International Center for Biosaline Agriculture

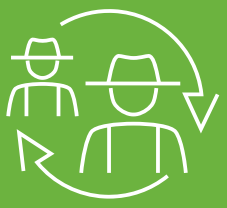
ICBA Annual Report 2016




نـزرع للغـد
ICBA
AGRICULTURE FOR TOMORROW

Innovation

Impact



Partnership

CONTENTS

Acronyms and Abbreviations

ADFD	Abu Dhabi Fund for Development
BADEA	Arab Bank for Economic Development in Africa
CODRA	Creating Opportunities to Develop Resilient Agriculture
CORDEX	Coordinated Regional Downscaling Experiment
CPET	Collaborative Program for Euphrates and Tigris
CIMMYT	International Maize and Wheat Improvement Center
EAD	Environment Agency – Abu Dhabi
FAO	Food and Agriculture Organization of the United Nations
GCC	Gulf Cooperation Council
IAAS	Integrated Aqua-Agriculture System
IAEA	International Atomic Energy Agency
ICARDA	International Center for Agricultural Research in the Dry Areas
ICBA	International Center for Biosaline Agriculture
IsDB	Islamic Development Bank
IFAD	International Fund for Agricultural Development
IWMI	International Water Management Institute
KAUST	King Abdallah University of Science and Technology
MAWRED	Modeling and Monitoring Agriculture and Water Resources for Development
MENA	Middle East and North Africa
MENA-RDMS	Middle East North Africa Regional Drought Management System
MoCCaE	Ministry of Climate Change and Environment [formerly Ministry of Environment and Water]
NARS	National Agricultural Research System
OCP	Office Chérifien des Phosphates
OFID	OPEC Fund for International Development
OPEC	Organization of the Petroleum Exporting Countries
QNRF	Qatar National Research Foundation
RAMSAP	Rehabilitation and Management of Salt-affected Soils to Improve Agricultural Productivity
SDG	Sustainable Development Goal
Sida	Swedish International Development Cooperation Agency
SSA	Sub-Saharan Africa
UAE	United Arab Emirates
USAID	United States Agency for International Development
USAID PEER	USAID Partnerships for Enhanced Engagement in Research
WANA	West Asia and North Africa
WHO	World Health Organization

Message from the President, IDB Group

At the outset, I wish to commend the International Center for Bio-saline Agriculture (ICBA) for its unrelenting efforts in contributing to the Islamic Development Bank (IDB) Group's mission through its wide range of activities and operations. IDB Group member countries are, indeed, benefitting from ICBA's research and development in agriculture and water sectors in marginal environments. It is very heartening to see that, over the period, ICBA has provided an exemplary leadership in steering this vitally important work along with other development partners.

In fact, I feel very pleased to see that, today, ICBA is in full gear to realizing its strategy (2013-2023) in line with its mission and vision of becoming "The Global Center of Excellence for Innovative Agriculture in saline and marginal environments", and has even developed a new business plan that incorporates the 2030 agenda for Sustainable Development Goals (SDGs). Perhaps another outstanding feature of this business plan, is that it focuses on mitigating financial risks and consolidating the financial position of the Center. It is also quite noteworthy that ICBA is stepping up resource mobilization and diversification of sources of funding to ensure delivery continuity in its core mission for improving lives and livelihoods of some of the most vulnerable communities.

For me, it is a source of pride to state that, in 2016, the IDB Group continued to support ICBA's different research and capacity building programs in Central Asia, the Middle East and North Africa, and Sub-Saharan Africa. Indeed, the Bank will continue to contribute to research and development initiatives geared towards improving agricultural productivity, environmental sustainability, and building resilience in rural communities particularly in marginal areas. These interventions are fully aligned with the core objectives of the IDB Group namely; alleviating poverty, providing food security, reducing inequalities and unemployment, developing infrastructure and promoting South-South cooperation as well as connectivity.

One of the strategic objectives of the IDB Group's 10-year strategy (2016-2025) is "Connectivity for Growth". Therefore, our partnership with ICBA is the extension of this objective of connectivity to further bring knowledge, capacity building, and research in agriculture and marginal environments to our member countries.

