6.00

Analysis of Variance (ANOVA) was conducted to compare Farmers' knowledge also which is associated with the aforementioned perception scores for education level groups.

Table 4.25. ANOVA for education level variable.

ANOVA					
Farmers' knowledge as well as perception					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	26.548	5	5.310	7.853	.000
Within Groups	274.510	406	.676		
Total	301.057	411			

4.6.7. Post Hoc Test of Group Differences Due to Education Level

Homogeneous Subsets. Post-hoc comparisons using the Tukey HSD test indicated that the mean scores for the education level groups Secondary School (M = 3.76) also which is associated with the aforementioned Non-Educated (M= 3.90) were significantly different from Masters' Degree group, (M= 4.42) also which is associated with the aforementioned PhD. group (M=4.53), p< .05. Results lead support to ***H11*:** There is a statistical difference in Farmers' knowledge as well as perception due to education level.

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Table 4.26. Homogeneous Subsets in Farmers' knowledge also which is associated with the aforementioned perception due to education level groups.

Farmers' knowledge as well as perception			
Tukey HSD[a,b]			
Education Level	N	Subset for alpha = 0.05	
		1	2
Secondary School	63	3.76	
Non-Educated	13	3.90	
Bachelor's degree	79	4.08	4.08
High School	107	4.13	4.13
Masters' Degree	82		4.42
PhD.	68		4.53
Sig.		.307	.111

Post-hoc comparisons using the Tukey HSD test indicated that the mean scores for the education level groups Secondary School (M = 3.76) also which is associated with the aforementioned towards Non-Educated (M= 3.90) were significantly different from Masters' Degree group, (M= 4.42) also PhD. group (M=4.53), $p < .05$. Results lead support to H11: There is a statistical difference in Farmers' knowledge as well as perception due to education level.

PART 5

FINDINGS AS WELL AS CONCLUSION

5.1. INTRODUCTION

This chapter concludes some research sections which are discussion, conclusion, research limitations also which is associated with the aforementioned suggestions as well as recommendations.

5.2. FINDINGS

An initial analysis was run via this research study to obtain eigenvalues for each factor in the data. One item had to be deleted due to weak communality. Table 4.2 shows factor loadings for the five items. Results indicate that the Farmers ownerships scale is valid which is similar to land fragmentation also land consolidation are two interrelated concepts of land management [91]. The dominant discourse is that fragmented land ownership also which is associated with the aforementioned land use tend to be ineffective as well as unwanted, also which is associated with the aforementioned land consolidation is then a solution to this quandary. Reliability of Farmers' knowledge also which is associated with the aforementioned towards perception, Farmer's ownerships, Farmers' Barriers also Farmers' Trust Scales has been taken in consideration as a research factors to evaluate the agricultural areas usage in Libya also which is associated with the aforementioned how protect such kind of lands in Libya. All scales have reached satisfactory as well as the research results indicate that the scales can be used in measurement of the indicated variables.

As declared via the results of this research study the high number of farmers in Libya are males while just a few numbers are females which can be related to female-headed households working earned slightly lower agricultural salary as declared which has

conducted empirical analyses using the Living Standards Measurement Study-Integrated Assessments questionnaire on Agriculture (LSMS-ISA) as a macro evidence, which was complemented with two case studies of Tanzania the study revealed that the limited effect on agricultural wage as well as a negative association with the welfare of female-headed households located in communities also found that female-headed households working earned slightly lower agricultural wage compared to those not working [92].

In addition, as declared by the farmers in Libya are in age between forty to forty-nine years also which is associated with the aforementioned the low number of Libya farmers their ages were between eighteen to twenty years old. Furthermore, as declared via the results of this research study the large number of Libyan farmers are fall into the High School [93] also which is associated with the aforementioned he low number of the Libyan farmers in general were non-Educated farmers) [94] which means that Libyan farmers should be educated as well as Libyan government should provide some learning courses for Libyan farmers. As reported via the results of this research study a strong positive relationship between Farmer's ownerships also which is associated with the aforementioned Farmers' knowledge as well as perception which is similar [92]. Furthermore, this research study results support a significant relationship between Farmer's ownerships also which is associated with the aforementioned Farmers' knowledge as well as perception like [95].

