Update, Conclusions, and Recommendations for "Agro-Environmental Sustainability in MENA Regions"

Mohamed Abu-hashim, El-Sayed E. Omran, Faiza Khebour Allouche, and Abdelazim Negm

Abstract The present situation in the Middle East and North Africa (MENA) regions is framed by triple environmental sustainability-related challenges. Natural resources are at the heart of sustainable development in MENA regions and are critical to socio-economic growth. This chapter captures the agro-environmental sustainability in MENA Regions (in terms of findings and suggestions) and provides ideas extracted from the volume cases. Besides, some (update) findings from a few recently published research works related to the agro-environmental sustainability covered themes. This chapter provides the present challenges faced by the agro-environmental sustainability in MENA Regions with a set of recommendations to safeguard the resources. Environmental sustainability is concerned with the possibility of protecting and maintaining environmental resources for future generations. Developing countries are looking for growth while developed nations are looking for instruments for post-growth and intellectual development to think about sustainable development (economically effective, socially equitable and environmentally sustainable). For any economy that needs progress and development, growth has always been a significant goal. It is based mainly on the growth of factors of production owing to the enhanced use of available resources. However, the MENA region faces a triple challenge: Emerging climate patterns herald a future where water

M. Abu-hashim
Department of Soil and Water Science, Faculty of Agriculture, Zagazig University, Zagazig, Egypt
e-mail: mabuhashim@zu.edu.eg

E.-S. E. Omran
Department of Soil and Water, Faculty of Agriculture, Suez Canal University, Ismailia 41522, Egypt

Institute of African Research and Studies and Nile Basin Countries. Aswan University, Aswan, Egypt

F. K. Allouche
Department of Horticultural Sciences and Landscape, High Institute of Agronomic Science-Chott Meriem, University of Sousse, ISA CM, BP 47, 4070 Sousse, Tunisia

A. Negm (✉)
Department of Water and Water Structures Engineering, Faculty of Engineering, Zagazig University, Zagazig 44519, Egypt
e-mail: amnegm@zu.edu.eg

M. Abu-hashim et al. (eds.), *Agro-Environmental Sustainability in MENA Regions*, Springer Water, https://doi.org/10.1007/978-3-030-78574-1_19

resources lie below sustainable levels; rapid population growth is threatening to imperil food security; and over-reliance on oil is curtailing governments' ability to act. Nevertheless, water crisis is more acute than in the MENA region. In addition to food security, water scarcity is the biggest threat to human and environmental security in the region. Droughts, soil salinity and pollution, land subsidence and rural exodus have been triggered by the lack and inefficient use of resources. It has also helped trigger conflicts. Agriculture and food production is a big culprit behind the water shortage in the MENA region. The situation needs new thoughts on sustainability, successful technology deployment and radical agricultural transformation. This book holds much promise and potential for agro-environmental sustainability in MENA Regions. This book addresses the question of how science and technology can be mobilized to make that promise come true.

Keywords Water resources · Agriculture · Assessment · Sustainability · Groundwater · Deserts · Environment · Egypt · MENA regions · Food security

1 Introduction

Environmental sustainability is concerned with the possibility of protecting and maintaining environmental resources for future generations. Developing countries are looking for growth while developed nations are looking for instruments for post-growth and intellectual development to think about sustainable development (economically effective, socially equitable and environmentally sustainable). For any economy that needs progress and development, growth has always been a significant goal. It is based mainly on the growth of factors of production owing to the enhanced use of available resources. The MENA region, however, faces a triple challenge: Emerging climate patterns herald a future where water resources lie below sustainable levels; rapid population growth is threatening to imperil food security; and over-reliance on oil is curtailing governments' ability to act. Nowhere else is the water crisis more acute than in the MENA region. In addition to food security, water scarcity is the biggest threat to human and environmental security in the region [1, 2]. Droughts, soil salinity and pollution, land subsidence and rural exodus have been triggered by the lack and inefficient use of resources. It has also helped trigger conflicts. A major culprit behind water scarcity in the MENA region is agriculture and food production. The situation needs new thinking on sustainability, efficient implementation of technology and radical transformation of agriculture.

This book holds much promise and potential for agro-environmental sustainability in MENA Regions. This book addresses the question of how science and technology can be mobilized to make that promise come true. Therefore, the intention of the book is to improve and address the following main theme.

- Climate change and Water Management Practices.
- Diagnosis and New Farming Technologies.
- Practices for Sustainable Plant and Soil Production.

- Industrial, Landscape, Touristic and political Approaches for Agro-environment sustainability.

The next section presents a brief of the important findings of some of the recent (updated) published studies on the agro-environmental sustainability in MENA Regions, then the main conclusions of the book chapters in addition to the main recommendations for researchers and decision makers. The update, conclusions, and recommendations presented in this chapter come from the data presented in this book.

2 Update

The following are the major update for the book project based on the main book theme:

2.1 Climate Change and Water Management Practices

Four chapters are identified in the book related to water management practices. The first study considers climate change impacts on water balance in Egypt and opportunities for adaptations. The MENA is known as one of the world's most water-scarce regions. The availability of freshwater declined from 990 m^3 in 2005–800 m^3 in 2015 [3] and is expected to reach 600 m^3 per capita by 2050 well below the indix of poverty (1000 m^3/capita) [4]. The region's water shortage will be compounded by the dramatically growing population, as it is expected to double to almost 450 million by 2050 [5]. According to the World Bank [6], most of MENA's agricultural areas rely primarily on rain-fed and 60% of the population lives in surface water-scarce areas, which means the country is highly vulnerable to changes in temperature and precipitation. Therefore, recognizing climate change threats is key to formulating policies and rectifying approaches to reduce the risks. With its limited water supplies and rapidly increasing population, Egypt is facing major challenges. Per capita water consumption has declined from 2200 m^3/capita/year in the 1960s to 570 m^3/capita/year in 2018, and is estimated to be only 324 m^3/capita/year in 2050. Across the world, climate change is projected to trigger much greater concerns, with significant environmental, social, and economic implications.

The second study gives an overview of the decentralized wastewater treatment by using biofilm technologies in the MENA region. Decentralized wastewater treatment used Biofilm technologies. Biofilm processes require less space as they consistently keep the active sludge concentration in the biological reactor at a high level. This is especially of great importance for applications where the type of waste implies the risk of high sludge volume indices. The increase of the demands on efficiency and cost of wastewater treatment leads to new interest in biofilm technology, which

is lead to an important positive impact that can affect the treatment cost, operation, and treatment efficiency in several countries in the region. Also, the effect of climate change on water resources in the MENA region is expected to be significant as a result of a decrease in precipitation and water technologies changes in its spatial and temporal distribution. Furthermore, to demonstrate the application of several biofilm technologies with the high-efficiency treatment of municipal wastewater in a small and large scale with respect to the application of low-cost wastewater treatment and also to reuse the treated wastewater for irrigation purpose as successful case studies from and out of the MENA region.

