



The Annual Technical Report For the Year 2016

Introduction

The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) is considered a distinguished Arab house in all of its work fields. It always seeks to develop its scientific level and technical performance under all circumstances, as it has maintained the preparation and implementation of work plans in a way that suits the trends of the Arab countries and reflects positively on the agricultural development process in the region.

The year 2016 has witnessed a remarkable support, development and modernization of the infrastructure to go in line with the scientific and technical development and comply with our increasing ambition. Three new research stations have been established in the headquarters country, in addition to the establishment of a plant tissue culture laboratory which will have a big role for the benefit of scientific researches in all Arab countries.

The Arab Center (ACSAD) has been able to implement its projects, programs and activities at highly technical and financial implementation rates through /20/ programs, under which there are /47/ research programs including: creation of wheat and barley varieties; cereal breeding, hybridization and distribution among Arab countries; adoption of improved varieties to reach the best production quantity and quality; fruit trees production development and rangeland development and rehabilitation. In the field of genetic improvement, the Arab Center (ACSAD) has been working over long years on improving the productivity of sheep and goat breeds, prevailing improved genetic structures, developing camel and small ruminant breeding programs, surveying fodder resources, studying non-conventional fodder sources and inventorying and characterizing plant and animal genetic resources to conserve biodiversity in the Arab region.

The Arab Center (ACSAD) has continued its activities in the fields of desertification combat and monitoring and development of sound methodologies necessary for that. It prepares soil, land and map studies that help in the planning and implementation process to ensure a sustainable management of lands and water uses. It is also distinguished by its remarkable achievements in the integrated water resource management through the use of math modeling and databases and the development and protection of water resources. ACSAD's researches in all fields have been always subject to the assessment of their economic and social results on the ground. Moreover, Arab staffs are trained and rehabilitated to achieve the maximum work efficiency that ensures filling the gap between researches and farmers, contributing to the achievement of agricultural development, seeking filling the Arab food gap and ensuring food and water security and natural resource sustainability.

The distinguished performance of ACSAD's experts and workers has enabled us to fulfill the plans that are subject to assessment, review and adjustment according to the current needs and updates. This is done through the rational use of the resources and the maximum utilization of the potentials, in a way that ensures achieving the desired goals and maintaining the service the of mutual Arab work.

Allah is the Arbiter of Success

Prof. Dr. Rafik Ali Saleh
Director General

ACSAD's Infrastructure Enhancement for the Year 2016

New Research Stations

Introduction:

The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) has worked on implementing its annual work plans according to a clear strategy challenging the circumstances that the Arab region is going through and depending on the necessary flexibility in activities and projects implementation. ACSAD has achieved a remarkable advance in all of its work fields, represented in the infrastructure support, development and modernization on one hand, to go in line with the scientific and technological development and its increasing ambition, and the fulfillment of the best performance of its study and research tasks and activities on



the other hand, in a way that complies with and suits the modern sciences and techniques to gain the science bet and increase the knowledge balance for achieving the desired results.

For the purpose of implementing the decisions of the General Assembly, the General Administration has sought to modernize the standing research stations, establish new ones and supply all with the necessary equipments and supplies in a way that helps in training the Arab staff.

ACSAD's research station in Al-Sinn (Lattakia):

Aiming at establishing and investing greenhouses in the propagation researches of extinction-endangered pastoral, aromatic and medical plant resources and species, a new station, with an area of 54 dunums at an altitude of 15 m above the sea, has been established. The station enjoys a Mediterranean climate which is cold and rainy in winter and hot and dry in summer with a rainfall average estimated at 800 mm/year. Its soil is red, heavily clay and poor with organic matter.



The station's objectives:

- 1- Study the hydrological relations under the area's conditions to increase the productivity per unit of water.
- 2- Study and evaluate the various agricultural crops to select the appropriate crop type.
- 3- Test the reaction of the cereal program entries of durum wheat, bread wheat and barley towards rust diseases "black stem rust and yellow leaf rust" and leaf spot diseases.
- 4- Raise the productivity of the field crops, medical and aromatic plants, fruit trees and protected cultivations and develop the human resources knowledge in the fields of environment and development.



- 5- Provide applied extension packages and scientific services to those who are interested in the various agricultural activities in the area.
- 6- Organize training courses in the fields of agricultural development especially for the young graduates.

The station's infrastructure:

- * Productive fields.
- * Laboratories for analyzing, isolating and characterizing the pathogens of the plant diseases.
- * Administrative offices and warehouses.

Protected cultivations



Cereal program and Arab production efficiency experiments for cereal and legume crops.



Cereal program and Arab production efficiency experiments for cereal and legume crops.

ACSAD's research station in Kherbt Al-Teen- Nour (Homs):

The station has been established in the year 2016 in the governorate of Homs at an area of 238 dunums. The station enjoys a Mediterranean climate which is cold and rainy in winter and hot and dry in summer with a rainfall average estimated at 600 mm/year. Its soil is red, heavily clay and poor with organic matter.

The station's objectives:

- 1- Study, evaluate and select the superior genotypes of durum wheat, bread wheat, barley and sorghum bicolor and disseminate the promising lines that are tolerant to environmental stresses to select the appropriate crop type.
- 2- Propagate and develop the non-conventional pastoral plants and shrubs to be used in the rangeland development programs whether by cultivation or sowing to face the desertification problems.
- 3- Develop and improve livestock in the desert and newly-reclaimed areas.
- 4- Provide applied extension packages and scientific services to those who are interested in the various agricultural activities in the area.



5- Organize training courses in the fields of agricultural development.

The station's infrastructure:

- * Animal production facilities and barns.
- * Productive fields.
- * Administrative offices and warehouses.



Seed distribution and cultivation of 196 dunums with ACSAD's promising varieties and lines (durum wheat, bread wheat and barley)

ACSAD's research station in Al-Sabboura (Rural Damascus):

The station has been established in the year 2016 in the governorate of Rural Damascus at an area of 25 dunums. The station enjoys a Mediterranean climate which is cold and rainy in winter and hot and dry in summer with a rainfall average estimated at 350 mm/year. Its soil is red, heavily clay and poor with organic matter.

The station's objectives:

- 1- Study, evaluate and select the superior genotypes of durum wheat, bread wheat, barley and sorghum bicolor and disseminate the promising lines that are tolerant to environmental stresses to select the appropriate crop type.
- 2- Provide applied extension packages and scientific services to those who are interested in the various agricultural activities in the area.
- 3- Organize training courses in the fields of agricultural development.

The station's infrastructure:

- * Productive fields.
- * Administrative offices.

Establishment of a laboratory for plant tissue culture at ACSAD's headquarters:

For the purpose of implementing the decision no. 22/2016 of the General Assembly in its 33rd session, stipulating the establishment of laboratories for agricultural microbiology, crop diseases and plant tissue culture to enable the researchers of ACSAD and the Arab countries to conduct modern applied scientific researches, the Plant Tissue Culture Laboratory has been established at ACSAD's premises.

This technique will enable the researchers to propagate and conserve the extinction-endangered lines and varieties of medical and aromatic species, fruit trees and ornamental plants, save time and effort, develop viral disease-free plants or seedlings and develop biotic and abiotic stresses-tolerant lines (such as salinity, drought and pesticides).



Palm propagation



Apricot and olive propagation



Banana and almond propagation

Plant Resources

The Plant Resources Department works on implementing its activities through the following main programs:

1- Program of “Rainfed Agriculture Development and Improvement in the Arab Countries”:

This program aims to improve the cereal crops productivity, especially wheat (durum and bread) and barley, increase their productive capacity under the Arab arid and semi-arid areas conditions and develop the cultivation of sorghum and millet crops due to their food and feeding importance and highly drought- tolerance.

2- Program of “Conservation Agriculture”:

This program encourages farmers in the Arab countries to adopt the conservation agriculture system. It aims to improve the crops productivity, the farmers' income and the irrigation water management and alleviate the severity of drought as a result of climatic changes. It also aims to build the Arab agricultural institutions' capacities in the field of sustainable agricultural production and increase the awareness of researchers and technicians towards the positive effects of this system from the environmental, economic and social points of view.

3- Program of “Development of Appropriate Fruit Tree Lines for Arid Areas”:

This program aims to improve the productivity of fruit trees that are appropriate for Arab arid and semi-arid areas (olive, almonds, pistachio, figs and grapes), conserve the reliable genetic material and provide Arab countries with it.

4- Program of “Palm tree Development in the Arab Countries”:

It aims to develop and take care of date palm trees in the Arab countries through services and picking up process improvement, integrated pest management and extension activities promotion.

5- Program of “Rangelands and Forestry Resources Rehabilitation and Development”:

It aims to survey and inventory the pastoral vegetation cover, identify the proper grazing systems and pastoral management practices, rehabilitate the degraded pastoral arid and semi-arid areas, collect, evaluate and classify the pastoral varieties and select the environmental stress- tolerant genotypes to be propagated and distributed among the Arab countries.

It also aims to establish gene banks and breeding fields for the pastoral species that have a good feeding value and high adaptive capacity, in addition to studying the pastoral plant vegetation changes and preparing plant and pastoral maps in the Arab countries.

6- Program of “Biodiversity Conservation”:

It aims to document the biodiversity in the Arab region by inventorying, collecting and documenting the plant varieties that grow in the arid and semi-arid environments, establishing databases and producing qualitative atlases that meet the requirements of specialists in the related research and developmental programs. It also aims to support other programs with the genetic resources of economically important plants and coordinate among Arab countries to implement the CBD convention and Cartagena Protocol for Biosafety.

First: Program of «Rainfed Agriculture Development and Improvement in the Arab Countries»

The program of rainfed agriculture development and improvement in the Arab countries is considered one of the most important continuous main programs implemented by the Arab Center (ACSAD), due to its direct relation with the agricultural development process in the arid and semi-arid areas of the Arab World and its importance in decreasing the gap between production and consumption through the vertical and horizontal expansion strategy. The agricultural development under rainfed conditions is considered a main goal that necessitates: 1-working on creating and improving the cultivated varieties of strategic crops (durum wheat, bread wheat, barley and sorghum bicolor that are characterized by their big adaptive capacity and high productivity under biotic and abiotic stress conditions), 2-supporting the research centers in creating new lines with local adaptive capacity by using isolated generations and conducting evaluation and selection processes under the local environmental conditions and 3-raising the efficiency of the Arab technical expertise through training courses, conferences and workshops.

The cereal program includes /6/ projects (4 ongoing research projects and 2 developmental projects) which are implemented with the concerned agencies and commissions in the Arab countries. The following is the activities and achievements of the implemented projects during the season 2015-2016:



Project of «Development of Highly Biotic and Abiotic Stress-Tolerant and Highly Productive Wheat and Barley Varieties»

Project objective:

The project aims to develop and enhance the productivity of small cereal crops (durum wheat, bread wheat and barley) in a way that ensures the achievement of food security and sustainable agricultural development of the Arab agricultural system components.

Project site:

Jordan, Tunisia, Algeria, Saudi Arabia, Sudan, Syria, Oman, Iraq, Palestine, Kuwait, Lebanon, Libya, Egypt, Morocco, Mauritania and Yemen.

Project progress:

The implemented activities of the breeding and improvement program of durum wheat, bread wheat and barley, during the agricultural season 2015-2016, have included the following:

1- Evaluation of genetic resources for biotic and abiotic stress tolerance:

The performance of the genetic resources which are introduced or developed by the Arab Center (ACSAD) is evaluated towards the biotic and abiotic stress tolerance at ACSAD's research stations of Ezra'a, Al-Sinn and Al-Sabboura in the headquarters country/Syria and Kufrdan in Lebanon.

During the agricultural season 2015-2016, several genetic resources of durum wheat, bread wheat and barley crops were evaluated, including 3088 entries from some Arab countries and specialized regional and international organizations, in addition to ACSAD's lines that are used in the experiments of primary production efficiency, Arab production efficiency and observation lines. As a result of this evaluation, 703 genetic resources of the three crops were selected to be tested later in the various breeding stages aiming at reaching the promising lines.

Project participating parties: ACSAD's research stations.

2- General hybrids:



/544/ successful hybridization processes have been conducted between the selected parents for the crops of durum wheat, bread wheat and barley (six-row and two-row) at a rate of /136/ hybrids of each crop for the purpose of developing new promising lines during the isolated and next advanced generations, taking into consideration that the used parents in the hybridization process have been evaluated for more than one season at several study sites to study their biotic and abiotic stress tolerance. The methods of natural infection and artificial infection have been used to study their tolerance towards the major and common diseases (rust, smut, leaf spots and other diseases).

3- Evaluation of hybrids; isolated and advanced generations:



These generations cover the different stages of durum wheat, bread wheat and barley breeding programs starting from the first generation «F1» till the fifth generation «F5». /586/ hybrids that contained /4329/ families and lines were evaluated; out of which /407/ hybrids, containing /4227/ families and lines, were selected. The evaluation and selection processes will be continued during the different isolated generations aiming at introducing the successful lines in the fifth generation to be used as promising ones in the primary production efficiency experiment which is considered the first stage of line evaluation.



4- Observation lines:

These observation lines have contained /2393/ entries of durum wheat, bread wheat and barley. The entries were evaluated for two successive agricultural seasons to make sure of their traits stability and their adaptation with the test environment. /228/ promising entries were selected to be used as hybrid parents for genetic improvement in the season 2016-2017.

5- Primary production efficiency experiments:

The tested lines of durum wheat, bread wheat and barley, in the first year of the primary production efficiency experiments, were /120/ lines during the season 2015-2016. These lines were compared to the best local control plants cultivated in «Ezra'a-Syria» and «Kafrdan-Lebanon» stations. The evaluation focused on the productive, morphological and physiological properties and disease-tolerance extent. As a result, /60/ promising lines were selected to be tested for a second year in the season 2016-2017 and introduced later into the Arab production efficiency experiments.

6- Arab production efficiency experiments:

The purpose of these experiments is to evaluate the performance of ACSAD's superior lines of the primary production efficiency experiments under the rainfed and irrigated agriculture conditions at many different environmental sites distributed among 16 Arab countries (Jordan, Tunisia, Algeria, Saudi Arabia, Susan, Syria, Oman, Iraq, Palestine, Kuwait, Lebanon, Libya, Egypt, Morocco, Mauritania and Yemen). The aim also is to identify the superior lines in comparison with the local and improved control plants under the target environmental conditions, follow-up the evaluation process and register the most superior ones as new improved varieties.

Each experiment included /19/ superior lines of durum and bread wheat and /18/ superior lines of barley (six and two rows), in addition to the local and improved control plants. The 2015-2016 experiments at several sites in the Arab countries showed the superiority of ACSAD's lines over the local control plants in more than one country; these lines were the following:

Durum wheat: ACSAD (1517- 1505- 1499- 1483- 1469- 1456- 1453- 1433).

Bread wheat: ACSAD (1330- 1328- 1314- 1304- 1302- 1300- 1288- 1334- 1342).

Barley: ACSAD (1766- 1765- 1760- 1753- 1752- 1746- 1745- 1725- 1724- 1772).



7- ACSAD's varieties of durum wheat, bread wheat and barley that are registered in the Arab countries:

/24/ varieties have been registered in /8/ Arab countries up to date as illustrated in the following table:

Table (1): Number of varieties registered in the Arab countries

Country	Durum wheat	Bread wheat	Barley
Jordan	1	--	2
Syria	3	3	2
Lebanon	2	1	--
Morocco	1	1	2
Algeria	1	6	5
Yemen	2	2	--
Libya	3	2	1
Iraq	1	--	--

Table (2): ACSAD's durum wheat varieties registered in the Arab countries

Variety/breed	Country	Given name	Year of adoption
ACSAD 65	Jordan	ACSAD 65	1985
	Syria	ACSAD 65	1985
	Morocco	ACSAD 65	1985
	Lebanon	Tel Amara 1	2010
	Iraq	ACSAD 65	-
ACSAD 357	Libya	Bhouth 107	
ACSAD 363	Libya		
ACSAD 1105	Syria	Douma 1	2002
	Lebanon	Tel Amara 3	2013
ACSAD 1107	Algeria	Sawra	2012
ACSAD 1119	Yemen	Na>aem 1	2008
ACSAD 1169	Yemen	Bhouth 5	2008
ACSAD 1229	Syria	Douma 3	2010



Table (3): ACSAD's bread wheat varieties registered in the Arab countries

Variety/breed	Country	Given name	Year of adoption
ACSAD 59	Algeria	Haddna	1985
	Morocco	ACSAD 59	1985
ACSAD 885	Syria	Douma 2	2004
	Algeria	Ramada	2011
ACSAD 899	Algeria	Jannat	2012
ACSAD 901	Syria	Douma 4	2007
	Lebanon	Tel Ammara 2	2010
	Libya		2010
	Algeria	Mouna	2013
ACSAD 935	Libya		2010
ACSAD 969	Algeria	Jamila	2012
ACSAD 1097	Yemen	Shibam 1	2008
ACSAD 1119	Yemen	Shibam 2	2008
ACSAD 1133	Syria	Douma 6	2014
ACSAD 1139	Algeria	Taitari	2014

Table (4): ACSAD's barley varieties registered in the Arab countries

Variety/breed	Country	Given name	Year of adoption
ACSAD 60	Syria	ACSAD 60	1985
	Jordan	ACSAD 60	1985
	Morocco	ACSAD 60	1985
	Algeria	Bahria	1985
ACSAD 68	Morocco	ACSAD 68	1985
ACSAD 68	Algeria	Ramada	1985
ACSAD 176	Syria	ACSAD 176	1985
	Jordan	ACSAD 176	1985
	Morocco	ACSAD 176	1985
	Algeria	Nailia	1985
ACSAD 1230	Libya	Maimoun	
ACSAD 1688	Algeria	Soukar	2014
ACSAD 1704	Algeria	Tahart	2014



Project of «Crop Agricultural Systems in Rainfed Areas»

Project objective:

Study some agricultural techniques that affect the cereal crops productivity in the arid and semi-arid areas, identify the best ones and introduce some new agricultural systems that achieve integration and balance between animal production and plant production.

Project site:

The project primary experiments activities are conducted in the research stations of ACSAD. When the final results are reached, they are directly communicated to the interested Arab countries.

Project progress:

The project activities during the year 2016 have included the following:

1- Development of an appropriate agricultural technique package to improve the productivity of ACSAD's registered wheat varieties under the rainfed and irrigated agriculture conditions:

A field experiment has been implemented at ACSAD's research station of Ezra'a. The results have showed that early cultivating (11/15), associated with a nitrogen fertilization rate of 200 kg/ha⁻¹ and seed quantity of 150 kg/ha, would register the highest productivity under irrigated and rain-fed agriculture conditions.

2- Study of the impact of different salinity levels on the productivity of (bread wheat, durum wheat and barley):

This study has been implemented at ACSAD's research station of Ezra'a in the agricultural season (2015-2016) by conducting cultivation in lysimeters and irrigating with highly-saline solutions (0, 50, 100 and 150mmol/l). Six varieties have been cultivated namely; ACSAD885, ACSAD899, ACSAD901, ACSAD969, ACSAD 1133 and ACSAD 981. The plant growth has been monitored and the required properties indicators have been registered: grain weight, grain number, plant height, number of tillers per plant and number of spikes per plant. After the statistical analysis of the data, the results have showed that the variety; ACSAD 885, had the highest yield.



3- Study of the use of wild genetic resources and local lines in developing and improving durum wheat tolerance for abiotic stresses and productivity stability:

/4/ local lines of durum wheat and /4/ ACSAD's registered varieties of durum wheat have been cultivated at ACSAD's research station of Ezra'a, where the parents hybridization process has been conducted to get the seeds of /16/ hybrids of /F0/ plant. The seeds will be cultivated next season to get the /F1/ plant to continue the evaluation and selection processes.

4- Evaluation of sorghum genotypes (green fodder):

The purpose of the study was to evaluate the performance of /10/ varieties of sorghum that could be used as fodder crop (Egypt 6, Giza 113, red Jazan, white Jazan, Mayo, Veteray, Bodelly, Jioui, Biufuel and Fello), in addition to /3/ genotypes of millet .

The experiment was implemented at ACSAD's research station of Ezra'a starting from the season 2015- 2016 , and the initial results showed the superiority of dry matter yield for of Veteray, red Jazan and white Jazan varieties. The study will be continued next seasons to confirm the initial results.

5- Pearl millet evaluation and introduction into the semi- arid environments:

/25/ genotypes of imported pearl millet (from CRISAT) have been cultivated during the season 2015/2016 at ACSAD's research station of Ezra'a at two growing dates and three planting distances for the purpose of evaluating the adaptation degree of this crop with the semi-arid environments. The study will be continued next season to confirm the initial results.

Project of «Seed Multiplication of Promising Wheat and Barley Lines and Varieties Seeds»

Project objective:

Multiply the breeder seeds of ACSAD's varieties and lines of durum wheat, bread wheat and barley. The multiplication is conducted basically at ACSAD's research stations under the rainfed agriculture conditions. ACSAD, by this project, provides the required seeds quantities while conserving at the same time the seeds purity by conducting the mechanical and genetic refinement processes during the growth season and the appropriate sieving, sterilization and storing processes later.

Project site:

ACSAD's research stations.

Project progress:

/123/ varieties and lines of durum wheat, bread wheat and barley were multiplied during the agricultural season 2015- 2016 at different multiplication stages (G0 and G1); and /344/ kg of seeds were sent to /14/ Arab countries as promising lines and hybrids to be cultivated during the agricultural season 2016-2017 as illustrated in the following table:

Wheat and barley seeds quantities that were sent to the Arab countries to be cultivated in the agricultural season 2016-2017

Country	Seed quantity (kg)
Syria	28
Lebanon	27
Jordan	26
Palestine	13
Iraq	13
Kuwait	13
Saudi Arabia	13
Sultanate of Oman	13
Sudan	28
Egypt	26
Tunisia	90
Algeria	28
Morocco	13
Mauritania	13
Total	344



Sorghum Bicolor Development and Improvement Project

Project objective:

The project aims to increase the Arab farmer's income through developing and enhancing the sorghum bicolor productivity in the Arab countries, provide national programs with the improved genetic material and raise the Arab technical staff efficiency.

Project site:

ACSAD's research stations.

Project progress:

The executive plan of the project during the year 2016 has included several activities as follows:

- Cultivate /25/ families of different isolated generations; out of which /10/ families were selected based on morphological and productive characteristics and disease tolerance.
- Select /19/ promising lines of high productivity to be introduced next season in the primary production efficiency experiments. According to the primary production efficiency experiments



results, 10 promising lines have recorded the highest grain yield as follows; ACSAD1, ACSAD 4 ACSAD 5 ACSAD 6 ACSAD 9 ACSAD 10 ACSAD 14 ACSAD 16 ACSAD 17 ACSAD18 with grain yield of 3034.3, 3230.0, 2455.0, 2250, 3160.0, 2213.3, 3167.6, 2226.7, 3034.3kg/ha respectively compared with the control plant Ezra'a 7 (1920 kg/ha). The increase rate of grain yield has ranged from 9.7% to 68%.

- Evaluate /69/ genotypes and select /31/ superior ones with high yield and rich contents to be introduced into the various breeding programs; these types were the following: Ezra'a 3, Ezra'a 5, Ezra'a 7, Ezra'a 63, Ezra'a 66, Ezra'a 67, Kharabo 115, Tel Abiad1, Baladi 4, Shalakh 3, Shalakh 6 (Syria), Dorado 9, Giza 15, Giza 113, Egypt 5, Egypt 9, Egypt 11, Veteray, Mayo (Sudan), Omani (Oman), Biufuel, Jioue and Djodilwans (Mauritania).
- Introduce and evaluate /13/ new genotypes of sorghum bicolor and /3/ genotypes of millet from the General Commission for Scientific Agricultural Research in Syria and Agricultural Research Center in Egypt. This activity was conducted under the experiments of «observation lines»; the result of which was the selection of /7/ genotypes of sorghum bicolor and /1/ genotype of millet (ICSV-700) based on morphological characteristics and environmental adaptation.
- Provide the Technical Institute for Extensive Cultivations in Algeria with /20/ genotypes of sorghum bicolor under the Arab production efficiency experiment.
- Provide the National Center for Agriculture and Livestock Research in Saudi Arabia with /20/ genotypes of sorghum bicolor under the Arab production efficiency experiment.

Biological Techniques Researches and Studies Project

Project objective:

The project aims to identify the DNA and the genetic relationship degree of ACSAD's durum wheat, bread wheat and barley varieties and lines and protect ACSAD's property rights in terms of the produced genetic varieties, lines and genetic materials.

Project site:

ACSAD's laboratory for advanced biological techniques.

Project Progress:

ACSAD's experts have conducted laboratory studies and analysis for more than /600/ different samples (soil-fodder-milk) through scientific researches and experiments on: wheat crop response to fertilization with major minerals, conservation agriculture, olive pruning residues use in sheep feeding and evaluation of arability of some soils in a way that serves ACSAD's projects according to the research plans.

Special Developmental Projects in the Arab Countries

1- Project of Wheat and Barley Productivity Improvement in the State of Palestine:

- Under the resolutions of ACSAD' Executive Council and General Assembly, the technical program has been implemented completely with a budget estimated at /150000/ USD. The following has been achieved:
- A quantity of /13/ kg of ACSAD's promising lines and varieties has been sent to be cultivated in

the season 2016/2017.

- A training course for trainees from the state of Palestine has been implemented under the title of «Cereal Crops Genetic Improvement under the Biotic and abiotic Stress Conditions and Conservation of Variety Purity» at the Scientific Agricultural Research Service in Lebanon- Tel Amara during the period 15- 20/5/2016.

2- Project of “Multiplication of 30000 tons of Wheat Seeds by Cultivating 200000 ha in the Northern State of Sudan” :

The technical project document has been prepared, adopted by the Ministry of Agriculture and Irrigation in Sudan and then raised to the Islamic Development Bank to provide the necessary financing.

Cooperation with the Arab and Foreign Centers and Commissions

1- Ministry of agriculture and Agrarian Reform of the Syrian Arab Republic - General Organization for Seeds Multiplication:

The General Organization for Seeds Multiplication has been provided with /25/ kg (pure lines) of 6 lines and varieties of ACSAD's adopted ones in Syria as the following:

/2/ varieties of durum wheat: (ACSAD 65) and Douma 3 (ACSAD 1229) and

/4/ varieties of bread wheat: Douma 4 (ACSAD 901), Douma 2 (ACSAD 885), Douma6 (ACSAD 1133) and ACSAD 899.

2- Faculty of Agriculture- Damascus University- Syrian Arab Republic:

Within the framework of cooperation with Damascus University- Faculty of Agriculture, the mutated barley lines, produced from the treatment of two varieties namely Furat 1 (six rows) and Arabi Aswad (two rows) with three doses of Gamma radiation (5, 15, 15 kr), have been evaluated.

The experiment has been implemented during the season 2015/2016 at two sites namely: ACSAD's research stations of Ezra'a in Syria and Kafrdan in Lebanon. The primary results have showed the superiority of several lines (in terms of productivity and rich contents) over the control plants and the noticeable effect of the environmental factor on the selected ones. The genes responsible for the qualitative and quantitative characteristics of the lines will be identified at ACSAD's biotechnology laboratories and the study will be continued next season.

/5/ lines have been introduced into the primary efficiency experiments/second year to test their performance in comparison with the barley program and /3/ lines have been selected to be used as hybrid parents in the season 2016/2017.

Cooperation with International Organizations

- Activate cooperation with the International Center for Agricultural Research in Dry Lands (ICAR-DA) to exchange genetic materials, as /362/ lines of barley, bread wheat and durum wheat have been received to be cultivated during the season 2016/2017 at ACSAD's research stations of AL-Jammasa (Tartous) and Ezra'a (Dara'a).
- Activate cooperation with the International Center for Wheat and Corn Improvement (CYMMET) to exchange genetic materials, as /812/ lines of bread wheat and durum wheat have been re-

ceived to be cultivated during the season 2016/2017 at ACSAD's research stations of AL-Jammasa (Tartous) and Ezra'a (Dara'a).

- Activate cooperation with (ICRISAT) to exchange the genetic resources of sorghum bicolor and millet, as /21/ genotypes of sorghum bicolor and /25/ genotypes of millet have been received to be cultivated during the season 2016/2017.

Second: Program of "Conservation Agriculture



The conservation agriculture system depends on four basic pillars namely: the zero or minimum tillage of the soil, the constant coverage of the soil surface with plant residues or green coverage crops, the application of the appropriate agricultural rotation and the effective control of weeds especially in the first years of the application of this system.

Being aware of the importance of rainfed agricultural areas utilization and the application of the agricultural practices that improve the water use efficiency (as water availability in such environments is considered a vital factor for agricultural production), the Arab Center (ACSAD) has realized that it is necessary to adopt the conservation agriculture system which ensures the lesser depletion of natural resources (soil and water) and protects agricultural soils from water and wind drifting. It also contributes to the rehabilitation process of degraded agricultural lands by improving their content of organic matter, helps in improving productivity and increasing its stability and leads, as a result, to the increase of farmer's income and livelihood improvement.

Program objectives:

- Rehabilitate degraded eco-agricultural systems.
- Decrease the costs of agricultural production and improve the productivity of land, water and crop.
- Increase the economic gain margin of the farmer and improve his living standards.
- Increase the adaptive capacity of eco-agricultural systems and alleviate the impact of climatic changes.
- Transfer success stories to the farmers' fields in the interested Arab countries.
- Develop the appropriate management factors of land and crop and increase their productive capacities.
- Train Arab technical staffs on the principles of land and crop management.

Program implementing parties: The program is implemented in cooperation between the Arab Center (ACSAD), the Ministries of Agriculture and their research institutions and the farmers in the concerned Arab countries.

Program progress: The executive plan of the program during the year 2016 has included the following program activities for the agricultural season 2015- 2016:

1- The research project of “Evaluation of the Importance of Conservation Agriculture System Application for the Long- Term Improvement of Cereal Crops and Soil Properties) at ACSAD’s Research Station of Ezra’a:

Project outputs:

- The average grain yield of wheat crop has increased under the conservation agriculture conditions (2782 kg/ha^{-1}) in comparison with conventional agriculture system (2355 kg/ha^{-1}) at an increase rate estimated at 15.35%.
- Upon the application of agricultural rotation with the vetch crop, the average grain yield has increased (2651 kg/ha^{-1}) in comparison with the absence of the agricultural rotation (2487 kg/ha^{-1}) at an increase rate estimated at 6.19%.
- It was noticed that the average grain yield was the highest for the durum wheat variety of ACSAD 357 (2761 kg/ha^{-1}) in comparison with the bread wheat variety of ACSAD 901 (2378 kg/ha^{-1}) at an increase rate estimated at 38.30%.
- The superiority of the conservation agriculture system was proven in terms of rainfall water use efficiency ($12.20 \text{ kg/mm/season}$) in comparison with the conventional agriculture system ($10.51 \text{ kg/mm of rainfall/season}$) at an increase rate estimated at 13.85%.
- The increase rates of revenue and return/ ha were 15.35% and 25.90% respectively under the conservation agriculture system in comparison with the conventional one. The decrease rate of costs was about 18.06%.
- The application of conservation agriculture system has led to the improvement of soil content of organic matter and major mineral elements NPK in comparison with the conventional agriculture system.
- The application of conservation agriculture system as an integrated agricultural package (zero tillage, constant coverage of soil surface and agricultural rotation application) has contributed to the improvement of wheat crop productivity and water use efficiency. It has also led to the increase of agricultural production outputs in comparison with the inputs and the improvement of soil chemical properties.





2- The Research Project of «Application of Conservation Agriculture System to Improve Small Cereals Productivity- Wheat and Barley- and Soil Properties in the Arab Countries»:

Project objective:

Develop the agricultural production systems sustainability in the Arab region by increasing the cereal crops productivity, ensuring the agricultural production stability and conserving agricultural resources.

Project participating parties:

Ministries of Agriculture and the concerned national institutions in the Arab countries (Tunisia, Algeria, Sudan, Syria, Lebanon and Egypt).

Project progress:

- The national coordinators of ACSAD in the Arab countries have been communicated to implement the research project. Positive responses have been received concerning the provision of conservation agriculture machinery and the potential of implementing this project in each of Tunisia, Algeria, Sudan, Syria, Egypt and Lebanon.
- The Ministries of agriculture in the mentioned Arab countries have been communicated to get acquainted with the executive plan of the research project and nominate a national project coordinator starting from the next agricultural season 2016- 2017.

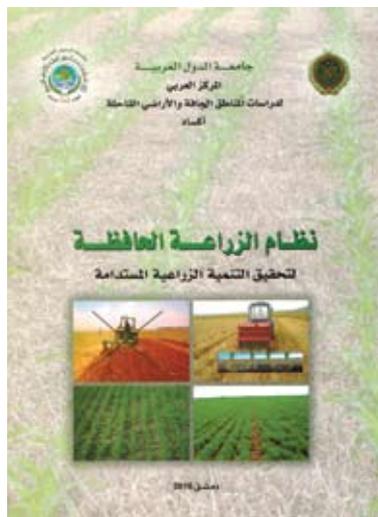
Project components and activities:

- Characterize the target environments to correct the soil flaws before starting the application of conservation agriculture system.
- Implement experiments concerning the impact of conservation agriculture system application as an integrated agricultural package (zero tillage, covering soil with plant residues, following the appropriate agricultural rotation and integrated weeds management) on the productivity of small cereal crops (wheat and barley).
- Monitor the development of the different properties and characteristics of soil under conservation agriculture system in comparison with the application of conventional agriculture system.

- Study the economic feasibility at the different sites of the Arab countries where the conservation agriculture system is applied (research stations or farmers' fields).
- Follow-up the experiments at the research stations and farmers' fields by the team of conservation agriculture program of ACSAD and the Ministries of Agriculture in the Arab countries.
- Hold applied training courses for the technicians and extension workers on the principles of conservation agriculture system application to get them acquainted with the Arab and world success stories.
- Hold a field workshop (field days) in the target areas of the project and invite all the concerned technicians, farmers and decisions makers to it.
- Produce information materials that are available to the farmers and agricultural extension workers and include sufficient theoretical and applied information explained in a simple language.

3- Publications, periodicals and workshops:

- For the purpose of implementing ACSAD's work plan, a book on "Conservation Agriculture to Achieve Sustainable Agricultural Development" has been issued and distributed among the Arab countries. The book contains /13/ chapters in Arabic with terms in both Arabic and English languages and a set of images, graphs, figures and tables.
- A research paper on "Conservation agriculture Impact on Growth Indicators and Productivity of Durum Wheat and Chickpea Crops in Comparison with Conventional Agriculture System" has been published in the Arab Journal for Arid Environments "ACSAD".
- A research paper on "Improvement of Durum Wheat and Vetch Productivity by Using Conservation Agriculture System Under Rainfed Agriculture Conditions" has been published in the Arab Journal for Arid Environments "ACSAD".
- An article on "Conservation Agriculture System Application to Alleviate Climatic Changes" has been published in the Agriculture and Water Journal "ACSAD".
- Participate in a workshop on "Measures of Adaptation with Climatic Changes in the Agricultural Sector by Using the Tools of Integrated Water Resource Management" which was held at the ES-CWA facility in Beirut- Lebanon. In this workshop, ACSAD's experience has been presented in the fields of "adaptation measures with climatic changes in the agricultural sector under rainfed agriculture conditions", "conservation agriculture system application to adapt with climatic changes and achieve food security" and "adaptation actions with climatic changes in the agricultural sector- Rangelands and Forests Department".



Third: Program of «Development of Appropriate Fruit Tree Lines for Arid Areas»:

1- Project of Development of Appropriate Fruit Tree Lines for Arid Areas in the Arab Countries:

Project objective:

The project aims to develop the cultivation of drought-tolerant fruit trees in the Arab countries, identify the appropriate varieties and lines to expand their cultivation, establish mothers' nurseries and fields for the drought-tolerant varieties in the target countries, qualify and train the technical staffs and farmers in the Arab countries on the techniques of "drought-tolerant fruit trees cultivation and care" and "optimal use of poor and marginal lands in which other species of fruit trees are difficult to grow", increase farmer's income and improve his living standards and stability in his land by improving agricultural productivity.



Project site:

The Democratic People's Republic of Algeria.

Project progress:

- 1- Establish a nursery for pistachio, almond and olive crops at an area of /15/ ha.
- 2- Establish mothers' field for the mentioned species.
- 3- Hold training courses to qualify and train the technical staffs of the Ministry of Agriculture, Rural Development and Fishery in Algeria.

Project outputs:

- Extend the project duration until the year 2019.
- Continue the activities according to the project work plan, as agricultural service operations have been provided for the fields established by the Arab Center (ACSAD) and training courses will be conducted on "pistachio grafting" for the project technical staff, while farmers will be provided with field training on pruning.
- It has been agreed with the Algerian side to send Algerian drought-tolerant local varieties of olive, almond and vine crops to the Arab Center (ACSAD), translate the guidebook of Algerian olive varieties into Arabic language and establish a gene bank for drought-tolerant fruit trees provided that the bank is put under the disposal of the Arab Center (ACSAD) for the benefit of all Arab countries.

2- Project of “Conservation of Drought-Tolerant Wild Fruit Tree Resources”:

The importance of wild fruit tree species is reflected in their richness with genetic characteristics related to fungi, viral and bacterial disease- resistance or physiological and biochemical properties related to abiotic stress tolerance; as such diseases and stresses are considered ones of the most important constraints to the sustainable development of Arab agriculture. These species grow under very severe conditions in different types of stony, rocky, calcareous and dry soils. Some of them prevail in locations at an altitude up to 2000 m above the sea and are covered with snow for several months without being damaged like «*Pyrus syriaca* aBoiss». Other species live in dry environments like «*Amygdalus Arabica*» which is present in the Syrian steppe in a sandy gravel soil and in Al-Azraqq region in the east of Jordan at an altitude of 604 m above the sea where the rainfall quantity is estimated at 160 mm.

Project objective:

- Benefit from the genetic stock of wild fruit trees resources in the programs of genetic breeding and improvement and creation of pest-resistant and environmental stress-tolerant pests varieties.
- Develop the national and regional technical expertise in the field of fruit tree genetic resources and qualify the local specialized staff in the field of fruit and forestry afforestation.

Project site:

The genetic bank of Gellin- Syria (one of ACSAD’s research stations specialized in fruit trees).

The most important studied wild trees are:

Olea europaea, *Amygdalus orientalis*, *Pistacia atlantica*, *Crateagus* spp., *Pyrus Syriaca* and *Zyphus* spp. All of these trees are from the Syrian natural environment.

In addition to the gene bank at ACSAD’s research station of Gellin, the Arab Center (ACSAD) has sought to implement the decision No. 21/2016 of the 33rd General Assembly’s session that stipulates the establishment of a research station for conservation of endangered medical and pastoral plant species and resources at ACSAD’s research station of Al-Sinn. Currently, an olive genet bank is under establishment at the new station to complete the group of varieties at ACSAD’s research station of Al-Bouqa. It is considered a second copy of Gellin bank due to the olive varieties there.



Amygdalus orientalis



Pistacia atlantica



Olea europaea



Pyrus Syriaca



Crateagus spp.



Zizyphus spp.