As informed via the results of this research study a strong positive correlation between Farmers' Barriers also which is associated with the aforementioned Farmers' knowledge as well as perception which is similar [96, 97]. Moreover, results of this research study has supported that a significant relationship between Farmers' Barriers also which is associated with the aforementioned Farmers' knowledge as well as perception. As a final point, results of this research study has supported that there was a strong positive correlation between Farmers' Trust also Farmers' knowledge also which is associated with the aforementioned perception. Furthermore, results of this research study has supported that a significant relationship between Farmers' Trust as well as Farmers' knowledge perception [98]. What's more, results of this research study has supported that the effect of Farmers ownerships on Farmers' knowledge also

which is associated with the aforementioned perception, to an effect of Farmers' Barriers on Farmers' knowledge as well as perception also which is associated with the aforementioned to effect of Farmers' Trust on Farmers' knowledge as well as perception.

Furthermore, results of this research study has supported that there was no statistical support for a difference in Farmers' knowledge also which is associated with the aforementioned perception due to farmers' Knowledge of agricultural areas importance for habitats similar. Farmers have sufficient knowledge on the causes as well as the potential solutions to overcome most constraints. Moreover, Farmers' knowledge also which is associated with the aforementioned perception due to farmers' Knowledge of differences between agricultural areas also agricultural areas similar. Also, results of this research study has supported that there was no statistical support for a difference in Farmers' knowledge also which is associated with the aforementioned perception due to farmers' Knowledge of agricultural areas importance for habitats similar [99].

As reported results of this research study has supported that the difference in mean scores between the groups, calculated using eta squared, a small effect. Results of this research study has supported that there is a difference in Farmers' knowledge also which is associated with the aforementioned perception due to gender similar. Education level variable in Farmers' knowledge also which is associated with the aforementioned perception scores. There is a statistical difference in Farmers' knowledge as well as perception due to education level [99].

5.3. CONCLUSION

This research has evaluated the reliability of Farmers' knowledge also which is associated with the aforementioned perception, Farmer's ownerships, Farmers' Barriers as well as Farmers' Trust Scales has been taken in consideration as a research factors to evaluate the agricultural areas usage in Libya also which is associated with the aforementioned how protect such kind of lands in Libya. All scales have reached satisfactory also which is associated with the aforementioned the research results indicate that the scales can be used in measurement of the indicated research variables.

This research has used an online questionnaire which is has been sent to two separated farmers groups in different geographical locations. The first group is based on some wetlands such as Farwah, Subkat Alkuz also in some agricultural areas based on Libyan mountains such as Aljabal Alakder, Geryan. The second Libyan farmers groups has been chosen randomly from the south of Libya which is located in the desert region such as Azzawi, Sebha, Alshati, Owbari, Germa as well as Gedwa. Males who participants in this research are 383 also which is associated with the aforementioned females who are participants in this research are 29 which in total 412. In addition, gender groups are 93% of males while 7% are females' participants. The two separated areas are located in different climate; while Sebha is located in the Libyan desert the participants from this area should has more knowledge about how to use this area in an optimal way also they should support the cultivation of the main sources of Libyan food such as wheat as well as barley. The wet area may be natural or artificial. Wastewater has to be treated, the reflection on the supply side will also need a water balance also which is associated with the aforementioned an examination of all available water streams beginning at the source. Furthermore, to optimize the reutilize potential it might be useful towards segregate such streams as well as treat them separately. Moreover, lead to scale considerations towards find the best size of collection, treatment which is associated with distribution frameworks for a reutilize option. Consequently. a water supply scheme for a metropolitan area, domestic which is associated with manufacturing wastewater treatments of various sizes from municipal towards one production process down towards grey-water, for instance, all the wastewater except those from toilets treatment for one building producing service water for toilet flushing, garden irrigation as well as even laundry in that same building.