> Perhaps another outstanding feature of this business plan, is that it focuses on mitigating financial risks and consolidating the financial position of the Center.
>
> H.E. Dr. Bandar M. H. Hajjar

I would like to highly praise the UAE Government's continued patronage and contribution that has led to the successful growth of ICBA's wide-ranging research and development programs. The IDB Group views the Center's achievements as a unique example of successful partnership with the UAE Government and other international organizations.

On behalf of the IDB Group, I would like to appreciate ICBA's Board of Directors and management for their relentless efforts towards fulfilling the Center's mission and vision. We, on our part, reaffirm IDB Group's commitment to the global community and our development partners.

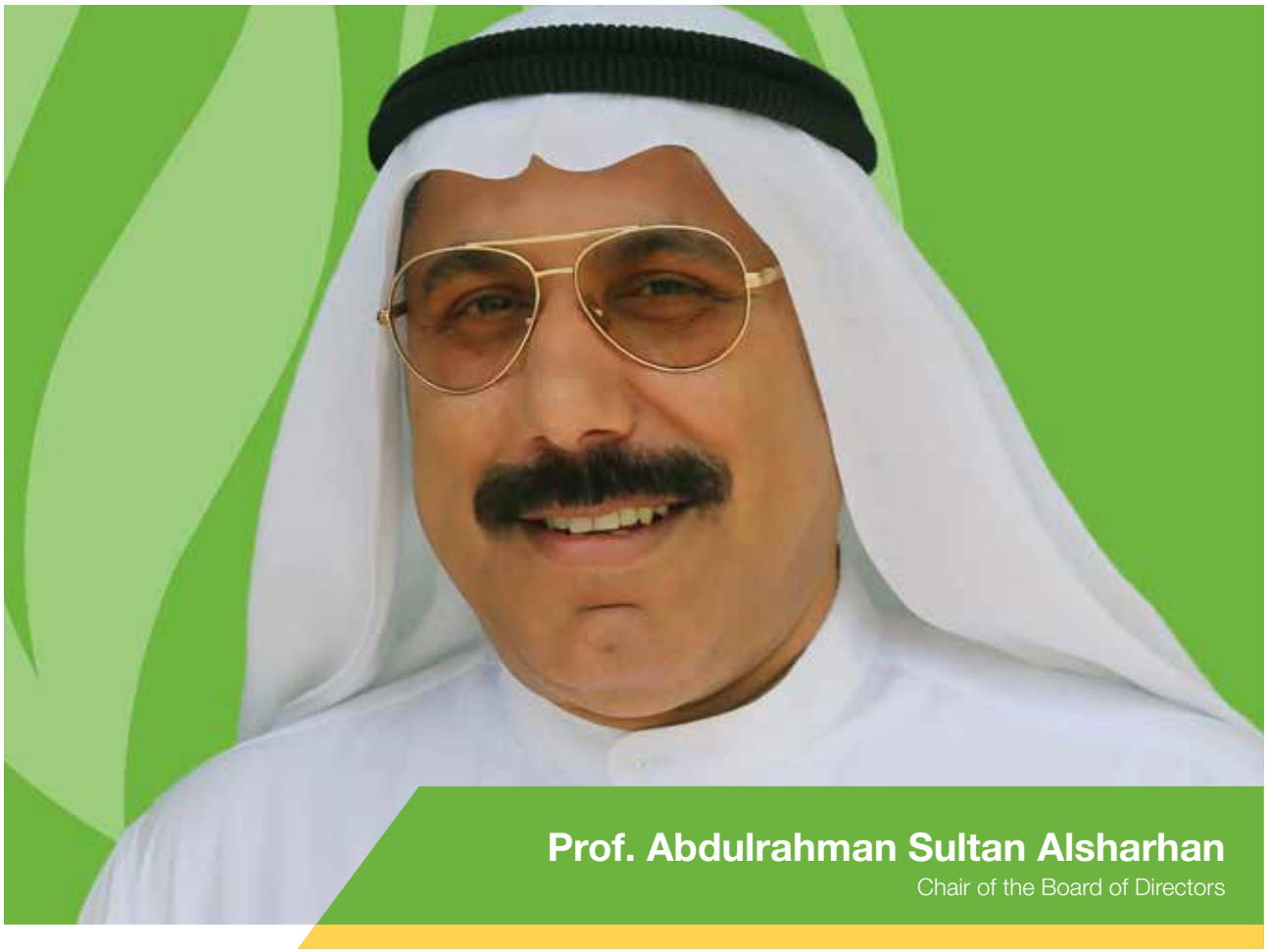
H.E. Dr. Bandar M. H. Hajjar
President of the Islamic Development Bank Group