The third study concern the estimation of the olive orchards' water requirements using climatic and physiological methods: Case study Tunisian Semi-arid. Irrigation water management should be done with methods to save water and maximize productivity. Water productivity increases with deficit irrigation. This technique aims to save water and control vegetative growth in orchards without any adverse effects on production. During the first years after planting, irrigation should compensate for the water requirements needed for tree growth to establish as soon as possible [7]. Subsequently, a deficit irrigation strategy is the best option for most olive orchards [7–9]. Whenever there is a shortage of water for irrigation, supplementary or supplementary irrigation is sufficient to significantly increase crop performance.

2.2 Diagnosis and New Farming Technologies

Five approaches are used to delineate and discussed the new farming technologies. The first approach is the agrarian system diagnosis in Kerkennah Archipelago, Tunisia. The application of a detailed diagnosis on the agrarian systems in MENA region, more precisely in a Tunisian archipelago through a social survey allowed us to describe the characteristics of cropping systems in general and detailed farming systems. The interaction between different agricultural and social indicators helped to identify gaps in the evolution of such system. Tunisia needs to develop the agricultural practices of its producers. The purpose of diagnostic analysis of the agrarian system in a small region is to identify the factors that influence the evolution of agricultural production systems. "Agrarian system is the theoretical expression of a historically constituted and geographically located type of agriculture, consisting of a characteristic cultivated ecosystem and a defined productive social system. This allows sustainable exploitation of the corresponding cultivated ecosystem".

The second approach is precision farming technologies to increase soil and crop productivity. In precision farming (PF) or Site-specific land management (SSLM), the farm field is classified into "site-specific management zones" depending on soil pH, yield rates, pest invasion, and other factors that affect soil and crop production. Management decisions become in need for each zone and SSLM tools, for example, remote sensing, GPS, and GIS are used to observe zone variable-rate inputs. This method differs from traditional farming due to traditional farming used a "whole field" approach where the field is considered as a homogeneous area, but SSLM

method classifies the field into zones based on the field variability [10, 11]. The application of new advanced technology in order to increase agricultural productivity becomes an urgent solution to meet the food demand of the growing population. Remote sensing technique is an important factor in precision farming [12]. Different components of technologies used in precision farming include remote sensings such as satellites, aerial photography, UAVs, GIS, GPS, the variable rate application, and geostatistics. UAVs have been normally used for image surveys such as mapping weed in coffee farms, finding the anomaly in the fertilization delivery system and determining maturity analyses [13].

The third potential practice is implementing an environmental information system in data-scarce countries: issues and guidelines. Integrating the environmental dimension into socio-economic development strategies has become a requirement for sustainable development. To reach this goal, it is necessary to monitor the state of the environment in order to identify, manage and supervise the different environmental issues and to determine the appropriate responses for them. This objective cannot be achieved without organizing environmental data in an information system that can be used and updated by all the actors and partners concerned by the environmental questions. The aim of implementing an Environmental Information System (EIS) is to develop an integrated framework for the storage, production, management and exchange of environmental information in a decision-making perspective. However, the availability and scarcity of data remains a major obstacle for realizing such systems, especially in developing countries. Society responds then by trying to provide solutions to these changes by adopting environmental, economic and social policies (Responses) [14]. To overcome the problems of access and availability of data, other alternatives are to be explored. Earth observation data captured from satellites is one of the promising options in this regard. Indeed, with the free and open access to satellite data of many types and resolutions, these databases become a valuable source that countries suffering from data availability problems can exploit and glamorize [15]. Big data techniques present three significant advantages for the implementation of information systems. Firstly, they provide solutions for the storage of mass data that evolve over time, such as those concerning the environment. They provide algorithms and methods for processing and analyzing extensive data coming from various sources. Finally, they provide tools and interfaces to display information in many ways that make it easy to understand and interpret the phenomena being studied [16].

The fourth approach is related to the green spaces for residential projects as a commitment to environmental concerns and a sustainable development initiative: Design of a periurban park in Casablanca, Morocco. Morocco has embarked on a long process of modernization of the territorial administrative organization and its adaptation to the current political, economic and social context while gradually introducing a decentralization that will allow a rapprochement between the administration and the local authorities. The need for green space is no longer to be demonstrated in urban areas; It is not only a question of environmental and aesthetic stakes but also the place of founding experiences and social openness. The presence of this vital space is essential for the well-being of human populations because its absence

presents itself as a phenomenon to be analyzed. Casablanca is a city that is much better known for its buildings than for its green spaces. Places of relaxation in the White City are numerous, but they are poorly maintained. This will make Morocco one of the most emerging countries in the MENA region. The processes of territorial recomposition in Morocco are characterized by a continuous dynamic, reflecting the major changes that affected the different sectors of the country during the twentieth century.

The fifth approach is related to the environment and sustainable development in front of the artificialisation of the coastlines: Coasts of Tunisia, Morocco and Algeria. The traditional economy of the Sahel region was mainly based on agriculture and, in particular, olive growing, livestock farming and vegetable crops. This was also the case for all of Tunisia, which had just emerged from decades of colonialism. Thus, at that time, the coastal landscapes of the Sahelian region, in general, and the Sousse region, in particular, were formed, essentially, as the following figures show, by a succession of traditional vegetable crops plots (called chatts) and olive groves. The latter were particular and occupied most of the fertile coastal lands of the region [17]. The impact of coastal artificialisation, notably on the environment and sustainable development, is found not only in the Sahelian region of Tunisia but also in several countries of the Mediterranean basin, such as: Morocco, where tourist and resort urbanization has taken place in the form of a ribbon along the beaches and on former coastal agricultural land, and Algeria, where diffuse urbanization generated in particular by the most widespread form of dwelling which is the form of individual dwelling, has invaded coastlines such as those of the city of Oran. This development of coastal tourism infrastructure has therefore not been made for the sake of sustainability, given that we have noticed that, in recent decades, tourism has been turning more and more towards new concepts. We are no longer talking about seaside tourism alone (this concept is the main reason for the coastal polarization of tourist infrastructures) but also about other concepts among them cultural tourism, green tourism and agritourism. Tunisia has important potentials that could be essential in promoting these new concepts. Among these potentials: coastal agriculture. Indeed, the Sahel region is characterized not only by its tourism but also by its agriculture located on the seafront and which is entirely productive. This agriculture could play, in addition to its primary function of food production, other functions that can be assets for the promotion of tourism respectful of the environment and perfectly in agreement with sustainable development of the region. It could also be one of the links in the chain that would lead to environmental protection and sustainable development of this region.