3- Project of "Fruit Tree Seedlings Production Expansion for Meeting Arab Countries Demands":

Project objective:

The project aims to produce the plant material of healthy reliable fruit tree varieties and lines (seed and grafted seedlings- rooted cuttings- grafts- seeds) with a genetic content capable of tolerating the severe environmental conditions, provide Arab countries with a reliable genetic material to establish mothers' fields and green belts, qualify the Arab technical staff and improve seedlings production and multiplication methods.

1- ACSAD's research stations allocated for fruit seedlings production:

- ACSAD's research station of AL-Bouqa, which is allocated for the production of olive seedlings propagated by softwood cutting, is continuing its production plan for the season 2016 by producing about 100000 seedlings of different varieties at a rate of 30000 Khaddiri seedlings, 25000 Sorani seedlings, 20000 Kaissi seedlings, 10000 Jlett seedlings, 5000 Dann seedlings and 4000 Mhazzam Abou Sattl seedlings (Syrian varieties; table and bi-purpose varieties); 5000 Besholin seedlings (France) and 1000 Corniky seedlings (Greece).
- ACSAD's research station of Ezra'a is continuing the production of grafted pistachio seedlings as /4000-5000/ seeds are cultivated annually to produce seed seedlings and /2500/ seed seedlings of female and male varieties are grafted. These seedlings will be distributed by ACSAD among Arab countries based on their demands and requirements.



Ezra'a station for pistachio grafted seedlings production



Al-Bouqa station for olive propagation by softwood cuttings



In the year 2016, the Arab Center (ACSAD) has sent the following items to some countries as illustrated in the following table:

Country	Number and quantity	Item
Lebanese Republic	30.000 seedlings	Olive seedlings
	3.000 seedlings	Almond seedlings
	1.000 seedlings	Pistachio
	2.500 seedlings	Walnuts
	700 kg	Figs
Algerian Republic	30 kg	Pistachio seeds
	120 seedlings	Pistachio seedlings

2- Seedlings distribution among Arab countries:

Since its establishment, the Arab Center (ACSAD) has been very careful in terms of production and distribution of disease-free reliable propagation units (seedlings, cuttings and seeds), as different plant types are distributed among Arab countries according to their specific needs. The total quantities of the consignments of the fruit trees program to the Arab countries during the period 1997-2016 can be illustrated in the following table:



Country	Quantity	Number	Item
Algeria- Libya- Saudi Arabia- Iraq- Bahrain- Yemen- Jordan- Egypt- Lebanon- Syria- Kuwait		374.529	Olive seedlings
Saudi Arabia-Algeria- Egypt- Iraq- Yemen- Libya- Lebanon-		2.014.148	Olive cuttings
Algeria- Libya- Yemen- Jordan	700		Olive seeds
Algeria- Libya- Jordan- Tunisia- Saudi Arabia- Iraq- Morocco- Yemen- Egypt- Lebanon- Palestine		77.746	Pistachio seedlings
Algeria- Libya- Saudi Arabia- Tunisia- Iraq- Egypt- Lebanon- Jordan	3.412		Pistachio seeds
Libya- Jordan- Syria		92.195	Pistachio cuttings
Saudi Arabia- Iraq- Algeria- Syria- Libya- Yemen- Egypt- Lebanon- Jordan		25.630	Almond seedlings
Iraq		500	Almond cuttings
Libya- Lebanon- Algeria- Jordan	2.800		Almond seeds
Lebanon- Libya- Yemen- Egypt- Syria		4.495	Fig seedlings

Iraq- Jordan- Syria- Lebanon- Yemen- Egypt- Libya		4.675	Fig cuttings
Syria- Iraq- Saudi Arabia		2.450	Vine cuttings
Lebanon- Libya		9.575	Vine seedlings
Libya		17.475	Vine cuttings
Libya- Lebanon		246.135	Pome and stone fruit seedlings
Libya	6.400		Apricot seeds
Tunisia- Morocco- Yemen		8.600	Pistacia atlantica seedlings
Libya	5		Mahaleb seeds

3- Project of Establishment of Fruit Tree and Forestry Seedlings Nursery in the Region of Kamd Allowz- West-Bekaa- Lebanon:

During the year 2016, the work in the nursery has continued in terms of the technical and technological aspects and the provision of the necessary expertise and consultation. As a result of this work, the nursery has started the production of olive seedlings at no less than 15000- 20000 olive seedlings annually and the distribution process has begun.



Mothers' fields of olives, pistachio and almonds and samples of the nursery production of olive seedling, Kamd Allowz- West Bekaa- Lebanon

4- Scientific Researches and Studies at the Research Stations:

Project site:

Gellin gene bank- Syria (one of ACSAD's research stations that is specialized in fruit trees).

1- In the field of olive:

1- Project of «Characterization of Cultivated Olive Varieties at the Gene Bank of Gellin».

For the purpose of completing ACSAD's work plan concerning the characterization of the cultivated olive varieties at the gene bank of Gellin totaling /100/ local, Arab and international varieties and lines, /5/ Syrian local varieties have been characterized as follows:

- Table varieties (Al-Jlett and Al-Kaissi).
- Bi- purpose varieties (Al-Sowrani, Al-Khdeiri and Al-Khowkhi).

The purpose of this characterization process is to evaluate the performance of these varieties under the rainfed agriculture conditions and supplementary irrigation conditions at the research station of Gellin in Dara'a/Syria based on the standard guide for olive characterization.

The morphological characterization has been also conducted based on the selected standards adopted in the characterization process of the tree nature, leaves, blooming and bearing. Oil samples have been analyzed at ACSAD's laboratories to get acquainted with the physical and chemical properties of the oil of these varieties.



Jlett



Kaisi variety



Khowkhi variety



Khdeiri variety



Sorani variety

The study results have showed the superiority of treatment with supplementary irrigation agriculture over the rainfed agriculture for most of the studied varieties in terms of the average annual vegetation growth, leaf properties (length, width and size), fruit properties (length, width, weight and size), average number of fruits/cluster, budding rate and bearing factor which has reached 2.01% for rainfed agriculture and 2.88% for supplementary irrigation agriculture, in addition to the oil rate based on the dry weight (24.91% as an average for all varieties for rainfed agriculture and 41.78% for irrigated agriculture). The results were reverse concerning the oil rate based on the wet weight (20.75% as an average for all varieties for rainfed agriculture and 17.24% for irrigated agriculture); It is very natural due to the big size and weight of the fruit resulted from the increase of water, oil and other contents in the holes.



Khowkhi variety

Khdeiri variety

Sorani variety

The annual vegetation growth rate and the leaf area of the studied varieties

Variety		Annual growth rate (cm)			Leaf area (cm ²)		
		Rainfed Agriculture	supplementary irrigation	General average A	Rainfed Agriculture	supplementary irrigation	General average A
Jlett	Table	11.12	12.75	11.94 ^b	19.83	48.20	34.02 ^{ab}
Kaisi		15.75	27.25	21.50 ^a	34.71	37.43	36.07 ^a
Khowkhi	Bi- purpose	5.00	17.25	11.12 ^b	28.40	32.73	30.56 ^b
Khdeiri		19.00	22.12	20.56 ^a	18.10	26.60	22.35 ^c
Sorani		16.00	21.75	18.88 ^a	28.60	36.57	32.58 ^{ab}
General average B		13.38 ^b	20.23 ^a		25.928 ^b	36.306 ^a	
LSD0.05	A	6.235			3.965		
	B	3.943			2.508		
	A×B	8.818			5.607		

Fruit size and weight of the studied varieties

Variety		Fruit weight (g)				Fruit size (cm ³)		
		Rainfed Agriculture	supplementary irrigation	General average (A)	evaluation	Rainfed Agriculture	supplementary irrigation	General average (A)
Jlett	Table	4.870	8.180	6.525 ^a	Very high	4.08	8.00	6.04 ^a
Kaisi		6.140	6.790	6.465 ^a	Very high	5.00	5.60	5.30 ^a
Khowkhi	Bi-purpose	4.570	6.070	5.320 ^b	High	3.07	5.23	4.15 ^b
Khdeiri		1.320	3.410	2.365 ^c	Medium	1.30	2.17	1.73 ^c
Sorani		1.590	2.620	2.105 ^c	Medium	1.20	2.37	1.78 ^c
General average (B)		3.698 ^b	5.414 ^a			2.93 ^b	4.67 ^a	
LSD _{0.05}	A	0.3796				0.769		
	B	0.2401				0.487		
	AxB	0.5368				1.088		

The oil rate based on the wet and dry weight of the studied varieties

Variety		oil rate based on the wet weight (%)			oil rate based on the dry weight (%)		
		Rainfed Agriculture	supplementary irrigation	General average (A)	Rainfed Agriculture	supplementary irrigation	General average (A)
Jlett	Table	16.55	10.41	13.48 ^d	13.42	27.86	20.64 ^c
Kaisi		18.57	14.44	16.01 ^c	26.48	35.94	31.21 ^b
Khowkhi	Bi-purpose	22.80	18.06	20.43 ^b	28.58	46.32	37.95 ^a
Khdeiri		21.13	20.59	20.86 ^b	28.35	46.60	37.48 ^a
Sorani		24.7	22.7	23.70 ^a	27.71	52.20	39.95 ^a
General average (B)		20.75 ^a	17.24 ^b		24.908 ^b	41.784 ^a	
LSD _{0.05}	A	1.008			2.520		
	B	0.637			1.594		
	AxB	1.425			3.564		

Some drought standards of the studied varieties

Variety		Chlorophyll A	Chlorophyll B	Water saturation content %	Leaf water content %	Water deficiency %	Leaf's dry material rate %	Glucose	proline
Jlett	Table	0.914 ^a	0.651 ^a	62.6 ^{ab}	53.75 ^a	37.4 ^{ab}	46.25 ^a	34.95 ^{abc}	26.4 ^b
Kaisi		0.558 ^b	0.363 ^a	72.9 ^a	57.66 ^a	27.1 ^a	42.34 ^a	32.42 ^{bc}	39.8 ^{ab}
Khawkhi	Bi-purpose	1.052 ^a	0.683 ^a	51.7 ^b	55.37 ^a	48.3 ^b	44.63 ^a	41.71 ^{ab}	64.2 ^{ab}
Khdeiri		0.855 ^a	0.638 ^a	53.5 ^b	49.27 ^a	46.5 ^b	50.73 ^a	28.48 ^c	47.8 ^{ab}
Sorani		1.085 ^a	0.695 ^a	56.0 ^b	52.92 ^a	44.0 ^b	47.08 ^a	44.80 ^a	69.6 ^a
LSD 0.01		0.2546	0.3526	11.42	9.151	11.42	9.151	10.44	38.23

Upon studying the relativity tree based on the studied drought standards (chlorophyll A, chlorophyll B, water saturation content, leaf water content, water deficiency, leaf's dry matter rate, Glucose and proline), the studied varieties were classified into two groups; the first group was more drought-tolerant and included two varieties (Keissi and Jlett- table varieties), while the second group was less drought-tolerant and included the varieties of (Sorani, Khdeiri and Khawkhi; i-e: bi-purpose varieties). As a result, it is recommended to disseminate and cultivate the varieties that are more drought-tolerant in the Arab countries with dry conditions.

2- Project of «Selection of Verticillium Wilt (*Verticillium dahlia* Kleb) Disease- Resistant Wild Olive Lines and Grafting of Some Economic Varieties With Them»:

Project objective:

- Get wild olive cuttings from several areas in the headquarters country, test their ability to rooting, identify the collection sites by using GPS and identify the climatic conditions of their environments.
- Collect samples of infected olive trees, isolate the infecting fungi and study its properties and its infecting capacity.
- Test the reaction of the wild genotypes, for which the rooting process was successful, towards the pathogenic fungi and maintain the resistant ones to serve as a bank for wild genetic resources



Verticillium wilt disease pathogen colonies and tree infection symptoms

resistant to Verticillium wilt (*Verticillium dahlia* Kleb) in Syria.

- Test the tolerance trait of the variety that is grafted with tolerant wild types.

The first and second objectives have been achieved after collecting and transporting wild olive lines cuttings to ACSAD's research station in Al-Boukka for the purpose of rooting. Some isolates of the pathogenic fungi have been also isolated in the laboratory to study their properties and pathogenic capacity.

3- Project of «Study of Reaction of Some Olive Varieties and Types with Different Origins to the *Pseudomonas savastanoipv. Savastanoi* Disease»:

Project objective:

- Isolate the pathogen of the *Pseudomonas savastanoipv. Savastanoi* disease that prevails in the olive cultivation areas and characterize it by studying its biochemical properties and pathogenic capacity.
- Study the sensitivity of several olive varieties with different origins towards the infection with the *Pseudomonas savastanoipv. Savastanoi* disease.
- Conduct a molecular study for olive varieties by using SSR technique aiming at studying the relation among the tested varieties and their reaction to the *Pseudomonas savastanoipv. Savastanoi* disease.



Pseudomonas savastanoipv. Savastanoi disease infection symptoms

In the field of pistachio:

1- Study the genetic relation between some Syrian pistachio varieties and other pistachio varieties of Al-Maghreb countries:

The data has been taken through the field morphological characterization of six pistachio varieties which are: Al-Matter, Mknas and Kithar (Al-Maghreb countries varieties) and A>ashouri, Batouri and ACSAD (Syrian varieties), by using the pistachio characterization guidebook. Samples of young leaves have been taken, kept in liquid nitrogen and then transferred to the bio-techniques laboratory of ACSAD where genetic printing has been conducted.

The six varieties are divided into two groups; the first one has two sub-groups of which the first one includes Matter, A>ashour and Batouri (the relativity between Matter and A>ashouri is bigger than that with Batouri variety), and the second one includes Mknasi and Kithar (Al-Maghreb countries varieties). It is noticed that Batoury variety of ACSAD- Ezra'a stands alone; and that proves how distant it is in terms of genetic relativity with other varieties.



Batouri and Matter varieties

Forth: Program of Palm tree Development

1- Project of "Land and Vertical Palm Tree Service Processes Development for Production Increase and Quality Improvement in the Arab Region»:

Project objective:

Improve the economic returns of the date palm tree by increasing production; improving the fruit quality and raising the marketing and storing capacities, conserve the superior seed lines and enhance the research, developmental and extension capacities of the national institutions.

Program participating parties: The Hashemite Kingdom of Jordan, the Republic of Tunisia, the Democratic People's Republic of Algeria, the Kingdom of Saudi Arabia, the Republic of Sudan, the Syrian Arab Republic, the Federal Republic of Somalia, the State of Palestine, the Arab Republic of Egypt, the Islamic Republic of Mauritania.

Project progress:

- 1- The participating Arab countries have nominated their national coordinators to start up the actual implementation.
- 2- The first national coordinators meeting has been held during the period 24- 26/8/2015 at the

office of the Arab Center (ACSAD) in Cairo, in which the national coordinators have participated and the project document has been prepared to start up the project.

- 3- A study visit has been conducted by ACSAD's experts to the two sites proposed to be the two pilot fields to implement the project activities in each of the following countries: Tunisia, Somalia, Egypt and Mauritania. The aim is to get acquainted with their compliance with the technical requirements and their appropriateness for project activities implementation. Other field visits are planned to the rest of the participating countries.
- 5- The 2nd national coordinators meeting has been held during the period 25- 26/8/2016 in Egypt with the participation of the national project coordinators where the first- year achievements of the project have been presented and solutions have been developed for the problems and constraints faced by the countries in the project activities implementation.
- 6- A national training course under the title of "Palm Tree Head Service" has been held during the period 27- 30/8/2016 in the Arab Republic of Egypt for a number of trainees from the following Arab countries: Jordan, Tunisia, Algeria, Sudan, Syria, Somalia, Palestine, Egypt and Mauritania. In this course, It has been agreed on unifying the mechanisms for activities implementation and expected results measurement.



National training course on "Palm Tree Head Service", 27-30/8/2016, Egypt



2nd meeting of national project coordinators, 25-26/8/2016, Egypt



Typical field, Egypt 2016



Typical field, Tunisia 2016

2- Project of "Molecular Characterization and Documentation of Genetic Resources of Selected Date Palm Tree Lines in the Arab Republic of Egypt":

Project objective:

- 1- Collect the genetic resources, study the natural biodiversity of date palm tree, conserve the genetic resources of the selected date palm lines by the Arab Center (ACSAD) in the Arab Republic of Egypt and identify the important genetic properties of the selected date palm lines.

- 2- Use bioinformatics in the preparation of a genetic print database for the selected lines and save the database at ACSAD's Bio-techniques Center.
- 3- Support the Arab efforts in the productivity improvement program of date palm lines through the identification of the genetic print of each breed.

Project progress:

- 1- The DNA genetic material has been extracted from the palm samples and saved for conducting the next experiments.
- 2- The starters of the techniques that will be applied on the studied samples have been designed.
- 3- The RADP and ISSR techniques have been applied in the molecular characterization of the genetic resources of the selected date palm lines in the Arab Republic of Egypt.
- 04- The results of the studied samples have been concluded and saved until the genetic print data is collected and compared with the results of other techniques.

3- Research Plan of Palm Tree Development Program:

1- Research Project: "Selection and Evaluation of Some Male-Palm Trees under Arid and Semi-Arid Areas Conditions":

The research has been conducted in the Arab Republic of Egypt and the field experiments have been implemented in the seasons of 2014 and 2015. Currently, the final report and results are under preparation.

2- Research Project: "Infection Evaluation and Impact of Palm Tree Age and Stem Height on the Presence of *Rhynchophorus ferrugineus* in Some Date Palm Varieties under Arid and Semi-Arid Areas Conditions"



The research has been conducted in the Arab Republic of Egypt and the field experiments have been implemented in the seasons of 2014 and 2015. The data are now classified and the results are finalized.

3- Research Project: "Genetic Identification and Comparison of Local Isolates Efficiency in the Pathogenic Microbes of Palm Pests and the Potentials of the Isolates Production in the Fermenters":

Project objective:

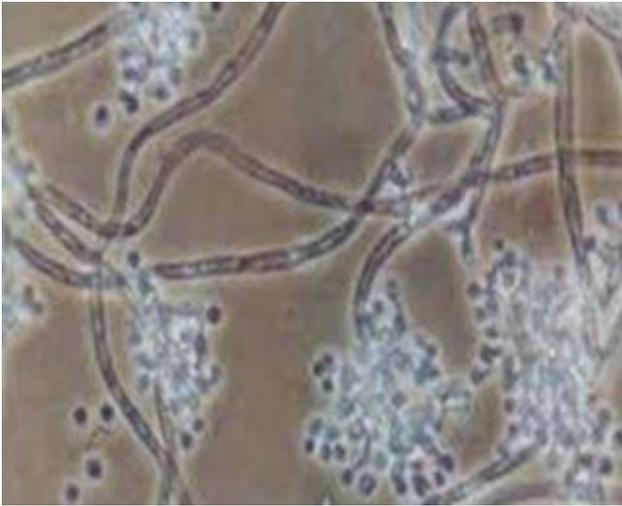
- Inventory the pathogenic insect infections of the palm trees.
- Investigate the bio factors presence in the palm tree environment in the arid and semi- arid areas.
- Identify the killing concentrations and quantities of these bio factors.

- Field application of bio control for palm tree pests.

Project progress:

- 1- The infection with *Rhynchophorus ferrugineus* has been focused on due to the wide prevalence of this insect on the fan and fruit palm trees in the governorate of Lattakia in the Syrian Arab Republic.
- 2- A field visit to /7/ sites, where the infection prevails, has been conducted. In this visit, insect samples of all *Rhynchophorus ferrugineus* growth stages have been collected and a laboratory breeding for the insect has been performed on parts of sugar cane stems where the insect has not completed its life cycle. It has been noticed also that pathogenic infections have appeared on the full-grown insects coming from the collected pupas, and on the larva collected from the infected trees.
- 3- The pathogen has been also isolated in the NA and YPGA nutritious mediums and a pathogenic diagnosis has been performed. Two isolates of *Beauveria* sp. fungi have been isolated and identified in the laboratory to make sure of the fungi pathogenic capacity by applying the hypothesis of Gogh on the meal moth, which has been bred at the Bio Control Studies and Research Center, and on healthy larva of *Rhynchophorus ferrugineus*.





Fifth: Program of “Rangeland and Forestry Resource Rehabilitation and Development”

1- Project of “Arab Rangeland Rehabilitation and Management and Collection and Propagation of Promising Plant Species Seeds”:

Project objective:

Provide the appropriate plant species seeds, develop and conserve the arid and semi-arid areas in the Arab region and collect, conserve and propagate the seeds of the genetic resources.

Project site:

Arab countries.

1- Project of “Rangelands Rehabilitation in the Algerian steppes”:

Project objective:

Develop pastoral areas, increase breeders’ income, contribute to the economic development, combat lands degradation, achieve the optimal use of rainfall, raise the pastoral vegetation cover productivity, develop wild life, train the national technical staff and activate the local communities role in lands degradation control and rangelands management.

Project progress:

- 1- The Arab Center (ACSAD) has been keen to implement all scientific and technical activities according to the project agreement.
- 2- The protection results at the site of Al-Doam have shown the appearance of highly satisfactory new plants, the renewability of old- age species and the appearance of important new species such as : *Plantago albicans* and *Helianthemum* sp.
- 3- The results of establishing a reserve in the site of «Ben Hamed» at an area of 4500 ha of *Cladium mariscus* and *Artemisia* rangelands are monitored and followed-up.
- 4- The project technical report has been prepared and submitted to the Algerian side.

2- Project of “Desert Rangelands Development and Productive Capacity Raising”:

Project Outputs:

- 1- ACSAD’s experts have worked during the year 2016 on collecting the seeds of “*Medicago arborea*” and “*Poterium sanguisorba*”, as /200/ bags of each have been cultivated at the nursery of ACSAD’s research station of Ezra’a to be transferred and disseminated later in the Arab countries.
- 2- The “*Retama raetam*” plant is considered one of the important drought-resistant pastoral species in the Arab region. It is prepared now to be cultivated at ACSAD’s research stations aiming at disseminating it in the Arab countries for rangelands rehabilitation.
- 3- The Arab center (ACSAD) has provided the Algerian side with the seeds of *Atriplex leucoclada*, *Atriplex halimus*, *Atriplex canescens* and *Salsola* species for supporting the activities of the Project of “Desert Rangelands Development in Algeria”.
- 4- A nursery has been developed in Warqqla- Algeria with a productive capacity estimated at

/6000/ seedlings annually, and /1000/ bags of pastoral species (Atriplex and Salsola) have been cultivated in the mentioned nursery.

5- A breeding field has been established in the campus of Warqqla University,

6- Two training courses have been conducted for a number of Algerian trainees working in the project in the following fields:

“Pastoral nurseries management and establishment” in February 2016.

“Pastoral surveys and measurements” in November 2016.

3- Project of “Al-Hammad Basin Development in Iraq”:

Project objective:

Improve and rehabilitate rangelands in Al-Hammad basin in Iraq by identifying the pastoral settlement zones for developing a pilot project and utilizing satellite images, identify the promising areas according to the available data, identify land uses and evaluate the available water and plant resources in the light of the prevailing climatic conditions and soil nature.

Project progress:

1- Propagate Haloxylon persicum plant in Al-Hammad nurseries.

2- Follow-up the transplantation of 10000 seedlings of Haloxylon persicum plant that has been introduced by the Arab Center (ACSAD) to the project area.

3- Prepare a technical investment plan for /3/ pastoral projects based on the study results of Al-Hammad basin in Iraq.

5- Monitor the development of the vegetation cover transplanted by the Haloxylon persicum, Atriplex and Salsola species.

2- Project of “Inventory of Multi- Purpose Tree and Shrub Species and Enhancing their Role in the Support of Local Community Income Sources”:

Project objective:

The project aims to conduct an inventory process of the promising and multi-purpose tree and shrub species in the forest and rangeland areas, set up the appropriate plans for collecting and propagating seeds and study the role of these species in contributing to the micro projects establishment and local communities’ income support.

Project site: ACSAD’s research stations and interested Arab countries.

Project progress: During the year 2016, seeds of a number of promising multi-purpose shrub species have been collected as follows:

1- The Retama raetam plant, being a drought-tolerant and sand creeping- controlling species.

2- The Acacia lebbek plant, being a fodder and drought-tolerant species.

3- The Atriplex and Salsola plants.

4- A number of promising multi-purpose shrub species such as «Salvadora persica», «Prosopis cineraria», «Jatropha glauca», «Acacia salicina» and «Colutea cilicica».

5- Germinate /150/ seedlings of Acacia salicina and /80/ seedlings of Colutea cilicica.

6- Cultivate Poterium sanguisorba and Medicago arborea species as seed sources in the nursery of Ezra’a station.



Plant measurement training course



Desert plant detection- Algeria

Sixth: Biodiversity Program

1- Project of “Biodiversity Conservation and International Convention on Biodiversity Implementation Follow-up”:

Project objective:

The project aims to utilize the agro- biodiversity genetic resources in the food and medicine production programs, document and exchange the available information on biodiversity components in the Arab arid and semi-arid zones, contribute to the eco-systems rehabilitation in a way that conserves the biodiversity in the disturbed environments, cooperate and coordinate among the Arab countries in the field of implementing the International Convention on Biodiversity and Cartagena Protocol for Biosafety and build national capacities in the field of biodiversity conservation and management.

Project progress:

- 1- Coordinate among the Arab countries for implementing the International Convention on Biodiversity and Cartagena Protocol for Biosafety.
- 2- Prepare a progress report on ACSAD’s biodiversity program and submit it to the Housing and Environment administration at the League of Arab States headquarters through the Arab Team for Environmental Agreements.
- 3- Participate in the preparation and scientific review of the Syrian Arab Republic country report on “Biodiversity for Food and Agriculture”.

2- Project of “Medical and Aromatic Plants Study in the Arab World”:

Project objective:

Study the medical plants prevailing in the Arab region and find out the potential of utilizing them in a scientific way, while attempting seriously to conserve these precious plant species due to their therapeutic characteristics and economic values.

Project site:

Syrian Arab Republic.

Project progress:

- 1- An aromatic medical endangered plant present in the middle-coast region and called «Irisun-

guicularis cretensis» has been selected. This species has faced a highly human pressure during the recent years.

- 2- Inventory the sites in which the «Irisunguicularis cretensis» species prevails, get acquainted with the optimal environmental conditions for its growth and evaluate its current actuality.
- 3- The «Iris unguicularis cretensis» sites in the Syrian coast have been identified through field tours. As a result, the main sites have been identified and the «Iris unguicularis cretensis» plant has been considered present if /5/ colonies at least were discovered in the surveyed site.
- 4- After designing and testing the necessary forms in the sites, the forms have been reviewed, the data has been completed and analyzed and the results have been reached and discussed in a scientific paper (which is under publication).
- 5- The fodder value of the "Iris unguicularis cretensis" plant will be analyzed in the spring of 2017.

In a parallel context and under ACSAD's concerns with projects of sustainable development, desertification combat, biodiversity and local communities livelihood improvement in the non-stable environments, a study has been conducted on some Syrian multi-use natural wood species (Colutea cilicica, Cercis siliquastrum and Arbutus andrachne) to get accurate scientific information on these species, their propagation methods, their potential services and their optimal management and utilization. The field and nursery studies have been implemented and the data has been analyzed to present the results in a scientific research paper.

A project on the use of «Allelopathy» is also under implementation, as the impact of different concentrations of water and alcoholic extractions and dry powder of a number of pastoral species (such as Cupressus sempervirens, Ceratonia siliquae, Eucalyptus, Myrtus, Nerium oleander, Ficus religiosa and Quercus infectoria) has been tested in terms of germination and growing of common weed species in Syria, some growth stages of some insects, some storing molds and some species of snails. Several research papers have been published in the Arab Journal for Dry Environments and a special research on the «Quercus infectoria» results is now under implementation.



Lands and Water Uses

The lands and water uses Department works on implementing its activities through the following main programs:

1- Program of “Desertification Combat and Monitoring in the Arab Countries”:

The program aims to monitor and combat desertification through the adoption of a sound and scientific methodology by using advanced techniques for early detection of lands degradation and implementing pilot projects to rehabilitate desertification areas in the Arab countries.

2- Program of “Soil and Land Studies and Mapping”:

This program aims to prepare soil, lands and mapping studies, as the land resource survey studies ,particularly the land and digital purpose mapping, are considered one of the most important elements that helps in understanding the land resources components in the Arab region to establish a database for natural resources in the region and assists the decision makers in the rational planning process, sustainable use of the limited available resources, agricultural production intensification and ,ultimately, agricultural income and revenue increase. This is all done through a more efficient and appropriate use of lands and resources.

3- Program of “Sustainable Land and Water Uses Mangement”:

This program aims to develop an optimal management of lands and water and find improved scientific techniques and methods that achieve an economic production. Accordingly, ACSAD continues its applied and research programs which lead to the efficient and safe use of non-conventional water (such as saline and waste water) and the safe treatment that does not cause soil degradation and conserves its sustainability.



Program of “Desertification Combat and Monitoring in the Arab Countries”

1- Project of “Sand Storm and Creeping Sand Control”:

Project objective:

The project aims to conserve environment and control the impact of sand storms and creeping sands on man and environment in the Arab region.

Project site:

The Republic of Iraq and the Arab Republic of Egypt.

Project progress:

In the previous years, the Arab Center (ACSAD) has sought to achieve positive results in this field as follows:

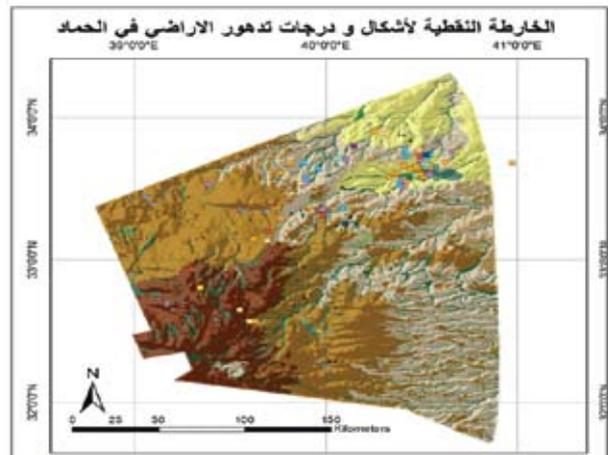
1- Project of “Al-Hammad Basin Development in Iraq (land studies component)”:

The project is implemented in cooperation between ACSAD and the Iraqi Ministry of Agriculture aiming at achieving the comprehensive agricultural development of Al-Hammad basin region including desertification combat and creeping sand fixation. The most important activities are the following:

- Analyze land degradation forms and prepare tables for degradation types, reasons and severity degree.
- Prepare land degradation map.
- Prepare the executive guidelines for sand creeping control.
- Prepare a typical project proposal document for sand fixation.
- Prepare and submit the final report to the Iraqi side.

Project implementation outputs:

- 1- Prepare /25/ basic physiographic maps and maps of drought, land degradation and soil types distribution in the study area.
- 2- Prepare /33/ explanatory and graphic figures for the study methodology and results.
- 3- Characterize and classify /56/ soil sects in /2/ classification classes, /8/ sub-classes and /18/ big groups based on the soil genetic and diagnostic properties.
- 4- Conduct a mechanical, chemical and fertilization analysis for /249/ soil samples.
- 5- Implement /6/ training courses on the use of remote sensing techniques in desertification monitoring and the application of the measures of sand creeping control and degraded land rehabilitation.
- 6- Prepare three proposals as follows:
 - Implement a typical project for sand dunes fixation in the region of Al-Walj in Iraq.
 - Design and implement a biogas production unit.
 - Establish a remote sensing unit and GISs.



2- Project of “Sand Dunes Fixation Using Agricultural Waste Water in Siewa Oasis in the Arab Republic of Egypt”:

The project is implemented in cooperation between ACSAD and the Desert Research Center aiming at improving the environmental conditions, protecting the development areas from the sand creeping risks in the recent reclamation areas of Siewa oasis, implementing a typical project for desertification combat and creeping sand fixation and developing a developmental society that is considered an attractive model for investors. Within the project framework in the year 2016, the following has been achieved:

- Temporary protection.
- Green belt cultivation.
- Drip-irrigation network implementation.
- Training courses.

1- Temporary protection:

Due to the prevailing environmental and climatic conditions in the project area, the plants have faced severe winds, high temperature in summer and low temperature in winter; the fact that necessitates the protection of the cultivated seedlings, especially in their early growing stage, through the establishment of mechanical or biological systems that could protect plants from the negative reverse conditions. Within this framework, the following has been achieved:

A-Construct a tunnel with a length of /1/ km, width of /1/ m and depth of /1/ m for the purpose of decreasing the sand quantity that creeps towards the green belt site in the project area.

B-Fences establishment: A fence made of palm leaves has been established with /1/ km length, /1.5/ m height and a leaf content estimated at /8/ leaves in length, i.e. with a penetration capacity of 30%. The construction has been made at /10/ m away from the tunnel; in parallel with it and vertically with the wind direction. The purpose of this fence is to protect the green belt (the cultivated plants) from the sand creeping risks.

2- Green belt cultivation:

Green belts and wind breakers are considered the most effective tools to protect establishments from the sand creeping risks. The efficiency of these belts and breakers in controlling the wind speed and sand creeping depends on the suitable design in terms of the used tree species, their structure inside the belt, the rows number and the spaces between trees to achieve the optimal

penetration. Accordingly, in the light of the project work program, which aims to implement an extension model that can be used to establish an integrated system of green belts in the areas encountering sand creeping in Siewa oasis, the green belt has been designed in a way that achieves the diversity of the plant types and provides the efficiency necessary for controlling wind speed and sand creeping. The green belt has been cultivated for effective sand fixing, as a set of plants that suit the environmental conditions of the area have been selected and cultivated in certain and various designs and structures according to their growth nature in a way that achieves the maximum benefit in controlling sand creeping.

3- Drip irrigation network implementation:

A drip irrigation network has been implemented in the project area. The suitable design has been selected in a way that provides the cultivated plants with their water requirement during their different growing periods.

4- Training courses:

Training courses gathering civil society organizations, agricultural engineers, interested investors and farmers have been organized on sand dune control tools and methods including:

- A- The technical principles for planning projects of sand creeping control and irrigation canals afforestation.
- B- Developed irrigation systems management.
- C- Agriculture and optimal agricultural practices for cultivated plants and the economic and environmental returns of such a project.



3- Project of “Infrastructure Protection from Sand Creeping Risks in Sina’a”:

Project participating parties: The project is implemented in cooperation between the Arab Center (ACSAD) and the Desert Research Center in the Arab Republic of Egypt based on a three-year joint cooperation agreement aiming at protecting the national projects and infrastructures and improving the environmental conditions. The site of «Al-Maghara» in Sina'a has been selected for the project activities implementation and the work has started up in May 2016. The work plan for the season 2016-2017 has been as follows:

- Select and identify the study area.
- Collect the previous studies.
- Analyze the climatic elements.
- Study the sand structures distribution.
- Identify the sand creeping-affected areas.
- Analyze satellite images of various dates.
- Calculate the relative quantities of moving sands.
- Implement field visits to scrutinize the data and information.
- Inventory the natural vegetation cover in the sand areas.
- Equip a nursery for producing the necessary plants.

4- Preparation of Sand Dunes Encyclopedia in the Arab Region:

Under the initiative of the Arab Center (ACSAD) and led by its concern towards enhancing the cooperation with the national institutions in the Arab countries, a mutual project has been launched in cooperation with the Desert Research Center in Egypt and the Arid Zones Institute in Madnin in Tunisia, on « Preparation of Sand Dunes Encyclopedia in The Arab Region» in the year 2016. Under this project, the following activities have been achieved:

- A mutual workshop has been held in Cairo during the period 16-18/5/2016 to start up the project.
- The coordination committees have held their first meeting in Cairo during the period 16-18/7/2016 where the executive plan has been set up and has included the following:

A- Justifications, objectives and importance.

B- Encyclopedia components: it consists of /7/ chapters namely: (1- sand dunes characteristics in the Arab Region, 2- the factors that affect the distribution and prevalence of sand dunes in the Arab Region, 3- plant biodiversity of sand environments, 4- sand dunes movement, 5- positive and negative aspects of sand dunes and their economic and social reflections and 6- sand dunes fixation and desertification combat).

- The second coordination meeting for the representatives of the three parties has been held in the city of Madnin in Tunisia during the period 24-26/10/2016 with the attendance of the concerned technical teams aiming at performing the interim review of the encyclopedia progress. The meeting has included the following activities:

A- Organize a general meeting for all participants aiming at reviewing what has been agreed on in the first coordination meeting and reviewing what has been collected and prepared in terms of the necessary information.

B- Qualitative meetings have been held for the sub- workgroups, in which the encyclopedia chapters have been discussed and the general guidelines for completing the sub-activities of encyclopedia content preparation have been developed in a way that suits the tasks of each sub-group.

C- Agree on completing the work phases in a way that suits the project executive plan.



Project of “Degraded Land Rehabilitation in the Arab Countries”:

Project objective:

Monitor and evaluate land degradation processes, work on degraded lands rehabilitation and natural resources development in the affected areas and improve the livelihood standards of local community.

Project site:

The Democratic People’s Republic of Algeria, the Syrian Arab Republic and the Arab Republic of Egypt.

Project progress: During the recent years, the Arab Center (ACSAD) has achieved good scientific results in the project implementation as follows:

1- Project of “Rangeland Rehabilitation in the Algerian Steppe Area”:

Project participating parties: The project is implemented in cooperation between ACSAD and the Ministry of Agriculture and Rural Development in Algeria represented by the High Governorate for Steppe Development. It aims to develop pastoral areas, increase breeders’ income and contribute to the economic development.

Project implementation period: /5/ years ending at the end of 2016.

The project activities have included the following:

- Follow-up seedlings cultivation and seeds sowing in the rehabilitated sites.
- Continue the application of the protection measures.
- Implement water harvesting measures.
- Continue the application of mechanical and biological fixation activities for the moving sands.
- Conduct the repair and maintenance activities of the rehabilitated sites to maintain the reached positive results of the project in terms of soil conservation and pastoral vegetation cover development.
- Send ACSAD’s technical report on the project progress to the Algerian side to get informed and acquainted with the project activities.



Project outputs:

- Contribute to the rehabilitation process of the degraded rangelands.
- Control sand creeping and sand storm blowing.
- Optimal use of surface flow water.
- Increase the vegetation cover rate and raise the pastoral capacity.
- Form a team of Algerian technical staff capable of transferring the applied techniques to other sites in Algeria.



2- Project of “Desertification and Land Degradation Indicators Development in the Syrian Arab Republic”:

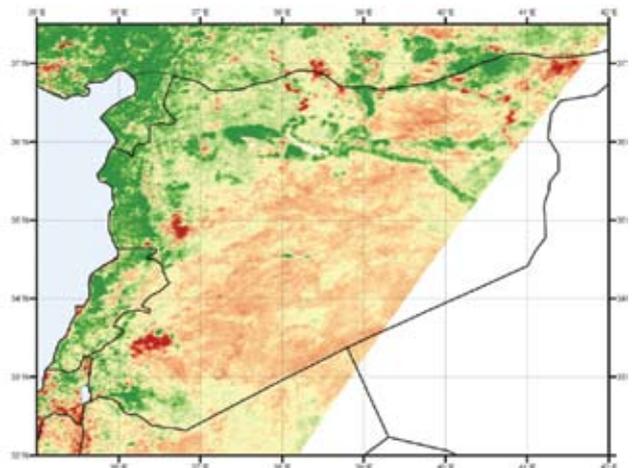
Project participating parties:

The project is implemented in cooperation between ACSAD and the Ministry of Local Administration and Environment in the Syrian Arab Republic based on the signed cooperation agreement that contains the cooperation in the fields of desertification, drought and climatic changes problems facing. The importance of this issue comes from the importance of the indicators being the easiest standards for expressing the occurred change, characterizing the process responsible for desertification and land degradation and identifying the degradation degree.