Message from the Board Chair and the Director General

2016 was another proud year for ICBA. It reached many milestones and continued its mission of making a difference in the lives of some of the most vulnerable communities around the world with increased vigor and focus. The past year marked the end of the first Business Plan 2013-2016, which provided focus and direction for the center's activities for four years. So ICBA conducted an extensive analysis of its previous work and completed a major exercise to devise a new three-year business plan. The Business Plan 2017-2019 both builds on past efforts and improves on the first plan.

The past year marked the end of the first Business Plan 2013-2016, which provided focus and direction for the center's activities for four years.

It specifically reflects the center's commitment to the United Nations Sustainable Development Agenda 2030, whereby all research projects and programs are now aligned with the six most relevant Sustainable Development Goals (SDGs). What is more, the Business Plan 2017-2019 also anticipates phasing in a full-cost recovery business model over three years. Committed



Prof. Abdulrahman Sultan Alsharhan
Chair of the Board of Directors

Dr. Ismahane Elouafi
Director General

to improving rural livelihoods, ICBA began several new projects, including a project funded by the International Fund for Agricultural Development (IFAD) to fight salinity in parts of Ethiopia and South Sudan.

In collaboration with the Ministry of Climate Change and Environment of the United Arab Emirates (MoCCaE, UAE), the center initiated a new project to examine the economic potential of Salicornia production in coastal regions of the UAE by using non-conventional water resources, including canal water, aquaculture effluents and seawater.

Under another project, scientists studied the feasibility of saffron production in Afghanistan. The center also continued efforts to improve transboundary water management under the long-term Collaborative Program for Euphrates and Tigris (CPET). In recognition of its work on climate change adaptation and mitigation in the Middle East and North Africa (MENA) region, ICBA was appointed the lead organization on crop modelling and climate change in the international Half a degree Additional warming, Prognosis and Projected Impacts (HAPPI) project led by the University of Oxford.

One of the highlights last year was a major international conference on quinoa in marginal environments, which brought together more than 150 participants from over 48 countries. The center also inaugurated the Emirates Soil Museum, the first of its kind in the MENA region, with support from the Abu Dhabi Fund for Development (ADFD), the Islamic Development Bank (IsDB), the Environment Agency – Abu Dhabi (EAD), and the MoCCaE.

To empower women scientists in the MENA region, the center partnered with the Gates Foundation and the IsDB to start the inception phase of a pioneering Arab Women Fellowship Leadership Program (Tamkeen). ICBA also conducted a major research grant competition in collaboration with CRDF Global for young Arab women researchers.

All these achievements were possible thanks to continued support from many donors and partners, whom we would like to thank for their invaluable contribution and firm commitment to the center's mission.

Going Forward: Business Plan 2017-2019

As 2016 was the last year of the Business Plan 2013-2016, ICBA undertook a center-wide effort to devise the new three-year business plan. It is the second business plan developed in support of the ICBA Strategy 2013-2023 that was approved by the Board of Directors in March 2013. It builds on the successes and lessons learned from implementing the first business plan and is intended to be used as an operational guide for ICBA's management and staff to lead them towards reaching the center's strategic objectives and fulfilling the vision to be "the global Center of Excellence for innovative agriculture in saline and marginal environments". Moreover, the business plan helps to inform stakeholders, including donors, of the capacities that ICBA possesses in its aim to provide solutions and support to farmers working in marginal environments.