2.3 Practices for Sustainable Plant and Soil Production

Six potential practices for Sustainable Soil Production are updated. The first potential practice is sustainable agriculture in some Arab Maghreb countries (Morocco, Algeria, and Tunisia). Agriculture has changed fundamentally and over time has

become the main economic sector responsible for multiple environmental impacts. The environmental impact of a pesticide depends on the degree of exposure (resulting from its dispersion and concentration in the environment) and its toxicological characteristics. Intensive agriculture exposed Arab Maghreb countries (Marocco, Algeria, Tunisia) to chemical pollution in irrigated areas: contamination and degradation of water ground, watercourses and soil, mainly due to the use of mineral fertilizers and crop protection products [18]. As many countries in this planet are exposed to climate change, due to the bad management of this fragile sector, the reduction of yields in Arab Maghreb countries depends on climate changes [18, 19]. Without forgetting the lower levels of the agriculture users, they had the hard effects on agrosystems then on the environment [19].

The second approach is the possibilities of mineral fertilizer substitution via bio and organic fertilizers for decreasing environmental pollution and improving of sesame (*Sesamumindicum* L.) vegetative growth. Nitrogen is an essential element for other vital processes like carbohydrates, proteins, metabolism, and (reinforcing both stages of cell division and cell enlargement). Potassium is playing a vital role in stimulating the enzymes and fight biotic and abiotic stresses such as cold, diseases, waterlogging, other opposite conditions [20], pests, drought, salinity. Mineral fertilizers are expensive, not easily available, and increasing its doses about plant needs lead to environmental pollution. Possibilities of partial or complete substitution of mineral fertilizer via bio and organic fertilizers were assessed for improving the characteristics of sesame vegetative growth and contributing to decreasing environmental pollution. The sesame plant is an important oilseed crop, which has medical and pharmaceutical uses. Its seed oil contains some of vitamins and minerals such as copper, calcium, high content of phosphorus, iron, magnesium, manganese, zinc, and vitamin B1.

The third potential practice gives an overview of the animal and Rangeland resources in Shalatin—AbouRamad—HalaibsTriangle Region (SAHTR), Red Sea governorate, Egypt. Shalatin—AbouRamad—HalaibTriangle Region (SAHTR) has vital and strategic importance to Egypt. Due to harsh climatic conditions, low and erratic rainfall precipitation and lack of knowledge, there is no any traditional agriculture activities [21]. The major income and food sources have been traditionally through nomadic animal husbandry and trading. A part from livestock, other traditional sources of income is charcoal, wild honey, medicinal herbs, and seed collection. A combination of severing long–lasting drought and loss of access to traditional grazing areas has dramatically undetermined the continued viability of their nomadic pastoralist way of life. Most of them loose their animals and become extremely poor and food insecure, with high levels of malnutrition amongst women and children. The chapter focuses animal and natural range resources in Shalatin—Abou Ramad—Halaib Triangle Region (SAHTR) to identify the potentialities of animal and rangeland resources; main constraints and problems that would help in planning specific strategies for developing animal production in the region and enhancing local Bedouin's welfare.

2.4 *Industrial, Landscape, Touristic and Political Approaches for Agro-Environment Sustainability*

Six sustainable industry approaches are identified. The first approach is the Chemical Industry Vis-A-Vis Sustainability In MENA Regions: The Case Of Tunisia. While the second approach is the sustainable mining site remediation under (Semi) Arid Climates in the Middle East and in Northern Africa. The Djebel Ressas Mine in Tunisia as an example of the Orphaned Mines Issue. Orphaned mines after coal, metals, oil shale, and other extracting, are a universal problem all over the world, in different cultures [22]. As primary effects, if the underground or open cast mining is stopped, abandoned mines can cause unstable underground structures or a heightened exposure of minerals releasing chemicals, for example. As secondary effects, deforestation, erosion and groundwater contamination from isolating metals can follow, among others. As a tertiary effect, areas near open-cast mines can become inhabitable. For example, as mining often affects the groundwater levels via pumping, the stopping of the mining activities does not only restore the former groundwater levels. It may also create an artificial hydrogeological situation where the underground aquifers are even destroyed. Even if the site remediation addresses the groundwater levels' restoration, the water quality could be deteriorated by heavy metals and other pollutants such as radioactive substances. So for agriculture and human habitats, the availability of fresh, unpolluted water is a key issue. The semi-arid climate limits the water availability in the MENA area, so water issues will be among the top priority future issues. For the third approach is the steppe ecological systems dynamics: between conservation of diversity and adaptation to agropastoral production systems.

The second approach is the agricultural landscape of Sahel Bizertin: A Heritage in Peril. The knowledge of landscapes as a value has become very distinctive and topical in the last decades. The landscape with harmonious and consistent relations between human activity and preserved nature is an essential competitive advantage. A recognizable outstanding landscape presents above all the identity of a certain area at different levels. The treatment of the landscape also depends on the attitude of society towards it, thus influencing the state and image of landscapes and the quality of our life. The Sahel of Bizerte is rich in heritage and landscape identity reflecting the evolution of the human occupation of the territory. The heritage value of the landscape is mainly due to the time.

The third approach is the urban tree: a key element for the sustainable development of Tunisian cities. A number of programs and projects aiming to improve the quality of life in urban and rural areas, have been developed by the Tunisian Ministry of the Environment and implemented. We can cite the program of the promotion of urban aesthetics (green spaces, urban parks, environmental boulevards, boulevards of the earth, strategic routes and entrances of cities …), besides the program of assistance to the preparation and implementation of Agenda 21 and urban development strategies. Green spaces are an essential element for the aesthetics, setting and quality of life of a city. They help to ventilate the cities and must be considered as the lungs of the city. They are places of relaxation, walk, rest, games for the youngest, sports fields

for all ages. It was necessary to return to the role of the tree in the city, a role that merges with the three pillars of sustainable development because of its benefits for the territory, for man and society. Then, it was about to see the short history of the introduction of the tree in urban areas in Tunisia and especially in the city of Tunis. The tree that was having a role only food now is having an ecological ornamental role and even symbolic.

The fourth approach is related to the question: What prospects for sustainable tourism development in Hergla (Tunisia)? Hergla is an old farming village located on the eastern coast. It is located to the north of the integrated El Kantaoui Tourist Resorts, in the governorate of Sousse. Faced with the natural and cultural specificities of the site, the authorities are compelled to adjust tourism spaces otherwise in response to new international standards in terms of sustainable tourism. Tourism is affected by a tight transformation aimed at a development that is inevitably more sustainable [23]. To achieve the principles of sustainable development, the Charter initiates the creation of new partnership relationships between the main actors involved in this activity, in particular, the territorial actors, to forge the hope of developing more responsible tourism in regard with our common heritage. Moreover, tourism development is part of a global land management, which integrates local actors. Indeed, "the concept of sustainable land management (SLM) offers solutions that go beyond technologic recommendations by including aspects of social participation and policy dialogue".