The activities of this project have continued during the year 2016 to review and agree upon the climate and remote sensing indicators and the social and economic indicators by holding qualitative meetings as a step towards developing the final integrated indicators. The Ministry of Local Administration and Environment in Syria is working on issuing and circulating the indicators among the concerned national agencies in the Syrian Arab Republic.

Project outputs:

Develop specific standards for desertification and land degradation indicators including the indicators of land and water resources, vegetation cover, climate, remote sensing and socio-economic conditions of the population in the desertification and land degradation-affected areas.



3- Project of “Estimation of Water Drifting Severity and Quantity by Using Field Measurements and Math Modeling”:

The project is implemented in Syria in the agricultural nursery area next to ACSAD’s research station of Al-Sinn in the governorate of Lattakia. The project aims to estimate the water drifting quantity of the soil and identify the fertilizing and organic elements that are lost because of the surface runoff.

Project period:

/2/ years starting from April 2016.

The following activities have been achieved:

- A- Install tanks for surface water runoff harvesting.
- B- Collect surface runoff during the rainfall season and take samples from the harvested water to be analyzed in the laboratory.
- C- Collect the climatic data of the coastal area to be used in the scheduled modeling.
- D- Collect the data of soil and vegetation cover.
- E- Apply the model (RUSLE) and conduct the necessary calibration.



4- Project of “Degraded Natural Resources Rehabilitation in the Governorate of Matrouh in the Arab Republic of Egypt”:

Project participating parties:

The project is implemented in cooperation between the Arab Center (ACSAD) and the Desert Research Center in the Arab Republic of Egypt.

Project outputs:

- A- Conduct chemical and microbiological analysis of water and soil in the project areas.
- B- Study the land, geological and water resources and vegetation cover and the most important characteristics of the agricultural activity.
- C- Rainfall water harvesting, water drifting control and land rehabilitation activities in the areas of Wadi Om Eshttan and Al-Sanb.
- D- Provide farmers with the necessary irrigation network for cultivating the various seedlings of olives, fruits and rangeland species and vegetable seeds.
- E- Provide some farmers with the technical expertise and pesticides necessary for pathogenic and insect pests.
- F- Implement the awareness and extension activities by providing a typical extension program for degraded land rehabilitation with the participation of the local community to achieve the sustainable development in the northern east coast region –governorate of Matrouh.
- G- Apply the modern techniques, which are appropriate for the project area conditions, on water harvesting and ground water resource provision.
- H- Protect the natural resources in the project area by conducting some agricultural operations to adapt with the climatic changes.
- I- Train the technical staff and farmers in the project area on natural resource management and rehabilitation.



5- Project of «Follow-up of UNCCD Recommendations and Activities and the Related Arab Mechanisms»:

Project objective:

The project is implemented by ACSAD being officially- authorized by the Secretary General of the League of Arab States to follow up the implementation of the convention in the Arab countries. The project aims to support the implementation of the convention in the Arab countries, coordinate among them, unify their attitudes and coordinate with the concerned Arab mechanisms in this field.

Project site:

ACSAD and the Arab countries.

Project progress:

The Arab Center (ACSAD) has implemented the following activities in the year 2016:

- A- Celebrate the International Day of Desertification Combat: As usual, the Arab Center (ACSAD) joins the international community every year in this prominent event on the 17th of June aiming at raising the public awareness towards the environmental, economic and social problems of desertification. On this occasion, the Arab Center (ACSAD) has issued a leaflet and a poster on the slogan raised by the convention secretariat for the year 2016 entitled «Together to Involve People in Land Protection and Reclamation». The leaflet and poster have been sent to the technical secretariat of the Arab Ministers Council for Environmental Affairs to be distributed among the Arab countries.
- B- Prepare a technical memo on «land degradation neutrality» for the purpose of implementing the resolutions of the Arab Ministers Council for Environmental Affairs in its 27th session, submit it to the Secretary General of the council and present it in the 16th session meeting of the Arab team responsible for following-up the international environmental agreements.
- C- For the purpose of implementing the resolutions of the Arab Minister Council for Environmental Affairs, a training course on desertification and drought mapping has been organized for engineers from the Palestinian Environment Quality Authority.
- D- Participate in the 16th session meeting of the Arab team responsible for following-up the implementation of international environmental agreements and present a detailed report on ACSAD's activities in the field of desertification combat and biodiversity.
- E- Participate in the 18th session meeting of Environment and Development Committee in the Arab Region and the 28th session meetings of the Arab Ministers Council for Environmental Affairs, present "PowerPoint" presentations on the progress of the project of «Green Belts Establishment in the Arab Region» and prepare desertification and drought maps for the State of Palestine.



Project implementation results:

- Raise awareness towards desertification and land degradation issues in the Arab region.
- Enlighten the importance of land degradation neutrality (LDN).
- Build the Palestinian technical capacities for the application of ACSAD's methodology for desertification and drought monitoring.
- Activate the participation of the Arab countries in the activities of the Arab team responsible for following-up the implementation of international environmental agreements (desertification and biodiversity).

Second: Program of Soil and Land Studies and Mapping

1- Project of "Land Degradation Monitoring and Evaluation in the Arab Region":

Project objective:

This project represents one of the activities that ACSAD has started to prepare for, aiming at achieving a long-term monitoring for land degradation in the Arab region. This has come as a result of the recommendations of UNCCD Science and Technology Commission, since holding the Land Degradation Monitoring Forum in Bonn- Germany and the 9th session meeting of COP (COP9) in Buenos Aires- Argentina, where ACSAD was charged with the mission of coordination and following-up among the Arab countries to activate the convention.

Project site:

All the Arab countries.

Project progress:

The most important achievements in this field can be summarized as follows:

1- Vegetation Cover Degradation Monitoring in the Arab World:

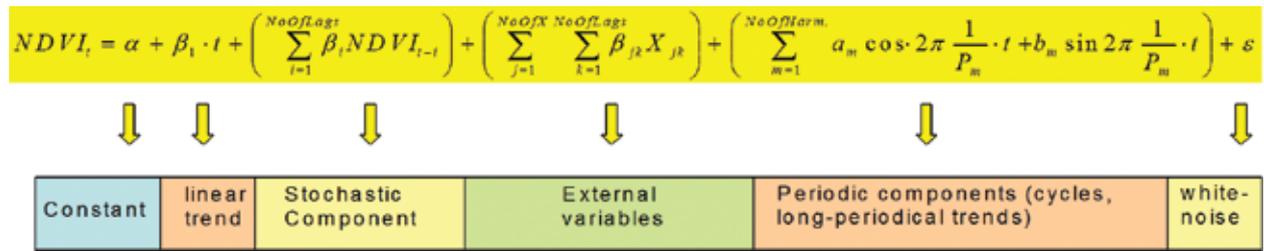
The project aims to monitor the situation of land degradation at the regional and national levels, link land degradation policies, control risks affecting agricultural productivity, evaluate the degree, nature and type of land degradation and identify the most endangered areas.

The dry lands in the Arab Region face different types of degradation resulted basically from the poor natural resource management and misuse (water, soil and vegetation cover), in addition to drought which largely contributes to the degradation process. The land degradation monitoring represents a vital part of desertification combat activities; it is a process that starts with monitoring the areas vulnerable to vegetation cover changes, estimates the extent and situation of land degradation there and ends with identifying the hot spots and bright spots.

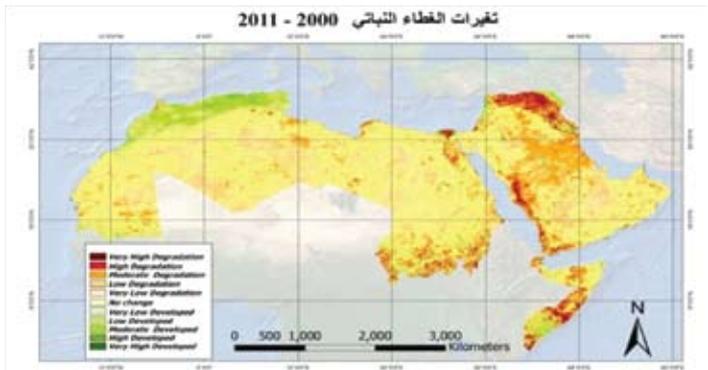
No doubt, land degradation monitoring requires a sound methodology and accurate studies; as remote sensing techniques are used in monitoring and evaluating the general situation of the vegetation cover and degradation extent. This is done as follows:

- 1- Prepare and develop NDVI vegetation cover image archives of MODIS type with a spatial resolution of 1 km for a period covering 2000-2014.
- 2- Calculate the variation trend of the vegetation cover by using the model of "TimeStats Software

Package”, which has been prepared in cooperation between the Arab Center (ACSAD) and the University of Trier in Germany.



ACSAD’s research studies on «Early Warning System of Desertification in the Arab Region» indicate that 28.1 million ha are exposed to degradation of which 12.7 million ha are classified as «severe», 9.6 million ha are medium and 5.7 million ha are low, and that an area of almost 4 million ha has improved.



The archives analysis (MODIS and SPOT Vegetation 1km) of the project of «Early Warning System for Land Degradation between the Years 2000-2011» has shown that there is a clear decline in the vegetation cover in general estimated at about 45% as a result of calculating the «degradation» and «improvement» percentages as in the following table:

Vegetation cover changes during the period 2000-2011

Arab country	Bright spots (ha)	%	Degraded spots (ha)	%
Morocco	1690327	4	6338726	15
Algeria	2603744	3	34716584	40
Tunisia	1257957	13	2612679	27
Mauritania	6831317	9	28084304	37
Libya	7098288	13	25117021	46
Syria	762212	9	5335482	63
Lebanon	92639	60	15440	10
Iraq	4130786	10	26437028	64
Jordan	28817	2	417853	29
Palestine	10559	15	26748	38
Egypt	2007514	2	47176588	47
Sudan	5534573	5	52024989	47
Somalia	2313710	15	7712366	50
Djibouti	78136	2	3203559	82
Saudi Arabia	2338468	1	161354286	69
Qatar	35382	2	813784	46
Oman	1195979	3	15149064	38

Kuwait	94367	3	2610822	83
UAE	1406417	17	2895564	35
Yemen	1433960	2	32981079	46
Total	40945151	5	455023968	50

The severely-affected areas by land degradation and agricultural drought risks have been estimated at about 7.1% (94.30 million ha) of the total area; as 1.7% of the agricultural area is highly affected by both land degradation and agricultural drought risks, 3.3% is highly affected by land degradation and moderately by agricultural drought risks, 0.5% is moderately affected by land degradation and highly by agricultural drought risks and 1.6% is moderately affected by both land degradation and agricultural drought risks.

The recent results of the project of «Early Warning of Land Degradation by Analyzing Satellite Image Archives of MODIS and SPOT Vegetation 1km for the years 2000-2014» have shown that there is a clear decline in the vegetation cover in general estimated at about 387794115 ha (about 28.93% of the total area) as a result of calculating the «degradation» and «improvement» percentages in the Arab region, and that the human factor has had a clear impact on accelerating the land degradation as a result of agricultural intensification, groundwater depletion and drought in particular; which has negatively affected the "Mashreq" region. On the other hand, an area of about 2084228098 ha (15.55%) has improved.

The vegetation cover change, which is considered one of the most important indicators of land degradation, has been analyzed separately for each country and presented in a report published in the year 2016 under the title of «Monitoring and Estimation of Vegetation Cover Changes and Land Degradation by Using Remote Sensing Techniques».

The following table illustrates the vegetation cover changes during the period (2000-2014)

Arab country	Area (ha)	Bright spots (ha)	%	Degraded areas (ha)	%
Jordan	8934200	1621429	18.14	2879094	32.22
UAE	8360000	643596.5	7.69	3795276	45.39
Bahrain	66500	14548	21.87	38939.85	58.55
Tunisia	16361000	6798319	41.55	5124669	31.32
Algeria	238174100	4191552361	17.59	7677882264	32.23
Djibouti	2300000	51746.27	2.24	2157749	93.81
KSA	214968999.9	12162681.86	5.65	139362972.3	64.82
Sudan	186581300	38537492	20.65	65703967	35.21
Syria	18518000	1420912.78	7.68	10327523.42	55.77
Somalia	63765700	17037595	26.71	34051394	53.40
Iraq	43831700	12974337.06	29.60	20476034.73	46.71
Oman	30950000	4499816	14.53	12120855.96	39.16
Palestine	622000	200525.94	32.24	63990.76	10.30
Qatar	1143700	114592.6	10.01	592243.8	51.78
Kuwait	1781800	127068.4	7.131	1285746	72.15
Lebanon	1040000	750926.8	72.20	195928	18.83

Libya	175954000	6329608	3.59	66655265.27	37.88
Egypt	99545000	8461298.515	8.49	34372380.39	34.52
Morocco	71255000	42564151.13	59.73	7996973	9.12
Mauritania	103070000	27330808	20.96	37580816	28.82
Yemen	52800000	5964764.56	11.29	27725648	52.51
Total	1340023000	208422809.8	15.55367406	387794115.3	28.93

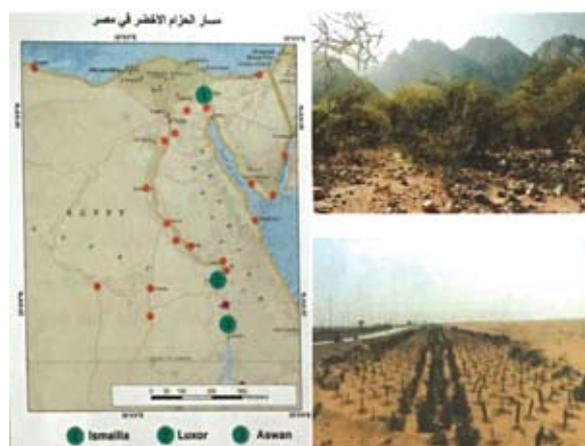
2- Project of "Green Belts in the Arab World Regions (Phase 1)":

Project objective:

It aims to support Arab countries in the implementation of national and regional projects for green belts establishment, degraded land rehabilitation and vegetation plot increase in the Arab Region.

Project site:

Hashemite Kingdome of Jordan, Democratic People's Republic of Algeria, Republic of Iraq, Republic of Sudan, Syrian Arab Republic and Arab Republic of Egypt.



Project outputs:

Based on the resolution of the "Arab League Council at the Summit Level" dated 28/03/2010 and the related resolutions issued by the Economic and Social Council, the Arab Ministers Council for Environmental Affairs and ACSAD's General Assembly; and for the purpose of implementing the content of these resolutions concerning the project of «Green Belts in the Arab Regions», the Arab Center (ACSAD) has performed all the activities of the first phase of this project in terms of preparing the executive program, contacting Arab countries and cooperating with those who have agreed upon the first phase activities implementation and application until fully performed. The Arab Center (ACSAD) has continued the project activities implementation in the year 2016 as the following:

A- Issue and send the first-phase technical report to the Secretariat General of LAS (league of Arab States) and the concerned authorities in the participating countries. The report includes the background, the justification focusing on the social, economic and environmental role of the green belts, a detailed review on the work methodology and a comprehensive characterization of the green belts progress in the participating countries (Hashemite Kingdome of Jordan, Democratic People's Republic of Algeria, Republic of Iraq, Republic of Sudan, Syrian Arab Republic and Arab Republic of Egypt).



B- The Arab Center (ACSAD) has prepared the executive plan of the second phase including objectives, period, general and annual executive plan and estimated budget, in addition to detailed tables on the activities of this phase including vegetation cover development, sand creeping control, capacity building of the concerned national institutions and development of human communities living in the green belt areas.

C- The work results and outputs have been presented in the 98th session meetings of the Social and Economic Council which has issued the resolution no. 2105 including authorizing the Arab Center (ACSAD) to contact all member countries concerning the second phase of the project provided that the interested countries bear the required cost and communicate with the Arab, regional and international funds to contribute to the second phase implementation. Accordingly, the Arab Center (ACSAD) has performed all the necessary correspondence with the concerned countries and financing funds.

D- Based on the letter of the LAS Secretariat General no. (5/6211) dated 20/11/2016, the project outputs have been presented in the 18th session meetings of the "Joint Committee for Environment and Development in the Arab World" and the 28th session meeting of the "Arab Ministers Council for Environmental Affairs" which has decided to request the Arab Center (ACSAD) to continue the project implementation, submit a periodical report to the council and present a visual presentation on it in one of the Arab countries.

3- Land Cover and Land Uses Mapping Project:

Project objective:

The project aims to prepare land use maps to comply with the progress achieved in GIS and remote sensing techniques use, prepare land and vegetation cover databases to reach the optimal lands use mapping, prepare the soil and cultivations maps for the purpose of developing good agricultural plans and train Arab technical staff on modern techniques such as remote sensing, GISs and land databases preparation.

Project site:

Democratic People's Republic of Algeria and Syrian Arab Republic.

1- Project of «Monitoring of Land Use Changes in Main Crops Areas by Using Remote Sensing Techniques in the Desert Areas of Algeria»:

Project objective:

Monitor the development of agricultural land utilization in the desert areas by using remote sensing and GIS techniques and train staff on data analyzing and mapping to be used by decision makers for the purpose of achieving a sustainable land management.

Being the basic step towards developing land resources, the agricultural land use monitoring mapping in the desert areas aims to achieve the optimal use and planning of these resources, get acquainted with the new vast areas and use the desert areas in cultivating main crops.

Project participating parties:

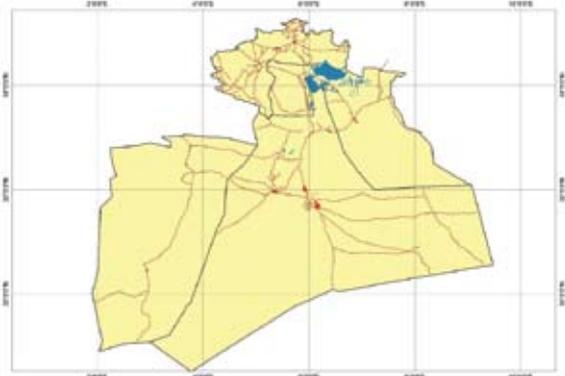
This project is implemented within the framework of cooperation between the Arab Center (ACSAD) and the Governorate of Agricultural Development in the Desert areas in the Democratic People's Republic of Algeria.

Project outputs:

A digital database has been developed for land uses. This database is always used to monitor, control, compare and review the various changes of land uses and select the best solutions for the optimal use. No doubt, the techniques of remote sensing and GISs related to the databases are considered the most important techniques that serve this purpose in line with the field study.

Study area:

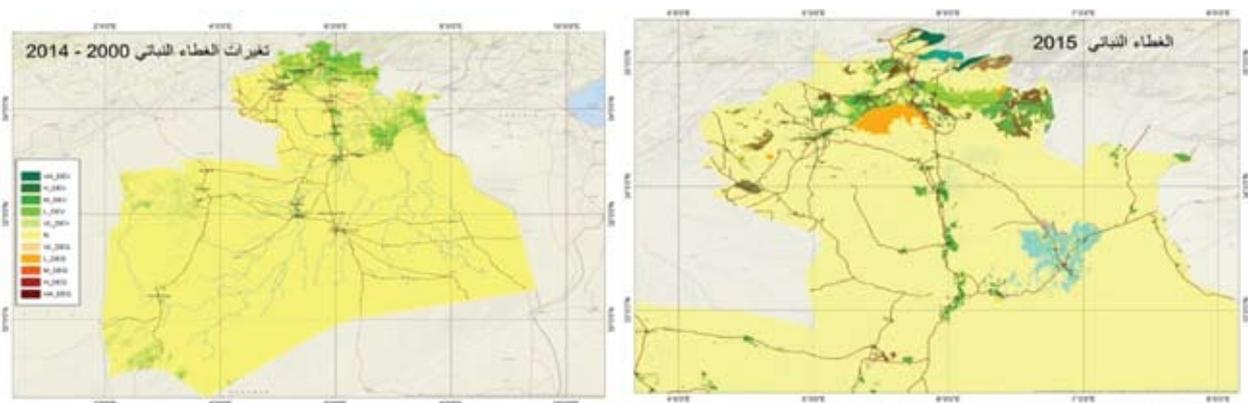
The study area is located in the eastern region of Algeria, covers an area of 308.6 thousand km² (about 30.86 million ha) and includes the states of Warqqla, Baskara, Alwad and Ghrdaya. After identifying the study area, the activity of separating the various physiographic units (land surface units) has started by using the visual analysis of satellite images taken by the thematic mapper (TM) of (Landsat) with a spatial resolution of (30*30) m for the year 2015. This is done by conducting the processes of geometric correction, spectral improvement and color structuring (2,3,4) which give an idea about the land figures and the types of active and non-active geomorphologic operations. The digital elevation model (DEM) has been also used for the visual interpretation mapping of the various land surface units (physiographic analysis) to study the soil cover and identify its properties. A preliminary map for the physiographic units has been produced to prepare for the field activities and conduct the field surveys.



The monthly satellite imagery archives of MODIS type (with a spatial resolution of 250 m for a period of 15 years 2000-2014) has been prepared. The vegetation cover curve of the four states has been analyzed to detect the areas with positive change in the vegetation cover; this is an indicator of the cultivation expansion and the prominence of new areas like reclaimed, pastoral or forest areas. On the other hand, areas with negative change could be degraded areas, areas that are left without cultivation or degraded rangelands and forests.

A physiographic unit map has been also developed to help the field team in surveying the agricultural places and getting acquainted with the degraded places. The field check points have been spotted on this map.

A physiographic unit map has been also developed to help the field team in surveying the agricultural places and getting acquainted with the degraded places. The field check points have been spotted on this map.



2- Project of “Rainfall Water Harvesting in the State of Tamnrastr-Algeria”:

Project objective:

Detect the surface water discharge network by using the automatic processing of the satellite image data. The project focuses on studying rainfall water harvesting and utilization methods (by using the techniques of Geographic Information System (GIS) and remote sensing) and the negative and positive impacts on the economic and social life of the study area’s population.

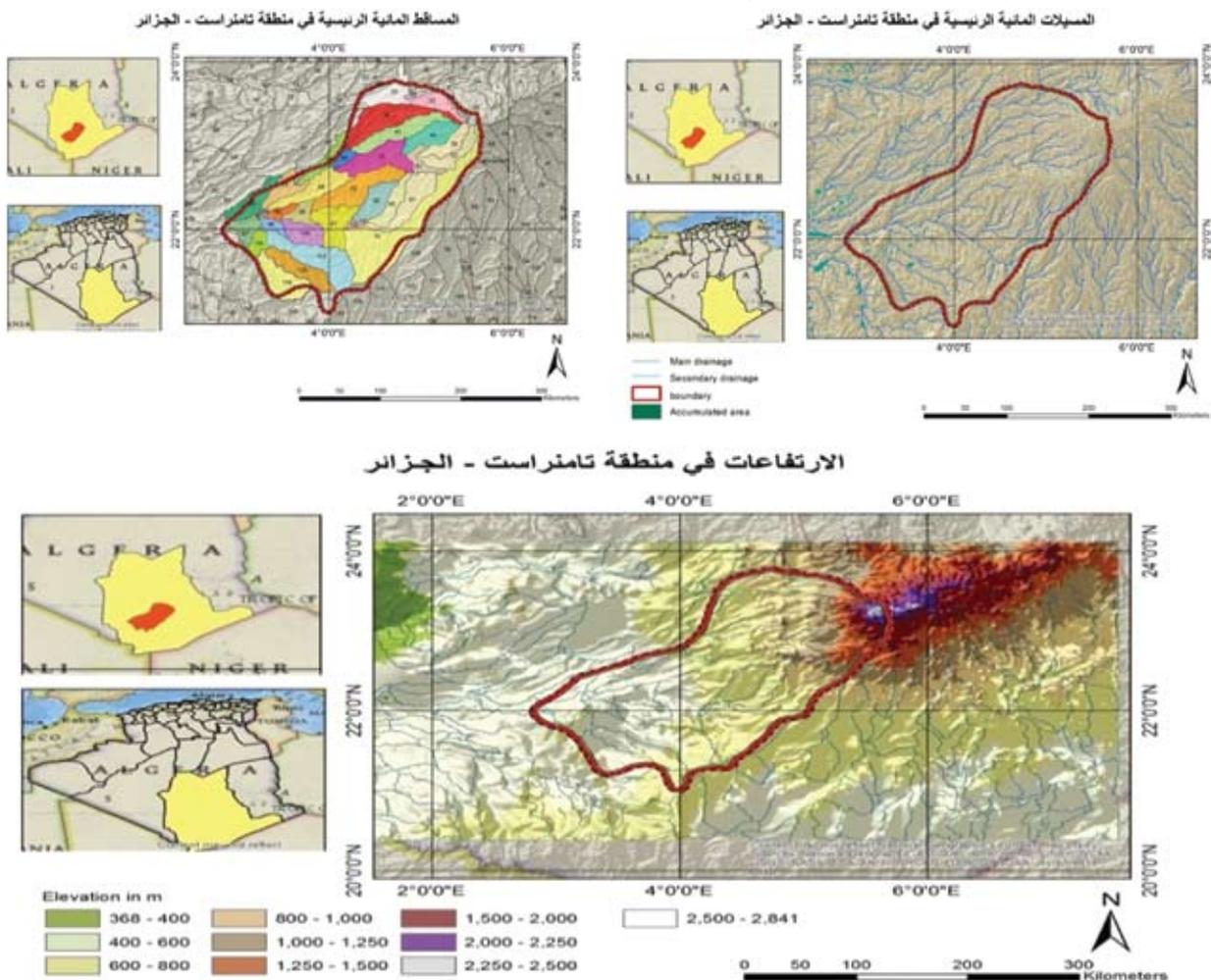


Project participating parties:

The project is implemented in the state of Tamnrastr in cooperation between the Arab Center (AC-SAD) and the Governorate of Agricultural Development in the Algerian Republic.

Project progress:

The rainfall water harvesting is considered one of the most important tools for strategic water storing. In this project, the study depends on the data of the Shuttle Radar Topography Mission (SRTM); which is considered the output of the most important satellite surveys conducted by NASA to produce radar data. The data is of (DEM) model type with an accuracy of /30/ m. As a



result, digital elevation models (DEM) have become successful alternatives for contour maps of 1:50.000 scale. Accordingly, the (DEM) model is considered one of the basic components of GIS and the basis for concluding the properties of valley topography, deriving information on elevations and conducting the hydrological simulation for rainfall water runoff.

Project outputs:

Being a house of expertise in this field and a professional user of modern techniques in identifying waterfalls, runoffs and water locations, the Arab Center (ACSAD) has produced a number of maps that are considered the base for identifying the optimal sites for water storage dikes establishment and developing models for identifying the promising development areas. The study of surface water discharge is considered very important in analyzing the factors that affect water resources and understanding the geomorphologic process in general, especially that the surface water discharge networks reflect the actual situation of the climate, topography, soil, rocky structure and vegetation cover. The measurement and analysis of surface water discharge network is considered one of the basic missions in the geomorphologic studies and highly important in several geomorphologic and hydrologic applications.

3- Vegetation Cover Classification Mapping in the Orontes Basin by Using Remote Sensing Technique:

Project objective:

Use the remote sensing images in pursuing the changes in the region such as drought, land degradation, desertification, erosion, drifting, salinity and agricultural intensification. The aim is to get acquainted with the general situation of region in case that there is a land or water misuse and prepare the vegetation cover classification maps for the winter and summer seasons.

Project participating parties:

the project is implemented in the area of the Orontes basin in cooperation between the Arab Center (ACSAD) and the General Commission for Water Resources in the Syrian Arab Republic.

Project outputs:

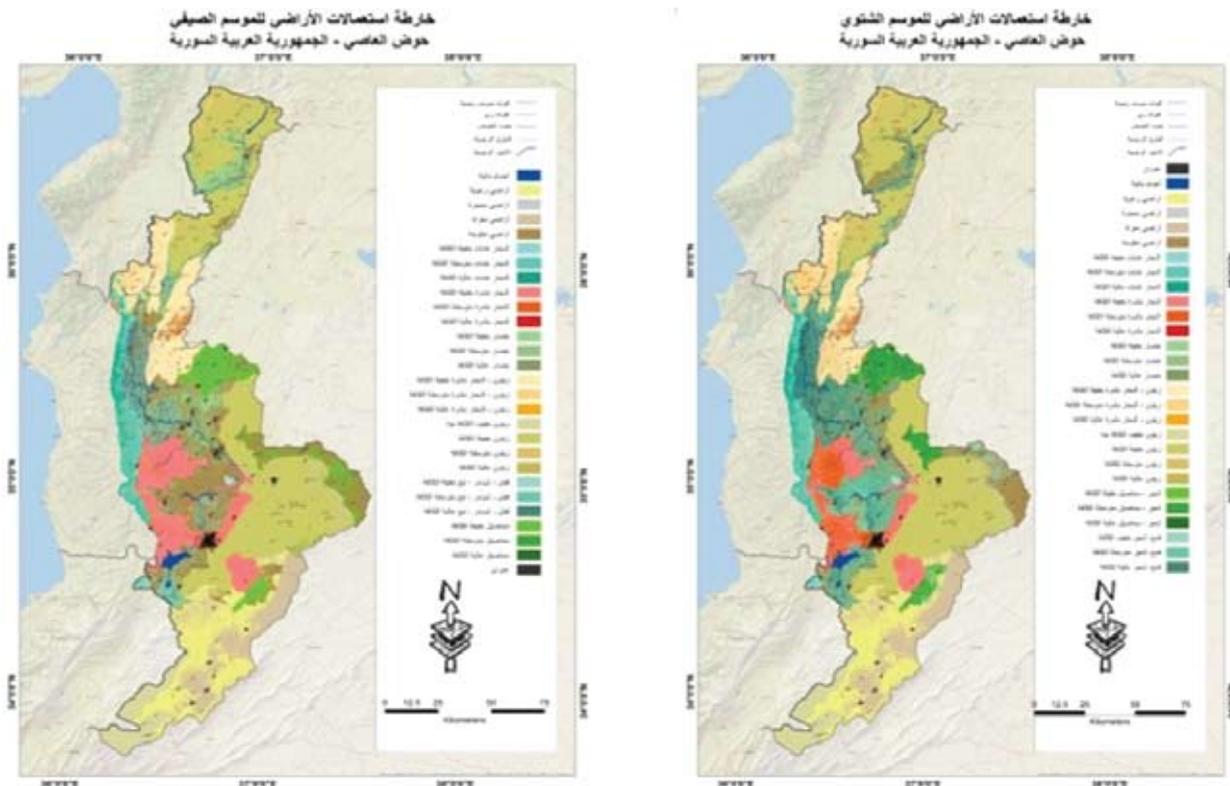
The remote sensing technique is considered one of the effective modern tools for studying natural resources (soil, water and vegetation cover) due to the vast area of the study site. The Satellite images for the winter season 2007 have been analyzed to survey cultivations and get acquainted with the crop types. A satellite image for the summer season 2011 has been also analyzed and the irrigated areas have been identified to be introduced into the water model. The Remote sensing images have been used in pursuing the changes in the area such as drought, land degradation, desertification, erosion, drifting, salinity and agricultural intensification. The aim is to know the general behavior of the area in case that there is a land or water misuse. After identifying the vegetation cover density, a non-controlled classification has been conducted to find out clusters with similar reflective values for the digital numbers (DN) known as "spectral classes" which represent different landscapes. By using the non-oriented classification process, the clusters locations are identified automatically through the ISODATA algorithm which is a common way to get acquainted with the landscape types and get a simple idea about the classes of the study area. This classification is considered the initial one for the vegetation cover in the summer season, as an initial map consisting of /15/ classes has been produced. These classes have been linked with the initial agricultural survey sites in a way that gives us an idea on each class and its contents of

plants and vegetation cover.

Also, the initial classification map of the vegetation cover for the winter season has been prepared, as an initial map consisting of /16/ classes has been produced. These classes have been linked with the initial agricultural survey sites in a way that gives us an idea on each class and its contents of plants and vegetation cover. To improve the produced classification, additional actions have been taken as follows:

- 1- Increase the number of the field check points: New field check points have been added especially in the areas that do not have previous points, as no less than 500 check points of several sources have been added to cover most lands of the basin.
- 2- Increase the number of the produced classes of the non-controlled classification: The aim is to get classes that are purer than the previous ones.
- 3- Depend on the topography and landscapes: As land use types are highly related to the soil properties and topography, in addition to land slop and soil depth.

After conducting all these processes and intersecting the initial classification map and the field and topographic check points, the vegetation cover maps for the winter season 2007 and the summer season 2011 have been produced and a guidebook for each map has been prepared



Vegetation cover types for the winter season 2007, the area and percentage of each type

Vegetation cover/winter season	Area/ha	Percentage %	Total area/ha	Total percentage %
Water bodies	9319.87	0.532	9319.87	0.532
Rangelands	128860.44	7.353	128860.44	7.353
Stony areas	19534.57	1.115	19534.57	1.115
Bare lands	128666.11	7.342	128666.11	7.342
Ploughed lands	159488.08	9.101	159488.08	9.101
Lightly dense forests trees	13275.29	0.758		
Medium- dense forests trees	38836.92	2.216		
Highly dense forests trees	13699.84	0.782	65812.05	3.756
Lightly dense fruit trees (grapes- almonds-pistachio)	101337.39	5.783		
Medium- dense fruit trees (grapes- almonds-pistachio)	58413.07	3.333		
Highly dense fruit trees (grapes- almonds-pistachio)	104.07	0.006	159854.54	9.122
Lightly dense vegetables	14623.96	0.835		
Medium- dense vegetables	7195.29	0.411		
Highly dense vegetables	1.82	0.000	21821.07	1.245
Olives-lightly dense fruit trees (pomegranate-cherries-figs)	83740.00	4.779		
Olives-medium dense fruit trees (pomegranate-cherries-figs)	70152.33	4.003		
Olives-highly dense fruit trees (pomegranate-cherries-figs)	4192.31	0.239	158084.64	9.021
Very lightly dense olives	58749.66	3.353		
Lightly dense olives	417040.33	23.799		
Medium- dense olives	70033.80	3.997		
Highly dense olives	76.00	0.004	545899.79	31.152
Crops/barley-Lightly dense legumes	11.32	0.001		
Crops/barley-medium dense legumes	72138.23	4.117	75878.00	4.330
Crops/barley-highly dense legumes	3728.45	0.213		
Urban areas	238.21	0.014	238.21	0.014
Wheat-barley-lightly dense	25841.48	1.474		
Wheat-barley-medium dense	162348.33	9.265		
Wheat-barley-highly dense	90726.37	5.177	278916.18	15.916
Total	1752373.55	100.000	1752373.55	100.000

Vegetation cover types for the summer season 2001, the area and percentage of each type

Vegetation cover/summer	Area/ha	Percentage %	Total area/ha	Total percentage %
Water bodies	9319.87	0.532	9319.87	0.532
Rangelands	128860.44	7.353	128860.44	7.353
Stony areas	19534.57	1.115	19534.57	1.115
Bare lands	128666.11	7.342	128666.11	7.342
Ploughed lands	295751.26	16.877	295751.2615	16.877
Lightly dense forests trees	13273.10	0.757		
Medium- dense forests trees	38839.11	2.216		
Highly dense forests trees	13699.84	0.782	65812.05	3.756
Lightly dense fruit trees (grapes- almonds-pistachio)	142217.17	8.116		
Medium- dense fruit trees (grapes- almonds-pistachio)	17479.56	0.997		
Highly dense fruit trees (grapes- almonds-pistachio)	157.80	0.009	159854.54	9.122
Lightly dense vegetables	68983.96	3.937		
Medium- dense vegetables	26844.14	1.532		
Highly dense vegetables	1953.54	0.111	97781.64	5.580
Olives-lightly dense fruit trees (pomegranate-cherries-figs)	124570.04	7.109		
Olives-medium dense fruit trees (pomegranate-cherries-figs)	30975.83	1.768		
Olives-highly dense fruit trees (pomegranate-cherries-figs)	2538.77	0.145	158084.64	9.021
Very lightly dense olives	58749.66	3.353		
Lightly dense olives	461479.30	26.335		
Medium- dense olives	26433.55	1.508		
Highly dense olives	254.02	0.014	546916.53	31.210
Crops/barley-Lightly dense legumes	62918.24	3.590		
Crops/barley-medium dense legumes	700.98	0.040		
Crops/barley-highly dense legumes	41.30	0.002	63660.53	3.633
Urban areas	238.21	0.014	238.21	0.014
Wheat-barley-lightly dense	42386.71	2.419		
Wheat-barley-medium dense	33120.14	1.890		
Wheat-barley-highly dense	2386.32	0.136	77893.17	4.445
Total	1752373.55	100.000	1752373.55	100.000

Project of “Planning for Drought Impact Mitigation Preparedness in the Arab Region”

Project objective:

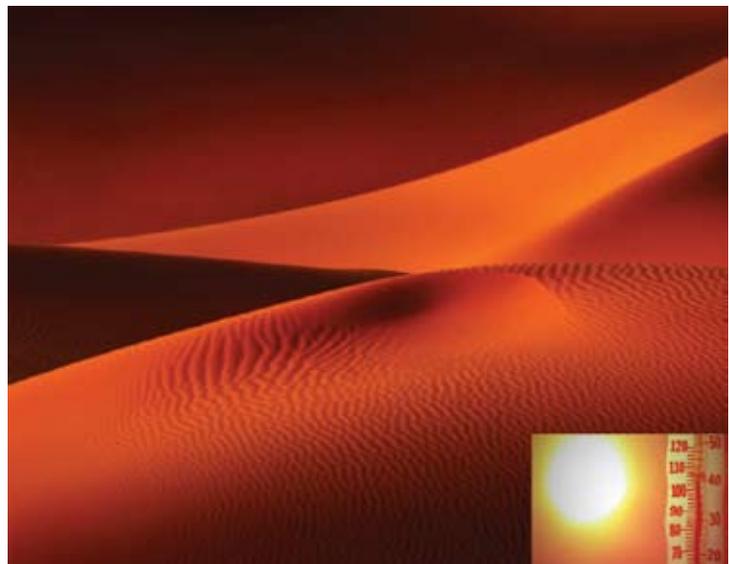
- Develop a national vision and strategy on controlling and managing disasters, identifying and classifying national risks including the slow natural risks (drought and other risks) and identifying in details the nature of these risks and the endangered sectors.
- Enhance institutional capacities for planning and implementing strategies and programs of adaptation with climatic changes and drought management and alleviation.

Project site:

All Arab countries.