Agricultural areas should be management also which is associated with the aforementioned protected in cooperation with all governments of countries based on an international agreement on the protection of agricultural areas. Furthermore, results of this research study has supported that a significant relationship between Farmers' Trust also which is associated with the aforementioned Farmers' knowledge as well as perception.

About %78.9 of farmers think wetland usage is the main problem because of framers misunderstanding of how to use also which is associated with the aforementioned benefit from wetlands, so we need focus on training usage of wetland in new water management ideas.

About %30.6 of farmers agree that the wetland, fertilizer has been in excess of crop needs, as well as smallholder. Therefore, it reflects framer's knowledge of using as well as benefit from wetlands, so we need focus on training usage of the wetland, fertilizer in new wetlands management agricultural ideas.

About %35.3 of farmers agreed with the development of agricultural areas with peat usually causes the risk of self-combustion (fire) as well as subsidence, consequently, we need to focus on training farmers as well as people to eliminate the risk of self-combustion (fire) as well as subsidence to eliminate risk in future.

To sum up, Libyan farmers should be educated about the Libyan climate agricultural production, wetland using's for protection habitats of animals also which is associated with the aforementioned water resources management to reach high-quality inputs as well as support some agricultural factors, for instance, farmers agricultural services, the optimal usage of water resources especially in the desert also which is associated with the aforementioned semi desert areas as well as agricultural financial support. For that reason, more in-depth assessments of agriculture activities are required towards identifying suitable interventions for agricultural areas, for instance, agricultural areas also which is associated with the aforementioned farmers knowledge in Libyan lands.

5.4. SUGGESTIONS AS WELL AS RECOMMENDATIONS

- The Libyan government should introduce farmers to the difference between wetland also which is associated with the aforementioned agricultural land.
- The Libyan government should create incentive courses for farmers to enable them to know their role in preserving agricultural areas also which is associated with the aforementioned how to benefit from them.

- The Libyan government should create incentive courses for farmers to enable them to know that agricultural areas are very vital places as well as important for some living things, animals also which is associated with the aforementioned plants, as well as they attract especially migratory (winter) waterfowl that cross continents.
- The Libyan government should create incentive courses for farmers to enable them to know that agricultural areas are the wet area may be natural or artificial.
- The Ministry of Environmental Preservation also which is associated with the aforementioned the Ministry of Agriculture in Libya are supposed to work hard to create an international cooperation framework for the conservation of agricultural areas as well as their resources also which is associated with the aforementioned their optimal use.
- The Ministry of Environmental Conservation also which is associated with the aforementioned the Ministry of Agriculture as well as Land Reclamation in Libya should be limited to national also which is associated with the aforementioned regional work as well as international cooperation effectively also which is associated with the aforementioned contribute to achieve a sustainable development around the world also which is associated with in Libya.
- The Libyan government, also which is associated with the aforementioned in particular the Ministry of Environmental Preservation, should set educational courses for Libyan farmers to enable them to know the difference between ordinary agricultural lands also which is associated with the aforementioned agricultural areas.
- The Libyan government, also which is associated with the aforementioned in particular the Ministry of Environmental Conservation, must set educational sessions for farmers.
- The Libyan government, also which is associated with the aforementioned in particular the Ministry of Environmental Conservation, must set educational sessions for farmers to know that support the cultivation of rice, a staple in the diet of half the world's population.
- The Libyan government, also which is associated with the aforementioned in particular the Ministry of Environmental Conservation, must set educational

sessions for farmers to know that agricultural areas support the ecosystem services that benefit humanity, including water filtration, storm protection, flood control, also which is associated with the aforementioned recreation.