The fifth approach is the climate factors affecting sustainable human and tourism comfort in Aswan Governorate. Tourism has become one of world's most notable industries and is a main driver for many countries' economies around the world. The development of tourism should be sustainable, but the issue of how this can be achieved remains the subject of discussion. Sustainable tourism is the application of sustainable development ideas to the tourism sector, that is, tourism that meets the needs of the present generation without compromising the ability of future generations to meet their own needs [24]. The tourism industry, which is mainly an outdoor economy, can be particularly vulnerable to climate and weather effects [25]. Weather and climate variables can affect seasonal tourist arrivals, affecting financial activity's sustainability [26]. Climate and its various components influence, directly on the human body and its social and psychological life. Because the place chosen by the tourist must have adequate climatic and environmental conditions for his movements and needs, which is different from the place where he lives, therefore, the elements of climate are one of the most important natural geographical components on which tourism is based.

The sixth approach is the Agri-environmental policies: Comparison and critical evaluation between EU and Egyptian structure. Everyone and every country contribute to today´s challenges and the achievement of the 2030 Agenda. For example, "the way we produce and consume food is causing major environmental and human health issues. Transforming the agri-food system has become a priority for achieving Sustainable Development Goals. Food must be produced, distributed, consumed and disposed of in ways that optimize resource use, minimize greenhouse gas emissions, avoid chemicals that harm ecosystems or human health, and

stop further loss of biodiversity", states the United Nations Environment Programme [27]. Agricultural transformation is believed to be vital for achieving a sustainable future and being able to contribute to the achievement of several SDGs [28]. Agriculture uses a lot of land—37% of the total land area are being used for agriculture worldwide [29]. 70% of all freshwater withdrawals go to agriculture for irrigation [28] and many more resources are involved. Thus, it is certainly true, that agriculture can cause damages and induce negative impacts. On the other hand, however, agriculture produces what we all need for living: food. It employed 27% of the world's population in 2016 [29] and is thus the main source of income for a lot of people worldwide. In the European Union (EU), 39% of the total land area were being used for agriculture in 2016, yet only 4.2% of the population worked in the agricultural sector at the same time [30]. In 2017, agriculture contributed to just 1.7% of the gross domestic product (GDP) [30]. In Egypt, however, agriculture is the largest employer providing income-generating activities to more than 30% of the workforce [31]. The agricultural sector plays a central role in the Egyptian economy as it accounts for 14.5% of the GDP [31]. At the same time, the estimated land under agricultural use consists of only about 2.5% of the country's total area (24,960 km^2 of 1 million km^2) [32].

3 Conclusions

Throughout the course of the present book project, several conclusions drawn from this book were reached by the editorial teams. In addition to methodological ideas, the chapter draws important lessons from the book cases, in specific the agro-environmental sustainability covered themes. This book provides the present challenges faced by the agro-environmental sustainability in MENA Regions. In order to improve the sustainable environment in MENA Regions, these findings are crucial. Based on the materials described in all chapters of this volume, the following findings could be indicated:

1. The expected impacts of climate change on the water resources in Egypt are related to rainfall patterns over the Nile Basin and evaporation rates over open water bodies. Therefore, some of the available climate change impact studies for the Nile River Basin and Egypt were reviewed in this article to provide helpful literature for future climate change studies in Egypt. There is a consensus among the regional climate projections performed in the literature indicating a general increase in precipitation during the main rainy season (JJAS) in the Ethiopian Plateau, where both the Blue Nile and the Atbara River have their sources (the main freshwater source in Egypt). For other seasons, no significant model agreement was found. For the Nile Equatorial Lakes region, however, most of the models indicate a significant drying during the summer and a general increase in precipitation during the winter. Furthermore, most of the studies concluded that the uncertainties in predicting the impact of climate

change on Nile flows are very high, which complicate the proposed plans of water resources in basin countries.

2. The applications of wastewater treatment by biofilm technologies were successful in improving wastewater treatment efficiency in the MENA region. In the two previous pilot projects in Jordan and in Tunis, the treated wastewater was usable for irrigation after disinfection or discharging to the appointed recipient according to the local wastewater disposal standards. The generated excess sludge in the two above pilot projects was exposed for drying in sludge drying bed for composting and sludge reduces from the wastewater treatment stages, and also the sludge as an end product. This is after ensuring that it meets the local reuse standard which can be reused safely in agriculture or for any other sludge disposal purposes.
3. Water has particular importance in the agricultural sector, particularly in arid and semi-arid regions, but water resources are increasingly scarce. Having reached a high level of mobilization of these hydraulic resources, Tunisia is now confronted with the imperative to better manage and valorize them. The study of the olive water needs allowed more efficient management of the water supplies and saving in irrigation water and this by an estimation of the needs in water by using more precise methods integrating the maximum of parameters from the Soil–Plant-Atmosphere continuum. Each of these methods is based on a set of climatic, edaphic and/or physiological parameters of the olive tree. The study of the water requirements of the olive tree in a semi-arid region has allowed us to manage water supplies more efficiently and save on irrigation water using the climatic method and/or the physiological method. The evaluation of the different irrigation doses applied according to the climatic (T2 = 60% ET0) and physiological (T1 = 100% sap flow) methods and in relation to the transpiration of the trees measured by the sap flow method, allows to note that the higher the irrigation dose is, the highest is loses by transpiration.
4. Some of our recent results in the context of the stochastic hydrological processes modeling and prediction in case of time-varying linear systems are presented. It concerns water resources in the northern part of Algeria, where discrete Kalman Filter technique has been applied to the modeling and prediction of Stream flows and rainfalls in a number of sites simultaneously (multi-site) for each of the monthly and annual scales. The developed operators have the particularity of automatic self-adapting as soon as a new measure becomes available. This is an advantage of the KF algorithm recursive character that can be used in real-time predictions. As a result, optimal stream flow and rainfall predictions are obtained considering time variations of the underlying hydrological generating processes, as well as their stochastic character. The obtained predictions can be appreciated from a temporal point of view, where observations and predictions in a single site are obtained during a period of time, but can also be the extent to any further step where observation is available. These predictions can also be appreciated from a spatial point of view, where observations and predictions in all considered sites are obtained during a period of time, but can also be the extent to any other site

where observation is available. One of the most important advantages of the developed operators is to provide the error prediction covariance matrix with certainty at each calculation step. This is of great interest because it constitutes a measure of the prediction accuracy at each step calculation. The accuracy of the predictions, consequently the suitability of the operators, has also been checked by the prediction relative error in percent whose overall average value is less than 10% which is highly acceptable. Another advantage of the developed operators is that the algorithm may be initiated with very little objective information and the prediction is obtained in the time-domain. This is of great interest because it offers a real time forecasting possibility. The developed operators are interesting because they can help policy and decision-makers in water resources in Algeria acting efficiently for a better management and sustainable development of such resources in the country.