1- Project of “Study of Drought Monitoring and Agricultural Drought Risks Mapping in the Arab World”:

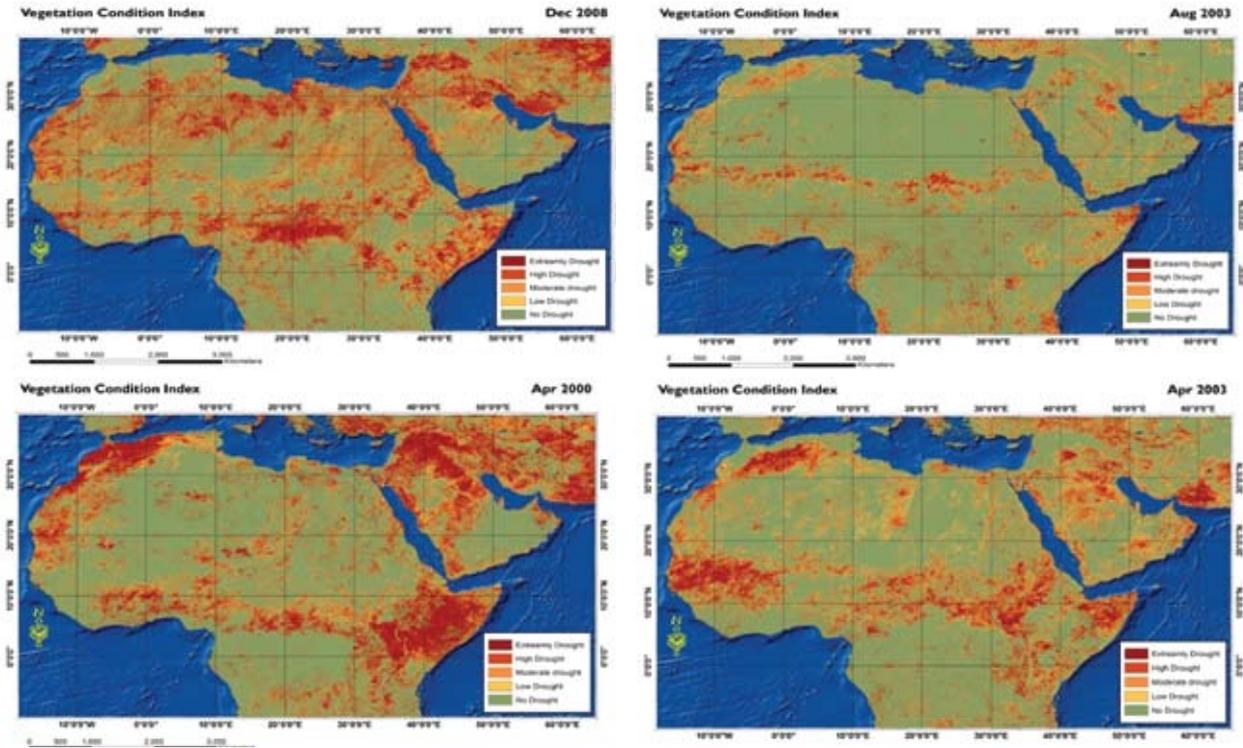
Drought is a natural phenomenon that occurs in most areas of the globe including the humid and rainfall areas; the reason why the type of drought differs from one area to another and why it's complex to have a unified world definition of drought. According to many experts, drought is a climatic phenomenon that reoccurs in areas with low rainfall rates and continues for long months or years. Therefore, the concept of drought is relative and necessitates the identification of the activities affected by it. The decrease in rainfall quantities is thus called “climatic drought” and the



drought that leads to the decrease in the moisture content of soil that affects the agricultural season and agricultural production can be called “agricultural drought or soil moisture drought”. On the other hand, the drought that affects the extent of surface water runoff and water recharge inside the soil is called “hydrological drought”; this type of drought affects the scale of surface and ground water, while the increase of the actual evapotranspiration accompanied with the rainfall decrease cause the “climatic drought”. The period of drought which lasts for a decade or more is called “mega drought”.

The work has continued by the Arab Center (ACSAD) on monitoring agricultural drought by using remote sensing techniques including analyzing MODIS satellite images with a spatial resolution of /1/ km and using the international index to calculate the vegetation condition index (VCI), temperature condition index(TCI) and vegetation condition index(VHI), in addition to ACSAD's methodology for drought hazards assessment (which was internationally adopted by the WMO) to calculate drought intensity, frequency and consecution in addition to rainfall variability in order to produce drought risks map. This map gives us a more accurate information on drought-vulnerable areas and provides the potential for developing a strategy for adaptation and alleviation

of drought impacts by taking several actions such as: creation of new drought-resistant varieties, conservation agriculture and land use change.



Some products of satellite image archives analysis totaling 180 maps on drought in the Arab Region for each month during the period 2000-2015

Third: Program of Sustainable Land Management and Water Uses

1- Project of “Applied Researches of Saline and Medium-Saline Water Use and Technology Transfer to the farmers in the Arab Countries”:

1- Project of Technology Transfer of Saline and Brackish Water Uses to the Farmers in Arab Countries:

Project objective:

Develop a good and appropriate management of the saline water use in the agricultural system and introduce alternative crops that can improve the farmers’ income.

Project site:

The Tunisian Republic.

Project participating parties:

This project is implemented in cooperation with the National Institute for Rural Engineering, Water and Forest Research (INRGEF) within the framework of the cooperation agreement for the years 2015 and 2016.

Project progress:

In the recent years, the Arab Center (ACSAD) has achieved good scientific results. The implemented activities and studies during the year 2016 can be summarized as the following:

- Study of “Saline Clay Land Reclamation in the Plain of Al-Siseb- Kairouan”:

The study aims to improve the management of irrigating highly-saline clay soil with medium-saline water by estimating salinity at different levels through the use of electromagnetic induction devices (EM38 and EM31) which have allowed to study soil properties and salinity development at different levels and depths and for different periods, monitor the pomegranate tree growing and identify the salt impact on the productivity.

The results have showed that irrigation water is medium-saline at the level of 4.4m/dS equaling 2.9g/l and that surface ground water exists at the depth of 15m with high salinity estimated at about 22m/dS equaling 36g/l. In line with soil moisture measurement, the reclaimed



soil salinity ranges between 19 and 48m/dS and is much lesser than that of the non-reclaimed soil of the control plant (44m/dS in the surface layer and 72m/dS as maximum). This change in the soil salinity affects positively the pomegranate growth and yield and explains the time and spatial change of surface layer salinity from one year to another, from one season to another and from one place to another due to the factors of topography, irrigation managements and rainfall.

- Monitoring of Soil Salinity in the Irrigated Area of Siedi Thabet- Sharfash:

Within the framework of irrigation process modernization in the irrigated area of Siedi Thabet-

Sharfash, the levels of ground water and soil salinity have been monitored in the whole area in irrigated lands.

At the whole irrigated area level in Siedi Thabet-Sharfash, the data has been collected, archived and processed (annual measurements of ground water depth and salinity).

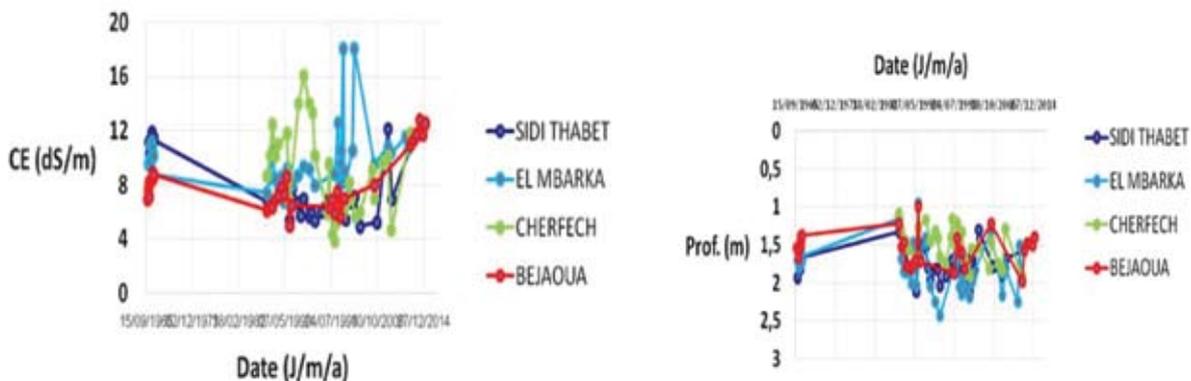
At the level of 5 agricultural plots (of which four plots belong to farmers and one plot is at the research station of Sharfash), measurement devices have been supplied to continuously measure the ground water salinity and depth in piezometers and conduct a periodical monitoring.



Periodical field monitoring

The graphs of the changes in the ground water depth and salinity have been charted for four irrigated areas from the first step of irrigation to identify the long-term development of these factors. In the next stage, maps have been developed to identify the places with recharge deficiency and the results can be explained as follows:

- The soil salinity has changed according to the depth, with salt accumulation at the depth of 1.5 m.
- The soil salinity has changed from one place to another in the same plot.



• Impact of Irrigation with Saline Water on the Plant of “*Sesbania aculeate*” and Nitrogen Fixation Efficiency:

Within the framework of looking for new plants with important value capable of adapting with highly-saline conditions, the “*Sesbania aculeate*” plant of the Indian origin has been selected. This plant is used in the agricultural field as a good fodder for animal feeding and is utilized in soil recovery and fertility improvement due to its capacity of nitrogen fixation. It is also characterized by its ability to endure high concentrations of salinity, as some studies have proved that it can endure a salinity level of 12m/dS.

In the summer of 2016, a field experiment has been initiated at the research station of Sharfash aiming at studying the salinity stress impact on the growth of “*Sesbania aculeate*” which seeds have been planted in a silty clay soil. Three concentrations of salinity have been used in irrigating the plant which are (1.5, 4 and 8)m/dS equaling (0.96, 2.58 and 5.12)g/l respectively.

The field measurement results have showed that a concentration of up to 8m/dS of salinity in



Salinity impact on *Sesbania aculeate* height and diameter

irrigation water would not affect negatively on the height and diameter of the plant stem, and no significant effect has been noticed on the upper part of the plant in comparison with the control plant.

On the other hand, the wet weight of the plant has decreased in comparison with the control plant but the decrease has not been significant, while the concentration of more than 4m/dS of salinity in irrigation water has led to shrinking and decreasing in the root growth in comparison with the control plant and the decrease has been significant at a concentration of 8m/dS; the reason that makes us conclude that, unlike the

upper part of the plant which has not been affected by the salinity, the root growth has been negatively affected by irrigation water with salinity of 8m/dS.

• Impact of Electromagnetically Treated Saline Water on the Soil:

In the year 2016, a laboratory study has been conducted to evaluate the impact of the electromagnetic treatment period on some properties of the soil. Saline water with a concentration of 4.5m/dS equaling 2g/l has been used and electromagnetically treated for three periods of time (one minute, 15 minutes and 30 minutes). The water then has been used to irrigate soil within pots, where the irrigation water quantity and salinity and the soil moisture have been monitored before and after irrigation by using the devices of Trace TDR and EM50.



Tests in pots and moisture monitoring devices



(Aqua 4D) electromagnetic device

The initial results have clearly showed the difference in soil moisture before and after irrigation; whenever the water treatment period increases, the moisture increases. It's obvious and significant to notice the positive impact of the electromagnetic treatment period on the soil moisture.

• **Impact of Irrigation with Saline Water on the Growth and Production of Chenopodium Quinoa Willd:**

The Chenopodium Quinoa Willd is considered a salinity-tolerant and drought-tolerant crop which has the ability to adapt with different types of climate and all types of soil. It has a high productive and nutritious value as a cereal, oil, vegetable and non-conventional fodder; the reason that makes this plant a new promising important crop.

The study, that has started two years ago, aims to identify the adaptation of this plant with the Tunisian climatic conditions and study its morphological and physiological properties under the water-stress and salinity-stress conditions through irrigation with different quantities and qualities of saline water.

The experiment has been repeated in the year 2016 to confirm the previous results, as the following factors have been studied:

- The morphological properties: Height, width, leaf size, weight, branching number, weight of 100 grains and weight of grains/plant.
- The plant content of nutrients: K/P/Ca⁺⁺/Mg⁺⁺/Na⁺⁺/Cl-



The results of the water stress impact on the growth of Chenopodium Quinoa Willd have showed the following:

The plant growth is very good in spite of the high rate of water stress and there is an increase in the root size and in the sucking hairs growing for the water stress rates of 50% and 75% in comparison with the control plant (100%). The highest production is registered at the stress rate of 75% followed by 50% in comparison with the control plant (100%).

The results of the salinity stress impact on the growth of Chenopodium Quinoa Willd have showed the following:

The plant height and branching number have increased with the increase of the irrigation water salinity in comparison with the control plant. The root size has increased for the concentration of 6g/l in comparison with the control plant (0g/l). According to this experiment, the best yield of grains has been registered for the plants irrigated with saline water of concentration at 6g/l. Currently, the salts rate is being identified in the grains.



2- Project of Sustainable and Safe Use of Treated Waste Water and its Solid Residues in the Arab Agriculture and its Impact on Environment:

1- Project of Use of Treated Waste Water and its Solid Residues in the Arab Agriculture and its Impact on Environment:

Project objective:

Identify the optimal management of agricultural systems that use this type of non-conventional water and benefit from the sludge and treated water sources in irrigating and fertilizing different agricultural crops.

Project site:

The Democratic People's Republic of Algeria, the Republic of Tunisia and the Syrian Arab Republic.

Project participating parties:

This project is implemented in cooperation between the Arab Center (ACSAD), the National Institute for Research in Rural Engineering, Water and Forests in Tunisia and the National Institute for Lands, Irrigation and Waste Water in Algeria. At the beginning of the year 2016, a mutual cooperation agreement has been signed between the Arab Center (ACSAD) and the General Commission for Scientific Agricultural Research of the Ministry of Agriculture and Agrarian Reform in Syria.

The Tunisian Republic:

• Safe Agricultural Use of Treated Water in Agriculture:

The activities of this project have continued in the year 2016 in the areas that widely use the treated water and on several crops and plant types. The following activities have been implemented within the framework of this project:

• The impact of electromagnetic treatment of water on some soil properties and waste water:

This new study has been listed in the year 2016 aiming at improving the treated water use efficiency, alleviating its impacts through the electromagnetic treatment and evaluating the performance of the treatment device and its impact on the efficiency and quality of the recharged waste water, soil properties and plant productivity.

The electromagnetically treated waste water and non- electromagnetically treated waste water have been used to irrigate silty clay soil rich with lime and poor with organic matter in pots planted with barley. The treated water salinity has been estimated at about 5.35m/dS equaling 3.5g/l, and the acidity degree has been 8.34.



The initial results have shown the following:

- The quantity of recharged waste water from the treated irrigation water is less than that from

the non-treated irrigation water.

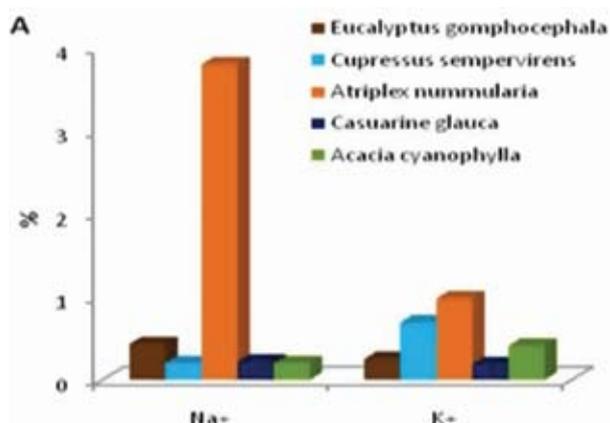
- The salinity of recharged waste water from the treated irrigation water is less than that from the non-treated irrigation water.
- The harmful microbe number inside the recharged waste water from non-treated irrigation water is higher than that from treated irrigation water.
- The harmful microbe number inside the soil irrigated with non-treated water is higher than that inside the soil irrigated with electromagnetically treated water.
- As for the remaining soil and plant properties, the analysis is still under implementation and the data has not been processed yet.

• **Use of treated water in irrigating forest trees in highly-saline and waterlogged lands:**

The activities of this study have continued during the year 2016 in the village of Andalusia Castle in the north of Tunisia, in waterlogged lands which soil is clay and highly saline and which has been cultivated randomly with forestry species. The purpose is to study the impact of irrigation with treated water on the seedling height, diameter and survival. The planted species and numbers are illustrated in the following table:

Plant	Scientific name	Number
Eucalyptus	Eucalyptus gomphocephala	35
Casuarina	Casuarine glauca	30
Pin d'Alep	Pinus halepensis	16
Atriplex	Atriplex nummularia	20
Cypres	Cupressus sempervirens	33
Acacia	Acacia cyanophylla	27

The double-treated waste water has been used to irrigate the a.m forestry seedlings. This type of water has a low alkaline pH (7.73) and a medium salinity (4.78)m/dS and complies with the Tunisian standard specification (NT106.03) that identifies the heavy metal concentrations in the treated waste water for agricultural irrigation purposes.



The results have showed that the highest mortality rate (100%) has been registered for the Pinus halepensis species as all plants have dried up and died. On the other hand, the lowest mortality rate (10%) has been registered for the Atriplex nummularia species as two plants only out of 20 seedlings have dried up. The results also have showed that the Eucalyptus gomphocephala and Acacia cyanophylla species have been the most growing plants registering a height of more than 180cm. As for the plant content of Na and k nutrients, the figure illustrates that their highest concentrations are in the leaves of Atriplex nummularia; the species that has registered the lowest mortality rate.

• **Study of the Environmental Impact of the Treated Water Use on Soil and Plant:**

The implementation of this study has continued during the year 2016 in the area of Al-Sabbala-Burj Al-Taweel, where treated water is used a lot long years ago to irrigate the cultivations in this area.

The waste water of a sub-canal has been continuously monitored by using the device of (CT Diver) to measure the water scale, flow and salinity. Water samples have been taken to conduct the required chemical analysis. In the year 2016, the impact of irrigation with treated water on some soil properties and fodder corn productivity has been studied by taking samples from the irrigation water and soil (before and after irrigation).



The results have showed the following:

- The treated water used in irrigation has complied with the Tunisian standard specification in terms of the chemical structure and the heavy metals content.
- Irrigation with treated water has led to a simple decrease in soil acidity and a simple increase in soil salinity.
- The concentration of the studied heavy metals in the soil has remained within the normal range except for Cd which has exceeded the range.
- The ground water has approached the soil surface at about 118cm which reflects the bad recharge.
- The concentration of some heavy metals content in the ground water has exceeded the Tunisian specification (such as Cr, Fe and Cd), while others have remained within the Tunisian standard specifications (such as Ni, Mn, Zn, Cu, Pb and Co). The following table illustrates the concentration of some heavy metals content in the ground water.

Nutrient	Cd	Co	Cr	Cu	Fe	Mn	Ni	Pb	Zn
Concentration (mg/l)	0.009	0.030	0.017	0.025	1.288	0.467	0.044	0.051	0.433
Tunisian specification NT 106.03	0.005	0.1	0.01	0.5	1	0.5	0.2	0.1	5

Safe agricultural use of gray water:

This activity has continued during the year 2016 in the farms of (Halloumeh and Rashideh) in Sakkra which is one of the suburbs of the Tunisian capital; located at 6 km away from the capital in the northern east. The following activities have been implemented:

- Separate gray water from black water.
- Refine and harvest gray water in a special tank.
- Treat gray water in a basin containing layers of sands and stones at a specific order of laying.
- Collect treated gray water in a special tank.

- Irrigate some olive trees with the treated gray water through a drip irrigation network. Currently, the gray water quality is monitored and controlled before and after the treatment to study the impact on plant and soil. The impact of the treated gray water on the olive tree productivity and the resulted oil quality will be also studied to identify the potential of using this type of non-conventional water in agricultural irrigation.



The Algerian Republic:

This project is implemented in cooperation with the National Institute for Lands, Irrigation and Waste Water in Algeria. The 2016 schedule has included the implementation of several activities and researches as follows:

- **Use of Treated Waste Water in Agriculture and its Environmental Impact:**

- **Continuation of monitoring the treated water properties in the study area:**

This project is implemented in cooperation with the National Institute of Soils, Irrigation and Drainage in Algeria in the state of Talmsan where treated water is available. Within the framework of this project, the following activities have been implemented:

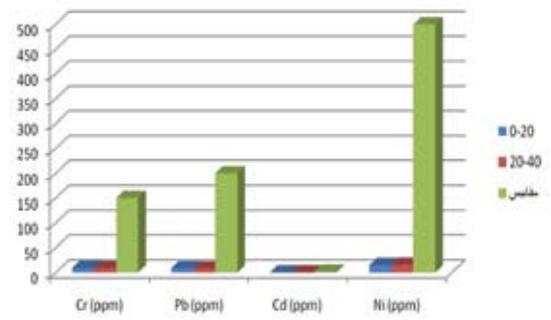
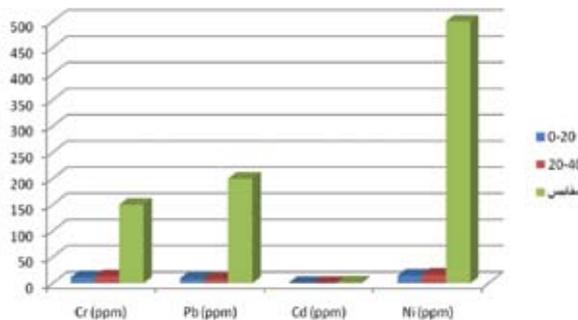
In this year, a periodical monitoring has been conducted on the properties of the used treated water coming from the treatment station in the state of Talmsan, as the results have showed that the treated water properties and characteristics fall within the international, Arab and local standards and measurements and that the microbial content varies from one season to another but is still within the acceptable limits of the WHO standards. The average concentrations of BOD5 and COD have been estimated at 2.91mg/l and 30mg/l respectively, which are less than the allowed limits by FAO standards (30mg/l and 60mg/l respectively). These results encourage to use this type of water in agricultural irrigation under a good management, high efficiency and for limited kinds of crops.

- **Impact of irrigation with treated water on the productivity of alfalfa crop:**

The alfalfa crop has been cultivated for the fourth season in the same place and for the same Algerian farmer in the state of Talmsan, aiming at confirming the results concerning treated water use and heavy metals accumulation and moving to the plant tissue. Two types of water have been used for irrigation: treated and ground water. The results have showed that the total production of the crop irrigated with treated water is better than the crop irrigated with ground water (28 tons/ha and 19 tons/ha respectively with an increase estimated at about 32%).



The laboratory analysis results have showed that the concentrations of some heavy metals in the soil irrigated with treated or ground water fall within the allowed limits, which are far away from the contamination limits. The plant samples analysis is still under implementation to estimate the content of the most important studied heavy metals.



• Impact of waste sludge adding on soil properties and wheat productivity:

The wheat crop cultivation and fertilization with sludge at rates of (10 and 15tons/ha) have been repeated for the winter season 2015-2016 with the recommended chemical fertilization content. The following table illustrates the properties of the sludge used in the study.



The following figure illustrates the impact of the sludge adding on the wheat yield of grains, as adding sludge with rates at 10 and 15 tons/ha has led to an increase in wheat yield of grains estimated at 23 and 42% respectively in comparison with the control plant.

The following table illustrates the concentrations of Cr and Pb in the grains and straw of the wheat that is fertilized with sludge and chemical fertilizers in comparison with the control plant.

Treatment type	Plant part	Cr, mg/kg	Pb, mg/kg
Control plant	Grain	0.99	1.093
	Straw	0.90	0.816
Chemical fertilizer adding	Grain	1.038	1.049
	Straw	0.87	0.819
Sludge adding (15 tons/ha)	Grain	1.043	1.046
	Straw	0.99	0.907
Sludge adding (10 tons/ha)	Grain	0.989	1.038
	Straw	0.950	1.056
Natural content (mg/kg)		5 >	30 >

The Syrian Arab Republic:

At the beginning of the year 2016, a mutual cooperation agreement has been signed between the Arab Center (ACSAD) and the General Commission for Scientific Agricultural Research (GCSAR) of the Ministry of Agriculture and Agrarian Reform to implement a project on the use of non-conventional water in the crop production aiming at utilizing and using the non-conventional water like waste water and agricultural waste water in the production of environmentally- safe and healthy fodder crops to support livestock breeders by providing fodders all over the year. The aim also is to alleviate the burden on the use of fresh water. The project has included the implementation of several activities in three areas which are Al-Salamiah, Al-Ghab and Lattakia.

- Study of Impact of Irrigation with Treated Waste Water on Fodder Crop Productivity and Accumulation of Heavy Metals in the Soil and Plant:

This study has been implemented in each of Al-Salamiah Research Center in Hama governorate

and Lattakia Research Center/Snowbar Research Station, where the treated water quality, soil nature and climatic conditions are different, to irrigate the crops of Triticale and *Sesbania aculeata* under a specific agricultural rotation. The experiment in split plot design has included two irrigation methods namely; drip and surface irrigation, and two water qualities namely; ground water and treated waste water.

The soil and water have been analyzed before cultivation; the results have shown that all the measurements were within the allowed limits according to the Syrian standard specification No. 2008/2752.

• **Triticale:**

The results have shown the presence of significant differences among the three treatment in terms of the crop productivity, as the grain productivity has been estimated at 2.06tons/ha with the treated waste water irrigation and 1.39tons/ha with the ground water irrigation. On the other hand, the increase in the productivity of grain and straw has not been significant with the drip irrigation method (1.88 and 7.20tons/ha respectively) in comparison with the surface irrigation method (1.57 and 6.71tons/ha respectively). No significant differences have been noticed in terms of heavy metals accumulation in the plant tissue of this crop.



• **Sesbania aculeata:**

The results have shown a significant difference in the *Sesbania aculeata* productivity as a green fodder when irrigated with treated waste water (39.18tons/ha) in comparison with irrigating with ground water (35.25tons/ha). No significant difference has been noticed in the *Sesbania aculeata* productivity of grains when irrigated with treated waste water (3.21tons/ha) in comparison with irrigating with ground water (2.82tons/ha). The drip irrigation method has led to a significant increase in the green fodder yield estimated at 42.3tons/ha in comparison with the surface irrigation method (32.13tons/ha). The difference has been also significant in the grain yield with the drip irrigation method (1.1tons/ha) in comparison with the surface irrigation method (0.74tons/ha).



- The laboratory analysis results have also showed the transmission and accumulation of the heavy metals (Cd, Co, Cr and Pb) in the vegetative mass of *Sesbania aculeata* when irrigated with treated waste water (0.14, 5.73, 16.67 and 5.383mg/kg respectively) in comparison with irrigating with ground water (0.11, 3.4, 12.5 and 3.63mg/kg respectively). However, all these concentrations have remained within the allowed limits.

On the other hand, the soil analysis results have showed an increase in each of P and K nutrients

when the soil is irrigated with treated waste water (46.5 and 1091mg/kg respectively) in comparison with irrigating with ground water (24.5 and 848mg/kg respectively). No significant differences have been registered in terms of the heavy metals accumulation in the soil when irrigated with treated waste water or ground water; the same for drip and surface irrigation methods.

It is concluded that the use of treated waste water in agricultural irrigation under a good management has led to environmentally-safe positive results on the soil and crop in the two agricultural seasons.

• **Field day in Al-Salamiah:**

Under the project activities, a field day has been conducted on the cultivation of *Sesbania aculeate* at one farmer's field in Al-Salamiah on 10/10/2016 with the attendance and participation of a big number of farmers, engineers, technicians and agricultural extension workers. The aim was to get acquainted with the treated water use and the importance of this fodder crop.



• **Use of Agricultural Waste Water in Irrigating the Fodder Sugar Beet Crop:**

In the autumn of 2016, the fodder sugar beet crop has been cultivated in one farmer's field in Al-A'asharneh in Al-Ghab area in the governorate of Hama. The crop has been irrigated with the agricultural waste water which is available in big quantities in the area. The aim was to produce economic fodder crops by using non-conventional water to meet a part of the livestock demands and alleviate the burden on the fresh conventional water. The soil and irrigation water have been analyzed before cultivation while the crop is still standing being considered a winter crop.



• **Project of Soil Management to Conserve its Fertility and Improve its Productivity:**

Project objective:

Increase the productive capacity of the soil, conserve its fertility and control its degradation by following the appropriate methods and techniques.

Project site: ACSAD's research stations.

Project progress:

In the year 2016, some new research activities have been conducted at ACSAD's research station of Ezra'a aiming at improving the soil properties, increasing its productive capacity and cultivating new crops, as the following experiments have been implemented:

- **Impact of Biogas Fertilizer Use on the Fertility Properties of the Soil and the Corn Crop Productivity (Variety Ezra'a 7):**

The experiment aims to study the biogas fertilizer impact on the fertility properties of the soil in comparison with the chemical fertilizers, organic fertilizers and control plant, and on the corn crop productivity. The biogas fertilizer, resulted from the anaerobic fermentation process of organic residues, has been added. On the other hand, the organic manure has been added according to the crop demand of nitrogen and the chemical fertilizer has been added according to the recommended fertilizer quantity and soil analysis.

The biogas fertilizer, resulted from the anaerobic fermentation process of organic residues, has been added. On the other hand, the organic manure has been added according to the crop demand of nitrogen and the chemical fertilizer has been added according to the recommended fertilizer quantity and soil analysis.

The experiment has included six treatment types as illustrated in the following table, which shows the impact of the fertilization type on the maize productivity and yield of grains and vegetative mass.



Fertilization type	Total weight	Vegetative mass	Grain
Biogas fertilizer	29.77 a	18.48 a	8.17 a
Organic manure	25.91 ab	16.79 ab	6.81 ab
Chemical fertilizer	20.33 ab	12.77 ab	5.39 b
Chemical and biogas fertilizers	28.83 a	17.17 ab	8.67 a
Chemical and organic manure fertilizers	29.81 a	18.23 a	8.62 a
Control plant	16.24 b	9.49 b	5.05 b
LSD 0.05	11.66	8.56	2.78

The results, in terms of grain productivity, have shown a significant difference between the crop productivity with the biogas fertilization and the control plant. The best yield has been registered with the biogas and chemical fertilization type in comparison with all other fertilization types, as it has been noticed that there was a significant superiority with "the biogas and chemical fertilization" in comparison with "the chemical fertilization" and "the control plant". Also, the organic manure and chemical fertilization type has achieved a significant increase over the chemical fertilization type and the control plant.

• **Impact of Fertilizer Quality (Green, Organic and chemical) on Some Soil Properties and Chenopodium Quinoa Willd Productivity:**

The Chenopodium Quinoa Willd cultivation has been introduced into Syria in the year 2015, as the cultivation has been successful in the coastal area with a productivity estimated at more than 3tons/ha of grains. It is necessary to promote researches and studies concerning this crop due to its importance as a supportive crop for wheat. Therefore, this experiment aims to study the impact of different types of fertilization (green, organic and chemical) on the soil properties and the Chenopodium Quinoa Willd growth and productivity.



The soil samples have been collected before cultivation to be analyzed and to get acquainted with soil fertility properties. The experiment has included four fertilization types: green fertilization, organic manure, chemical fertilizer and the control plant.

The Sesbanai aculeata legume plant has been cultivated as a green fertilizer and then turned upside down inside the soil at the blooming stage. This crop will be cultivated in February 2017.

• **Role of Organic Manure and Tillage Systems in Improving Some Hydrological and Physical Properties of Clay Cracked Soil and Olive Crop Productivity:**

This study has been implemented in the Autumn of 2016 at ACSAD's research station of Ezra>a aiming at identifying the best limits for tillage type and depth on one hand and for the added organic matter as «a natural optimizer» on the other, in order to improve some hydrological and physical properties of clay cracked soil and increase the olive tree growth and productivity.

Soil samples have been taken from the experiment site to identify the different soil properties. Currently, the required activities (including tillage, fertilization, organic matter adding, monitoring and climatic data registering) are conducted.

Animal Wealth

The Animal Wealth Department

The Animal Wealth Department works on implementing its activities through the following main programs:

1- Program of “Small Ruminant Care and Genetic Improvement in the Arab Countries”:

The program aims to develop the productive performance of local breeds, especially the promising ones, in the Arab countries by applying the animal genetic selection method based on the breeding properties of milk and meat production and taking into consideration the appearance characteristics of the promising breeds.

2- Program of “Development and Application of Artificial Insemination and Embryo Transfer Techniques in the Arab Countries”:

The program aims to exert efforts in the field of the optimal use of superior goat and sheep breeds that are genetically selected and improved in some Arab countries. The Arab Center (ACSAD) has established this program to accelerate the genetic improvement processes in the improved flocks and flocks planned to be improved through collecting the semen and embryos of the selected animals of the core herds and disseminating them as can as possible among the cooperative stations and breeders’ flocks in the Arab countries.

3- Program of “Camel Research and Development”:

The program aims to improve the camel breeders’ living standards by supporting the sustainable development research of camel production in the pastoral areas, improving and facilitating the processing and marketing of the various products, controlling the different diseases of camel, alleviating camels’ mortality causes, improving camels’ health, nutrition and care and raising the reproduction rates of camel. During the last years, the Arab Center (ACSAD) has paid a special attention to the “camel research and development program” in cooperation with the Arab countries, in which camels constitute a vital part of its livestock sector; as it has established a camel breeding and care station (Wadi Al-A'azib research station) in order to train the Arab technical staffs and study the productive and reproductive performance of camels. This station and its facilities serve as a center for providing expertise and consultations to the Arab countries.



4- Program of “Fodder Sources and Animal Nutrition Development in the Arab Countries”:

The program aims to implement surveys on the conventional and non-conventional fodder resources in the Arab countries, benefit from the relative advantage that some Arab countries enjoy in the fodder sources field, find the appropriate fodder alternatives, improve and enhance the role of agricultural and agro-industrial residues through the physical and chemical treatment to raise their food value and achieve their optimal utilization, and finally use the residues that have not been utilized yet (by the application of modern techniques) as balanced fodder mixes capable of filling a part of the fodder gap by the easiest and cheapest means.

5- Program of “Inventory and Characterization of Animal Genetic Resources in the Arab Countries”:

The Arab countries have a diversified agricultural livestock sector, which has enabled them to become the world leading countries in animal production. The Arab local breeds enjoy unique properties reflected in the disease-resistance and climate stress-tolerance traits that are necessary for facing the challenges of climate change, new animal diseases and increasing demand of animal products. However, the extinction rate of local animal breeds and lines has reached a terrifying level, the reason that leads to the possibility of breeds extinction before even studying their properties and assessing their productive capacity. This fact has forced the Arab Center (ACSAD) to start up the initiative of protecting animal genetic resources and ensuring the achievement of an improved management and sustainable use types especially for the extinction-endangered local animal breeds that fall under the conventional production system and exist in poor environments. Under these actual circumstances, ACSAD has established the animal genetic resources survey and characterization program.

Program of “Genetic Improvement and Small Ruminants Care in the Arab Countries”

1- Project of “Sheep Genetic Improvement and Production Care in the Arab Countries”:

Project objective:

Improve the productivity of Awassi sheep and promising local breeds by the selection and cross-breeding processes in the Arab countries.

Project site:

ACSAD’s scientific research stations, several research stations specialized in sheep breeding and breeders’ sites in the Arab countries.

Project progress:

In the recent years, ACSAD has achieved advanced scientific results in the field of genetic improvement as the following:

1- Improvement of Awassi sheep productivity by the selection process at ACSAD’s research stations:

A. Agricultural scientific research center in Al-Salamiah:

The productivity of Awassi sheep is improved by the selection process under three production lines namely, the milk line, the meat line and the bi-purpose line. In 1973, the elite herd was formed and the development of the milk and meat lines was started in 1975. In 2007, the bi-purpose line was established, and until now the genetic improvement by the selection process is continued within each line separately.

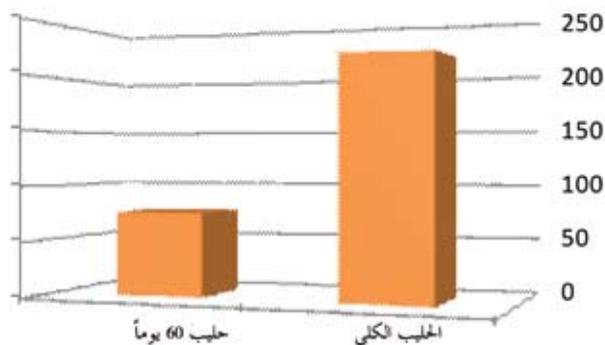


Small ruminants/ improved herd

The selection process in the milk production line depends on the total milk production of the ewes, while the genetic improvement in the meat line depends on the twin-birth rate, newborns’ weight at birth and weaning (60 days) and later weights (180, 360 and 480 days). On the other hand, the genetic improvement in the bi-purpose line is based on the total milk production, twin-birth rate and newborns’ weights at different age stages. The milk-producing ewes are milked automatically during the period of flow and then dried up when the production reaches less than 200g/day.

* The reproductive indicators:

The fertilization rates were 96.7%, 99.2% and 100% and the birth rates were 91%, 91.4% and 89.8% for milk, meat and bi-purpose flocks respectively, while the general average of the twin- birth rate was estimated at 43.47% in the year 2016.

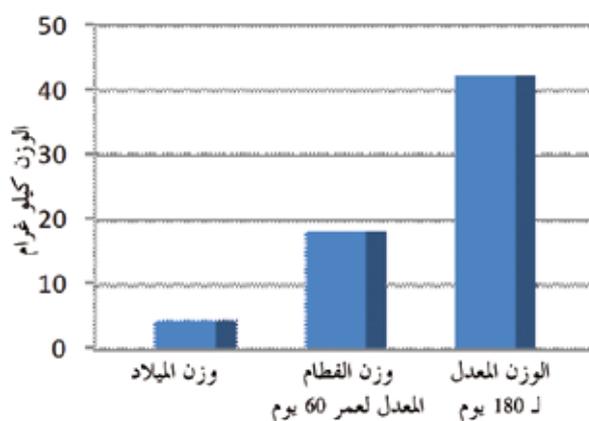
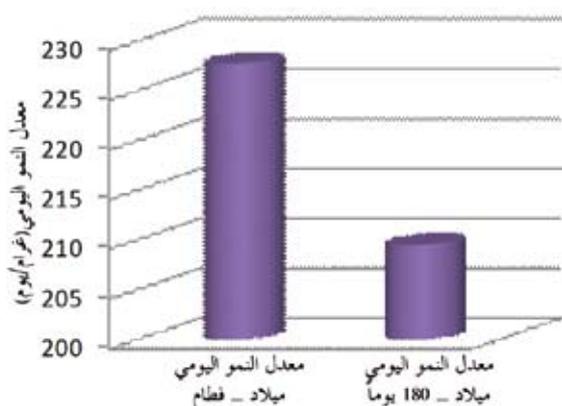


* The milk production indicators:

The milk production rate for a period of 60 days was 75.73kg; the total milk production was 215.84kg, the flow of milk period was 175 days and the daily milk production average was 1238.58g for the three herd types in the year 2016.

* The newborns' weight:

As in the following figures, it is illustrated that the weight average at birth was 4.51 kg; the weight average at weaning of age 60 days was 18.17 kg; the weight average at age 180 days was 42.22 kg and the growth rates were 227.71 g/day and 209.50 g/day for the "birth till weaning" period and the "birth till age 180 days" period respectively for the year 2016.