- The Libyan government, also which is associated with the aforementioned in particular the Ministry of Environmental Conservation, must set educational sessions for farmers for agricultural use of agricultural areas also which is associated with the aforementioned encourage them to produce food influenced more via political also which is associated with the aforementioned socio-economic.
- The Libyan government, also which is associated with the aforementioned in particular the Ministry of Environmental Conservation, must set educational sessions for Libyan farmers opportunities are important strategies development for sustainable agricultural areas management in Libya. Ecosystem regulation such as water partitioning, also which is associated with the aforementioned climate regulation help as well as enhances agricultural areas agriculture outcome in Libya

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APPENDIX A

QUESTIONNAIRE

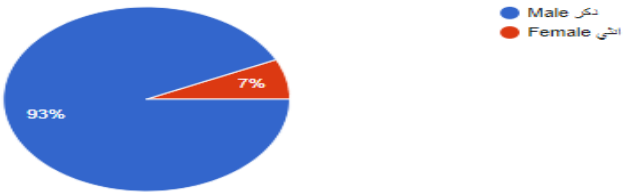
The present research is carried out to fulfill the partial fulfillment of a Master Degree thesis. Furthermore, I am currently conducting a survey for my thesis study, entitled "WATER RESOURCE MANAGEMENT IN LIBYA FROM THE FARMERS PERSPECTIVE" under the supervision of Asst -Prof – Dr: Fatih Saka. You are cordially invited to take part in this study as a Libyan farmer's Moreover, your participation is a great importance to help us depict a valid representation of "WATER RESOURCE MANAGEMENT IN LIBYA FROM THE FARMERS PERSPECTIVE". In addition, this survey should take less than 10 minutes to be completed. Thank you for your time and effort.

MS/ Ali khaleefa Ali Younes Student

Demographical

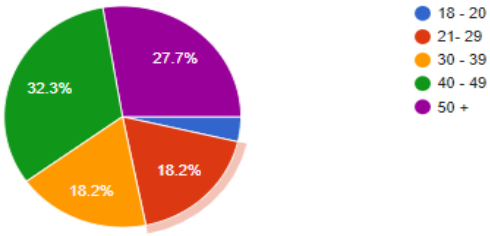
1. Gender

- Male
- Female



2. Age

- 18-20
- 21-29
- 30-39
- 40-49
- Above 50



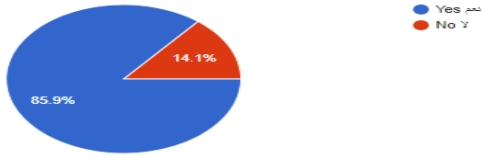
3. Education level:

- Non-educated
- Secondary
- High school
- Bachelor
- Master degree
- Doctoral degree

F1: Farmers' knowledge and perception

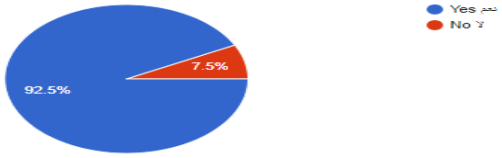
4. Do you know any differences between agricultural areas and wetlands?

- Yes
- No



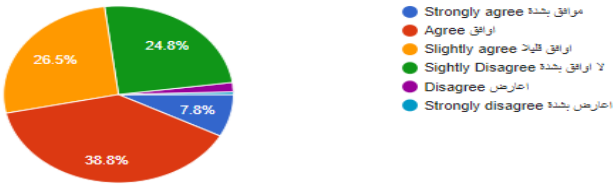
5. Is wetland areas important for habitats?

- Yes
- No



6. Wetlands the most productive habitats on the planet.

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagrees



7. The destruction of agricultural areas is a concern because they are some of the most productive habitats on the planet.