In preparing the Business Plan 2017-2019, ICBA took both a retrospective look, focusing on lessons learned from implementing the ICBA Strategy 2013-2023 and the Business Plan 2013-2016, and a forward look using SWOT analysis, specifically considering emerging opportunities and constraints.

The key lessons learned from the Business Plan 2013-2016:

1. There is a need for ICBA to focus beyond securing funding for programs and move to a plan of full-cost recovery;
2. Marginal environments are gaining interest from several development stakeholders, including donors. ICBA needs to sustain the case via hard data and strong analysis on poverty and hunger in marginal environments;
3. Strategic communications play a critical role in building ICBA's brand and positioning it as a center of excellence;
4. There is a need to improve internal efficiencies through instituting revised policies and procedures that are in line with those of other international organizations.

The United Nations Sustainable Development Agenda 2030 presents the center with new opportunities to contribute to addressing several global problems. The business plan was therefore designed with a view to working towards this agenda. The agenda, which was officially launched on 1 January 2016, includes 17 SDGs, and ICBA's mission contributes to six of them. All initiatives in the business plan were mapped on to the most closely related SDGs as follows:

- SDG 1: No poverty, improving agricultural production;
- SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture;
- SDG 6: Ensure availability and sustainable management of water and sanitation for all;
- SDG 13: Take urgent action to combat climate change and its impacts;
- SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss;
- SDG 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

The business plan will form the basis for developing future annual work plans, budgets, and monitoring and evaluation initiatives that ensure ICBA is on track and objectives and planned activities are reviewed periodically so that they remain relevant.

A key focus during the coming three-year period will be on improving ICBA's cost recovery with the goal of reaching full cost recovery by the end of the business plan period.

ICBA Strategic Framework

Research Innovations

Assessment of Natural Resources in Saline and Marginal Environments

ICBA's efforts under this theme contribute to:

Smallholder farmers who live and work in saline and marginal environments face increased risks of failure due to water shortages, recurrent droughts and varying degrees of soil and water salinity as traditional agricultural practices and crops they use do not fare well under these conditions.

Scientists at ICBA test and introduce alternative and non-traditional technologies, practices and crops that use less water and other input and produce better results in saline and marginal conditions. They also gather, generate and share scientific information on water and soil resources so that the causes of water and soil deterioration are better understood, managed and mitigated.

In 2016, continuing efforts to bring degraded lands back into production and minimize salinization, ICBA and its partners initiated a new project called the Rehabilitation and Management of Salt-affected Soils to Improve Agricultural Productivity (RAMSAP) in Ethiopia and South Sudan. The IFAD-sponsored project aims to rehabilitate salt-affected and degraded lands through introduction of salt- and drought-tolerant forages and halophytes. The project will run for four years and target 5,000 smallholder farmers directly in ten selected field sites covering about 300,000 ha of farmland (directly and indirectly).

ICBA also launched a new project to scale up small-scale irrigation technologies, and introduce best on-farm water and crop management practices to smallholder farmers in Sub-Saharan Africa (SSA). This four-year project is aimed at increasing agricultural productivity and contributing to better food security. It is supported by the OPEC Fund for International Development (OFID) and is implemented in collaboration with national partners in Burkina Faso, Mali, Niger, and Senegal.

As part of long-term studies on technologies to improve soil health and quality, scientists continued to assess the effects of biochar and inorganic soil amendments on plant growth. Biochar is a charcoal used as a soil amendment and produced from plant matter, including date palm waste, and stored in the soil as a means of removing carbon dioxide from the atmosphere. Studies showed that by improving soil water retention and nutrient availability, biochar helped to increase biomass of quinoa and cowpea by 54-113% and 16-27% respectively. In a separate study, scientists found that the combined use of an inorganic soil amendment called Austrablend MMSC and compost at the rate of 10 tonnes per ha each significantly increased barley biomass and saved 25% of water compared with when they were used individually.