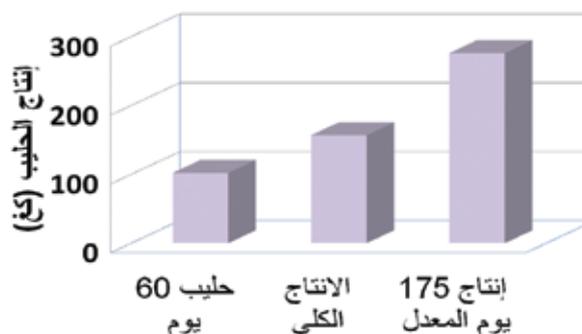


2- Ezra'a research station for Awassi sheep improvement and propagation:

The Arab Center (ACSAD) has established this station to serve as a source for the improved genetic types of Awassi sheep and train the Arab technical staff. Since the year 2001, the station has included two improved flocks of Awassi sheep; one is for milk production and the other is for meat production. This station serves as a basic component of the project of "Awassi sheep improvement in the Arab countries" and contributes to the acceleration of the genetic improvement process of this breed by distributing live animals and frozen semen straws among the Arab countries aiming at achieving the genetic improvement of local breeds by selection or crossbreeding with the improved breed.

* The reproductive indicators:

The fertilization rate was 100%; the birth rate was 92.0% and the twin- birth rate was 25.0% for the sheep flock in Ezra'a in the year 2015. On other hand, the fertilization rate was 100%; the birth rate was 92.1% and the twin- birth rate was 29.23% for the sheep flock in the year 2016.



*The milk production indicators:

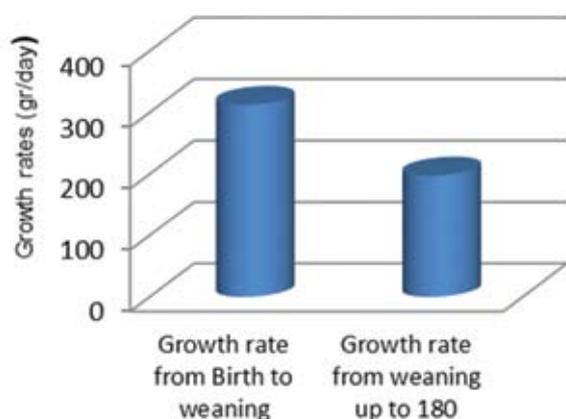
The daily milk production rate was 1.669 kg; the milk production rate for a period of 60 days was 103.1 kg; the total milk production was 235.75kg, the flow of milk period was 122.3 days and the modified milk production rate for a period of 175 days was 292.3kg for the year 2016.

Milk production indicators averages for Awassi ewes at Ezra'a research station

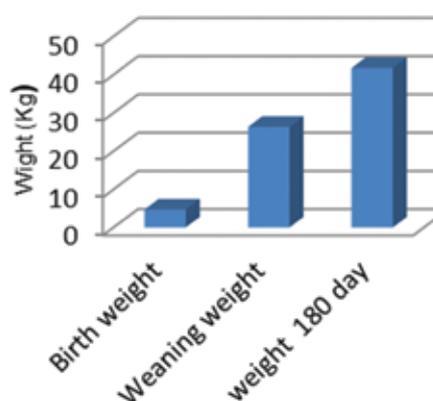
Affecting factors		Studied indicators				
		Daily milk production (kg)	Milk production for the first sixty days (kg)	Total milk production (kg)	Modified milk production in 175 days (kg)	Flow of milk period (day)
General average		1.669	103.1	235.7	292.3	122.3
Production line	Milk line	1.700	120.0	264.8	298.0	154.0
	Meat line	1.668	86.2	205.5	292.1	121.6

*Newborns' weight:

The weight averages at birth, weaning and age 180 days were 4.77 kg, 26.39 kg and 41.80 kg respectively; the annual growth rates were 312.53g/day and 197.53 g/day for the "birth till age 60 days" period and for the "age 60 days till age 180 days" period respectively for the year 2016.



Means of growth rates in Awassi lambs at Ezra'a research station for the year 2016



Overall means of Awassi lambs weights at Ezra'a research station for the year 2016



3- Kherbet Ghazi research station for Awassi sheep improvement and propagation:

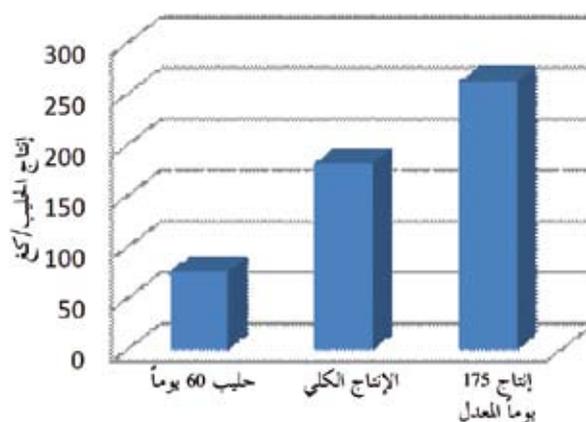
For the purpose of enhancing ACSAD's infrastructure and due to the expansion of research and study activities and implementation of developed projects, this station has been established in Kherbet Ghazi in the year 2016 where the experts have started up the implementation of projects and researches. The results were as follows:

* The reproductive indicators:

The fertilization rate was 100%; the birth rate was 88.2% and the twin- birth rate was 39.3% for the sheep flock in the year 2016.

* The milk production indicators:

The daily milk production rate was 1.524 kg; the milk production rate for a period of 60 days was 76.6 kg; the total milk production was 182.7 kg, the flow of milk period was 118.2 days and the modified milk production rate for a period of 175 days was 262.72 kg for the year 2016.

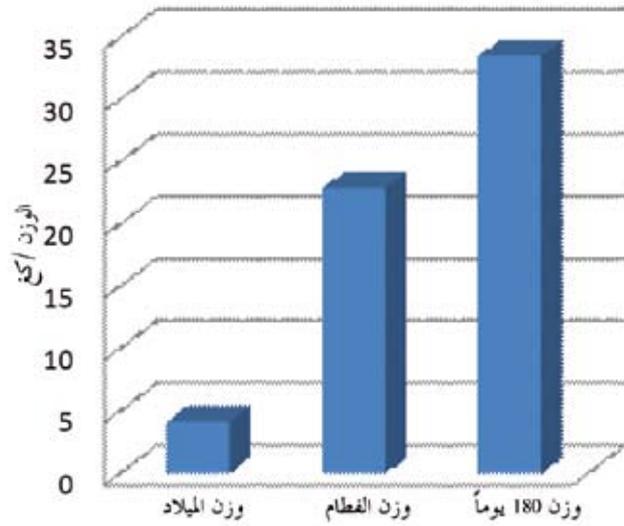
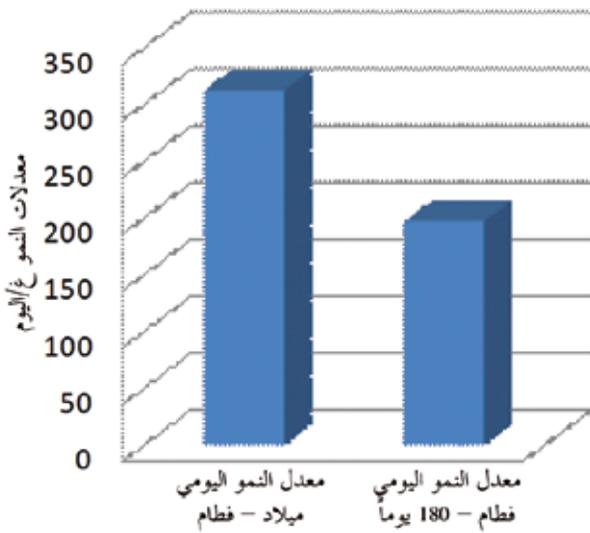


Milk production indicators averages for Awassi ewes at Kherbet Ghazi research station

Age (year)	Daily milk production (kg)	Milk production for a period of 60 days (kg)	Total milk production (kg)	Modified milk production for 175 days (kg)	Flow of milk period (day)
2	1.23	56.63	144.34	207.59	118.4
3	1.60	86.08	188.77	280.18	118.2
4	1.96	98.03	283.40	344.33	138.6
+5	1.76	92.84	211.69	308.43	115.3
General average	1.52	76.65	182.70	262.72	118.2

* Newborns' weight:

The results have showed that the weight averages at birth, weaning and age 180 days were 4.147 kg, 22.90 kg and 33.5kg respectively; the annual growth rates were 224.4g/day and 112.5g/day for the "birth till weaning" period and the "weaning till age 180 days" period respectively for the year 2016.



2- Project of "Goat Genetic Improvement and Care in the Arab Countries":

Project objective:

The project aims at the genetic improvement of goats by the selection process or crossbreeding between Shami goat breeds in Syria and the local goat breeds in the interested Arab countries such as Al-Barqi breed in Egypt, Al-Tohami breed in Yemen and the local goat breeds in Tunisia, Algeria and Libya.



Project site:

At the scientific research stations of ACSAD, at several research stations specialized in goat breeding and in the breeders' fields in the Arab countries as well.

The goat genetic improvement and care project has started up in the year 1993 by selecting the superior animals to form the elite flock aiming at propagating it and disseminating its improved genetic types in the Arab countries. The most important results of its activities during the year 2016 were the following:

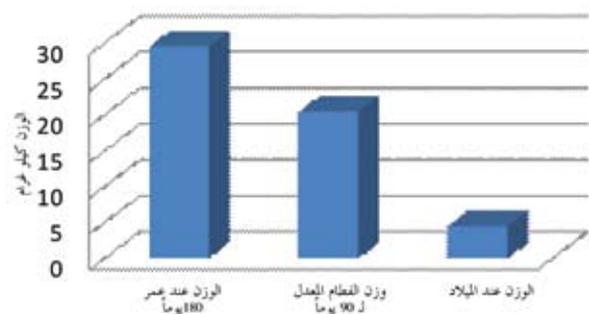
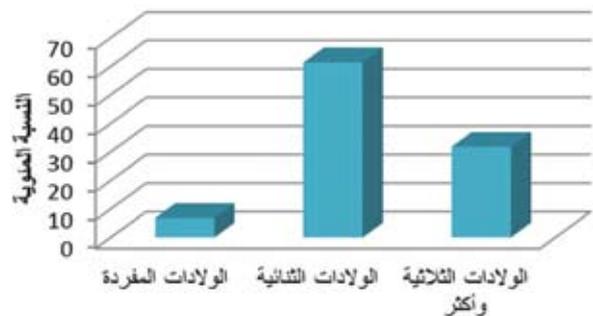
* The reproductive indicators:

The average rate of the pregnant females by natural mating was 98%, the birth rate was 96.4%, the single-birth rate was 6.8%, the twin-birth rate was 61.4% and the triple (and above) birth rate was 31.8% in the year 2016.

* Milk production indicators:

The daily milk production rate was 2475g; the milk production rate for a period of 90 days was 181kg; the total milk production rate was 497kg; the flow of milk period was 196 days and the modified milk production rate for a period of 220 days was 545kg for the year 2016.

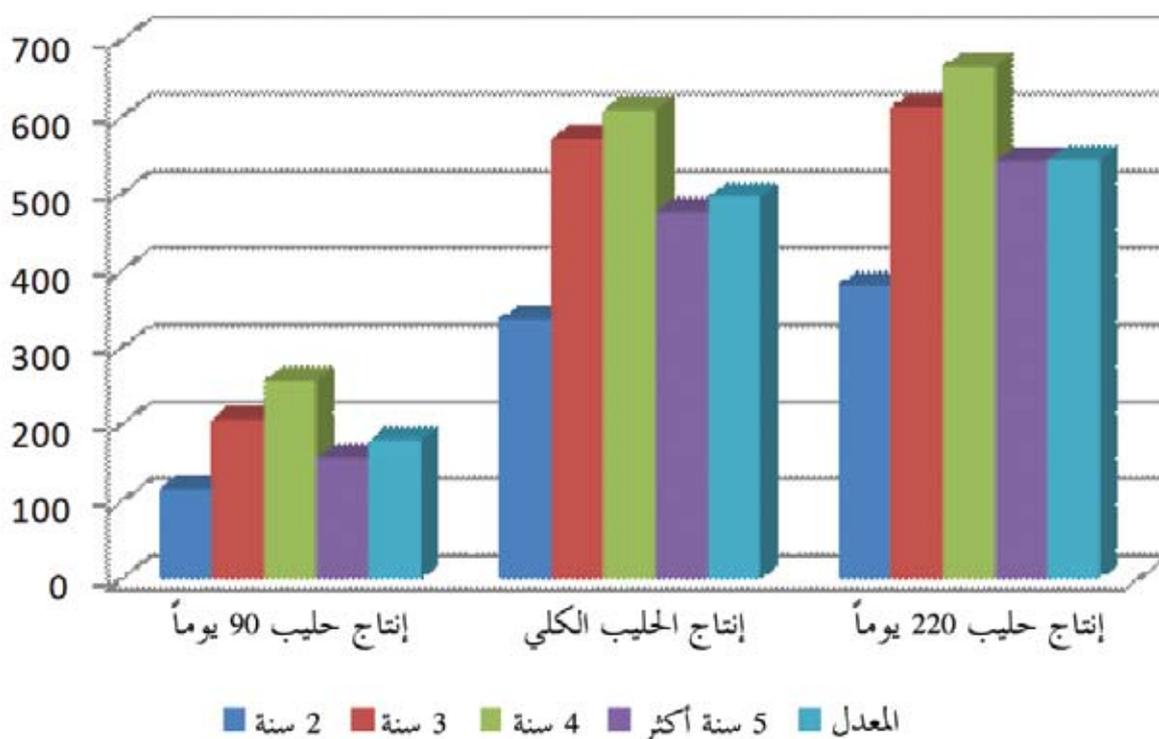
* Newborns' weight: The weight averages at birth, weaning and age 180 days were 4.50 kg, 20.44 kg and 29.53kg respectively for the year 2016.



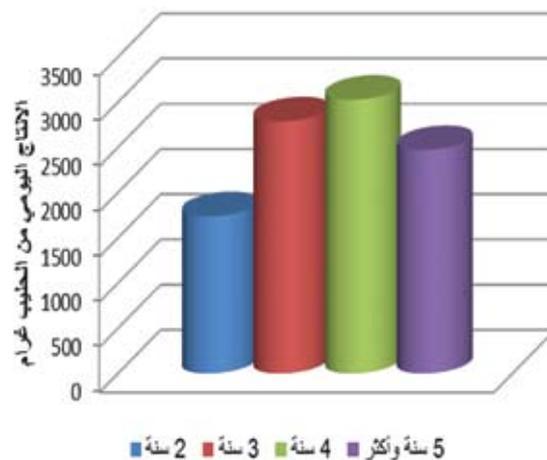
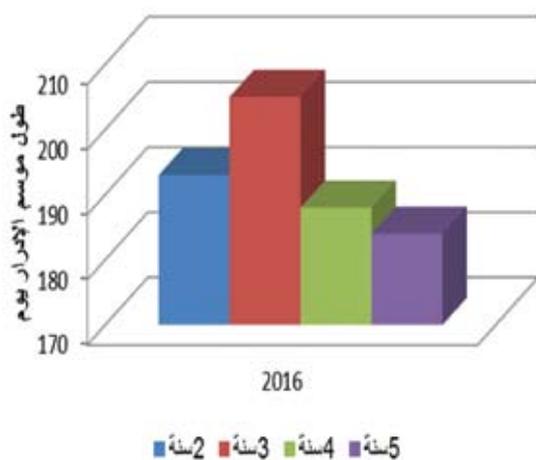
Averages of Milk production indicators for Shami goats at different ages at Ezra'a research station for the year 2016

Age (year)	Daily milk production (g)	Milk production for a period of 90 days (kg)	Total milk production (kg)	Modified milk production for 220 days (kg)	Flow of milk period (day)
2	1737	117	338	382	193
3	2787	208	572	613	205
4	3027	258	610	666	188
+5	2470	157	478	543	184
Average	2475	181	497	545	196

Weight (kg)		
At birth (kg)	At weaning (kg)	At age 180 days (kg)
4.50	20.44	29.53



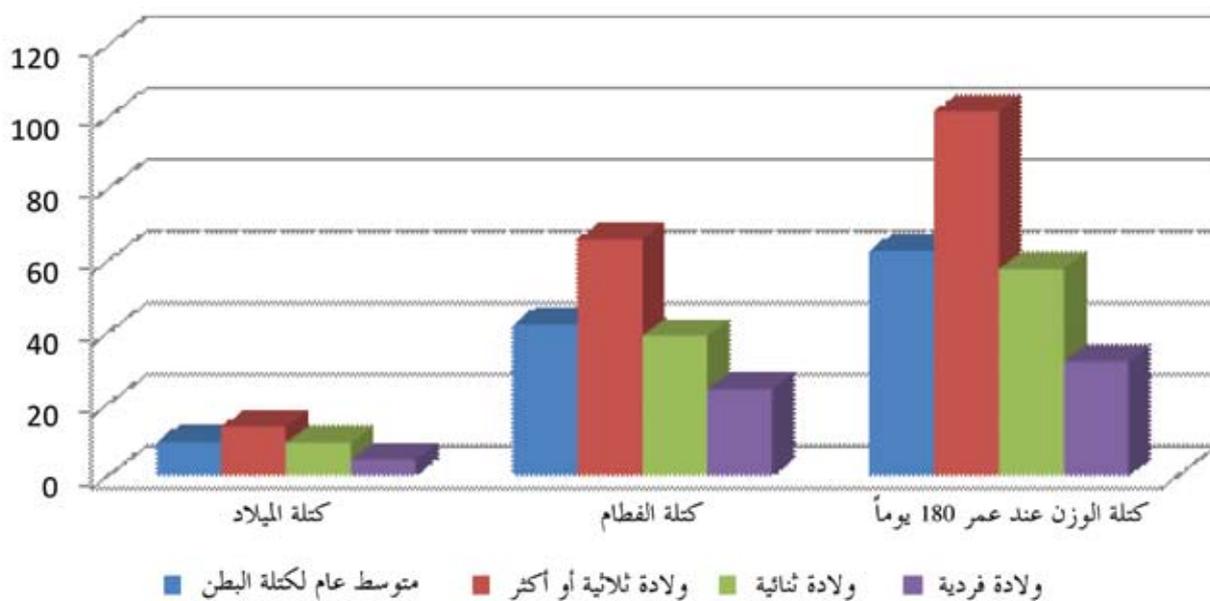
* The birth and weaning masses: The general mass averages for birth, weaning and age 180 days were 9.47kg, 42.28kg and 62.75kg respectively. On the other hand, the birth masses for single, twin and triple and above deliveries were 4.55kg, 9.20kg and 13.77kg respectively and the weaning masses for single, twin and triple and above deliveries were 24.25kg, 39kg and 66kg respectively.



On the other hand, the 180 days- age masses for single, twin and triple and above deliveries were 32kg, 57.73kg and 101.67kg respectively.

Mass average at birth, weaning and age 180 days according to the number of deliveries for Shami goats in the year 2016 at Ezra'a research station

Delivery type	At birth (kg)	At weaning (kg)	At age 180 days (kg)
1	4.55	24.25	32.00
2	9.20	39.09	57.73
+3	13.77	66.00	101.67
Average	9.47	42.28	62.75



Project of “Sheep and Goat Productivity Improvement in the Arab Countries”

The total number of ACSAD’s improved Awassi goats distributed among the Arab countries during the period 2003-2016 was /1000/ heads; of which /324/ heads were rams, /654/ heads were ewes, /21/ heads were weaned ewes and /500/ heads were for a fattening purpose. On the other hand, the Arab Center (ACSAD) has distributed during the period 1994-2016: /949/ improved heads of Shami goats (342 males and 606 females). Within the framework of this project, the most important implemented activities in the Arab countries for the year 2016 can be summarized as follows:



1- Jordan:

The cooperation has continued with the Hashemite Kingdome of Jordan in terms of two projects namely “sheep production improvement in the Arab countries project” and “goats production improvement in the Arab countries project” at Al-Fajj Al-Khnasri station for the first project and Al-Walla station of the Jordanian Ministry of Agriculture- National Center for Agricultural Extension and Research for the second project. In the year 2015, /600/ frozen semen straws of Awassi sheep were sent to implement the project plan.

Currently, the Arab Center ACSAD is implementing the project of “optimal use and processing of agricultural residues» through which Jordan will be provided with a machine for processing agricultural residues.

2- Tunisia:

Within the framework of the current cooperation in the field of genetic improvement of small ruminants between the Arab Center (ACSAD) and the Ministry of Agriculture, Water Resources and Marine Fishery of the Republic of Tunisia, ACSAD has established an artificial insemination laboratory in kairouan in the year 2016. Under this project, the Tunisian side has been provided with /3000/ straws of frozen semen (1500 straws of shami goats and 1500 straws of Awassi sheep) and the production activities have been launched for livestock improvement.

3- Sudan:

In the year 2016, the livestock component has been prepared to implement the project of “Optimal Uses of Agricultural Lands in Sudan”. The project document has been discussed with the Sudanese experts and the livestock data has been collected.

4- State of Palestine:

For the purpose of implementing the decisions of the “Economic and Social Council” and “General Assembly” of ACSAD and within the framework of the program of “Sheep and Goats Productivity Improvement in the Arab Countries” and the project of “Artificial Insemination Use and

Development of Small Ruminants in the Arab Countries”, ACSAD is cooperating with the Ministry of Agriculture in the State of Palestine in the years 2016 and 2017 to establish a livestock improvement station in Palestine through ACSAD’s financing by an amount of 150000 USD. The aim is to introduce highly improved and productive breeds, transfer technology and improve the income of Palestinian breeders.



5- State of Qatar:

Aiming at activating the cooperation activities in the field of genetic improvement of Awassi sheep and Shami goats by the selection and crossbreeding processes in the State of Qatar and supporting the cooperation framework between the Arab countries and ACSAD, the Arab Center (ACSAD) has provided “Baladuna” company in Qatar with (90) heads of improved Awassi sheep and Shami goats (30 females and 20 males of Awassi sheep and 25 females and 15 males of Shami goats) in the year 2016. The total number of the improved live animals sent to Qatar was (673) heads of live animals; of which (550) heads were of improved Awassi sheep (111 males, 418 females and 21 weaned ewes) and (123) heads were of Shami goats (34 males and 89 females) in addition to 500 heads of Awassi sheep for fattening purposes. Moreover, (5900) frozen semen straws were also sent; of which (3600) straws were of Awassi sheep and (2300) straws were of Sahmi goats, to support the programs of genetic improvement of these two breeds aiming at producing and distributing genetically-improved animals among breeders. The Ministry of Environment in the State of Qatar is currently contacted with, to send the data of the years 2014, 2015 and 2106.

6- State of Kuwait:

For the purpose of implementing the signed agreement between the Arab Center (ACSAD) and the General Commission for Agriculture and Fishery Affairs in Kuwait in the field of Al-A’aredi goat production improvement and development, (300) heads of Awassi sheep and Shami goats (125 females and 25 males of Awassi sheep and 125 females and 25 males of Shami goats) have been sent in the year 2016, in addition to the previous consignments totaling (75) heads of live animals. Moreover, (1800) frozen semen straws have been also sent; of which (1500) straws were of Awassi sheep and (300) straws were of Shami goats.

7- Lebanon:

The Arab Center (ACSAD) has provided the Lebanese Ministry of Agriculture with (10) heads of improved Shami goats (5 males and 5 females) in the year 2016. The total number of the sent improved live animals have been estimated at (80) heads of Awassi sheep and (80) heads of Shami goats in addition to (600) frozen semen straws; of which (300) straws were of Awassi sheep and (300) straws were of Shami goats.

Program of “Development and Use of Artificial Insemination and Embryo Transfer Techniques in the Arab Countries”

Project of “Artificial Insemination Use Development in Small Ruminants”

Project objective:

The project aims to contribute to the acceleration of the genetic improvement process of sheep and goat flocks by collecting the elite males’ semen in the core flock and disseminating them as can as possible among the cooperating stations and breeders’ flocks in the Arab countries within the framework of the exerted efforts to achieve the optimal utilization of goat and sheep superior breeds especially those genetically selected and improved in some Arab countries.

Project site:

The Hashemite Kingdom of Jordan, the Republic of Tunisia, the Democratic People s’ Republic of Algeria, the Republic of Sudan, the Syrian Arab Republic, the State of Qatar, the State of Libya, the Republic of Iraq, the State of Palestine, the Republic of Lebanon and the Republic of Yemen.

Project progress:

The activities have effectively continued in the laboratory of artificial insemination and embryo transfer at Ezra’a research station. This has been reflected in the processes of semen collection, freezing and development methods, in addition to the tests of embryo collection, manipulation and freezing, use of new programs for fertility improvement of small ruminants and training of Arab technical staff on all stages of the use of artificial insemination and embryo transfer techniques for small ruminants.

In the year 2016, a scientific research was implemented, in cooperation with the Faculty of Agriculture- Damascus University and Faculty of Medicine- Hama University, on the use of low density lipoproteins in freezing solutions of Awassi rams semen. The field applications have shown important results leading to the improvement of birth rate by frozen semen artificial insemination (10-12%) in comparison with the adopted method (ready-made dilute solutions). This reflects the potential of improving the artificial insemination efficiency for sheep and goats and the potential of using a local-made solution containing 8% of low density lipoproteins instead of expensive exported commercial dilute solutions.



Improved Shami buck- ACSAD



Quadruplets in Shami goats



Improved Awassi rams



Multiple births in Awassi sheep

1- Distribution of semen straws among Arab countries:

The work has continued in the laboratory of artificial insemination and embryo transfer at Ezra'a research station, where /12000/ straws of improved Awassi sheep and Shami goats lines have been produced and deposited in the year 2016 to be distributed among the interested Arab countries.

Within the framework of artificial insemination project, ACSAD has also cooperated with the General Commission for Agricultural Scientific Research in Syria to inseminate a part of the improved sheep and goat flock at some research stations by using fresh semen taken from the elite males at Ezra'a research station. The initial results have showed good rates of pregnancy and birth as a result of the use of this method. Currently, efforts are exerted to increase the number of stations and tested animals in a way that contributes to the spread of the acquired benefit as can as possible among flocks.

2- Reproductive efficiency improvement tests:

In the years 2015 and 2016, an experiment on Awassi sheep reproductive efficiency improvement has been implemented by using a mixture of (GnRH) and (PGF2) hormones and the results have been encouraging. Another research has been also implemented under the title of « comparison between long-term treatment with Progesterone hormone and short-term treatment with PGF2 hormone at the time of eroticism of Shami goats».

3- Provision of expertise and consultation, participation in scientific meetings and publication of scientific papers:

The program provides expertise and consultation in the field of the necessary supplies, tools and materials for the establishment of artificial insemination laboratories. This service has been provided to Tunisia, Algeria, Jordan and Qatar.

In the year 2016, several scientific papers have been published in certified scientific journals as follows:

- 1- Study of some ovular infections of Syrian pure Arab horses (Arab Journal for Arid Environments, ACSAD).
- 2- Evaluation of low density lipoprotein use efficiency in salty dilute solution for freezing semen of Syrian Awassi rams (Arab Journal for Arid Environments-ACSAD).

- 3- Use of amino acid with LDL molecules in the dilute solutions of Awassi rams semen (Arab Journal for Arid Environments- ACSAD).
- 4- Evaluation of fertility capacity of Awassi sheep frozen semen in various dilute solutions (Arab Journal for Arid Environments- ACSAD).
- 5- Use of different concentrations of low density lipoproteins to develop a new dilute solution for Awassi rams semen (Scientific Journal of King Faisal University).

Currently, three scientific papers are prepared on «comparison between long-term treatment with progesterone hormone and short-term treatment with PGF2 hormone at the time of eroticism of Shami goats», «impact of use of low density lipoprotein molecules of egg yolk in the locally-made dilute solution of semen of Syrian pure Arab horses» and «reproductive efficiency improvement of Awassi sheep by using the mixture of (GnRH) hormone and (PGF2) hormone».



Developed equipment in the artificial insemination lab at Ezra'a research station

Program of “Camel Researches and Development”

1- Project of “Camel Newborns> Mortality Rate Decrease in Some Arab Countries”:

Project objective: The project aims to decrease the rates of camel newborns mortality by studying and controlling mortality causes and developing a suitable protective program for protecting the newborns of camel flocks and decreasing their mortality rates. This will lead to the increase of camel numbers and encourage breeders to sell the surplus, and thus improve their economic return.

Project site:

The project is implemented through the financing of the Arab Center (ACSAD) in Tunisia, Algeria, Sudan and Mauritania.

Project progress:

The project activities have continued this year, as several field and study visits have been conducted to collect and bring the pathogenic samples of the mortal or sick camel newborns to the central laboratories to be diagnosed for the purpose of identifying the disease or mortality reasons.



2- Study Project of “Camel Grazing Systems, Breeders’ Income Improvement and Expertise Exchange in Algeria”:

Project objective:

The project aims to improve the livelihood conditions of the camel breeders in the desert areas, characterize the camel productive nature, evaluate the current situation of flock production and management tools, reach the best model of camel breeding and care methods, develop technical plans for camel and rangeland development and raise the vegetation cover productivity and the pastoral value. It also aims to activate the role of local communities in the rangeland conservation and degradation control, rehabilitate and train technical staff and exchange expertise. The project is implemented over a period of three years starting from the year 2015.

Project site:

The Democratic People’s Republic of Algeria.

Project progress:

An inventory study has been conducted in seven desert states namely; Adrar, Bashar, Tamnrast, Warqla, Al-Wadi, Eliezi and Tandoof. The purpose of this study is to get acquainted with the current situation of rangelands and camels in these states and identify the camel productive properties, camel flocks sizes and types and camel holdings sizes and types. It also aims to get acquainted with the available natural resources for camel breeding and care, identify the infrastructure situation and, thus, get acquainted with the constraints that face camel breeding and care in the study area. The study also concentrates on recognizing the diseases that prevail among camel flocks in

the area.

A training has been provided to the technicians responsible for the questionnaire filling up and data collection on how to proceed with the data collection and filling into the study questionnaire or the database that is prepared for this purpose. The inventory study data has been analyzed and a joint meeting with the Algerian side has been held. In this meeting, the study results, outputs and recommendations have been presented and the required interventions have been discussed to achieve the desired goals of the project.

The most important recommendations and outputs reached by the study to improve the camel breeding actuality in the desert areas of Algeria are the following:

- Raise the awareness of the breeders towards not using the «tattooing method» for identifying the camel flock procession and using instead other alternative tools: like plastic or metal ear numbers or electronic number slices fixed under the animal skin.
- Encourage the semi-intensive care method of camels instead of the traditional care method especially in the states where the traditional method prevails.
- Select and propagate the best males of Al-Rqeibi breed, which is a descendent of mothers with high production, to be distributed and disseminated among breeders to get newborns with highly productive and superior capacities and properties.
- Ensure that most breeders share the same view regarding the fact that there is no positive impact of early weaning and use of milk alternatives in the newborns feeding on the female reproductive capacity and the short period between deliveries.
- Improve the marketing capacities of the breeders to get the best revenue of dairy, meat and skin products from camel breeding and care activities.
- Instruct breeders and get them acquainted with the importance of camel supplementary nutrition and its positive impact on the animal health situation and productive capacity.
- Provide drinking water sources for camels in the rangeland areas such as: digging wells, providing water tanks and implementing water harvesting projects like tanks and dikes.
- Improve the rangeland situation in all the states of the Governorate of Agriculture Development in the Desert Areas, especially in the areas with the poorest rangelands like Warqla, Al-Wadi, Tamnast and Bashar or areas with medium-level poor rangelands like Tandoof and Eleizi.
- Control the prevailing diseases among camel flocks like diarrhea, smallpox, scabies and favus diseases in addition to respiratory diseases by providing the necessary protective and therapeutic services.

3- Other activities of the program of camel researches and development:

- In the year 2016, ACSAD's experts have conducted a work visit to the Federal Republic of Somalia to get acquainted with the factors of camel breeding and the available potentials there, aiming at cooperating under ACSAD's Program of Camel Researches and Development.
- An agreement has been reached with the Research Plants Complex at the Faculty of Agriculture-Cairo University to implement research projects to study the semen gene expression and the various stages of "C. dromedaries" embryos that are produced in laboratories, by using the technology of "Microarray" and getting marker genes for the fertility of camel males and females.



Program of “Development of Fodder Sources and Animal Feeding in the Arab Countries”

1- Project of “Fodder Processing From Agricultural Residues and Agro-industrial Residues and Improvement of Fodder food Value”:

Project objective:

Provide low-cost additional fodder resources, control environmental pollution, transfer and localize ACSAD’s food value improvement techniques of agricultural residues and agro-industrial residues, raise the food value of agricultural residues and process them, alleviate the pressure on degraded rangelands, use optimally the residues and avoid waste, motivate countries and investors to establish fodder production projects, increase livestock production and breeders’ income, create new job opportunities, control fodder imports from abroad, utilize optimally conventional fodder, process a part of conventional fodder together with a part of agricultural residues to reach an integrated formula of fodder (dry and wet, balanced and concentrated) and finally circulate the above mentioned measures among breeders and help them to implement them.





Project site:

The Tunisian Republic and the Republic of Sudan.

Project progress:

- In the year 2016, ACSAD has sought to design, process and provide the Tunisian Republic with a machine for agricultural residues processing; as the experts in ACSAD have exerted their efforts to install a machine for agricultural residue processing and train the Tunisian technical staff on the machine installment, maintenance and use.
- Efforts have been exerted to provide the Republic of Sudan with a machine for agricultural residues processing through a financing by the General Commission for Agricultural Investment. ACSAD's experts have installed the machine and trained the Sudanese technical staff on the machine installment, maintenance and use.
- Implement five training courses:
 - 1- A training course in the field of fodder production for the project of "Food Security and WASH Emergency Response to the Syrian Crisis" in Al-Hasakeh during the period 7-9/11/2016.
 - 2- A training course in the field of fodder production for the project of "Food Security and WASH Emergency Response to the Syrian Crisis" in Dara'a- Ezra'a research station during the period 7-9/11/2016.
 - 3- A training course in the field of agricultural residues inventory, evaluation and improvement in Damascus during the period 20-24/11/2016.
 - 4- A training course on the optimal utilization of agricultural residues and agro-industrial residues for the Tunisian technicians during the period 14-24/11/2016.
 - 5- A training course on the optimal utilization of agricultural residues and agro-industrial residues for the Sudanese technicians during the period 13-27/12/2016.
 - 6- A training course in the field of dairy products production for the project of "Food Security and WASH Emergency Response to the Syrian Crisis" in Dara'a – Ezra'a research station during the period 14-16/11/2016.
- Issue two scientific periodicals on:
 - 1- Fodder processing and agricultural residues unit.
 - 2- Project of "Optimal Utilization and Processing of Agricultural Residues".

Fifth: Program of “Animal Genetic Resources Inventory and Characterization”

1- Project of “Establishment of Regional or Sub-Regional Networks for Conservation and Exchange of Animal Genetic Resources (Gene Banks in the Arab countries)”:

1- Assistance in the Establishment of Animal Genetic Banks (Regional or Sub-Regional Assistance):

Project objective:

Since its establishment, the Arab Center (ACSAD) has continued its assistance to the Arab countries in the field of animal genetic resources conservation through: In-situ propagation and conservation: by providing expertise to the Arab countries to establish stations for propagation, improvement and management of local animal genetic resources particularly the promising breeds, or Ex-situ propagation and conservation (embryos or frozen semen).

Project site:

All the Arab countries.

Project progress:

- Participate in the Regional Conference for Animal Genetic Resources which was held in the Sultanate of Oman- Masqat during the period 22-26/2/2016 through a presentation under the title of “The Role of ACSAD in the Inventory and Characterization of Animal Genetic Resources in the Arab Countries”.
- Implement the project of “Preparation of a Unified Dictionary on Scientific terms in the Livestock Resources Field”, aiming at collecting the scientific and technical idioms and information related to the livestock field, unifying the proposals concerning the study of the scientific terms of animal resources in the Arab countries and arabizing the foreign terms in a clear and accurate way. The dictionary of livestock scientific terms has been issued at the end of the year 2016 and distributed among the researchers of the livestock scientific research centers in the Arab countries.
- Currently, a project proposal for a scientific reference entitled “Inventory and Characterization of Animal Genetic Resources in the Arab Countries” is under preparation. It includes a genetic and appearance (shape and productive traits) characterization of the agricultural animal species in the Arab countries, within the framework of the world orientation towards conserving and developing the local agricultural animal genetic resources. It will serve as a knowledge tool for students and researches in the Arab countries that will raise the awareness towards the vital and economic importance of these resources.
- Continue the in situ propagation process of genetic resources in the banks of the headquarters country and cooperating stations in the Arab countries (totaling 20 cooperating stations in 13 Arab countries). /400/ heads of genetic resources have been sent to each of Qatar, Kuwait and Lebanon within the framework of propagation and dissemination of live genetic types under different environmental conditions.
- Establish a mini bank for ex situ animal genetic resources in the form of frozen semen of Awassi

rams and Shami goat males in the headquarters country- Directorate of Animal Production- Artificial Insemination Section. /12000/ straws of Awassi sheep and Shami goats semen were frozen and stored to meet the requirements of the Arab countries and serve as a genetic resources bank for highly productive lines and limited numbers of rare animals like Shami goats.

- A database for animal genetic resources in the Arab countries is developed. It will facilitate the process of linking the cooperating stations in the Arab countries with the Arab Center (ACSAD) through the spider network and will help in the process of exchanging and receiving data from these stations to be processed, analyzed and then returned, in a way that contributes to the protection of animal genetic resources and the continuation of the local breeds propagation and productivity improvement.
- Start up the preparation of a guidebook entitled "Small Ruminants Transfer Methods" including:
 - 1- The sound scientific methods that should be followed during the transfer of live animal genetic resources to the Arab countries whether by land, sea or air.
 - 2- The conditions that should be followed during the transfer of animal genetic resources in terms of care, nutrition and health measures.

Water Resources

The Water Resources Department

The Water Resources Department implements its activities through the following main programs:

First: Program of Integrated Water Resources Management:

This program aims to apply the principles of integrated water resources management and participatory approach for the purpose of optimal and sustainable use of the available surface and ground water resources.

Second: Program of Water Resources Development:

The main objective of this program is to implement a number of important projects which contribute to the achievement of optimal use of the available water resources, control their waste and loss and develop them at the same time.

Third: Program of Water Environment Protection:

This program aims to evaluate the impacts of climate change and its extreme aspects on the fresh water resources in the Arab region, provide assistance in the preparation of alleviation and adaptation plans and policies at the national, regional and sub-regional levels and provide the necessary scientific and information base to expand the use of non- conventional water resources in the Arab region to provide additional resources that meet the future requirements and control water deficiency.



First: Program of Integrated Water Resources Management

1- Project of Arab Water Security:

1- Project of Executive plan of Arab Strategy for Water Security in the Arab Region to Face the Challenges and Future Requirements of Sustainable Development (2010-2030):

Project objective:

For the purpose of enhancing its contribution to the achievement of Arab water security and improving the conditions and tools of application of integrated water resources management, in addition to decreasing the food gap, supporting the Arab countries trend concerning adaptation with the negative impacts of climatic change and implementing the decisions of the Arab summits and ACSAD's General Assembly, the Arab Center (ACSAD) has cooperated with a technical committee, formed by the Arab Ministers Council for Water and consisting of Arab, regional and international parties, to prepare the executive plan of Arab strategy for water security in the Arab region to face the challenges and future requirements of sustainable development (2010-2030). In addition to its task in supervising the works of the committee, the Arab Center (ACSAD) has participated in the formulation of several projects and activities of the plan.