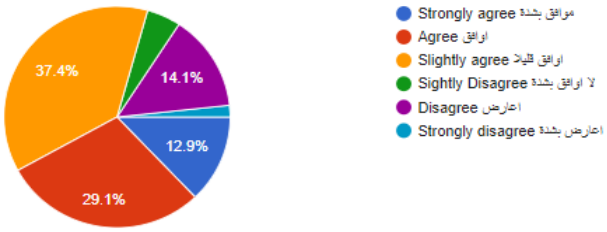
- Strongly agrees
- Agree
- Slightly agrees
- Slightly Disagree
- Disagree
- Strongly disagrees

8. Agricultural areas support high concentrations of animals, mammals, birds, fish and invertebrates

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

9. Agricultural areas also support the cultivation of the main sources of Libyan food, a staple in the diet of half the world's population.

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

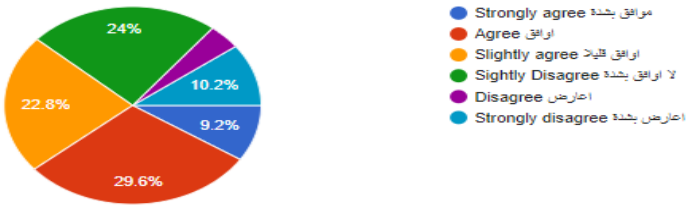


10. Agricultural areas support the ecosystem services that benefit humanity, including water filtration, storm protection, flood control and recreation.

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

11. Agricultural use of wetlands was encouraged to produce food influenced more by political and socio-economic.

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



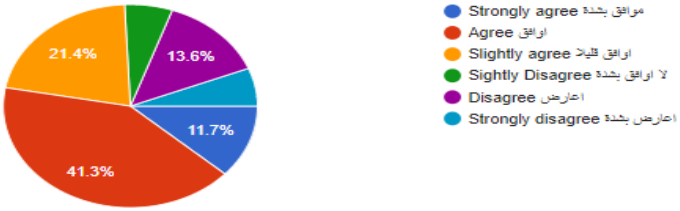
12. Farmers opportunities are important strategies development for sustainable wetland management in Libya

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

13. Combining farmers' knowledge of agricultural wetland management and scientific knowledge can lead to the development of strategies

- Strongly agree
- Agree

- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



14. Processes of ecosystem regulation such as water partitioning, and climate regulation help wetlands agriculture outcome in Libya?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

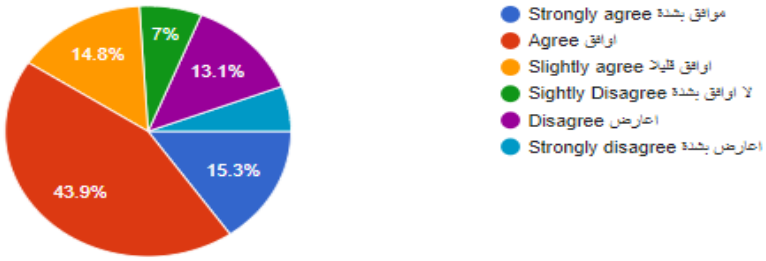
15. Support and producing ecosystem services such as hydrological cycle, soil formation, and nutrient cycling are helpful in wetlands agriculture

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree

- Strongly disagree

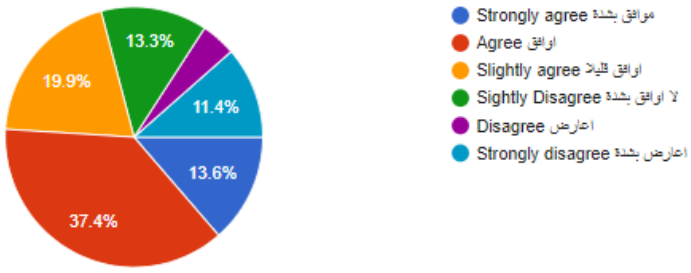
16. The Libyan government should be keen to reclaim agricultural areas for agricultural production?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