5. There is a clear need for agricultural extension services to support the education and awareness of breeders. In the Archipelago, a dominance of ovine breeding (73%) based on an aboveground farming system is noted. The majority of the breeders use the hay, the concentrated, and the agropastoral food as basic ration completes what establishes a constraint. Furthermore, the analysis of the ovine reproduction system shows that 94% of the breeders do not practice mating against the season, which explains the lack of knowledge of the breeding conduct. Also, more than half of the sheep and goat breeders do not apply the techniques of flushing, destemming and of creep-feeding.
6. Land degradation is threatening the livelihoods of some Two billion people living in the world's drylands. Remote sensing data and Geographic information systems provide essential base information for integrated, region- or problem-specific approaches combining satellite data products with specific GIS interpretation and modeling approaches for land degradation assessment. There are many products of remote sensing data with different spatial and temporal scales. These products are very useful for deriving spectral indices that contribute in land degradation assessment. Also, the geographic information system (GIS) is a database management system that deals primarily with spatial and temporal data and gives the ability to model land degradation derivatives and processes. Some land degradation assessment frameworks were developed under the umbrella of remote sensing and GIS. Those land degradation assessment frameworks are more accurate especially in the way of determining the land degradation indicators and derivatives, and also in the monitoring of the processes of land degradation and how they are changed spatially and temporally. This chapter focused very briefly on the role of remote sensing and geographic information system in the assessment of land degradation, with some attention to the research of assessing land degradation in Egypt using remote sensing and GIS.
7. Precision farming or precision agriculture or site-specific land management is relatively a new farming technology for increase soil and crop production. However, precision farming technology includes remote sensing, GIS, DGPS,

yield map, variable rate application, soil sampling, and site-specific management zones. The main aim of precision farming include a good understanding of soil and crop variability within-field and follow up by farm management inputs depending on the main source of the variability. In the last two decades, precision farming technology has been more and more developed, including mechanization and automation. Site-specific management has been an important sector of the agricultural system of the developed countries, but the implementation of this high technique of precision farming to farm through the farmers in developing countries is still very slow and needs a lot of extension efforts and farmer motivation. Due to most farmers do not know new information technologies, e.g. remote sensing, GIS, and GPS. The government should be made to increase investments to educate farmers for the application of new methods and technologies in agriculture. The size of the agricultural land is another problem for adopted precision farming technology in some countries like Egypt. Egyptian farmers and experts should use the PF experiences that have been used by developed countries such as USA, Germany, and Japan.

8. Today's context, triply marked by economic globalization, socio-technological changes and ideological and political uncertainties, poses new challenges for developing countries. Local governance consists of a set of institutions and mechanisms. Processes that allow citizens and citizens' groups to express their interests and needs, to settle their differences and to exercise their rights and obligations at the local level. Today, we talk about the attractiveness and competitiveness of territories, territorial anchoring of companies, industrial districts, territorial projects, etc. However, the question is no longer simply to initiate local projects but to ensure those synergies are created between the actors and accelerate the local dynamics observed in territories that remain to be built. What is the real contribution of these projects to problem-solving at the local, regional and national levels? How to act effectively and accelerate the dynamics of growth and development? In other words, how to move from localized action to a territorial approach to development problems? These are the questions facing Morocco today regarding local development.
9. The coasts of the Sahelian Tunisian region have undergone spectacular transformations throughout the decades that followed the independence of the country. Indeed, from an open green space, they have become the capital of tourist and resort urbanization. These transformations have not been without consequences including social, landscape and environmental. The installation of this urbanization has led to an artificialization of the coast; a barrier seems to have been erected between the coast and the hinterland. This barrier, formed by a narrow cordon of urbanization, has relegated coastal agriculture to the hinterland and has also given rise to a form of social segregation since most of the coastal territory has been invested by the tourist sector which privatizes the beaches. All these transformations have not been without environmental consequences. The precarious balance of this portion of the territory has been weakened by the large consumption of space of tourist and resort urbanization and by the acceleration of coastal erosion, mainly due to: the location of

the urbanization in front of the sea, the destruction of the coastal dune, the degradation of spontaneous plantations by the discharge of swimming-pool water, etc. However, until the end of the 1970s, coastal and traditional agriculture occupied most of this territory and, in addition to its social and landscape functions provided an environmental balance for this fragile area. The urbanization of the coastlines and its social, landscape and environmental impacts are a phenomenon that affects the majority of countries in the Middle East and North Africa and, in particular. Morocco where coastal farmland is giving way to tourist urbanization.

10. The Arab Maghreb countries (Morocco, Algeria and Tunisia) are among the growing countries whose economy is based on natural resources, agriculture and industry. Agriculture is practiced in a traditional and modern way, with large areas, irrigated and non-irrigated, which have absorbed a lot of work to ensure the availability of food. Since the independence of these countries have changed the policies, plans and programs for the recovery of this sector, but so far have not achieved the desired objectives, which are demonstrated by the large volume of the bill of the importation of basic foodstuffs. The geographical situation of the Arab Maghreb countries in the South of the Mediterranean sea, which is characterized by a semi and arid climate, lack rainfall generally, in addition to the random and excess use of water in the agricultural system, and even in drinking make these countries exposed to water shortage crises several times in their history, and this has had a negative impact on their environment in general: on soil structure, on vegetable biodiversity, and even on climate change; and these changes have also had a negative impact on the agro-socio-economic system. The impact studies available in these countries, though rare, have been shown to be intensive agriculture using many chemicals (fertilizers and pesticides) plus the human factor (unskilled) leads to soil pollution, water and air, as well as human exposure to health problems. Sustainable agricultural production and conservation of the environment is a dream for these countries comes after the dream of food insurance for lack of qualified human potential and material possibilities.
11. It can be concluded that the mineral fertilizer was partially replaced by the treatment of 50% of mineral in interaction with 50% of compost gave the highest values of the dry weight of whole plant (g), the dry weight of shoot (g), absolute growth rate (mg day^{-1}), and unit shoot rate (mg mg^{-1} day^{-1}) in the first season. Also, the treatment of 50% of mineral in interaction with 50% of compost attained a maximum value of absolute growth rate (mg day^{-1}) and unit shoot rate (mg mg^{-1} day^{-1}) in the second season and in both seasons. Treatment of 100% of bioformulations recorded the highest value of the dry weight ratio of shoot/root in the first season and in both seasons. Treatment of 100% of bioformulations in combination with 50% of mineral achieved a maximum value of total chlorophyll content (%) in the first season and in both seasons. Treatment of 100% of bioformulations combined with 33% of compost and 33% of mineral gave a maximum value of the dry weight of root (g) in the first season and in both seasons.