The executive plan aims basically to:

- Present items of participatory executive projects for "the Arab Strategy for Water Security in the Arab Region to Face the Challenges and Future Requirements of Sustainable Development (2010-2030)" in a way that ensures the best management of the available water resources, enhances the Millennium Development Goals (MDG) and protects water resources from contamination and depletion.
- Enhance cooperation, exchange climatic and water information and experiences among Arab countries in the field of water policies implementation, raise the awareness level of communities on water and environment and protect Arab water rights.

Project participating parties:

The concerned ministries in the Arab countries.

Project outputs:

- Follow up the implementation of several projects on integrated water resources management within the framework of the "Executive Plan of Arab Strategy for Water Security in the Arab Region". These projects are: the project of "Irrigation Efficiency Raising in the Arab Countries", the project of "Use of Integrated Water Resources Management Tools in the Development of Arab Countries' Capacities to Adapt with Climatic Changes for Issuing a Guidebook on Adaptation in the Agricultural Sector" and the project of "Development of a Water and Climatic Database for the Arab Region".
- Prepare executive plan summary and an explanatory brochure in Arab and English languages to be presented to Arab and International organizations interested in the implementation of the included projects.



2- Project of Integrated Water Resources Management to Achieve Sustainable Development in the Arab Region:

The Arab Center (ACSAD) seeks to implement four main projects under the project of integrated water resources management; these projects that have been approved by the "Arab Ministerial Council for Water" are:

Irrigation Efficiency Raising in the Arab Countries

Project objective:

Study the reasons of irrigation efficiency decrease in the Arab countries, identify the appropriate tools and measures that are applicable under the prevailing environmental, humanitarian, technical, economic and social conditions in the Arab countries to improve the water use efficiency for irrigation purposes, support and develop the capacities of those who work in the irrigation field including engineers, technicians and farmers and concentrate on the issues of extension and management at the field level.

Project participating parties:

The concerned ministries in the Arab countries.

Project outputs:

- Hold the second project workshop in Beirut- Lebanon in April, 2016 which was attended by ACSAD's experts, national coordinators from the Arab countries participating in the project imple-

mentation (13 countries) and experts from the Food and Agriculture Organization of the United Nations (FAO), the International Center for Agricultural Research in the Dry Areas (ICARDA) and the German Agency for International Cooperation (GIZ).

- Finalize the initial draft of a comprehensive study on the irrigation efficiency in the Arab countries.
- Prepare a summery on the most important results reached by the Arab Center (ACSAD) in the comprehensive study on irrigation efficiency in the Arab countries which is based on reference studies prepared by Arab experts on irrigation efficiency in the Arab countries participating in the project implementation. The summery has also included the most important proposals of the Arab Center (ACSAD) for improving irrigation efficiency. These proposals have concentrated on the fact that irrigation efficiency raising in general, and at the field level in particular, doesn't necessitate a direct and entire transformation from conventional surface irrigation to other irrigation methods that can decrease the water loss and improve the efficiency of irrigation water use; the efforts should be exerted to develop the conventional surface irrigation methods based on the prevailing conditions and within the available technical and financial potentials. The aim is to raise the efficiency, taking into consideration that these methods can be adjusted, improved and developed under the current irrigation networks and it is expected that their use will continue for the short and medium terms due to technical, economic and social reasons.
- After analyzing the reasons of the decrease of the surface irrigation efficiency in the Arab countries through ACSAD's analysis of the irrigation sector actuality in the Arab countries, it is noticed that the technical reasons and the issues related to water management are the most affecting



reasons of the efficiency decrease; the fact that explains why the efficiency improvement programs should take into consideration these reasons and should exert the utmost efforts and potentials in handling these reasons without ignoring the other ones.

- Send a summery, to the concerned authorities in the Arab countries, on the practical actions proposed by ACSAD to improve irrigation efficiency in the Arab countries.
- Continue the work for completing the final version of the comprehensive study.

Project of “Towards Concerted Sharing: Development of a Regional Economic Model for Water in the Jordan River Basin”

The Jordan river basin is considered one of the most important mutual basins in the Arab region that is shared among several Arab countries (Jordan, Syria, Palestine and Lebanon). It importance comes from the fact that the agricultural sector in this basin is growing and very important in the life of the farmers and there is a big competition between this sector and other sectors on the available conventional and non-conventional water resources.

Project objective:

- Build a model for water economies in the Jordan river basin that takes into consideration all aspects of the integrated management of the available water resources.
- Apply an actual case study for the management of a mutual water basin among several countries. This requires cooperation and coordination between these countries in terms of collecting and organizing data in a way that suits the model inputs, and then benefiting from the model outputs for an optimal management of the mutual water resources.
- Disseminate a modern technique based on an economic vision for water resources management.



Project participating parties:

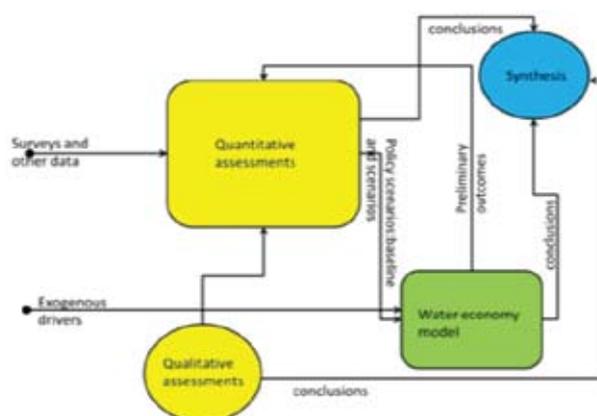
The project is implemented in cooperation among the Arab Center (ACSAD), the Jordanian University for Science and Technology, the American University in Beirut, the Jerusalem University in Palestine, as well as the World Food Study Center of Vrije University- Netherlands which serves as a coordinator for the project activities and interventions.

Project outputs:

- The first phase of the project has been completed by preparing the required climatic maps for the study area and generating the final climatic maps at an accuracy of /1 km/ including three basic climatic elements namely; the rainfall rate, the maximum and minimum temperature averages and the reference evapotranspiration rate. In the second phase, ACSAD has participated in the model building process and the preparation of a report on “woman role in the water resources management of the basin”, in addition to other reports on “impact of big water es-

establishments on the available resources of the basin”.

- In the year 2016, the activities of ACSAD have focused on participating in the model building and application on different case studies according to the conditions of each participating country. The Syrian case study has concentrated on the impact of irrigation efficiency raising, in the Syrian part of the basin, on several issues including: 1- the available water resources, 2-the investment horizons of the water surplus resulted from the increase in the irrigated area or irrigated agriculture intensification and 3- the potential of saving quantities of water in the areas located downstream the Jordan river valley. The study has showed that transforming to the compressed irrigation in the Syrian part of the basin will save 150000000 m³ of water annually.
- In the year 2016, the Arab Center (ACSAD) has participated in two workshops; the first was held in Beirut and the second was in Amsterdam in the Netherlands. The aim was to discuss the model and the resulted outputs and apply the case studies of the participating countries. ACSAD has also participated in the preparation of the final project report submitted to the financing party (SIDA) in addition to the preparation and publication of three scientific papers, concerning the model building and the Syrian case study, in international journals. Currently, the next phase of the project is prepared to invest the reached results in the decision support of the water resources management of the Jordan river basin; as a proposal will be prepared to be presented to the financing agency, namely (SIDA).
- In this proposal, the importance of the next phase is focused on by showing the benefit of the model building and improvement to become an adopted tool for the decision makers in the countries bordering the Jordan river basin.



Project of “Arab Countries’ Capacities Development to Adapt with Climatic Changes by Using Integrated Water Resource Management Tools”:

The assessment of the climatic changes impact on the climate elements (temperature, rainfall... etc) and water resources is considered the first step in the field of adaptation with climatic changes. Therefore, the project of (RICCAR), implemented by ACSAD in cooperation with ESCWA, is considered one of the pilot projects being concerned with the assessment of the climatic change impacts on the Arab region by applying regional climatic models and not international ones; the fact that increases the assessment accuracy and makes the reached results as the first database of its kind in the Arab region.

This project comes as a next phase for RICCAR project. The aim is to use the available outputs in the adaptation process with climatic changes by using the integrated water resource management tools in the Arab region in several sectors, including the agricultural sector.

Project participating parties:

The project is implemented by the Arab Center (ACSAD) in cooperation with a number of partners; namely: the United Nations Economic and Social Commission for Western Asia (ESCWA), the United Nations Environmental Program/Regional Office for West Asia as the coordinating

agency (UNEP/ROWA), the Arab Countries Water Utilities Association (ACWUA), the World Health Organization/the Regional Center for Environmental Health Action (WHO/CEHA) and the German Agency for International Cooperation(GIZ).

Project outputs:

Finalize the preparation of a guidebook on "adaptation in the agricultural sector" in the Arabic language and translate it into the English language. The guidebook has included a comprehensive review on the tools and methods of adaptation with climatic changes in the agricultural sectors with all its different aspects (water, soil, plant, animal and fishery). It has also included a summary of RICCAR project results concerning the assessment of the climatic change impact in the Arab region on some climate elements (rainfall, temperature,....etc) and the available water resources.

The general structure of the guidebook has been as follows:

- 1) Introduction.
- 2) Identification of problems frameworks.
- 3) Climatic change impact and the agricultural sector vulnerability based on the outputs of RICCAR.
- 4) Adaptation measures and options identification (integrated water resources management tools) in the agricultural sector.
- 5) Adaptation measures application matrix.
- 6) Work fields.

The climatic changes impacts on the agricultural sector have been classified into three categories relating to each other:

- The first category is related to basic climate elements including: rainfall, temperature and others.
- The second category reflects the environmental impacts of the climatic change.
- The third category is related to the agricultural sector itself, in terms of the cultivated and irrigated areas, production and economic and social reflections.

In terms of the response and adaptation measures, they have been classified as follows in the guidebook:

- A- The measures at the water resources level:
These measures are related to the methods of water collecting, storing and protecting from pollution, in addition to agricultural waste water recycling.
- B- The measures related to the vegetation cover type (forestry, forests...etc) and cultivation type (rainfed or irrigated): The measures differ according to the vegeta-



tion cover and the followed agricultural practices; the irrigated cultivations, for example, focus on irrigation efficiency raising for water saving and irrigated area increase. On the other hand, rainfed cultivations are based on alleviating the impact of the climatic changes on the productivity in terms of identifying the appropriate time for cultivation and selecting the drought-tolerant crops and plant resources.



- C- The measures related to livestock and fishery management: The livestock sector is very much affected by the rangeland quality, desertification and land degradation caused partly by the climatic changes. The fishery sector, on the other hand, is largely affected by water quality and temperature increase.

The guidebook has also included several success stories from the Arab countries in the field of adaptation with climatic changes in the agricultural sector.

A training course has been held for representatives of /15/ Arab countries and representatives of several international organizations. In this course, the contents of the guidebook and other training materials have been presented and the ways of using and benefiting from the guidebook have been explained. In this field, ACSAD has made all the necessary modifications of the guidebook in both Arabic and English versions to get the final version and circulate it among the agencies concerned with this field.

2- Project of "Application of Integrated Water Resources Management through using modern tools:

Project of Groundwater Modeling of Orontes Basin

Project objective:

Estimate the groundwater budget of Orontes basin through modeling and assess the expected impacts of groundwater use plans.

Project participating parties:

The Arab Center (ACSAD) in cooperation with the Ministry of Water Resources in Syria (General Commission for Water Resources- General Company for Hydrological Studies).

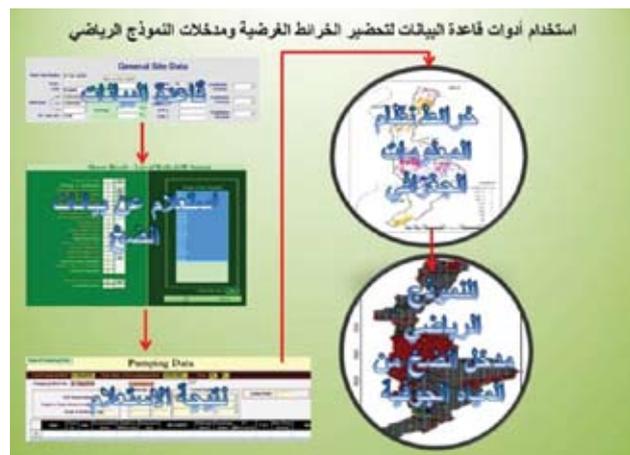
Project outputs:

1- Hydrological database:

A hydrological database has been prepared to help in analyzing the different hydrological data and preparing the model inputs.

2- Hydrological report:

The hydrological situation of the Orontes basin has been studied and analyzed and a technical re-



port has been prepared on the various aquifers prevailing in the basin, the groundwater resource renewal and recharge conditions and the relationship between the Orontes basin groundwater and the other neighboring groundwater basins. The report has shown the following:

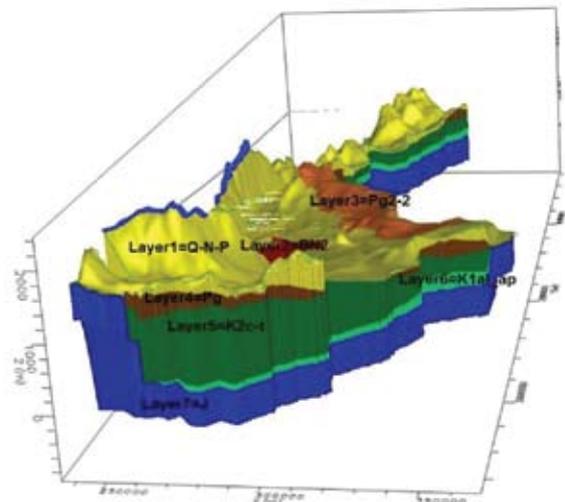
- The total area of the basin is (24660km²); out of which (16910km²) runs into the Syrian lands (68.6% of the basin area) and the rest runs in the Lebanese lands. Several dams exist in this basin, the most important of which are: Al-Rastan, Qattina, Mhardeh, Al-Qastoun and the 17th April dams. The basin rainfall average is estimated at 600-1500mm/year. The Orontes river receives 90% of its water from the groundwater runoff and the remaining 10% from the snow falls and surface water runoff. The agricultural irrigated area is estimated at (75000ha).
- Five aquifers of different geological ages and rock structure exist in this basin such as: the Quaternary Neogene aquifer, the Basalt Neogene aquifer, the Cretaceous aquifer and the Jurassic aquifer that contains the cracked dolomite calcareous rocks.
- The mentioned aquifers are recharged basically by rainfall and irrigation water. They also exchange the incoming and outgoing runoffs of the other neighboring basins, particularly: Aleppo and Al-Badia basins.

The geological and tectonic conditions are responsible for creating a large number of springs that flow with the water of the various aquifers, especially the Cretaceous and Jurassic ones. The coastal mountainous range and Al-Ghab lowland that are formed by the Lebanese-Syrian rift are considered the most important geological and tectonic structures that have led to the appearance of highly flowing springs distributed on both sides of the lowland.

The basin groundwater is exploited through a large number of wells totaling more than 1000 wells; the reason that led to the surface aquifers depletion and spring recharge decrease.

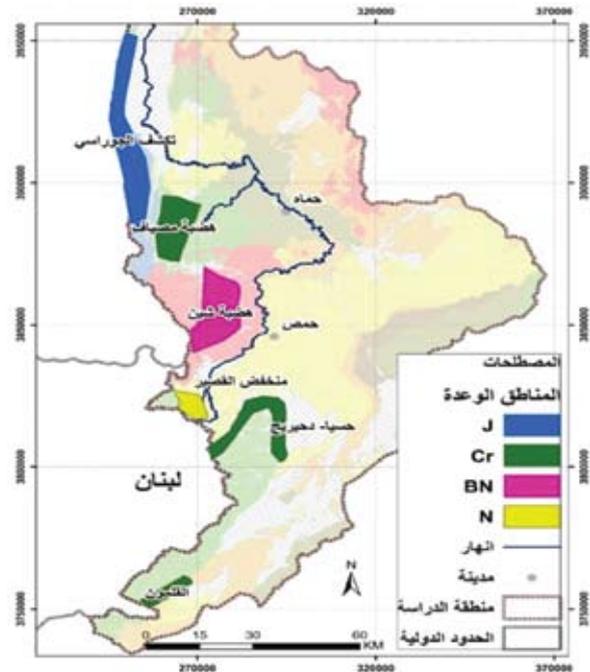
3- Model preparation and operation:

A conceptual hydrological model has been prepared and turned into a digital one to express the Orontes groundwater aquifer actuality. All the model inputs have been prepared such as: the aquifer dimensions, the groundwater recharge designs and the groundwater drainage wells designs. The model network has been built to cover the project area and the local conditions have been identified. The model, then, has been calibrated for the steady and non-steady states and operated for the whole water budget of the basin for the year 2010.



4- Identifying promising areas for groundwater exploitation:

As a result of the hydrological and geo-hydrological investigations and modeling activities, and after taking into consideration the promising areas selection criteria (such as the available renewable water resources of each aquifer, the current investment situation, the aquifer dimensions and hydrological characteristics, the groundwater level development, the spring recharge situation , the groundwater quality.... etc), six promising areas have been identified for groundwater exploitation of the Jurassic, Cretaceous, basalt Neogene and Neogene aquifers located in the western part of the Orontes basin.



5- Evaluating the impacts of the groundwater exploitation plans:

After calibrating the model with the steady and non-steady states and ensuring its representation of the aquifer actuality (Neogene Quaternary, Basalt Neogene, Baleogene, Cretaceous and Jurassic), the induction activities have been carried out for the potential aquifer developments resulting from groundwater exploitation plans implementation. The induction activities have concentrated on the potential changes in the groundwater levels and the water budget of the various aquifers. The activities have adopted the 2010 tolerance data and the rainfall and irrigation aquifer recharge data as a basis for calculating the future predictions for each of the following scenarios:



- **First scenario:** The groundwater recharge average by rainfall and irrigation water is steady and the exploited pumping quantities are steady, according to the 2010 data, for a period of 20 years (till the year 2030).
- **Second scenario:** The exploited groundwater quantities by wells for drinking purposes will increase by 4%, while the exploitation average of the irrigation wells is steady as well as the groundwater recharge average by rainfall and irrigation water.
- **Third scenario:** This scenario is related to the promising areas for groundwater exploitation as a result of the hydrological studies and modeling.
- **Fourth scenario:** It depends on exploiting the groundwater that is recharged into the Orontes river in some areas.

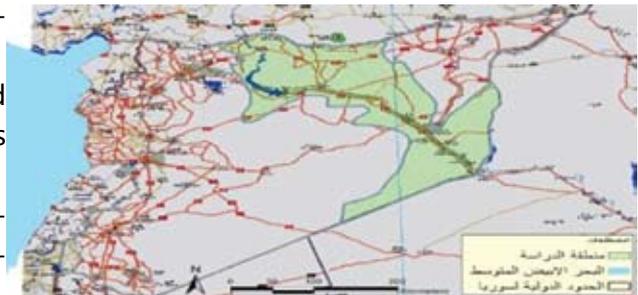
The results analysis has shown that the first scenario is the best for the Quaternary-Neogene aquifer and the Paleogene aquifer, while the second scenario is the best for the Cretaceous aquifer. On the other hand, the third scenario can be temporarily applied if the changes in the groundwater levels and springs recharging are monitored.

Project of “Modeling the Euphrates Basin in the Syrian Arab Republic”

The project site covering about 44 thousand km² is illustrated in the map below:

Project objective:

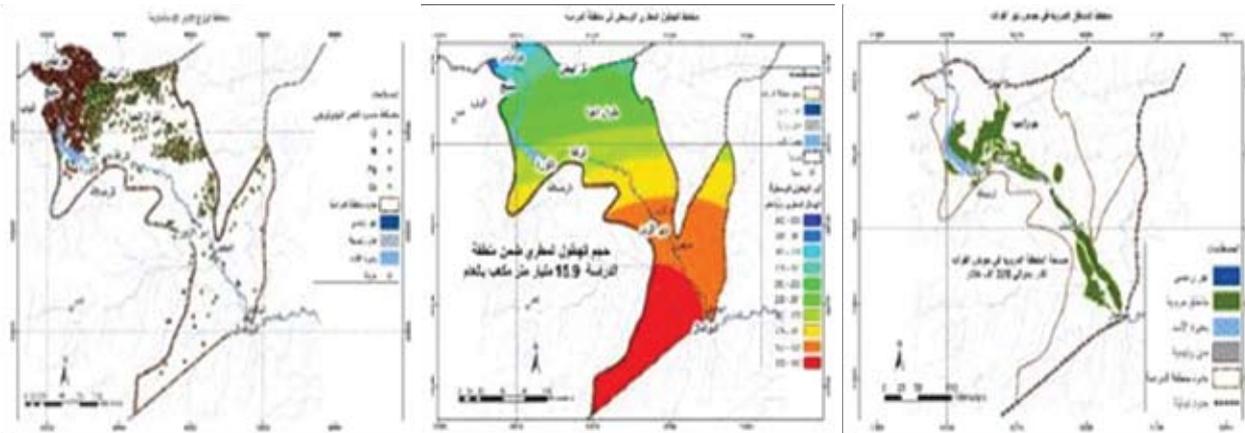
- Illustrate the groundwater movement, direction and hydro-chemical situation.
- Prepare a water budget (surface, ground and reserve water) for the basin (for all aquifers including the Jurassic one).
- Illustrate the hydro-geological relation between the basin and other neighboring basins.
- Identify the groundwater promising areas.



Project outputs:

- Collect geological and hydro-geological data and surveying data of the implemented wells in the study area, in addition to the implemented studies in the area and the neighboring areas.
- Prepare a GIS database including:
 - Geological map
 - Survey points of the exploitable wells.
 - Ground monitoring points.
 - Irrigated areas diagram.
 - Deep oil wells data.
 - Exploration wells data implemented in phase 1.
 - Russian tectonic map.
 - Baseline diagram (digital model for earth atmospheric altitudes of cities, villages, rivers, dams, lakes and international borders).
 - Climatic data.
 - Well pumping experiments data.
- Build a stratigraphic representation for the geological layers of the study area.

- Review the exploitable and exploration wells data and correct flaws in cooperation with the General Company for Hydrological Studies.
- Prepare a rainfall average chart for the study area.



3- Project of Coastal Basins Management:

Project of Developing a Regional Groundwater Model for the Coastal basin (Syria)

Project objective:

The project aims to build a groundwater model for the coastal basin in Syria and estimate the groundwater budget in this basin through the mathematical representation of the main water aquifers and water confining layers, and the use of Modflow model. Different scenarios representing the actual exploitation plan in the basin were applied and the best scenarios to ensure sustainability of groundwater resources were selected.

Project participating parties: The Arab Center (ACSAD) and the Ministry of Water Resources in the Syrian Arab Republic (General Commission for Water Resources and General Company for Hydrological Studies).

Project outputs:

- Completion of interactive data base for the groundwater in the coastal basin, including hydrological, hydro-geological, climatic and water uses data. This database could serve as a reference for all water studies in the basin including the current project on groundwater modeling. The concept of this database could be adjusted for any water basin in the Arab world.
- Preparation of a GIS database to be used in data input and preparing the base maps for the model building.
- Preparation, calibration and validation of the modflow model to test any virtual scenarios. The constructed model serves as an effective tool in groundwater management in the coastal area in Syria.
- Issuing a training tutorial about the model building, input data preparation and model output analysis by using the different software (ArcGIS, Visual Modflow, GMS).
- Estimating the groundwater budget for steady and transient state. Eight scenarios were pre-viewed in accordance with the exploitation plan in the basin, to support the decision makers.
- Developing maps for expected groundwater level and the drawdown for all tested scenarios, this enables to carry on comparative analyses between scenarios and to choose the best ones.
- Preparing technical reports, including hydro-geological analyses, description of groundwater

bearing layers, estimation of groundwater budget and defining of promising areas. These reports include also technical description of the mathematical model supported by base maps that show the flow directions and alternative exploitation plans for the current one proposed by the water administration in the area.

- Developing recommendations and criteria for the groundwater exploitation plan at both, district and whole basin level.

Project of Developing a Groundwater Model for Damsarkho area – Assessing the Impact of Sea Water Intrusion on Groundwater Quality

Project objective:

The project aims to assess the current status of sea water intrusion in Damsarkho area by developing a hydro-geological model and defining the impact of the different proposed groundwater exploitation scenarios to choose the best ones.

Project implementing parties:

The Arab Center (ACSAD), the Ministry of Water Resources in the Syrian Arab Republic and the General Company for Hydrological Studies.

Project outputs:

- Collecting data (geological, hydro-geological and hydro chemical data) about the study area.
- Building interactive database and checking the available information on the water points.
- Building a “geo-database” for Damsarkho area to serve as a reference for the future water studies.
- Preparing a hydro-geological study for Damsarkho area.
- Developing a mathematical model for sea water intrusion in Damsarkho to serve as a base for future hydro-geological studies.
- Running the model under different scenarios to predict the hydraulic response. These scenarios are;
 - 1) Keeping the same actual water pumping until 2020,
 - 2) Duplicating the pumping rate,
 - 3) Gradually reducing water pumping over a period of 10 years,
 - 4) Reducing rainfall recharge by 20% per two years and finally,
 - 5) Maintaining the groundwater level at a depth of at least 50 cm from the soil surface.
- The results showed that the best scenario is reducing water pumping with maintaining the average rainfall recharge, this scenario prevents the depletion of groundwater reserve and ensures a stability in groundwater level and salinity after 3 years. The results showed also that the groundwater exploitation at a distance of 1000 m from the coast should be reduced.
- Setting up recommendations and criteria for groundwater exploitation in Damsarkho.

Second: Program of Water Resources Development

Project of Rainfall Water Harvesting:

Project of Updating the Hydrological Study of Al-Hammad Basin in Iraq:

Project objective: update knowledge and information on the water resources (surface and ground)

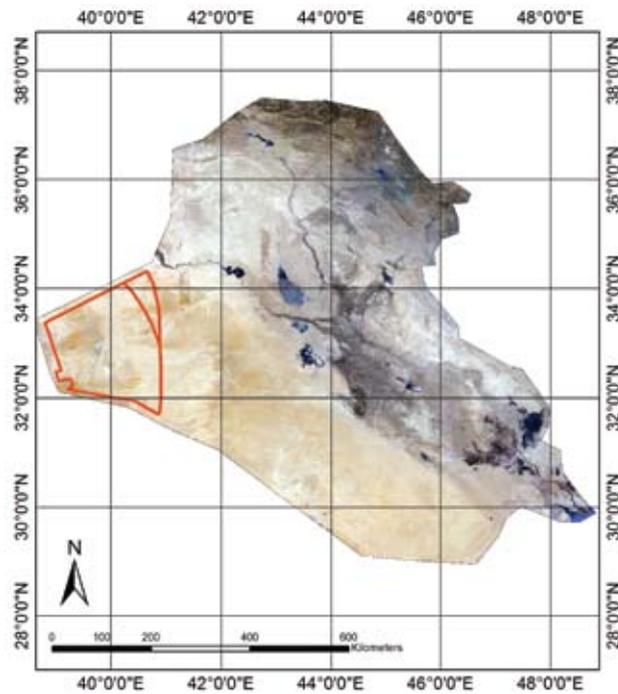
of Al-Hammad basin in Iraq based on the results of the previous studies and the recent developments in Al-Hammad region in terms of the climatic conditions or the development of the water resources investments.

Project participating parties:

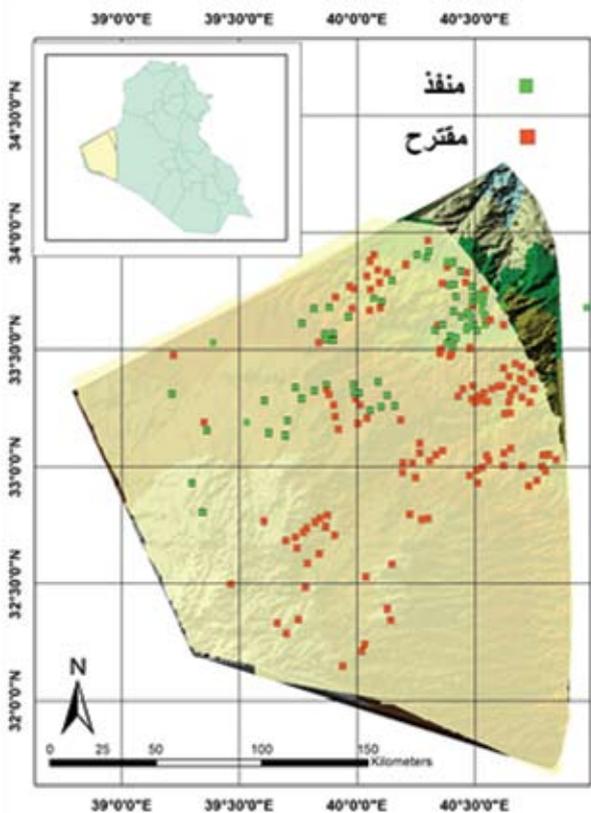
The Arab Center (ACSAD) and the Ministry of Agriculture in the Republic of Iraq.

Project outputs:

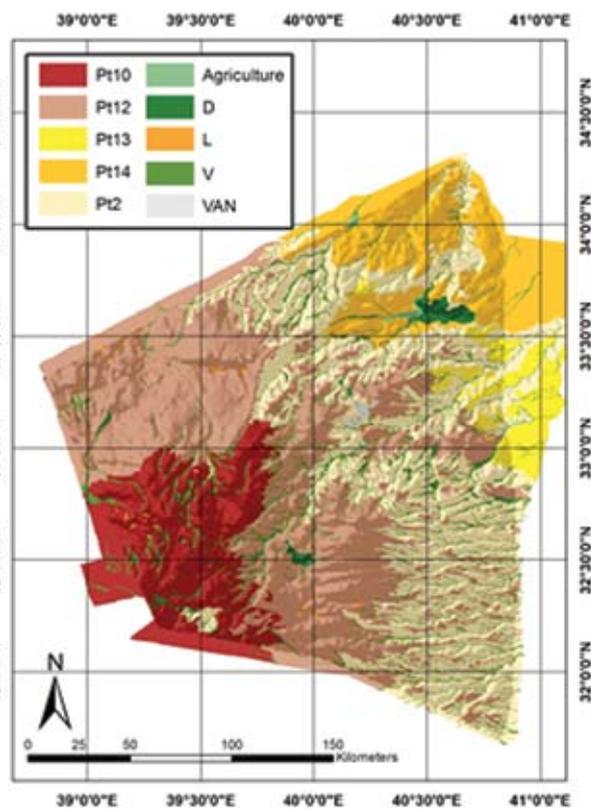
As a result of the current actuality evaluation and promising areas identification in terms of water resources availability through: 1- studying the morphometric characteristics of the hydrological basins, 2- studying the valleys, basins and sub-basins of Al-Hammad basin in Iraq and 3- estimating the surface runoff of each basin in terms of the harvested water quantity, the sites have been proposed for the hydrological establishments (dams and hafeers) to provide new water sources near the populated areas and meet the breeders requirements. Also, the promising areas have been identified for utilizing the surface and ground water of the most important major basins. These proposals represent the most important measures or projects for the proposed executive work plan for Al-Hammad basin development in Iraq.



خارطة مواقع القطاعات المقترحة والمنفذة في الحماد



خارطة الوحدات الجيوجرافية في الحماد



The most important sites proposed for the construction of small hafeers and medium-size dams in various areas of Al-Hammad basin are: Al-Herri, Al-Rteimi, A'amej, Al-Walj, Sawsan, Al-Taba'at, Khabbari Al-Khabab, Al-Massad, Al-Daba'a, Al-Ka'ara, Al-A'ajramiat, the basin of Wadi All-Rattkeh and its branches (Al-Aghri, Al-Malsi and Al-O'ja) and Al-Tarfat area (Wadi Horan basin).

The study outputs have showed that the basins of Al-Ghadaf, Horan, A'amj and Al-Rattkeh are the most important basins in terms of surface water intake of Al-Hammad basin in Iraq. It is recommended to continue the investment of water harvesting and the identification of the promising areas and the wells to be dug in each site according to the land reserve of water. An executive work plan has been also developed to study Al-Hammad basin in Iraq. This work plan is the practical interpretation of the study results and recommendations reflected in executive programs and projects. The proposals for the executive work plan have been presented through some projects like: 1- support of climatic and hydrological monitoring networks, 2- construction of hafeers and dams in various areas of Al-Hammad basin in Iraq, 3- rainwater and flood spreading, 4- establishment of bench terraces, 4- renewable energy use and 5- use of wind energy devices to pump water from wells.

Rainfall Water Harvesting in the Eastern Region of Syria:

Project objective: Provide additional water sources for farmers in Al-Hasakeh, Al-Raqqa and Deir Ezzor governorates by applying rainfall water harvesting techniques on the houses' roofs of the target area.

Project participating parties: This project is implemented in the Syrian crisis-affected areas by the Arab Center (ACSAD) in cooperation with the Ministry of Agriculture and Agrarian Reform and the Spanish Action Against Hunger (ACF) in Al-Hasakeh and Deir-Ezzor governorates.

Project outputs:

- Hold meetings with the local communities, explain the proposed techniques and listen to their own points of view.
- Select the buildings on which the rainfall water harvesting techniques will be applied in consultation with the local community. /22/ buildings have been selected to implement the harvesting process in the villages of Kherbet Al-Tamr, Al-Seiha and Al-Badiea'a.
- Construct a layer of concrete over the clay roofs and water- collection tanks made of reinforced concrete, and implement a pipe network to transport water from roofs to tanks.
- Develop a plan for controlling the water quality in the tanks and prepare a list of the necessary analysis.
- Develop a plan for maintaining the rainfall water harvesting establishments after installment.
- Identify a site for rainfall water harvesting located at 1.3 km away from Al-Tamr village. The area of the water pouring basin of this aquifer is 35 km².

Rainfall Water Harvesting in the State of Palestine:

For the purpose of implementing the decisions of ACSAD's Economic and Social Council, General Assembly and Executive Council concerning the Palestinian national economy support, ACSAD is working on carrying out a project on rainfall water harvesting in the State of Palestine within the framework of its annual work plan.

The problem of water deficiency is generally considered one of the most important problems that face the agricultural sector, as there is a severe and increasing decline in the quantity of the available water whether for drinking purposes or agricultural uses. This is due in the first place to

the control of the occupation forces on the water resources; the ground and surface ones, as 87% of the available water is controlled by these forces. The reasons are also reflected in the negative climatic changes and the rare and fluctuated rainfall during the recent years. In addition to that, the agricultural lands in the areas with available groundwater (the governorates of Tulkarm and Qaliqilya) have been vulnerable to erosion. On the other hand, there is a huge deficiency in the agricultural water sources, whether in quantity or quality, in the areas with agricultural lands (governorates of Ariha, Al-Aghwar, Jenin, Tobass, Al-Khalil and Bethlehem).

The Ministry of Agriculture, in cooperation with the Palestinian Water Authority, has looked for available alternatives to provide any additional water quantities that could be utilized in the agricultural sector. Therefore, the Ministry of Agriculture has adopted the concept of water harvesting (establishment of dams and sand pools). This is reflected in the construction of the dam of Al-O'ja in Palestine in the year 2011 with a capacity of about 700000 m³; the fact that may contribute to the solution of water deficiency problem in Al-O'aja area. For the purpose of completing the strategy of water harvesting, followed by the ministry in cooperation with the Palestinian Water Authority, and in line with the ministry's three- year plan for agricultural development (2013-2015), in terms of concentrating on the increase of the available quantity of agricultural water, it has been necessary to launch the water harvesting program and construct wells for collecting agricultural water to provide the largest quantity of the available water for irrigation by providing around 3200 m³ of water annually.

Project objective: The overall objective of the project is represented by increasing the available water for agriculture, while other objectives are the following:

- * Increase the water quantity that is allocated for supplementary irrigation by around 5400 m³ annually.
- * Increase the agricultural land productivity by increasing the supplementary irrigation area by around 54 dunums.
- * Improve the income of the farmers and target households.

Project participating parties: This project is implemented by the Arab Center (ACSAD) in cooperation with the Palestinian Ministry of Agriculture and the Palestinian Water Authority (Jerusalem, Rammallah and Al-Khalil).

Project outputs:

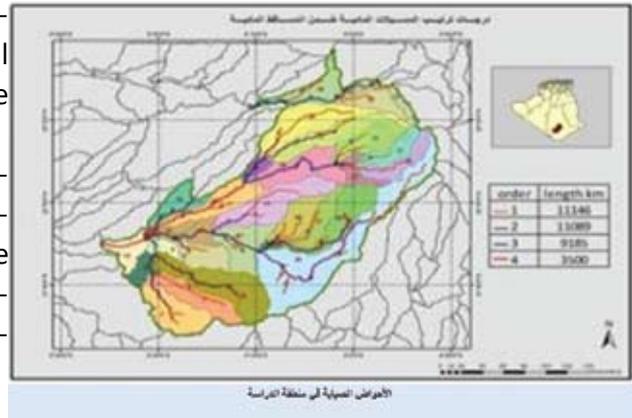
- * Dig and supply 26 wells for water harvesting.
- * Increase the allocated water for irrigation by around 5400 m³ annually.
- * Increase the supplementary irrigation areas in the project area by around 54 dunums.
- * Improve the social and economic conditions of 26 target households.
- * Construct a pool for collecting rainfall water and utilize the collected water in supplementary irrigation.

Project of Optimal Utilization of Surface Water Resources-Water Harvesting, Management and Utilization in Al-Haqqar Area in Tamnast State in Algeria Within the Framework of Cooperation Between the Arab Center (ACSAD) and the Governorate of Agriculture Development in the Desert Areas- Warqala- the Democratic People's Republic of Algeria:

Project objective: The project aims at the optimal utilization of surface water resources by applying suitable water harvesting techniques, controlling floods to alleviate the negative impacts of

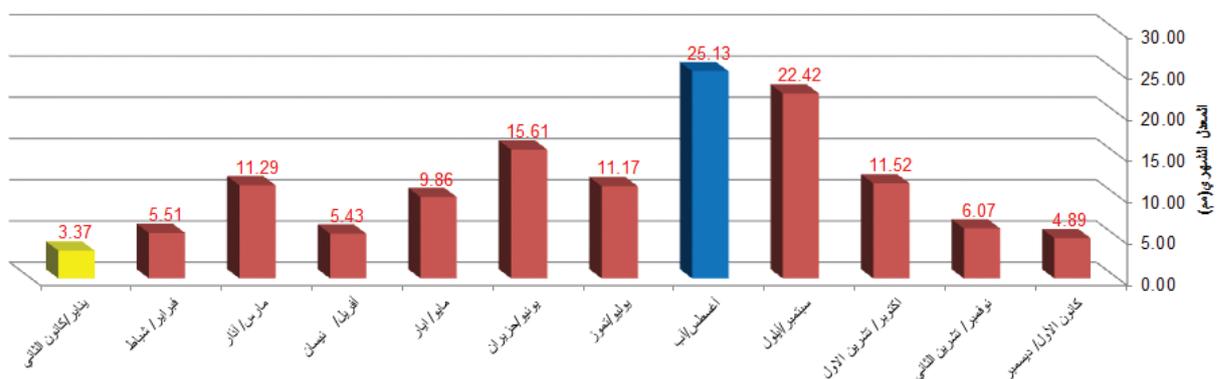
climatic changes, ensuring sustainable development, training and rehabilitating the technical staffs and raising the performance level in the field of analysis, advising and observation.