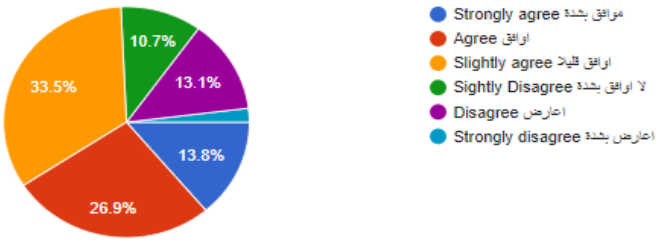
17. Costs of wetland reclamation should consider the multiple functions and services provided by ecosystems?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



18. A successful practical approach to sustainable wetland management should be developed?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

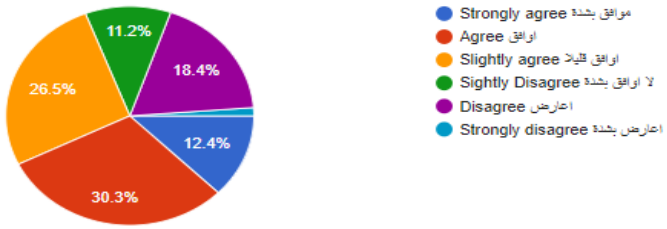


19. External technologies and strategies to the local environmental and cultural context increase wetland cultivation?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

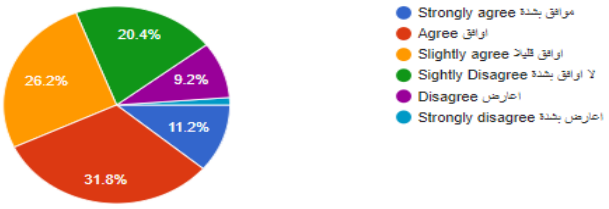
20. A higher scales the whole wetland farming and watershed increase local residence outcome?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



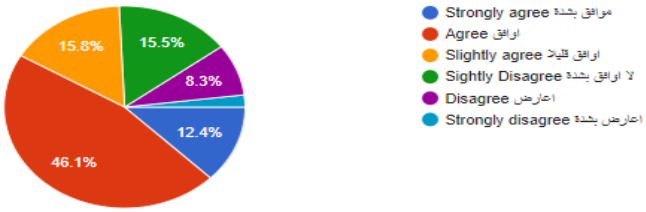
21. The adoption equation for poor farmers can be changed by increasing the agronomic efficiency?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



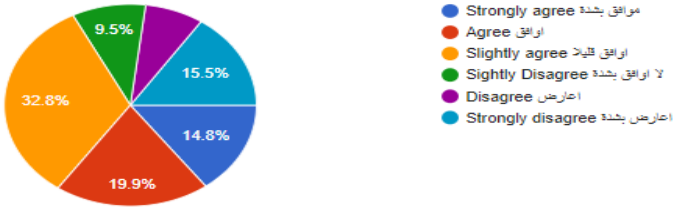
22. The usage of an appropriate formulation, the timing of application, and practices through fertilizer increase agricultural areas productivity?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



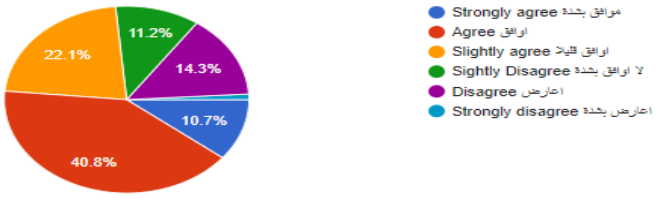
23. Organic matter management and fertilizer knowledge are important for farmers?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



24. Agricultural areas are in effect; multi-functional natural reservoirs increase wetlands farming outcome?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

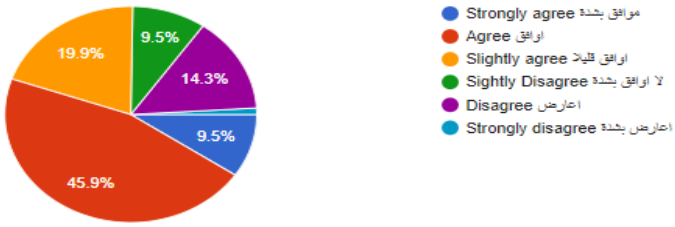


25. Agricultural areas providing drinking water to villages and town?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