12. As a result of the factors mentioned above, there was a significant effect by the combination of K-feldspar at different diameters and vermicomposting with SDB on yield, NPK-Si-uptake of wheat plants, available potassium and silicon in the soil. The application of K-feldspare > 45 μm combined with Ver in the presence of SDB gave the highest values of straw and grains yield of plants, the weight of 1000 grain, biological yield, protein content, NPK and Si-uptake, available K and Si in the soil. The available potassium and silicon were remarkably increased after 75 days at all treatments by application of various diameters of K-feldspar at different diameters and vermicomposting with SDB.
13. Shalatin—AbouRamad—Halaib Triangle Region (SAHTR) has vital and strategic importance to Egypt. It is characterized by broad biodiversity of both plant and animal resources. Livestock production on the native ranges of Shalatain—AbouRamad—Halaib Triangle Region. Red Sea Governorate is facing several major constraints mainly: drought, feed and water shortage, diseases, and environmental stresses.
14. The use of tree or shrub species that are capable of developing under conditions of extreme aridity and absolute marginality of soils represent a significant solution to the problem of desertification in the Mediterranean basin. Among these species, *Opuntiaficus-indica* is a potential candidate in rehabilitation programs besides to its food and forage properties. Our findings showed that after the establishment of *Opuntiaficus-indica* in arid and semi-arid steppes. There is an improvement in the environment, particularly in soil organic matter due to the accumulation of litter and vegetation cover. These plantations act as a refuge to plants or resource-plant for the sequestration of seeds that cannot be established elsewhere, and thus creating a favorable microhabitat. In addition, this species is mycotrophic (mycorrhizal colonization > 80%) that can contribute to the improvement of soil quality. All of these statements require certainly more elaborative and exhaustive studies to reinforce the inferences and conclusions: such as soil study at the foot of the shrub instead of interspacing or investigating soil enzymes that are considered as consistent indicators of any change in soil condition. The expansion of PPP is emerging as a promising strategy for raising resource dynamics and restoring vegetation in arid and semi-arid environments. The evaluation of the rehabilitation actions can be developed for producing aided decision tools for programs of combating desertification. Long-term rehabilitation with this allochtone species is possible because this cactus is a long-term soil stabilizer and without ecological requirements.
15. The soils of the Tadjmout perimeter belong to the arid zone. The analytical results show that these soils are at alkaline pH Cation exchange capacity (CEC) relatively average, which does not exceed 15 Cmol/kg; Low to medium and sometimes high salinity (EC); Exchangeable phosphorus: the values are between 26.62 and 34.87 ppm. This high content of exchangeable phosphorus could be due to phosphate fertilizers. Exchangeable potassium has average to low values. These soils require fertilization to improve their chemical fertility. The thematic maps allow us to manage a fertilization plan to improve the

chemical fertility of these soils, in order to increase agricultural production. It is imperative for the agricultural exploitation of arid soils in the context of sustainable development, further research based on experimentation and monitoring over a long period.

16. The main areas of rangelands are distributed over the Northwest Coast region, the Sinai Peninsula and the Halayeb-Shalateen region in the southeast corner of Egypt bordering the Red Sea. The increase of the number of palatable perennial forage species indicates that the pasture condition in the study area is generally good. Also, the vegetation potential has not been destroyed, and that there are some chances of improvement and development. The studied species can be ranked depending on its palatability and the percentage of DCP, TDN and water content as follows:*Alhagigraecorum. Asphodelusramosus,Panicum turgidum, Lyciumshawii,* new sprouts of*Pharagmitisaustralis,Gymnocarpusdecander,* fruits of *Acacia tortilis,* and new sprouts of*Juncusrigidus.* The productivity of *Alhagigraecorum,* Pharagmitis*australis,* and *Juncusrigidus* is high and these plants cover a wide area in the Egyptian Oases.These species vary in their chemical composition that may meet the requirements of the grazing animals. Most of the palatable shrubs had a low value of density due to these species subjected to heavy grazing. The grazing and burning had a negative effect on *Pharagmitisaustralis*particularly on productivity and palatability. The burning improves the palatability of *Juncusrigidus.* Most of carrying capacity of the eight range plants are reported are high.
17. Humanity is forced to adopt the concepts and requirements of sustainable development to handle the fragility of ecological equilibrium and the degradation of the environment as a result of the imperatives of socio-economic development. One of the pillars of this requirement is to continuously monitor the state of the environment through an operational information system that can assess and support the actions and policies of society towards the environment. The implementation of such systems encounters difficulties in developing countries due mainly to problems of availability and scarcity of data. This study provides an overview of the different issues concerning this topic and presents a list of suggestions to overcome these obstacles.
18. Throughout this article, we have shown that the interest of the agricultural landscapes of the Sahel of Bizerte is not limited to the fact that they offer a remarkable aesthetic beauty.We have also been able to show that the key to the preservation of an agro-biodiversity an overall meaning and present a valuable cultural heritage, but they also provide multiple sustainable solutions related to work, to food and the well-being of farmers. Although in most countries of the world, modernity has been characterized by a process of cultural homogenization and economic, in many rural areas, specific cultural groups are still associated with a geographical context and society in which there are special forms of agriculture. Dynamic conservation of these sites and their cultural identity may be the starting point for territorial development and social and cultural renewal.

19. For post-mining site remediation, the finding and application of environmental quality targets is feasible and can be modeled after projects like "Saumon 2020" or its predecessor "Saumon 2000". Redevelop the current nature reserve around the Djebel Ressas mountain top into an area in which *Macacasylvanus*is to be resettled into a habitat suitable for that species. That can be implemented if the growing cement works still allow such a measure. For Phytoextraction, Phytostabilization of the affected soil by adapted plants, Alfalfa could be used. However, as the Barbary macaque needs trees such as in "high cedar forests *(Cedrusatlantica),* cedar/holm oak *(Quercus ilex)* mixtures, pure holm oak forests and cliffs and gorges dominated by scrub vegetation.", the fauna must be adopted: The dietary habits of the ape species need to be considered: "Its diet is primarily composed of cedar *(Cedrusatlantica)* and the oak *(Quercus sp.),* which make up over 50% of its total intake. It eats fruits (33% of its intake), tree leaves (16%), and other plant parts (24%)." The local population should be fenced, in a natural way by trees and bushes, from the mining deposits' flue dusts so that the exposure to heavy metals via inhalation and ingestion is closer to international WHO levels than under the current conditions. Also, under a site remediation scheme, jobs in local projects can be created to ensure high acceptance levels among the inhabitants of Djebel Ressas village and the surrounding area.
20. In Tunisia and in the largest Tunisian cities, green spaces were born with the extension of the European city outside the medinas where this notion is totally illusory. Tunisia has also become, over the years, an attractive tourist destination, since then, the public authorities have tried to promote the creation of green spaces by multiplying the national programs of the creation of urban parks (PNPU), development of city entrances, creating boulevards of the environment in all Tunisian cities. The creation of green spaces in urbanized areas has become a recurring message in messages conveying an environmental policy, especially after adhering to the precepts of "sustainable development". Green spaces have been rationalized as urban equipment as well as cultural, sports or health facilities. They have been standardized in the form of m^2 per capita (the public authorities have set a minimum of 10 m^2 green space/inhabitant). This minimum standard was required for any new development project. Tunisian green policy should be more in the direction of a green infrastructure aimed at restoring connections between existing natural spaces and improving the ecological quality of the environment as a whole. For this, it may include several natural components (protected areas, wetlands, forests, etc.) as well as multifunctional areas in which priority is given to land uses that maintain or restore healthy and diverse ecosystems rather than other harmful activities. This could support the construction of "villedurable" while taking into account the preservation of biodiversity in current urban planning.
21. Several main results arose on the basis of an assessment of the present research. The issue of the effect of heat and humidity on human well-being in Aswan Governorate in general, as reflected in this study, is still considered new to the Egyptian Geographic Library. The importance of the topic of human well-being

in Aswan governorate, where there are climatic differences effects on human well-being. The development of meteorology in Aswan governorate and the availability of modern climate data for different climate elements throughout the year, thus enabling the use and adaptation of such data to serve geographical research.