Under another new project funded by the Qatar National Research Foundation (QNRF), ICBA teamed up with the Ministry of Environment of Qatar to compare the efficiency of conventional reverse osmosis units with that of nano-filtration units. Following a series of experiments, scientists found that nano-filtration systems consume less energy (2.85 kW/m3) compared with reverse osmosis units (3.15 kW/m^3). This finding may help to considerably reduce energy consumption as reverse osmosis plants are common in Qatar. In 2012, monthly water production from the well fields and reverse osmosis plants in the country stood at 244,251 m^3.

One of the main highlights in 2016 was the inauguration of the Emirates Soil Museum, a unique facility in the MENA region, with support from the ADFD, the IsDB, EAD and the MoCCaE. The museum, a product of many years of soil research in the UAE, is designed as a repository of knowledge on soils of the UAE.

On 8 December 2016, the first-of-its-kind Emirates Soil Museum opened its doors in Dubai, the UAE. The museum features a variety of aboveground and underground exhibits and a library collection of soil publications and soil atlases of the GCC region. Based at ICBA, the museum is designed to cater to the needs of a wide range of visitors, including school children, university students, researchers, professionals and scientists, environmentalists, professional contractors, land use planners, decision and policy-makers. It has its website at **www.emiratessoilmuseum.org.**

The Emirates Soil Museum is a unique knowledge hub for soil information on the UAE.

ICBA carried on with efforts to improve transboundary water management under the long-term Collaborative Program for Euphrates and Tigris (CPET), and to map soil salinity in Bahrain and the emirate of Abu Dhabi, the UAE. Under the CPET project, the center organized a series of workshops and meetings, including a well-represented meeting of task forces in Malaysia, to boost regional cooperation on water management. As part of the project to map soil salinity and soil properties in collaboration with the Arabian Gulf University[1], researchers collected soil samples at 39 sites in Bahrain and 82 soil and salt

[1] Soil salinity and properties mapping using remote sensing, geographical information system and field validation: a case study of Bahrain and the United Arab Emirates - Arabian Gulf University-ICBA

samples on the coast of Abu Dhabi. In partnership with ADFD, scientists conducted a feasibility study to assess potential for investment in saffron production in Afghanistan. The study evaluated how suitable natural resources in the country are for saffron production, and analyzed the current farming system and economic impact. Under a separate feasibility study funded by the OCP Foundation, the center worked with Mohammed VI University, Morocco, to evaluate prospects and benefits of establishing a biosaline agriculture center in Morocco.

On a different research front, scientists continued a project to study the use of treated wastewater for growing vegetables, landscaping plants, forages and fruit plants. They analyzed the accumulation of pathogens and heavy metals in carrot, lettuce, tomato, radish, spinach, eggplant, date palms, forages and Salvadora. Previous results showed that the presence of heavy metals in plants is significantly lower than the safe limits prescribed by the World Health Organization (WHO). This suggests that treated wastewater can be used for irrigating vegetables in the desert environment as there appears to be no serious threat in terms of accumulation of heavy metals in soils and vegetables. However, further testing and analysis is necessary to come to a definite conclusion.

Climate Change Impacts and Management

ICBA's efforts under this theme contribute to:

In 2016 global temperatures were the warmest since record-keeping began in 1880. This made 2016 the third year in a row to set a new record for global average surface temperatures. And more worrying is that 16 of the 17 warmest years on record had occurred since 2001. Beyond the meteorological statistics, farmers, water managers and government officials are already living with the consequence of changing climate conditions affecting their lives. ICBA's focus on marginal environments ensures its insight and experience are even more relevant as many areas become more challenging for agriculture. There is therefore a need to develop climate-smart agriculture under which the likely consequences of a changing climate are first understood and then adaptive management solutions for water and agricultural systems may be developed based on many years of scientific research at ICBA.