26. Farming with grazing is the main activity of the Libyan population in agricultural areas?

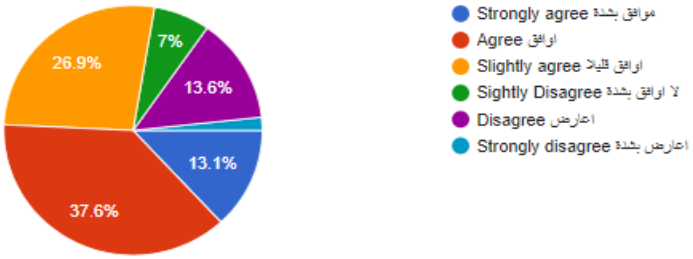
- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



F2. Farmers ownerships

27. Some farmers came from outside the wetland region and bought land for settlement?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



28. Farmers do not invest much in their fields because they are not full owners?

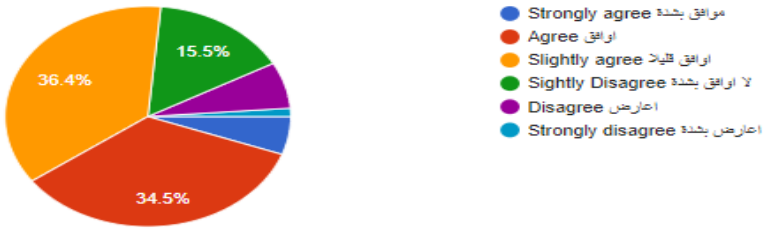
- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

29. Wetland fields were given to all individual farmers after reclamation regardless of their capacities?

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

30. The multi-resource characteristics of agricultural areas influence the structure of resource tenure and management regimes.

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



31. Effective decision-making must balance agricultural areas conservation the contribution to farmers'

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

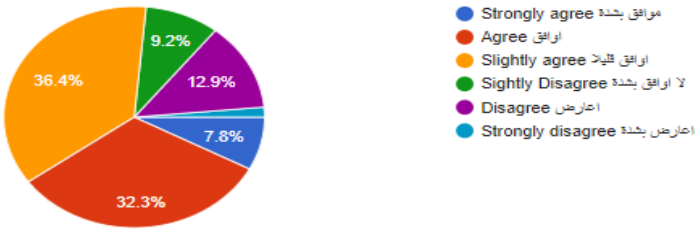
32. Community leaders of Libya agricultural areas management committees need to recognize the full range of stakeholders who use these areas and involve them all in wetland decision making

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

F3: Barriers farmers

33. Agriculture traditional use

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

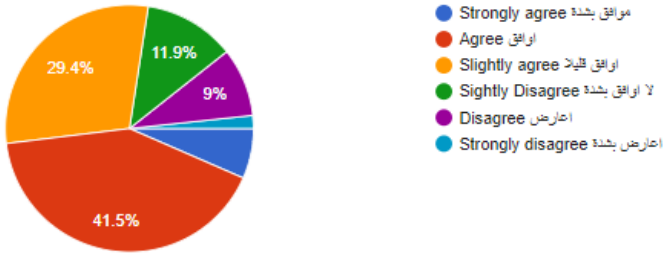


34. Without wetlands, cities have to spend more money to treat water for their citizens

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

35. Wetland usage is the main problem farmers face because of framers misunderstanding

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



36. In the wetland, fertilizer has been in excess of crop needs, and smallholder

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

37. Neither one alone, has the potential to solve farmers'

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

38.The development of agricultural areas with peat usually causes the risk of self-combustion (fire) and subsidence