Project participating parties: The project is implemented by the Arab Center (ACSAD) in cooperation with the Governorate of Agriculture Development in the Desert Areas- Warqala state- Al-Haqqar area- Tamnrast- the Democratic People’s Republic of Algeria.



Project outputs:

- * Collect the available climatic and water data, maps and reports.
- * Process topographic maps and images and extract the digital elevation model (DEM), purpose maps and sub-basins maps (39 maps).
- * Develop a database and analyze and process the available data (the daily, monthly and annual data).
- * Prepare, present and discuss the first interim report with the teamwork of Tamnrast in Algeria (21-22/11/2016).
- * Collect, analyze and process the climatic data and maps, evaluate the current situation of the study area and present proposals and recommendation.
- * Conduct field visits in the Tamnrast basin; as some hydrological establishments for water harvesting have been visited, in addition to the site of the climatic station in Tamnrast and the hydro-metric station in the Tamnrast valley.
- * Organize a training course on “ the hydrological study and water harvesting techniques” during the period 20-28/11/2016 in Tamnrast- Algeria for the benefit of several technicians and specialists in the field of water.



Project of “Sustainable Agricultural Development of the Northern West Coast Region in Egypt (Al-Qassabeh basin/Bajoush)”:

Project objective: Create a pilot developmental model for one of Al-Qassabeh basin valleys; a region that has a relatively limited quantity of rainfall. This is done through:

- Studying the soil and water resources and suggesting techniques for rainfall water harvesting.
- Developing the pastoral vegetation cover and introducing new varieties of horticultural crops.
- Increasing the efficiency of water resources in a way that reflects positively on the local community’s living standards and improves the environmental conditions.

- Studying the potential of expanding the applications and outcomes of this model to other valleys in the basin, especially the valleys of the northern west coast of Egypt and other similar regions in the Arab countries.

Project participating parties: This project is implemented by the Arab Center (ACSAD) in cooperation with the Desert Research Center in Egypt.

Project outputs:

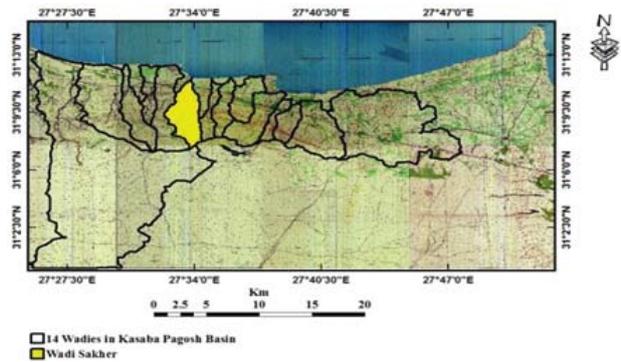
- * Complete field surveys and factory studies of the study area and pilot area in terms of the soil characteristics, surface and ground water resources, vegetation cover and land uses.
- * Produce land, plant and water maps.
- * Conduct field studies and surveys and office works especially in terms of the topographic, geomorphological and hydrological studies of Al-Qassabeh basin/Bajoush and the evaluation of water imports in the basin of Wadi Sakhr (the typical site).

Field tasks:

- * Explore the area (Wadi Sakhr basin) in terms of the geographical site, natural characteristics, population activities and followed systems in water resources harvesting and conservation...etc, document the information and data on the valley of the basin in terms of their borders and local names and conduct surveys and sampling for the soil traits, vegetation cover and hydrological establishments, in addition to the cadastral survey of some establishments.
- * Review the engineering designs of the hydrological establishments and conduct the geo-electric survey to identify the depth of the base layer at the dam site.

The geo-morphological and hydrological studies and the evaluation of the basins traits and water intake:

- * Study the soil traits in the area of Wadi Sakhr, where the teamwork has identified the sites and has taken the necessary samples (56 samples), and prepare the detailed map under the supervision of the specialized expert.
- * Design the suggested dikes at the typical site of Wadi Sakhr basin and start up the implementation (16 dikes).
- * Prepare the second interim technical report.
- * Conduct training courses on water harvesting and rangeland development.





**Project of “Artificial Groundwater Recharge”:
Sea Water Intrusion Control in Al-Hazemieh Region- Beirut, Lebanon (Artificial Groundwater Recharge Management in Al-Hazemieh to Control Seawater Intrusion):**

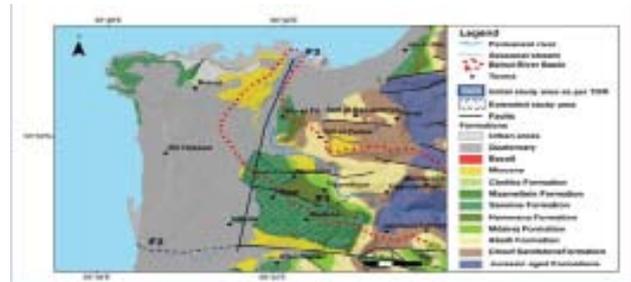
Al-Hazmieh region is located in the southeast of Beirut city. It is a populated area that depends on wells in meeting the water requirements. The over-pumping of ground water has led to the decrease of ground water level, the substitution of the fresh ground water with the salty seawater and the degradation of ground water quality. In the year 2000, the activities of artificial ground water recharge have been started by injecting water in one of the wells to control the intrusion.

Project objective:

Evaluate the technical and economic feasibility of the artificial ground water recharge activities to control seawater intrusion in Al-Hazemieh region in Beirut, Lebanon.

Project participating parties:

The project is implemented in cooperation between the Arab center (ACSAD), the German Agency for International Cooperation (GIZ) and the American University in Beirut, within the framework of the project of “adaptation with climatic changes (ACCWAM)”.



Project outputs:

- Build an integrated database for hydrological, hydro-geological and climatic information and water use information in the region of Al- Hazemieh. This database is considered as an important reference for all kinds of potential hydrological studies in the region.
- Analyze and characterize in details the actuality of water uses in Al- Hazemieh region by utilizing the field survey data and statistical analysis techniques.
- Implement a field survey for the quantity and quality of the surface water and rainfall water to evaluate the surface water resources.
- Conduct a detailed hydrological study for the region and develop a conceptual model that expresses the conditions of groundwater storing and movement in Al-Hazemieh region. This has helped in calculating the groundwater balance.

- Study the different choices for mitigating this phenomenon including:

* Measures related to water demand including: all water conservation aspects such as consumable water conservation in the public buildings and other public utilities, industrial and commercial establishments, private houses and gardens.

* Measures related to water supply including: different types of water supply such as public water network improvement, treated waste water recycling, gray water use and water harvesting on the building roofs.



It has been found that groundwater recharge can be achieved through various measures; some of which are suitable for application in the civil areas and others are suitable for application at the tributaries of the upper and middle parts of the water basin like Mount Lebanon governorate. The direct and indirect recharge measures can be applied in Beirut governorate; these measures include the following:

- * Inject the flooding water of the rainfall season (a step that is actually taken).
- * Inject the treated waste water (this is planned after establishing two big treatment stations).
- * Use rainfall water penetrating pavements to improve water leakage.
- * Construct basins for rainfall water leakage.
- * Impose restrictions on isolating the land of the roads, highways and parking with bitumen or waterproofing concrete.
- * Promote rainfall water harvesting for groundwater aquifers.

As for the tributaries at the middle and upper parts of the water basin (equaling the ground water tributaries that provide the coastal ground water aquifers with water), the following additional measures can be implemented to recharge groundwater aquifers:

- * Protect the vegetation cover and cultivated forests that serve as hydrological barriers.
- * Plan land uses in a way that achieves the minimal decrease of violation against natural areas and construction encroachment towards areas suitable for water leakage and recharge.
- * Decrease Bitumen land isolation upon road construction and shopping centers and houses building.
- * Avoid in situ and ex situ water pollution, caused by agricultural, industrial and oil activities, in the areas of groundwater aquifers recharge.
- * Construct a series of dams at the tributaries and main channel of Beirut river to slow down the process of water flow and save time for water leakage inside the ground.
- * Transform the water of floods at the down river tributaries to the leaking tanks.
- * Increase water storage in tanks and cisterns in general whenever it is feasible.

All these measures include advantages and disadvantages, as they necessitate certain prerequisites when a project is planned to recharge groundwater aquifers. In case of continuing the process of water extraction from one of the coastal groundwater aquifers, it is requested to add the same quantity of the water extracted through groundwater recharge (with a good quality sur-

face and rainfall water to stop seawater intrusion). The groundwater aquifers recharge should be repeated regularly until the balance level between the extracted water quantities and the added ones is reached.

project of “Adaptation with Climatic Changes”

Project of “Agricultural Waste Water Reuse to Adapt with Climatic Changes in Egypt”:

The project covers an area of 6000 acres ploughed by around 3000 farmers distributed among three water use associations, of which the women percentage reaches 30%. The farmers suffer from irrigation water deficiency in the experimental project area and that’s why they have been forced to deal with the problem individually by pumping agricultural waste water to be used in irrigation, the reason that has led to other problems related to water quality (salinity) and high rates of power consumption.

Project objective: Reuse agricultural waste water by using a mobile pumping unit to help local communities. This method is based on mixing waste water with irrigation water during the climax period of water demand (from May to September), taking into consideration that the main crops that will benefit from this method are rice, wheat, corn, alfalfa and vegetables in the governorate of Al-Bheira in the north of Egypt (Al-Mahmoudia city).

Project participating parties: The project is implemented in cooperation between the Arab Center (ACSAD), the Ministry of Irrigation and Water Resources in Egypt and the German Agency for International Cooperation (GIZ) within the framework of the Project of “Adaptation with Climatic Changes” (ACCWAM).

Project outputs:

- The area of Al-Mahmoudiah, as an area suffering from water deficiency and located at the end of one of the irrigation canals in the governorate of Al-Bheira in the north of Egypt, has been selected as a study area.
- Study the typical site in terms of collecting, analyzing and processing the necessary data to install a mobile pump and use it in mixing the agricultural waste water with the Nile river water for irrigation purposes.
- Study several potentials for pumping the water from the drainage canal into the irrigation canal to reuse the agricultural waste water. The choice of installing a mobile pump during the water deficiency period (the three months of summer) has been selected provided that environment-friendly pumps that depend on solar energy would be used at the field level, taking into consideration the activation of the role of “local water use associations” in the target area.
- Purchase a mobile pump to be used by farmers.
- Conduct the monitoring activities including samples taking and analysis.





It is expected that the project sustainability is ensured through involving the water use associations and local employees of the Ministry of Irrigation and Water Resources in the project and benefiting from the related technical and socio-economic studies.

The experimental project in the Nile Delta has fulfilled several achievements including the following:

- * Increase water supply.
- * Ensure the quality of the required water.
- * Improve water use efficiency.
- * Control energy consumption.



Program of Water Environment Protection

Project of “Evaluation of Climatic Change Impact on Arab Water Resources”:

Project of “Study of Climatic Change Impact on Water Resources in the Arab Countries”:

Project objective: Evaluate the current and future climatic changes in the Arab region and identify the impact of these changes on the available water resources.

Project participating parties: This project is implemented in cooperation between the Arab Center (ACSAD), the United Nations Economic and Social Commission for Western Asia (ESCWA), the World Meteorological Organization (WMO), the Swedish Meteorological and Hydrological Institute (SMHI), the Swedish International Development Cooperation Agency (SIDA), the German Agency for International Cooperation (GIZ), the United Nations Environment Program/Regional Office for West Asia, the Food and Agriculture Organization of the United Nations (FAO) and other organizations.

Project outputs:

The RCA4 model, which was prepared by the researchers of (SMHI) institute, has been used to identify the future climatic changes until the end of the current century by using the high emission scenario (RCP8.5) and the medium emission scenario (RCP4.5). The results have been obtained for

the whole Arab range at a spatial resolution of 50km.

For the purpose of identifying the climatic change impact on the water resources, the two hydrological models (HYPE and VIC) have been used to estimate the change in the surface runoff and evapotranspiration until the year 2100, taking into consideration that the climatic models have been used as input for the hydrological models.

Expected Future Changes of Temperatures

The results of the climatic models have showed in general an expected increase in temperatures in the whole Arab region.

By following good systems in alleviating gas emissions according to the medium emission scenario of RCP4.5, the temperature increase is expected to be 1.48 °C in the mid of the current century and 1.90 °C at the end of the century.

According to the worst scenarios where no additional procedures or measures are taken to alleviate the gas emissions, the temperature increase is expected to reach 2.5 °C in the mid of the current century and 4 °C at the end of the century.

The most vulnerable area to the temperature increase is the southern west region of the Maghreb, as it is expected that the climatic changes may lead to a temperature increase estimated at 1.71 °C in the mid of the century and 2.22 °C at the end of it according to the medium emission scenario (RCP4.5).

On the other hand, the temperature increase is expected to reach 2.43 °C in the mid of the current century and 4.73 °C at the end of it according to the high emission scenario (RCP8.5).

The temperature increase in the most important areas is illustrated as follows:

Geographical site	Expected change in temperature (°C)			
	According to the medium emission scenario (RCP4.5)		According to the high emission scenario (RCP8.5)	
	Mid of the century	End of the century	Mid of the century	End of the century
Eastern Mediterranean	1.32	1.65	1.81	3.48
Southern Mediterranean	1.22	1.64	1.81	3.43
Atlas Mountains	1.32	1.80	2.10	3.94
Eastern Red Sea	1.46	1.84	2.09	3.82
Middle Peninsula	1.53	1.85	2.54	3.99
Southern Peninsula	1.34	1.68	2.17	3.52
Tigris and Euphrates basins	1.53	1.85	2.54	4.21
Upper Nile	1.72	2.15	2.85	4.20
Horn of Africa	1.12	1.46	1.59	2.99
Southern west of the Maghreb (Mauritania)	1.71	2.22	2.43	4.73

Expected Future Changes of Rainfalls

The results of the climatic models have showed that, in the mid of the current century, around 17% of the Arab region area will be vulnerable to a decrease in the annual rainfall average, while 16% will be exposed to an increase in the values of the annual rainfall average. As for the remaining area (estimated at 68%), the change in the rainfall values will be slight or even nothing. At the end of the century, the area, that is vulnerable to the decrease in the annual rainfall average, will maintain the same percentage of decrease, while 24% will be exposed to an increase in the values of the annual rainfall average and the remaining area (61%) will witness a very slight or none change in the rainfall values.

It is also found that the change values of the rainfall averages differ in terms of "increasing" or "decreasing" according to the geographical site, as the rainfall decrease will be witnessed in the regions of eastern and southern Mediterranean, eastern Red Sea, Upper Nile, Atlas mountains and middle Peninsula.

The rainfall increase will be witnessed in the south of Mauritania, the southern east region of Peninsula, the Horn of Africa (Djibouti and Somalia), Al-Ahjar mountains in the south of Algeria and the south of Sirte in Libya. As for Tigris and Euphrates basins, they are expected to witness a rainfall increase according to the medium emission scenario (RCP4.5) and a rainfall decrease according to the high emission scenario (RCP8.5) in the mid and the end of the century.

The rainfall change in the most important areas can be illustrated as follows:

Geographical site	Expected change in rainfall (%)			
	According to the medium emission scenario (RCP4.5)		According to the high emission scenario (RCP8.5)	
	Mid of the century	End of the century	Mid of the century	End of the century
Eastern Mediterranean	+2.3	-1.6	-5.0	-10.7
Southern Mediterranean	- 0.8	-5.7	-8.4	-17.5
Tigris and Euphrates basins	+7.1	+3.1	+0.4	-0.6
Atlas Mountains	- 10.0	- 7.0	-14.4	-24.6
South of Sirte	+12.4	+17.6	-6.1	-12.1
Southern east of the Peninsula	-7.7	+15.9	+ 15.9	+8.4
Middle Peninsula	-8.5	+10.7	-8.3	+4.9
Eastern Red Sea	-6.1	-0.8	-5.4	-7.7
Upper Nile	-5.6	-4.2	-1.7	-0.73
South of Mauritania	+12.2	+9.5	+16.9	+27.7
Horn of Africa	+14.6	+22.2	+16.5	+31.3

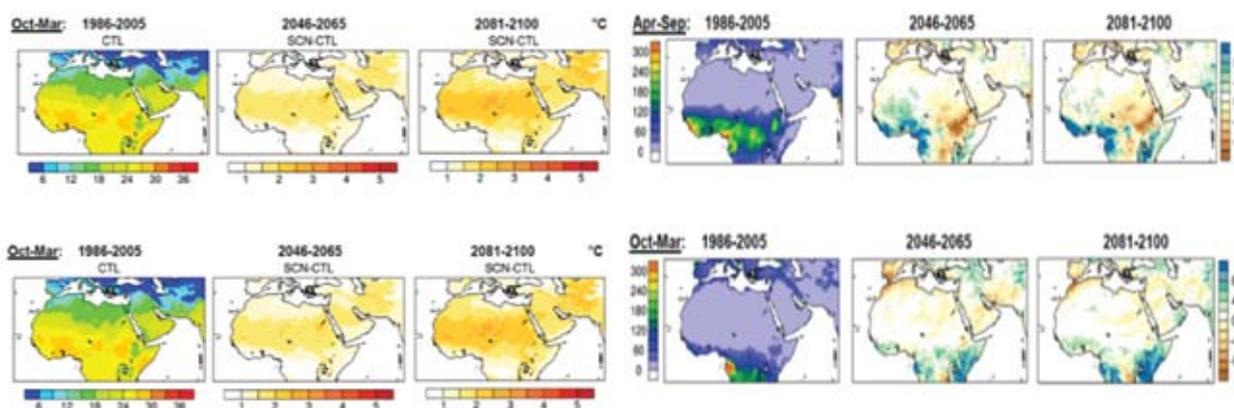
Expected Future Changes of Water Resources

The results of the climatic models have indicated that the expected change in the surface runoff values differs in terms of increasing or decreasing according to the geographical site, as the surface runoff decrease will be concentrated in the eastern Mediterranean, the Mountains of Ye-

men, A'asir, the Upper Nile, the Atlas mountains and the Green Mountain in Libya. On the other hand, the surface runoff increase will be concentrated in the south of Mauritania, the southern east of the Peninsula, the Horn of Africa (Djibouti and Somalia), Al-Ahjar mountains in the south of Algeria and the southern foothills of the Atlas mountains. As for Tigris and Euphrates basins, they are expected to witness a surface runoff increase according to the medium emission scenario (RCP4.5) and a surface runoff decrease according to the high emission scenario (RCP8.5) in the mid and the end of the century.

The surface runoff change in the most important areas can be illustrated as follows:

Geographical site	Expected change in surface runoff (%)			
	According to the medium emission scenario (RCP4.5)		According to the high emission scenario (RCP8.5)	
	Mid of the century	End of the century	Mid of the century	End of the century
Eastern Mediterranean	+ 4.3	- 1.97	-14.8	-28
Southern Mediterranean	+ 1.3	+ 5.6	+0.1	-1.4
Tigris and Euphrates basins	+10.4	+5.5	-8.5	-13.1
Atlas Mountains	-15.0	-12.4	-22.3	-32.6
Green mountain- Libya	-2.3	+0.3	-14.2	-16.8
Upper Tigris and Euphrates basins	+ 10.4	+ 5.6	-8.5	-13.1
Southern east of the Peninsula	+ 1.0	+ 14.1	+ 5.7	+8.5
Eastern mountains of the Red Sea	-1.6	+0.9	-0.06	-0.44
Al-Ahjar mountains- south of Algeria	+4.2	+5.2	+4.0	+5.9
South of Mauritania	+ 9.8	+9.2	+11.1	+24.0
Horn of Africa	+8.0	+13.4	+6.4	+16.0



Project of “ Assessment of Water Resources Vulnerability in the Arab Region and its Economic and social Impact”:

Project objective:

Assess the water resources vulnerability in the Arab region and identify the most vulnerable areas to the climatic changes.

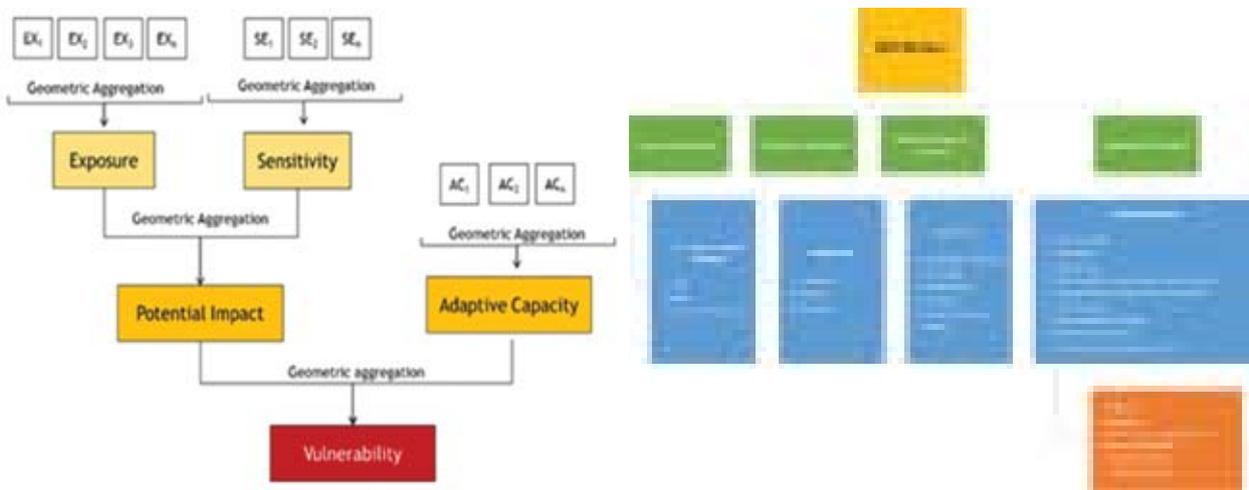
Project participating parties: This project is implemented in cooperation between the Arab Center (ACSAD), the United Nations Economic and Social Commission for Western Asia (ESCWA) and the German Agency for International Cooperation (GIZ).

Project outputs:

Assess vulnerability by dividing it into three components:

- * Exposure.
- * Sensitivity.
- * Adaptive capacity.

Each component was then divided into several files, under which a number of indicators was listed.



The sub vulnerability fields were divided into /5/ sectors:

- 1-Water.
- 2-Agriculture.
- 3-Biodiversity and ecosystems.
- 4-Infrastructure and human settlements.
- 5-Human resources.

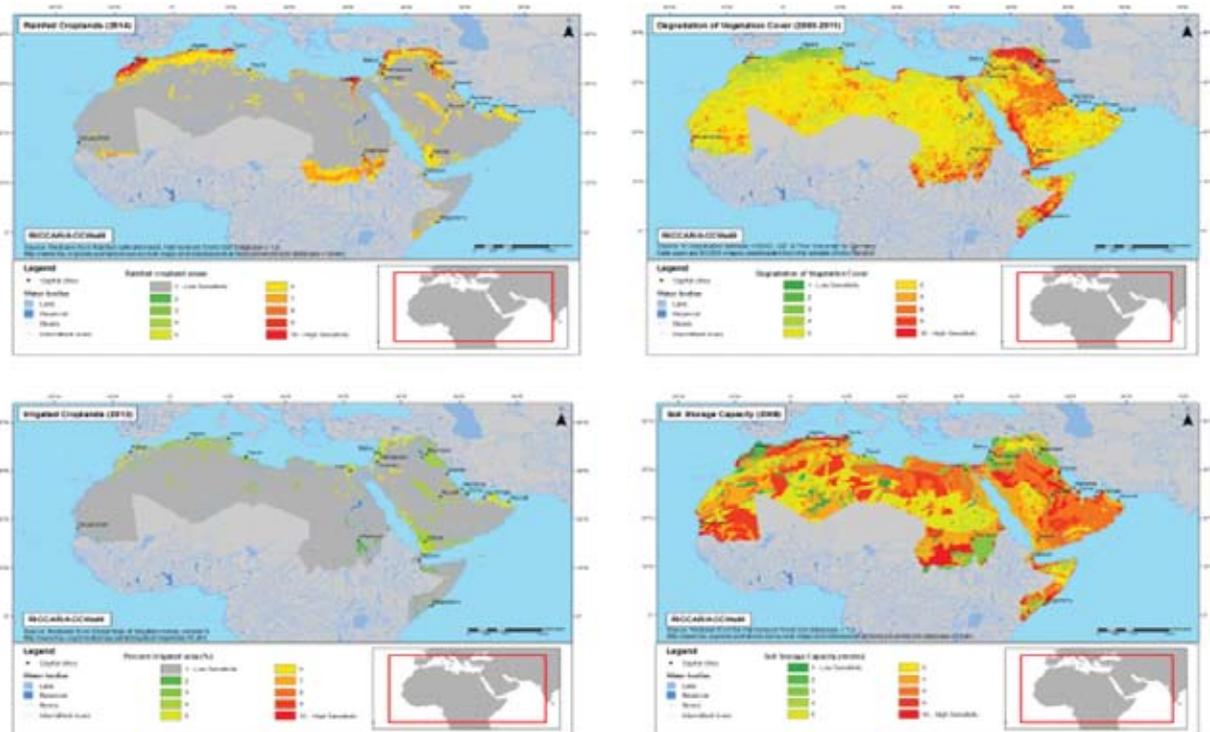
- The Arab Center (ACSAD) has participated in the vulnerability indicators development for each sector, as /65/ indicators have been selected for the different sectors.

- The Arab Center (ACSAD) has participated in the mapping of each indicator by using GISs, as the required data have been imported from the world databases, compared with the national data of the countries and improved. The indicators, then, have been mapped in maps with the same accuracy. In this context, the Arab Center (ACSAD)

	Impacts	Sub-Vulnerability
Water	Change in water availability	V1
Biodiversity & Ecosystems	Change in area covered by forests	V2
	Change in area of wetlands	V3
Agriculture	Change of water available for crops	V4
	Change of irrigation for farmland	V5
Infrastructure & Human Settlements	Damage from inland flooding	V6
	Damage from coastal flooding	V7
People	Change of water available for drinking	V8
	Change in health due to heat stress	V9
	Change of employment rate in the agricultural sector	V10

has prepared several maps at the Arab region level in two forms; the first form represents the real value of the indicator and the second one represents the vulnerability classification of the indicator. Of these maps are the following:

- * The map of the actual irrigated areas.
- * The map of the rainfed areas.
- * The map of the areas prepared for irrigation.
- * The map of the vegetation cover degradation for the period 2000- 2011.
- * The map of the most flood- endangered areas.
- * The map of the livestock distribution (goats, sheep and cattle) for the year 2005.
- * The map of the forest cover degradation for the year 2000- 2013.
- * The hydrological map.
- * The digital elevation map (DEM 90 m) and the ArcGIS map.
- * The vegetation cover map.
- * The roads distribution map.
- * The map of soil distribution and classification for the year 2014.
- * The map of dam distribution with the actual storing capacity of each dam.
- * The map of the areas supplied with dams.



- Participate in the classification methodology development for each indicator by giving vulnerability values ranging from 1-10 (as the value /1/ stands for the least vulnerable and value /10/ stands for the most vulnerable). This classification process has been conducted in consultation with experts from the Arab countries and the whole world.

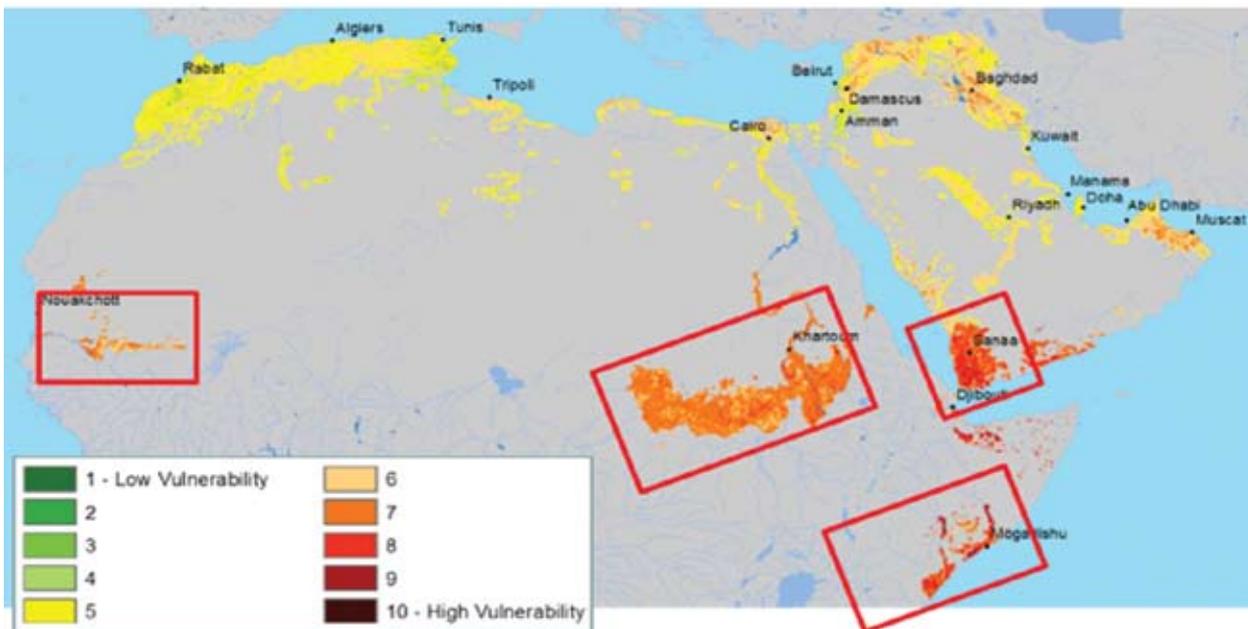
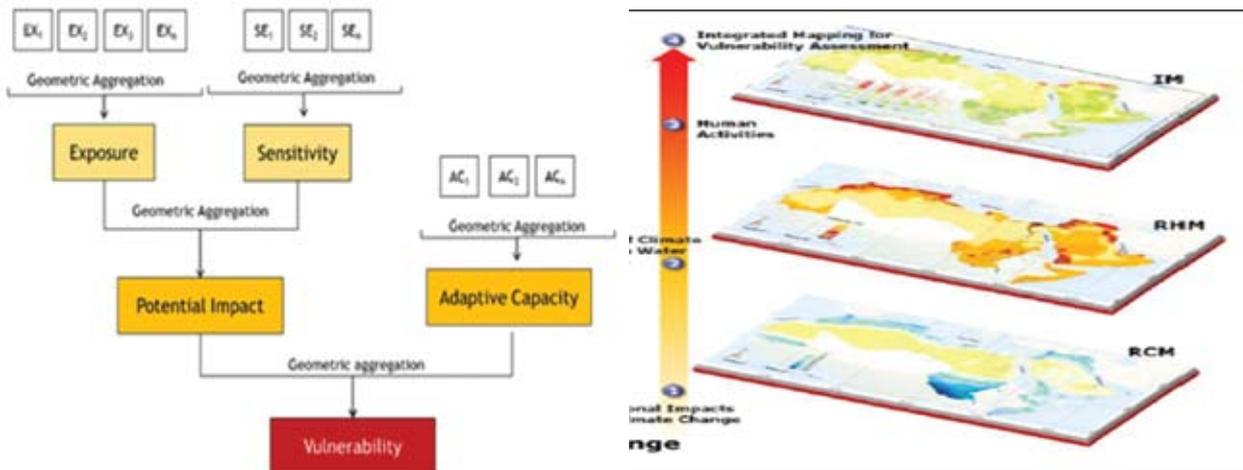
- A weighing process has been carried out for these indicators by preparing and distributing a questionnaire among Arab experts with hydrological, ecological, climatic and economic specializations to participate in assigning weights for indicators ranging from 1 (less important) to 10

(very important). The Arab Center (ACSAD) has participated in the development of this questionnaire, in addition to /15/ experts from all ACSAD's departments who have participated in answering the questions of the questionnaire.

- Carry out the "aggregation" process, according to the vulnerability components, for three sectors namely; the biodiversity and ecosystems sector, the agricultural sector and the infrastructure and human settlements sector:

$$V_{\text{overall}} = (V_1 * V_2 * V_3)^{1/3}$$

-Finalize the vulnerability maps produced by the aggregation process.



- Prepare a training manual, which has been distributed among all Arab countries, on the "Integrated Assessment Methodology of Vulnerability".

- Participate in all of the periodical meetings held at the premises of ESCWA in Beirut, in addition to the workshops that have been organized during the project period.

Project of “Evaluation of Climatic Change Impact on the Productivity of Some Agricultural Crops in the Arab Region”:

The climatic changes may affect the agricultural sector and reflect negatively on the agricultural crops productivity and water requirements. Several models can be used to study the climatic change impact on the agricultural crops; the “AquaCrop” model has been used in this project for the following reasons:

- * It is widely based on the soil moisture.
- * This model is freely available.
- * The required data for operating the model is limited in comparison with other models.
- * It is easy to use.
- * It takes into consideration the change impact of temperature, rainfall and CO₂ concentration.

Project objective: Study the impact of the climatic changes on some major agricultural crops in the following regions:

- Governorate of Karak in Jordan: the crops of wheat and barley have been studied.
- Orontes basin in Lebanon: the crops of eggplant, potato and corn have been studied.
- The northern Delta region in Egypt: the crops of wheat, corn and cotton have been studied.

Project participating parties: This project is implemented in cooperation between the Arab Center (ACSAD), the United Nations Food and Agriculture Organization (FAO), the German Agency for International Cooperation (GIZ) and the United Nations Economic and Social Commission for Western Asia (ESCWA).

Project outputs:

- Identify the climatic change impact on the agricultural crops by using the mathematical model (Aqua Crop) that was developed by FAO to study the relation between water and crop productivity.
- The work methodology has included the following stages:
 - Collecting the measured climatic data of the three study areas for a period not less than /10/ years.
 - Identifying the climatic changes of temperature and rainfall according to different global emission scenarios (RCP8.5 and RCP4.5).
 - Collecting the data of soil, irrigation and field management for the target study areas.
 - Calibrating the mathematical model by using the control plants to get acquainted with the productivity of the studied crops.
 - Identifying the climatic change impact on the crop productivity, growth period and water requirement by using the mathematical model (Aqua Crop).

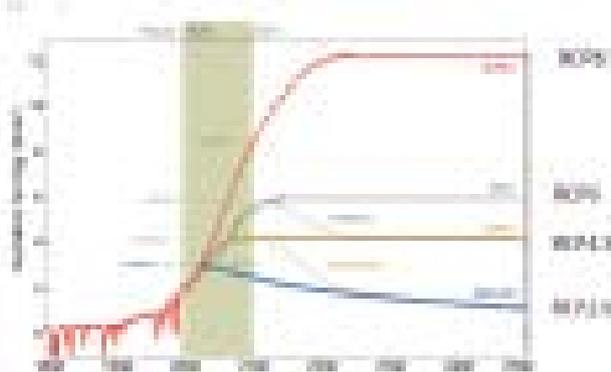
The studied climatic scenarios:

The study has taken the following climatic scenarios into consideration:

- The high emission scenario (RCP8.5): This scenario assumes that there will be no change without taking measures for gas emission alleviation.
- The medium emission scenario (RCP4.5): This scenario is relatively optimistic in terms of gas emission decrease; it assumes that there will be a little future increase in CO₂ emission starting to decrease again by the year 2040.

The study results have indicated that, according to the moderate scenario (RCP4.5), the eggplant productivity will decrease by 9.5% and 13% at the mid and the end of the century respectively. It

is also expected that the crop growth period will decrease by /17/ days due to the temperature increase. As for the crop water requirements, it is expected to decrease by 7% at the end of the century in spite of the temperature increase due to the short growth period. On the other hand, according to the worst scenario (RCP8.5), the eggplant productivity is expected to decrease by 10% and 27% in the mid and the end of the century respectively.



The obtained results have also indicated that, according to the moderate scenario (RCP4.5), the potato productivity will decrease by 4% and 5% in the mid and the end of the century respectively. On the other hand, according to the worst scenario, the potato productivity is expected to decrease in the Orontes basin in the north of Lebanon, by 5% and 11% in the mid and the end of the century respectively.

In the governorate of Karak in Jordan, according to the moderate scenario (RCP4.5), the rainfed wheat productivity is expected to decrease by 1.5% and 15.5% in the mid and the end of the century respectively. As for the worst scenario (RCP8.5), the wheat productivity will decrease by 5% and 55.3% in the mid and the end of the century respectively due to the temperature increase and the annual rainfall average decrease.

In the northern Delta region in Egypt, according to the moderate scenario (RCP4.5), the irrigated wheat productivity is expected to decrease by 4.1% and 5.7% in the mid and the end of the century respectively. As for the worst scenario (RCP8.5), the wheat productivity will decrease by 4% and 5.5% in the mid and the end of the century respectively. Concerning the cotton crop, the expected decrease is estimated at about 3% and 6.3% in the mid and the end of the century respectively (RCP8.5 scenario).

In general, it is found that the climatic change impact will be bigger on the rainfed crops, and will lead to the decrease of the growth season period and water requirements due to the short growth season period.

Project of “Study of Agricultural Sector Vulnerability to Climatic Changes in the Lebanese Republic”:

Project objective: Study the agricultural sector vulnerability to the climatic changes in Lebanon by using the climatic models outputs of the agricultural sector indicators.

Project participating parties: This project is implemented in cooperation between the Arab Center (ACSAD), the German Agency for International Cooperation (GIZ) and the National Center for Remote Sensing in Lebanon (CNRS).

Project outputs:

* ACSAD has prepared a reference study summarizing the previous studies on the agricultural sector in Lebanon, the expected climatic change impact according to the various climatic models and the adopted indicators.

* ACSAD has provided the necessary data to start up the work; the following maps have been prepared:

1- The map of the most flood- vulnerable areas.

- 2- The irrigated areas map.
- 3- The soil map.
- 4- The population density map.
- 5- The refugee distribution map.
- 6- The biological map.
- 7- The groundwater map.
- 8- The land use map.
- 9- The forest distribution map.
- 10-The desertification map.

Project of “National Indicators for Desertification in Water Sector in the Syrian Arab Republic”:

Project objective: Develop national indicators for desertification in Syria covering all sectors like water, soil and vegetation cover. These indicators take into consideration the local desertification conditions and the work nature of the concerned institutions. It also aims to disseminate these indicators among the concerned institutions to be adopted in the decision making process in the field of desertification combat and alleviation.

Project participating parties: This project is implemented in cooperation between the Arab Center (ACSAD), the Ministry of State for Environmental Affairs and all ministries, universities and commissions concerned with the desertification phenomenon in Syria.

Project outputs:

ACSAD has developed, in cooperation with experts from the Ministry of State for Environmental Affairs, national indicators for desertification. The indicators have been divided into four sectors namely; climate, water, soil and vegetation cover. While developing these indicators, ACSAD has taken into consideration the international standards like SMART standards (achievable, measurable, specific, time-bound and realistic), the local desertification conditions, the institutions' work mechanism and the data collection method. For example, ACSAD has developed /10/ indicators in the water sector covering all types of water resources (surface, ground and treated). The limits and the measurement way have been identified for these indicators and the necessary outputs have been concluded to support the decision making process.

During the various stages of the indicator development process, several meetings have been held among ACSAD's experts, specialists from the Ministry of State for Environmental Affairs and experts from the concerned institutions.