22. This study reviews the 2030 Agenda as a blueprint for water and ecosystem services in the context of agriculture. For both Egypt and the EU, implementation of this international consensus could lead to improved water handling and agricultural practices. Reviewing already existing legislation or ensuring its implementation can also be regarded as an important approach. Our results show that the 2030 Agenda with its ambitious targets has been adopted and to some extent, already passed into law by the EU member states and Egypt. However, these laws and decrees have to be adequately enforced for some of the targets to be achieved by the EU member states and Egypt. Results also show that there are still gaps to close, especially in areas where no new legislation has been introduced in the last two decades. Today, the whole world is in the same boat when it comes to the sustainable development pathway—with or without the 2030 Agenda. To put it simple: The UN member states committed to the SDGs and to providing voluntary reports about their progress. Thus, a development towards the achievement of the 2030 Agenda's targets should only be a question of time—and time is of the essence.
23. The Hergla site, through its landscape and local cultural, is quite potential for tourism development. Faced with the disengagement of the State and the weakness of local actors, the rise of private actors can lead to tourism development not in compliance with the principles of sustainable development. This observation inspires us to work more on governance and new perspectives of tourism planning, in Tunisia in general.

4 Recommendations

The capacity to adapt to future problems is a main element of agro-environmental sustainability in MENA Regions. We contend that to accomplish this objective, agro-environmental sustainability needs integrated flexibility. The editorial teams observed certain aspects that could be explored for further enhancement throughout the course of this book project. Based on the results and conclusions of the contributors, this chapter provides a number of recommendations that provide suggestions for future scientists to exceed the limited scope of the book to the future unlimited space of the topic.

1. The following are suggestions for possible future researches related to climate change impacts on water resources in Egypt: Evaluating the updated IPCC [33] climate change scenarios to have a comprehensive assessment of climate change impacts on different hydrometeorological processes (e.g., evapotranspiration and precipitation) in Egypt, updating Regional Climate Models

capable of predicting the impact of climate change on the local (Egypt) and regional (Nile Basin) water resources and studying the basic characteristics of stream networks that contribute to flash floods by using advanced tools (e.g., GIS and remote sensing). Investigating the impact of change in both land use and climate on hydrological processes and water resources and conducting comprehensive research on the joint impact of climate change and new water projects on the water resources of the Blue Nile and assessing climate change impacts on food security, energy, and water resources.

2. Biofilm system applications normally faced a several operations problem in the region. Some recommendations have to be taken into consideration. Fats, oils, Solids and Suspended solids, and greases must be removed or minimized in the influent by very good pre-treatment efficiency to protect the biofilm and its specific surface area. This leads to an increase pf the Biofilm treatment efficiency. If there is a high concentration of BOD5 and TSS in inflow, then some pre-treatment may be required to reduce it. Researches demonstrate that biofilm technologies should be designed based on surface area loading rate (g COD/m^2d), and the Media material and type play an important role in such treatment process. For tricking filter: Pressure distribution should be required for the design option in order to strive for equal distribution of effluent at the design organic loading rate and also to keep the attached biofilm wet. Some methods of effluent quality monitoring may be necessary. An intermediate clarifier tank is useful to build between treatment stages to draw out the sludge produced and to keep the attached bacteria working in its full capacity; this will increase the treatment efficiency.
3. Deficit irrigation strategies, applying climatic or physiological methods, allow better water use efficiency for olive orchards without affecting yield or fruit and oil quality. The physiological method (T1), equivalent to 32% of the ET0, allowed us a saving in water of the order of 50% in comparison with the climatic method. So the physiological method allows for more efficient management of water resources. To apply the physiological method in different bioclimatic stages, the use of transpiration modelingin relation to climatic parameters is necessary to meet the needs of the economy and the management of water supplies.
4. Precision farming systems can be implemented in developing countries through collect information about soil and crop using new information technology. Collecting data on the spatial variation in soil and crop features requires accurate position determination in the field, using GPS. Differential action. In response to spatial variability, farming operations, such as sowing rate, fertilizer, pesticide and lime application, tillage and water use, can be varied in real-time across a field. Variation in treatment corresponds to the mapped variation in the field attributes measured using remote sensing technology, GPS and GIS. Soil and crop monitoring. Soil and crop attributes are monitored on a finite scale. When observations are targeted with GPS, and remote sensing they provide data on the spatial variability of the attributes within a

field. Values for soil and crop attributes are predicted for unsampled locations across a field using GIS. This enables a detailed representation of the spatial variability within an entire field through the creation of a smoothed map. Knowledge about the effects of field variability on crop growth—and the suitable agronomic responses—can then be combined to formulate differential treatment strategies (http://www.fao.org/3/a0869t/a0869t04.pdf).

5. We recommend decision-makers to use the agrarian diagnosis method merged to new agronomic technologies for planning a future strategic plan. [10] Has proposed the introduction of this technology to improve the quality production, with the concern to save water in irrigable areas and to cultivate varieties adapted to the weakness and the irregularity of the pluviometry in rainfed areas, using energy-saving techniques energy and inputs from oil. The recommendation can be applied to different MENA agrarian systems.
6. First, the "urban and landscape soils" will recognize the quality of "urban and landscape terroir" in the periurban areas in which, the communes, departments, regions, and the state wish to carry out voluntary, concerted and contractual action. This label would be concretized by: the signing of a charter applicable to a territory; the definition of social, urban and agricultural objectives to respect to manage the space and requalify it when it is degraded; the mobilization of cross-financing State-local authorities. Second, develop the land policies of local authorities by: Including an agricultural and landscaping component in city contracts in order to treat peri-urban space as a heritage and dynamic component of the city; Reconsidering the question of property assessments, in particular, to enable municipalities to purchase land if they so wish and facilitate the maintenance of agriculture; Third, create regional environmental public institutions: These agencies would ensure the protection of peri-urban green and agricultural areas under; Allocate them a share of the proceeds of the departmental tax of sensitive natural areas.
7. The tourist development of the Tunisian Sahel region has, of course, had major repercussions on the economy of the region, which has become one of the most important Tunisian tourist polities, but this has not been without consequences both socially and environmentally. Moreover, today, tourist demand has evolved towards other centers of interest. Similarly, new concepts applied to the tourism industry have promoted its sustainability through the development of a "Sustainable Tourism" based on the respect, preservation and development of environmental aspects economic and sociocultural countries. Tunisian, in general, and Sahelian tourism, in particular, must set out new directions for its development. It is, therefore a question of stopping the increasing densification of the tourist zones and of easing the pressure which is exerted on several sites, including, in particular, the natural and agricultural sites of the Sahelian littoral. These should be protected and introduced as an integral part of a new tourism offer, based on the multifunctionality of agriculture and in accordance with the rules of sustainable development. The Tunisian Sahel is also the site of traditional coastal agriculture. The latter could play an important role, within the framework of this new tourist offer, on the one hand: its singularity, the

quality of its products, its contribution in the fight against the erosion of the beaches, its maintenance as an open space to inside the coastal urbanization, etc. …