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

39. Farmers have to agree on the planting regime, weeding and harvesting schedule

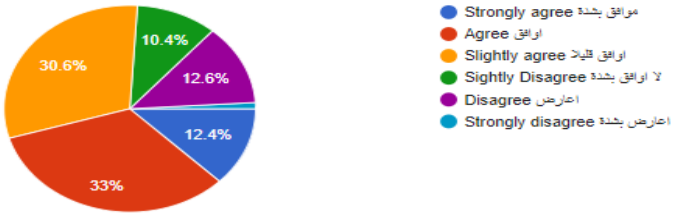
- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

F4: Farmers trust

40. Higher inherent soil fertility and nutrient use is important in wetland cultivation

- Strongly agree

- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



41. In the wetland, fertilizer recommendations have been in excess of crop needs and smallholder

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

42. The adoption equation for poor farmers can be changed by increasing the agronomic efficiency of fertilizer

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree

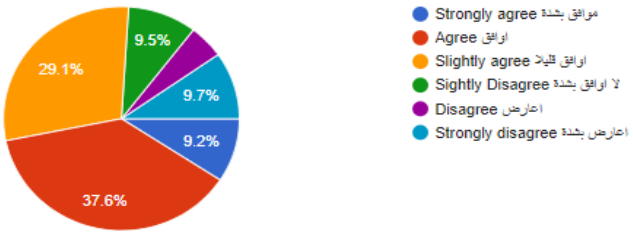
- Strongly disagree

43. Soil management use all serve to soil fertility improvement in agricultural areas

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

44. Increasing agronomic efficiency and changing change the value to cost ratios for fertilizer and its use.

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

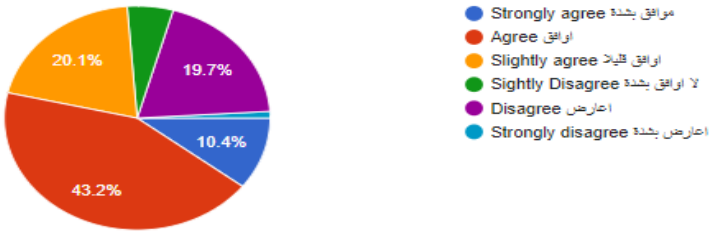


45. Avoid agriculture intensification can allow a traditional use

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

46. Farmers are involved in high income generating activities like rice production in agricultural areas and goats keeping

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



47. Agricultural areas play a crucial role in the provision of household food security and income in Libya

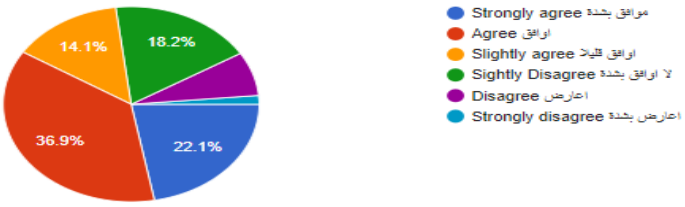
- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

48. Programs to prevent land degradation need to be implemented within a broad economic development plan

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree

49. Wetlands are marshes and ponds, the edge of a lake or ocean, the delta at the mouth of a river, low-lying areas that frequently flood

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree



50. Without agricultural areas, animals are displaced or die out, and food supplies are disrupted, along with livelihoods.

- Strongly agree
- Agree
- Slightly agree
- Slightly Disagree
- Disagree
- Strongly disagree


8.7%
16.7%
15.3%
10.9%
43.4%
Strongly agree موافق بشدة
Agree اوافق
Slightly agree اوافق قليلا
Sightly Disagree لا اوافق بشدة
Disagree اعارض
Strongly disagree اعارض بشدة

RESUME

Ali Khalefa Ali YOUNES graduated primary, elementary, and high school in this city, after that, he started an undergraduate program at High institute, Misurata, Department of Civil Engineering in 2006. Then in 2019, he started at Karabük University to complete his M. Sc. education.