In the last quarter of the year 2016, ACSAD has submitted to the Ministry of Environment, the final reports including a detailed explanation of these indicators. The Ministry of Environment, in turn, has distributed these indicators among the concerned governmental commissions to be disseminated and adopted later at the beginning of the year 2017 according to the project schedule.

The indicator selection standards, according to SMART, should meet the following conditions:

- The indicator should be specific.
- The indicator should be achievable in terms of data availability.
- The indicator should be measurable.
- The indicator should be realistic.
- The indicator should be time-bound.

Project of “Study of Extreme Climatic Phenomena Impact on Water Resources in the Arab Region”

Project of “Study of Climatic Change Impact on Extreme Climatic Events Occurrence”:

Project objective: Evaluate the climatic change impact on the extreme climatic events reoccurrence like drought and flood in three areas of the Arab region namely; Wadi Dayka basin in Oman, Wadi Mjarda in Tunisia and the Southern Great River basin in Syria and Lebanon.

Project participating parties: This project is implemented in cooperation between the Arab Center (ACSAD), the United Nations Economic and Social Commission for Western Asia (ESCWA), the Swedish Meteorological and Hydrological Institute (SMHI), the World Meteorology Organization (WMO), the German Cooperation for International Cooperation (GIZ) and the Swedish International Development Agency (SIDA).



Project outputs:

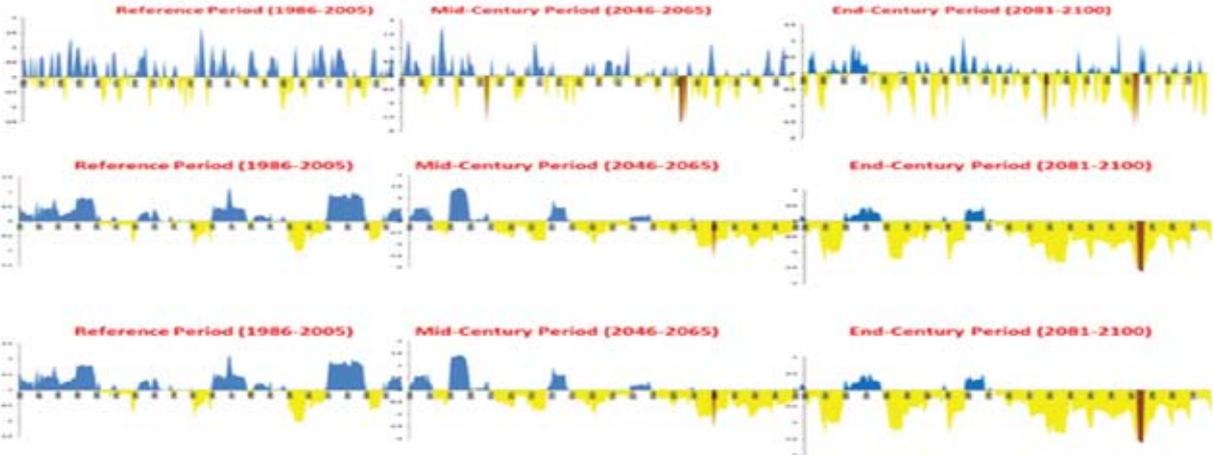
- ACSAD has used climatic models to conclude the extreme climatic events, and has finalized the preparation of the following indicators, according to the emission scenarios (RCP4.5) and (RCP8.5), for three periods of time (1985-2005, 2045-2065 and 2081-2100) for the a.m three areas respectively:

- * Maximum length of dry spell (CDD).
- * Maximum length of wet spell (CWD).
- * Number of Days when $T_{max} > 35\text{ }^{\circ}\text{C}$ (SU35).
- * Number of Days when $T_{max} > 40\text{ }^{\circ}\text{C}$ (SU40).
- * Number of nights when $T_{min} > 20\text{ }^{\circ}\text{C}$ (Tropical nights) (TR).
- * Number of Days when Precipitation $\geq 10\text{ mm}$ (R10).
- * Number of Days when Precipitation $\geq 20\text{ mm}$ (R20).

- ACSAD has studied the climatic change impact on drought in the three study areas according to the emission scenarios (RCP4.5) and (RCP8.5) for three periods of time (1986-2005, 2045-2065 and 2081-2100) respectively. The process has been carried out through calculating the SPI indicator by using the long-term monthly precipitation (1970-2100). According to this calculation, drought has been classified into /4/ levels:

- * Wet condition.
- * Slight and moderate drought.
- * Severe drought.
- * Extreme drought.

- The study has concluded that the drought times number and period will increase whenever we head towards the end of the century, especially in Mjardah basin, and that the three areas will be more vulnerable to drought according to the emission scenarios (RCP4.5) and (RCP8.5).



Economy and Planning

Economic and Planning Department

The Economic and Planning Department implements its activities through the following programs:

1- Socio-economic Studies Program:

This program aims to solve the outstanding economic and social problems which may arise in the field of sustainable use and conservation of natural resources in the dry areas in the Arab countries, implement economic feasibility studies for the results reached by the conducted researches and technical-economic feasibility studies for the implemented pilot developmental projects, disseminate the research results and developed techniques based on national economic basis and develop rural woman.

2- Knowledge Management and Localization Program:

This program aims to achieve an integrated knowledge system with developed flexible information tools to rise up with ACSAD, reach an advanced level of internal and external knowledge exchange and make the Arab Center (ACSAD) a basic source for knowledge and information in its specialized fields, in a way that allows it to take the lead among regional and international institutions.



Project of “Evaluation of ACSAD’s Research and Technical Results”

Project objective:

- Evaluate the research results that are reached by the Arab Center (ACSAD) aiming at confirming their economic feasibility in the field among farmers.
- Provide databases on the social and economic characteristics of the population of arid and semi-arid areas.
- Study agricultural systems.
- Identify the constraints of developed techniques adoption.
- Rehabilitate Arab staff and prepare economic and social studies which are required for the work of the Arab Center (ACSAD).

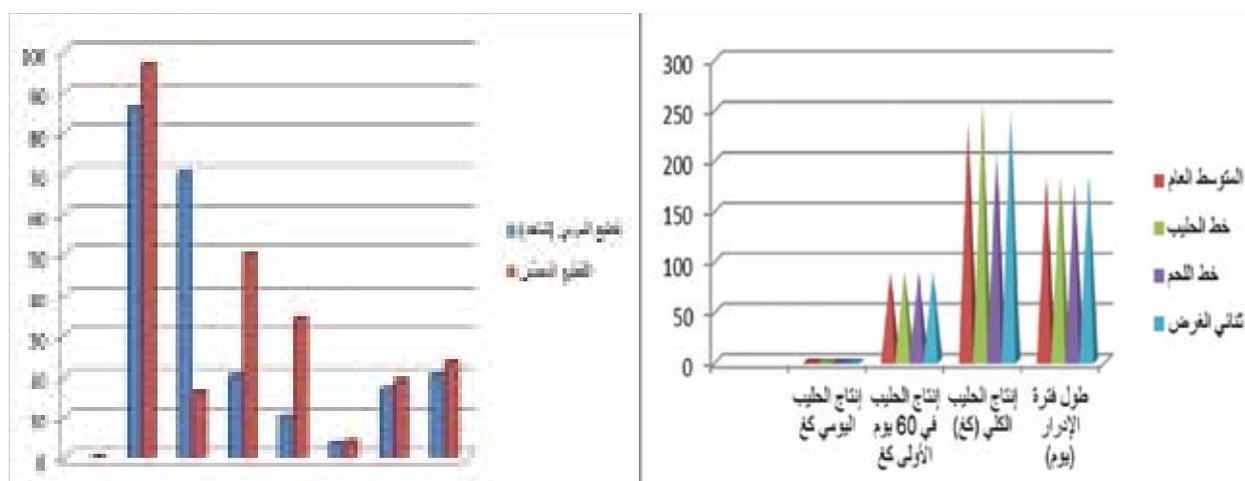
Project site:

All Arab countries.

Project progress:

Recently, the Arab Center (ACSAD) has achieved advanced scientific results as follows:

1- Study of “Small Ruminants Genetic Improvement and Economic Importance in the Arab Countries”:



In the year 2016, the study has been completed and its final version is currently reviewed, in coordination with the Animal Wealth Department, to be issued at the beginning of the year 2017.

2- Technical and Economic Study on Treated Water Uses in the Arab Countries:

The preliminary and initial data has been obtained and the necessary socio-economic forms have been designed (consumer-producer) for /4/ Arab countries (Jordan, Tunisia, Syria and Oman). The form data ,then, has been analyzed and the technical and economic study has been prepared. Currently, the final version of the study is reviewed, in coordination with the Lands and Water Uses Department, to be issued in the mid of the year 2017.



3- Economic Feasibility Study on “ACSAD’s Factory for Agricultural Plastic Production at Al-Sinn Research Station”:

Within the framework of implementing ACSAD’s plans and programs and expanding its infrastructure to serve the scientific research results and enhance self-financing, an economic feasibility study has been carried out on “ACSAD’s Factory for Agricultural Plastic Production at Al-Sinn Research Station”. The study has shown that the project is economically feasible, as the profit and revenue rates of costs have been estimated at 3.07% and 1.03% respectively, while the factory payback period has been estimated at 3.6 years; the fact that indicates that the project is economically successful.

4- For the purpose of implementing ACSAD’s plan for the year 2017, the following is conducted:

- 1- Prepare an economic feasibility study on the dikes that have been constructed by the Arab Center (ACSAD).
- 2- Prepare an economic feasibility study on ACSAD’s developed wheat varieties registered recently by the Arab countries.

Project of “Agricultural Extension Development in the Arab Countries”

Project objective:

- Enhance the exchange of experts and coordination and cooperation among the Arab extension services.
- Transfer ACSAD’s research results to the beneficiaries including farmers and breeders.
- Conduct applied extension researches in the Arab countries and corrective studies for the agricultural and rural development projects especially those that include an agricultural extension activity.



-Train the Arab staff in the fields of agricultural extension, participatory approach process and provision of consultation services.

Project site:

All the Arab countries.

Project progress:

The Arab Center (ACSAD) has recently achieved advanced scientific results as follows:

1- Project of “Livelihoods Support to Vulnerable Conflict-Affected Population in Syria-SDC”:

Project objective:

Improve the food security of the crisis-affected households of farmers and breeders in the governorates of Dara’a and Al-Hasakeh in Syria by supporting the livelihoods of these households.

Project progress:

*** The first phase of the project has been completed by implementing the following activities:**

- Conduct a post distribution survey to make sure that the beneficiaries have received the production inputs distributed by the project. This has been done by selecting a random sample of /101/ beneficiaries for the animal production component and /104/ beneficiaries for the plant production component. The results have shown that the majority of the target households are satisfied about the distribution process of the production inputs including wheat seeds, agricultural tools, fodders and veterinary medicines.



- After implementing the first phase of the project, a socio-economic survey has been conducted for the target beneficiaries to study the project impact on the households. This has been done by selecting a random sample of 10% of the beneficiaries number totaling /104/ households for the animal production component (sheep and cattle breeding) and /100/ households for the plant production component (wheat cultivation).

The survey results can be illustrated as follows:

* The wheat yield has increased by 10% for the beneficiaries from Dara’a and 13% for the beneficiaries from Al-Hasakeh, while the total income has increased by 18% and 28% for the beneficiaries in Dara’a and Al-Hasakeh respectively. About 63% of the beneficiaries have attended the training sessions of the project; of which 42% are women. A considerable improvement has been noticed in the food situation of the target households in terms of vegetables, legumes and dairy products consumption.

* The flock holding has increased for the households benefiting from the animal production component by 20% , while the annual income increase has been estimated at 30%. The health

situation of the flock has improved, as all breeders have vaccinated their animals against the contagious diseases. 42% of the total breeder number have attended the project training sessions and a considerable improvement has been noticed in the food situation of the target households in terms of eggs, fat and dairy products consumption.

* The second phase of the project has been implemented, of which the most important activities were the following:

- 2000 beneficiaries have been selected for the project, of which /800/ beneficiaries are from Dara'a governorate and /1200/ beneficiaries are from Al-Hasakeh governorate.
- A baseline survey has been conducted to identify the economic and social actuality of the beneficiaries and their necessary requirements.

The survey has reached the following conclusions:

* The average age of the target cereal farmer is about 50; most of them belong to middle-size families (about 7 members), depend on rainfed agriculture, own small holdings (less than 2 hectares) that generate income of no more than 51500 SYP annually and cultivate their lands with wheat which yield no more than 1155 kg/ha in Dara'a and 1900 kg/ha in Al-Hasakeh. The survey has also shown that the rate of the beneficiaries attending training activities in the cereal production field is 35%; most of them are suffering from the high cost of the production inputs and the lack of fertilizers and seeds.

* The average age of the target breeder is about 51 (half of the breeders are women); most of them belong to small-medium size families (about 6 members) and all of them depend on animal production as a main source for income (a small holding of only 11 heads of sheep generating an amount of 100000 SYP annually). They depend on fodder barley, bran and hay in feeding their animals and the woman plays an important role in animal breeding but doesn't attend any kind of training in this field. The data has indicated that the most important problems of the breeders are the lack of fodders and the high cost of veterinary medicines.

* Distribute a quantity of 300 kg of sieved and sterilized durum wheat seeds for each beneficiary from the agricultural component ((1000 beneficiaries in both governorates) in addition to a kit of agricultural inputs (6 different kinds) .

* Distribute a quantity of 750 kg of fodder barley for each beneficiary from the animal production component in Al-Hasakeh and 850 kg of bran for each beneficiary in Dara'a (1000 beneficiaries in both governorates) in addition to a kit of 11 necessary veterinary medicines for each breeder.

* Implement 25 water harvesting units, as the roof-water harvesting method has been adopted as a model for rainfall water harvesting for the target households.

* A training course on "Gender" has been conducted for the staff of the implemented projects in cooperation with ACF.

* Select 6 paravets in the two governorates to attend a training course in the fields of animal care and animal diseases diagnosis. The trainees have been provided with veterinary kits containing 26 kinds of the necessary veterinary medicines and devices.

* The field team has implemented about /20/ training sessions in both governorates to raise the awareness of the beneficiaries (farmers and breeders) in the fields of animal and plant production sectors.

2- Project of “Emergency Food Security and WaSH Support to Vulnerable Households in the Conflict-Affected Areas in Syria”:

Project objective:

Provide emergency assistance and early improvement to the agricultural producers and livestock breeders, by improving the access of the crisis-affected population in Syria to food security, agriculture and water.



Project progress:

- Carry out the post-distribution survey to make sure that the target beneficiaries have received the production inputs.
- Carry out the final survey of the project to identify the living and food situation of the beneficiaries by selecting a random sample of 10% of the total beneficiaries number.

The survey has reached the following conclusions:

- 1- Cultivate 1000 ha of wheat and achieve a productivity increase estimated at 14% in Dara'a and 27% in Al-Hasakeh, in addition to an increase in the total income estimated at 25% and an increase in the food self-sufficiency period estimated at /3/ additional months. Moreover, 84% of the farmers number have participated in the training sessions, of which 18% were women.
- 2- Provide fodders to about 10000 heads of sheep and cattle and achieve an increase in the flock size estimated at 20% and an increase in the total income estimated at 35%. Veterinary vaccines have also been provided to all flocks in cooperation with the Ministry of Agriculture in Syria. Moreover, a third of the total breeders number has participated in the extension sessions, of which 20% were women. It has been noticed that there is an improvement in the food situation of the target households in terms of the dairy products, meat and eggs consumption.
- 3- Provide winter and summer vegetable seeds to cultivate 500 dunums of household gardens, which has contributed to the vegetables provision all over the year, improved the food security situation of the households when compared with their situation at the beginning of the project and increased the target household income by 37% during the project implementation period.

3- Project of “Food Security and WaSH Emergency Response to the Syrian Crisis”:

Project objective:

Provide emergency assistance and early improvement to the agricultural producers and livestock breeders by improving the access of the crisis-affected population in Syria to food security, agriculture and water.

Project progress:

- * 1750 beneficiaries have been selected for the project; of which /875/ beneficiaries are from Dara'a governorate and /875/ beneficiaries are from Al-Hasakeh governorate (375 breeders, 375 cereal farmers and 125 rural women for the home- gardening component in each governorate).
- * Several field surveys have been conducted in both governorates to make sure of the beneficia-

ries' compliance with the selection standards and identify the economic actuality of the beneficiaries and their necessary requirements in addition to the ways that can be followed by the project to help them.

These surveys have reached the following conclusions:

- The average age of the plant production beneficiary is about 57; most of the beneficiaries belong to small- medium size families (more than 6 children), depend on rainfed wheat cultivation with an average yield of about 2350 kg/ha and own small holdings (less than 2.5 hectares) of which only the half is cultivated and generates an annual income of 400000 SYP. The surveys have also shown that the most important problem of the beneficiary is the lack of fuel, fertilizers and seeds and the high cost of agricultural inputs.



- The average age of the target breeder is 51; he has about 6 children and depends on animal breeding as a main source for his income (a small holding of about 14 heads generating an amount of 146400 SYP annually). Most households have been forced to sell a part of their flocks to purchase fodder for the remaining animals. The surveys have shown that most breeders depend on fodder barley (which they buy from markets at a high cost) in feeding their animals and that the rural woman plays an important role in animal breeding but doesn't attend any kind of training in this field. Moreover, the most important problem of the breeders is the lack, high cost and low quality of fodders.

* Most women benefiting from the home-gardening component depend on irrigated vegetables cultivation in small areas (as a main source for their income estimated at 125000 SYP annually). They have not attended any kind of training in the field of vegetable cultivation in spite of their active role in the production process. The data has shown that the most important problem facing the target woman is the high cost of vegetable seeds and the lack of fertilizers, pesticides and agricultural tools.

* Distribute a quantity of 500 kg of sieved and sterilized durum wheat seeds for each beneficiary from the agricultural component (750 beneficiaries in both governorates).

* Distribute 250 agricultural kits among rural women in Dara'a and Al-Hasakeh, each kit contains a set of vegetable seeds (cucumber, beans, lettuce, squash, cabbage, cauliflower, tomato, radish, chard, parsley, water melon, eggplant and green pepper) and agricultural tools (leveling comb, hoe, shovel, spade and greenhouse nylon for covering the seedlings).

* Distribute a quantity of 1000 kg of fodder barley for each beneficiary from the animal production component (750 beneficiaries in both governorates).

* Implement training courses for about 130 beneficiaries (males and females) in the two governorates (65 beneficiaries in each governorate) in the fields of: veterinary health, milk production, fodder production and vegetables processing and preservation, and distribute kits of tools related to each training component.

* The field team has implemented about /30/ training sessions in both governorates to raise the awareness of the beneficiaries in the fields of animal and plant production sectors and home gardening.

4- Project of “Early Recovery and Livelihood Support to Vulnerable Conflict-Affected Households in Syria- Al-Hasakeh Governorate”:

Project objective:

Provide assistance and early improvement to the agricultural producers by improving the access of the crisis-affected population in Syria to food security, agriculture and water.

Project progress:

* /1500/ beneficiaries have been selected for the project; of which /500/ are breeders, /500/ are cereal and vegetables farmers and /500/ are rural women for the dairy processing component).

* Conduct several field surveys in Al-Hasakeh to make sure of the beneficiaries' compliance with the selection standards and identify the economic actuality of the beneficiaries and their necessary requirements in addition to the ways that can be followed by the project to help them.

These surveys have reached the following conclusions:

- The average age of the vegetables cultivation beneficiary is about 46; most of the beneficiaries belong to medium size families, depend on agriculture as a main source for their income, own small holdings, cultivate no more than 0.8 ha with vegetables and generate an annual income of 379000 SYP. The surveys have also shown that the most important problem of the beneficiary is the lack of fuel, fertilizers and machinery and the high cost of vegetable seeds.



- The average age of the target breeder is 47; he has about 7 children and depends on animal breeding as a main source for his income (a small holding of about 9 heads generating an amount of 187000 SYP annually). The surveys have shown that most breeders depend on rangelands and crop residues in feeding their animals due to their inability to buy fodder at a high cost from the market. The rural woman plays an important role in animal breeding but hasn't received any kind of training in this field. Moreover, the most important problem of the breeders is the lack, high cost and low quality of fodders.

- The average age of the target rural woman is 47; she depends on animal breeding as a main source for her income (generating 72225 SYP annually). The surveys have shown that all of the women haven't received any training in the dairy processing field in spite of their major role in the production process. It has been noticed that the most important problems facing the target women are the production high cost, the trader exploitation and the damage of the production materials due to the lack of refrigerators and electricity.

* Distribute 500 kits of dairy processing tools among rural women, each kit includes containers for milk preservation and processing, “Rennen” enzyme tablets and filtering cloths.

* Distribute 500 agricultural kits farmers, each kit contains a set of vegetable seeds (spinach, cucumber, beans, lettuce, squash, cabbage, cauliflower, tomato, radish, chard, water melon and eggplant) and agricultural tools (leveling comb, hoe, shovel, spade, hose and green house nylon for covering the seedlings).

* Distribute a quantity of 500 kg of fodder barley for each beneficiary from the animal production component, in addition to 500 kits of veterinary medicines.

- * Implement a training course for the field managers and technical and extension workers in Al-Hasakeh in the plant and animal production sectors.
- * Carry out the post-distribution survey for 20% of the total beneficiaries number to measure up the appropriateness of the agricultural materials to their needs.
- * Distribute /9/ tons of lentil seeds among /275/ beneficiaries, who have been negatively affected by its cultivation in the last season.
- * Carry out the endline survey for a sample of beneficiaries to measure up the project intervention impact and contribution to requirements meeting and production support of the beneficiaries.
- * The field team has implemented about /24/ training sessions to raise the awareness of the beneficiaries in the fields of animal and plant production sectors and home gardening.

5- Conferences and workshops:

- Participate in the scientific agricultural research conference of the General Commission for Scientific Agricultural Research in the Syrian Arab Republic through a country paper entitled "ACSAD's Role in the Agricultural Projects Implementation in the Arab Countries".
- Participate in the consultative workshop of the World Food Program in Damascus.
- Participate in the ESCWA workshop on the project outputs discussion of "Climatic Change Impact on Natural Resources in the Arab Countries" in Beirut- December 2016.

Arab and International Cooperation Department

Objective: Increase the effective cooperation with all Arab and international developmental, research and extension institutions for the purpose of transferring ACSAD's scientific and practical expertise to the Arab countries and benefiting from the scientific and technological progress of the Arab and international research centers to support the agricultural development process.
Cooperation sites: All Arab countries.

Progress:

* Arab Ministries and Commissions and Research Centers in the Arab Countries:

- The Arab Center (ACSAD) has established cooperation relations with all Arab countries through bilateral agreements with the Ministries of Agriculture, Environment and Water in these countries under its annual work program. The Arab Center (ACSAD) is implementing its activities in more than (17) member and non-member Arab countries according to the requirements of each country to support the agricultural development process.



*** Arab, Regional and International Organizations and Commissions:**

- The Arab Center (ACSAD) seeks the enhancement of cooperation linkages with all regional and international organizations and commissions for the purpose of implementing the recommendations of the General Assembly and Executive Council and the resolutions of the Higher Committee for Arab Work Coordination to benefit from the acquired expertise of ACSAD.
- During the past years, the Arab Center (ACSAD) has signed several cooperation agreements with international organizations and commissions such as: the Islamic Development Bank, the German Agency for International Cooperation (GIZ), the Spanish non-governmental organization of (RES-CATE), the Spanish Action Against Hunger institution (ACF), the International Fund for Agricultural Development (IFAD), the Food and Agriculture Organization of the United Nations (FAO), the Economic and Social Committee for Western Asia (ESCWA), the Environment and Development Center for Arab Region and Europe (CIDARI), the International Center for Agricultural Research in the Dry Areas (ICARDA), the United Nations Development Program, the United Nations (UN), the Spanish Agency for Financing and Development, the UNICCD, the Secretariat General of Biodiversity Convention, the International Institute for Plant Genetic Resources, the International Center for Maize and Wheat Improvement and the International Network for Food Information.

*** Technical Cooperation Agencies, Research Centers and Universities in Developed Countries:**

- The Arab Center (ACSAD) has established scientific and technical cooperation linkages with several scientific research centers, agencies and commissions such as: the German Agency for International Cooperation (GIZ), the Federal Institute for Geosciences (BGR), the French Development Research Institute (IRD), the Agricultural Science University in Slovakia, Aachen University in Germany, Xinjiang Institution for Dry environment Science and Technology in China (XAEST), Humboldt University, the International Institute for Plant Feeding in Germany, The Catalanian Forest Institute, the Overseas Scientific Study Center in France, Universities of Lund and Uppsala in Sweden and the University of London-Imperial Faculty. The purpose of this cooperation is to seek the application of modern and developed methods in the implementation of its projects and transfer and localization of technologies that are appropriate for the Arab region climate.

Knowledge Management and Localization Program

In the year 2016, ACSAD has taken important measures to develop the electronic structure and digitalism use by developing and providing the necessary knowledge tools for the different activities in coordination with the Knowledge Management and Localization Program, the Information Technology Unit and the specialized departments. The following has been achieved in this field:



- Update ACSAD's website data in both Arabic and English languages in a way that reflects all the developments in ACSAD's work fields (like adding information on the new research stations).

الرئيسية | مواقع صديقه | خريطة الموقع | انصل بنا | English

عن أكساد
 6 الأصناف :
 36 عدد الأشجار من كل صنف :
 216 عدد الأشجار الكلي :
 1973 تاريخ الزراعة :

يساهم المركز مساهمة فعالة في تحسين الواقع الزراعي على مستوى الوطن العربي

أنت هنا: الرئيسية • المحطات البحثية • محطات البحث العربي • أكساد • محطة بحوث السن

يقدم المركز العربي أكساد المؤتمر الخامس، لمسؤولي البحث العلمي والإرشاد الزراعي، في الدول العربية، 20-21/2/2017 الجمهورية التونسية

محطة بحوث السن

أحدثت في عام 2015 في محافظة اللاذقية منطقة حقلية - حريصون على ارتفاع 15 متر من سطح البحر، تبلغ مساحتها 54 دونم وبسود فيها مناخ حوض البحر الأبيض المتوسط المازد والممطر نسياناً والحار والجاف صيفاً، متوسط الهطول المطري 800 ملم سنوياً، تربتها حمراء طينية ناعمة قلوية بالمادة العضوية.

هدف المحطة:

1. دراسة العلاقات المائية تحت ظروف المنطقة لزيادة إنتاجية الوحدة المائية
2. دراسة وتقييم المحاصيل الزراعية المختلفة لاختيار التركيب المحصولي الملائم.
3. تقديم الحزم الإرشادية الطبيعية والخدمات العلمية للمهنيين بالأنشطة الزراعية المختلفة بالمنطقة.
4. تنظيم الدورات التدريبية في مجالات التنمية الزراعية وبخاصة لنبات الخريصين.
5. رفع إنتاجية المحاصيل الحقلية والسمات الطيبة والعطرية والأشجار المثمرة والراعات المحمية وتطوير معارف العوى المنتهية العربية العاملة في مجالات السنة والتنمية.
6. اختبار مداخلات برنامج الحبوب من محاصيل العمح العاسي والعمح الطري والسعير لأراض الأصداء "صدأ الساق (الأسود) وصدأ الأوراق (الأصفر) وأمراض السعير الورقي"

السبة البحثية للمحطة:

- مكاتب إدارية ومخارج.
- مختبرات للتحليل وعزل وتوصيف المسببات للأمراض النباتية.

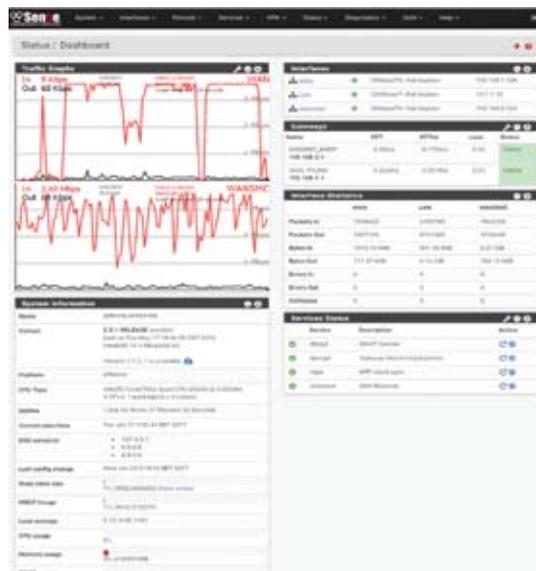
عن أكساد
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 المحطات البحثية
 الأقسام الخدمية
 المركز الإعلامي
 التدريب
 المشاريع
 فصل بحاج
 الإصدارات
 مقالات وأبحاث علمية
 جائزه أكساد
 مؤتمرات وندوات

الإحصائيات
 عدد الزوار: 57
 عدد الصفحات: 467
 عدد الزيارات: 1060919
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- Supply the Informatics Network at ACSAD's new premises in Al-Sabboura and provide the premises with a high speed optical Internet (20Mbps); ready to increase till (100Mbps) when necessary.



- The website has been provided with the Internet management application (pfsense) to ensure the optimal use of the Internet and protect the local network from passing through.



- Ensure the participation in the best software and applications of "Accunetix" to protect ACSAD's website from passing and breaking through.



Human Resource Development and Technology Transfer

Human Capacity Building Program

The Arab Center (ACSAD) has paid a special attention to human capacities building in the field of Arab agricultural development. It has sought to continuously develop the research stations and training centers, modernize and develop the necessary equipment and supplies in a way that complies with the most recent scientific techniques and contribute to the Arab staff training by transferring, localizing and developing the knowledge that is appropriate to the sustainable agricultural development conditions in the arid and semi-arid areas. This is reflected in the organization of training courses, seminars and scientific conferences that have contributed and are still contributing to the human capacity building of Arab staffs to enable them to get acquainted with the most recent theoretical and practical scientific updates aiming at creating the desired technical and technological changes in a way that contributes to the support and achievement of the Arab food security.



In the year 2016, ACSAD has worked on organizing /33/ training courses, /10/ scientific meetings and /20/ extension seminars; in which more than /2350/ technicians and experts have participated as follows:

Arab Staff Training and Rehabilitation Program:

- 1- Training course on "Pastoral Nurseries Establishment" organized in Warqala- Algeria, during the period 30/1-5/2/2016, for (10) trainees from the Ministry of Agriculture and Rural Development in Algeria.
- 2- Training course on "Field Vegetables and Crops Production" organized in the Directorate of Agriculture in Al-Hasakeh, during the period 24-25/4/2016, for (8) trainees from the teamwork of the project of "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria".
- 3- Training course on "Biogas Production Technique Dissemination in the Syrian Rural Areas" organized in the Directorate of Agricultural Extension, during the period 24-27/4/2016, for (20) trainees from the Ministry of Agriculture and Agrarian Reform in Syria.
- 4- Training course on "Dairy Production and Processing" organized in the Directorate of Agriculture in Al-Hasakeh, during the period 2-3/5/2016, for (8) trainees the teamwork of the project of "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria".
- 5- Training course on "Animal Production and Health" organized in the Directorate of Agriculture in Al-Hasakeh, during the period 8-9/5/2016, for (8) trainees from the teamwork of the project of "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria".
- 6- Training course on "Land Degradation Monitoring" organized in Lebanon, during the period 8- 11/5/2016, for (4) trainees in Palestine.
- 7- Training course on "Gender" organized in the Directorate of Agriculture in Al-Hasakeh, during the period 15-16/5/2016, for (8) trainees from the teamwork of the project of "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria".
- 8- Trainig course on "Genetic Improvement of Cereal Crops Under Biotic and Abiotic Stresses Conditions and Variety Purity Conservation" organized in Tel-Amara, Lebanon during the period 15-20/5/2016 for /2/ trainees from the Ministry of Agriculture in Palestine.
- 9- Advanced Training course on "Gender" organized at ACSAD's headquarters during the period 12-13/7/2016 for (17) trainees from the field team of the projects of "Livelihood Support of Crisis-Affected Population in Syria" and "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria" in the governorates of Dara'a and Al-Hasakeh.
- 10- Training course on "Animal Production and Health" organized in the Directorate of Agriculture in Al-Hasakeh during the period 1-2/8/2016 for (8) trainees from the teamwork of the project of "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria".





11- Training course on "Paravets Training" organized in Al-Qahtania and Tel-Hmeis during the period 8-11/8/2016 for (6) paravets from the beneficiaries of the project of "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria".

12- Training course on "Palm Tree Head Service" organized in the Arab Republic of Egypt during the period 27-30/8/2016 for (9) trainees from the Arab countries.

13- Training course on "Microsoft Office/Word" organized at ACSAD's headquarters during the period 15/8-6/9/2016 for (14) trainees from ACSAD's staff.

14- Training course on "Paravets Training" organized at Ezra'a research station during the period 9-13/10/2016 for (2) paravets from the project "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria".

15- Training course on "Paravets Training" organized in the Directorate of Agriculture in Al-Hasakeh for (4) paravets from the beneficiaries of the project of "Early Recovery and Livelihoods Support of Crisis-Affected Vulnerable Households in Syria".

16- Training course on "Paravets Training" organized in the Directorate of Agriculture during the period 9-13/10/2016 in Al-Hasakeh for (5) paravets from the beneficiaries of the project of "Emergency Response to the Crisis in Syria in the Fields of Food Security and Water".

17- Training course on "Paravets Training" organized in at Ezra'a research station during the period 9-13/10/2016 for (5) paravets from the beneficiaries of the project of "Emergency Response to the Crisis in Syria in the Fields of Food Security and Water".

18- Training course on "Non-Conventional Water Use in Agriculture" organized at ACSAD's premises during the period 16-20/10/2016 for (18) trainees from the Ministry of Agriculture and Agrarian Reform in Syria.

19- Training course on "Microsoft Office Excel" organized at ACSAD's premises during the period 9/10-3/11/2016 for (19) trainees from ACSAD's staff.

20- Training course on "Vegetables Processing and Conservation" organized in the Directorate of Agriculture in Al-Hasakeh during the period 1-3/11/2106 for (20) trainees from the beneficiaries of the project of "Emergency Response to the Crisis in Syria in the Fields of Food Security and Water".

21- Training course on "Fodder Production" organized in the Directorate of Agriculture in Al-Hasakeh during the period 7-9/11/2106 for (20) trainees from the beneficiaries of the project of "Emergency Response to the Crisis in Syria in the Fields of Food Security and Water".

22- Training course on "Fodder Production" organized at Ezra'a research station during the period 7-9/11/2106 for (20) trainees from the beneficiaries of the project of "Emergency Response to the Crisis in Syria in the Fields of Food Security and Water".



23- Training course on "Dairy Products" organized in the Directorate of Agriculture in Al-Hasakeh during the period 14-16/11/2016 for (20) trainees from the beneficiaries of the project of "Emergency Response to the Crisis in Syria in the Fields of Food Security and Water".

24- Training course on "Dairy Products" organized At Ezra'a research station during the period 14-16/11/2016 for (20) trainees from the beneficiaries of the project of "Emergency Response to the Crisis in Syria in the Fields of Food Security and Water".

25- Training course on "Fodder Processing Machine Installment, disassembly, maintenance and Investment" organized in the state of Zaghwan- Tunisia during the period 14-18/11/2016 for (6) trainees from the Office of Livestock in Tunisia.

26- Training course on "Agricultural Residues Improvement Based on the Machine Optimal Utilization" organized in the state of Zaghwan- Tunisia during the period 19-24/11/2016 for (22) trainees from the Office of Livestock in Tunisia.

27- Training course on "Agricultural Residues Inventory, Evaluation and Improvement" organized at ACSAD's premises during the period 20-24/11/2016 for (5) trainees from the Ministry of agriculture and Agrarian reform in Syria.

28- Training course on "Remote Sensing Techniques Use in Modis-Stram Satellite Imagery Analysis" organized in the state of Warqqala- Algeria, during the period 22-27/11/2016 for (9) trainees from the project of "Main Crop Production" in Warqqala- Algeria.

29- Training course on "Pastoral Surveys and Measurement" organized in the state of Warqqala- Algeria, during the period 22-27/11/2016 for (9) trainees from the project of "Main Crop Production" in Warqqala- Algeria.

30- Training course on "Hydrology and Water Harvesting Techniques" organized in the state of Warqqala-Algeria, during the period 23-27/11/2016 for (8) trainees from the Governorate of Agri-

culture Development in the Desert Areas- Ministry of Agriculture, Rural Development and Fisheries- Algeria.

31- Training course on "Microsoft Power Point" organized at ACSAD's premises during the period 1-5/12/2106 for (42) trainees from ACSAD's staff.

32- Training course on "None-Conventional Water Use in Agriculture" organized in the General Commission for Scientific Agricultural Research in Lattakia, for five days, for (18) trainees from the technical staff of the Ministry of Agriculture in Syria.



33 -Training course on "Agricultural Residues Optimal Use and Processing as Animal Fodder" organized in Al-Khartoom- Sudan, during the period 13-27/12/2016, for (10) technicians from the Arab Commission for Agricultural Development and Investment.

Technology Transfer Program:

1- Workshop on "Adaptation with Climatic Changes in the Agricultural Sector" organized in Beirut, Lebanon, during the period 15-17/2/2016, for (20) participants from the Arab countries.

2- Participation in the Regional Conference on "Animal Genetic Resources Inventory, Characterization and Protection in the Arab Countries" organized in Oman, during the period 22-26/2/2016, for (50) participants from several Arab countries.

3- Meeting of "Scientific Terms Review Committee in the Livestock Field in the Arab World" organized in Beirut- Lebanon, during the period 20-22/3/2016, for (10) participants from the Arab countries.

4- Second workshop on "Irrigation Efficiency Raising in the Arab Countries" organized in Beirut- Lebanon, during the period 2-3/4/2016, for (22) participants from the Arab countries.

5- Participation in the conference of "Investments in the Palm and Dates Sector (Actuality and Horizons)" organized in Oman, during the period 23-25/5/2016, for (100) participants from the Arab countries.

6- Workshop on "Rainfall Water Harvesting and Rangeland Development" organized in the gover-



norate of Mersi Mattrouh- Egypt, during the period 23-27/7/2016, for (15) participants.

7- Second meeting of Director General with the national coordinators of the "Palm Development Project" organized in Cairo- Egypt, during the period 25-26/8/2016. /8/ Arab national coordinators have attended the meeting .

8- Workshop on "Biotechnology Role in Developing Drought-Resistant Varieties" organized in Cairo- Egypt in cooperation with the Desert Research Center and the Biotechnology Information Center, during the period 8-10/10/2016, for (21) participants from the Arab countries.

9- Fourth Meeting of Director General with ACSAD's national coordinators in the Arab countries organized in Beirut- Lebanon, during the period 22-23/10/2016. /12/ national coordinators have attended the meeting, in addition to ACSAD's delegation.

10- Meeting for discussing the investigation results of "Camel Grazing Systems Study to Improve Breeders Income and Exchange Expertise" organized in Warqqala- Algeria, during the period 21-28/11/2016, for (15) participants from Camel Grazing Project Committee in the state of Warqqala.

11- ACSAD has also conducted (20) extension seminars for (1657) beneficiaries from the implemented projects with ACF in the following field:

- Dairy processing
- Vegetables and field crops production.
- Animal production and animal health.