8. Water is a natural resource; where there is there is a life, balance and sustainability. It is important to these Maghreb countries to study how to exploit this dear gold to their life, eventually for their food security: Storage of rainwater in dams and distribute tightly in agriculture and drinking. Establish strict laws prohibiting water loss. It is best to irrigate cultures by drip system. Cultivate varieties in appropriate places according to their environmental needs (soil, water and temperature). Uses desalinate water of the sea or the ocean. It is necessary to fertilize the poor soil, and to control plant diseases with bioproducts to avoid negative impacts of chemical products. Climate change, always followed by special attention to the soil and the cultivation of plant varieties adapted to the new climate. Most important for preserving safety agriculture without impact on the environment; It is the human factor that practices agriculture; it needs to be structured to understand what it is for sustainable agriculture.As well as coordination between all actors in the agricultural sector.
9. The recent major problem facing the farmers is the high coast of chemical fertilizers. The alternative depending on expensively imported fertilizers is to exploit indigenous resources such as K-bearing minerals. Making use of such minerals is meaningful in increasing crop yield and protecting the ecological environment. The main source of K and silicon for plants growing under natural conditions comes from the weathering of K minerals and organic K-sources such as composts and plant residues. The application of K-feldspare at different diameters combined with vermicomposting at the rate of 2% (20 Mg ha^{-1}) in the presence of silicate dissolving bacteria increases yield, nutrient uptake of wheat plants and available nutrients in sandy soils. Finally, From an economic point of view, this approach of using the naturally deposited materials (K-feldspar) instead of chemical fertilizers or combination together or mixed with vermicomposting will be very beneficial for the farmers who subsidize the costs of chemical fertilizers (potassium sulphate).
10. All efforts should be directed towards setting up a sustainable national strategy to improve both rangelands and livestock production which has the following tasks: Optimum utilization of the available local feed and drinking water resources—applying proper approaches for native range management and conservation. Development of watering points combined with proper control of grazing. Utilizing the available non-conventional feed resources efficiently. Genetically constitution improvement, particularly through the selection. An effective program for the improvement of feeding, disease control, and management should precede any attempt at genetic improvement. They were providing proper assistance and advice to local Bedouins or investors to best utilize available resources, strengthening the cooperation between scientists, specialists, policymakers and Bedouins.
11. The experiences of the countries with PPP are quite developed. PPP show its importance in the valorization of degraded soils, in the use of cladodes as fodder

for animals, and in human consumption (fruits and extraction of essential oils). It would be wise to develop this culture for agricultural and rural renewal in the arid and semi-arid zones: (i) to develop the agroforestry approach and associate the cultivation of *Opuntia* spp. with the suitable crops in particular olive, pistachio and legume trees, (ii) initiate research projects on improving planting techniques to improve yields (study the effect of interline spacing, planting in pots or inline), (iii) sensitize rural populations on the different uses and ecological functions and services of this crop such soil protection, agricultural, industrial, cosmetic, culinary uses, and (iv) develop the role of rural women by integrating them into all income-generating activities.

12. The mapped soils require phospho-potassium and nitrogen fertilizer maintenance to improve their chemical fertility. Before the planting of each crop, the analysis of nitrogen and phosphorus in the soil is necessary in order to avoid pollution of groundwater.
13. Using the reported species as forage resources particularly in the dry season. Complete protection for at least five consecutive years in some sites of the communities of *A. ramosus* and *L. shawii*to increase their regeneration and productivity. It would perhaps be advisable to reseed, or established as mother plants the endangered high palatable species e.g. *L. shawii*, *Gymnocarposdecander*especially in the soil deep enough and soil moisture content is high. It would be useful to utilizating high techniques of water harvesting in the growing area of the reported species for cultivation of these species and to promote the seedling and propagation of these plants. Using the palatable halophytic species e.g. *Alhagigraecorum and Panicum turgidum* in the rehabilitation of the salt affected lands and increase their productivity. They were promoting the fire technique in the habitat of *J. rigidus* to manage these grasses for forage. Improve the acceptability of the medium and low palatable species for animal through mix these species with the other acceptable species.
14. To implement a successful and useful environmental information system, the authors recommend taking into consideration all the elements of the guideline presented in this study. They highlight the need to pay special attention to the problem of lack or scarcity of data. For that, they also recommend studying and analyzing the new opportunities offered by remote sensing techniques and big data technologies.
15. In order to increase the efficiency of GHs, other systems are integrated with the GH, such as desalination, solar power generation and heating systems. In these systems, the extrasolar radiation is used to generate electricity via PVs or to produce water via desalination systems. Also, an Aquifer Coupled Cavity Flow Heat Exchanger System (ACCFHES) is integrated with the GH for its cooling and heating.
16. It is essential today to involve the local community in local government. With the new direction taken by the Tunisian government in 2018, promoting decentralization, it is necessary to involve the population for a participatory approach. The local government to support by the participation of the population can prove the solution for the future and the safeguarding of the agricultural lands

of Ghar El Melh. A site remediation project around Djebel Ressas village should ideally satisfy all three aspects of sustainable development as defined by the Rio AGENDA 21: economic factors**,** social factors, and environmental factor.

17. For future vision, tourist countries, including Egypt, need to develop a new model of tourism that should also be based on so-called alternative tourism. Alternative tourism is a generic concept encompassing various forms of tourism, such as cultural tourism, Ecotourism, agro-tourism, rural tourism, agritourism, and green tourism. Identify the climatic characteristics of the air temperature and relative humidity elements in Aswan in great detail and depth because the relative humidity element did not receive a detailed independent study. The need to select and apply some of the global climate equations, models, and curves to Aswan governorate that have not been applied before in the physiological climate studies on Aswan to modeling and classification. Identify the boundaries of the physiological balance and comfort of the human body in Aswan throughout the year.
18. The management of a sustainable tourism offer in a fragile territory such as that of Hergla cannot be done without good coordination between actors concerned. For that very reason we are proposing the achievement of the regional pattern of development of tourism integrating of all these actors.

Acknowledgements Mohamed Abu-hashim and Abdelazim Negm acknowledge the support of the Science, Technology, and Innovation Authority (STIFA) of Egypt in the framework of the grant no. 30771 for the project titled "a novel standalone solar-driven agriculture greenhouse—desalination system: that grows its energy and irrigation water" via the Newton-Mosharafa funding scheme.

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