To understand the likely impacts, researchers at ICBA continued in 2016 to run numerous downscaling and modelling activities for different regions converting global climate model data sets into national and regional scale information. Researchers combined the downscaled data with that of other regional climate models on the Coordinated Regional Climate Downscaling Experiment (CORDEX) portal to generate insight at a more local level under the IFAD- and IsDB-funded Creating Opportunities to Develop Resilient Agriculture (CODRA) and the USAID-funded Middle East and North Africa Regional Drought Management System (MENA-RDMS) initiatives. This work was aimed at identifying vulnerable areas for Morocco, Tunisia, Jordan, Lebanon, Egypt, Yemen, the UAE, Senegal, and Mauritania. The data showed that many areas are likely to become more than 3 degrees warmer in the next 50 years with rises in evapotranspiration being likely to have an increasingly negative impact on agriculture and water resources. The values for these new climate conditions were then used in water and crop modeling and vulnerability assessments to predict impacts on these specific areas. With the signing of the Paris Agreement in 2015, one new area of focus has been modeling the different impacts of 1.5 and 2.0 degree rises in temperature on agricultural systems. ICBA was invited to join the international consortium Half a degree Additional warming, Prognosis and Projected Impacts (HAPPI) *(http://www.happimip.org/)* led by the University of Oxford. ICBA is leading the efforts on crop modelling and climate change and presented the results of its work on the impacts of a limited temperature rise on wheat production in Tunisia, at a conference in Oxford, UK, in September 2016.

Adapting to climate change in farming systems involves introducing new agricultural practices that are better suited to the new conditions. ICBA continues to test and introduce crops, practices and technologies to this end in different regions, with a specific focus on Central Asia, MENA and West Africa. For example, through a number of training

The data showed that many areas are likely to become more than 3 degrees warmer in the next 50 years with rises in evapotranspiration being likely to have an increasingly negative impact on agriculture and water resources.

seminars and field days with a rural network of more than 200 smallholder farmers[2], including 42 women, in Uzbekistan, scientists shared best practices and research results of the CGIAR Research Program on Dryland Systems[3] on post-harvest activities and seed quality analysis. Similarly, under a USAID Partnerships for Enhanced Engagement in Research (PEER)[4] project, 156 participants, including 75 women, in Karauzyak District, Uzbekistan, received training on crop diversification and better nutrition in marginal conditions.

Scientists also continued a quinoa project in Central Asia[5], organizing an annual review meeting for project partners from Uzbekistan, Tajikistan, and Kyrgyzstan, where eight demo trials were set up with five ICBA quinoa lines and three promising FAO quinoa cultivars. As part of another project[6], scientists cultivated different genotypes of sorghum, pearl millet and dual-purpose amaranth in salt-affected lands in southern Kazakhstan.

ICBA organizes regular training courses for women farmers in Uzbekistan.

[2]The network is made up of farmers (152 from nine villages in Karauzyak District, Uzbekistan), agro-pastoralists (15 small-scale livestock keepers from the Koybak cooperative and Ermak livestock farm) and women's groups (42 women in two groups from nine villages of Karauzyak District), who showed interest in adopting mixed farming, improved winter forage production and agro-pastoral production systems.

[3]CRP Drylands Systems – CGIAR/Russian Government

[4]Use of Non-Conventional Agricultural Water Resources to Strengthen Water and Food Security in Transboundary Watersheds of the Amu Darya River Basin (UNCAWR) - USAID PEER

[5]Cross-regional Partnerships for Improving Food and Nutrition Security in Marginal Environments of Central Asia – ICBA

[6]Promotion of high-yield forage crops in short-farming rotation system under sprinkler irrigation in marginal lands (Kazakhstan) – Ministry of Agriculture of Kazakhstan

Improved water management is also a crucial part of climate change adaptation strategies. Under the near-real time monitoring initiative[7], scientists linked data from sensors located in Oman, the UAE, Tunisia, Jordan and Yemen with satellite-based modelling to determine values for actual evapotranspiration. Using this data and resulting maps it was possible to understand better water consumption and productivity of current agricultural systems. These can then be used to focus water-saving activities in these areas.

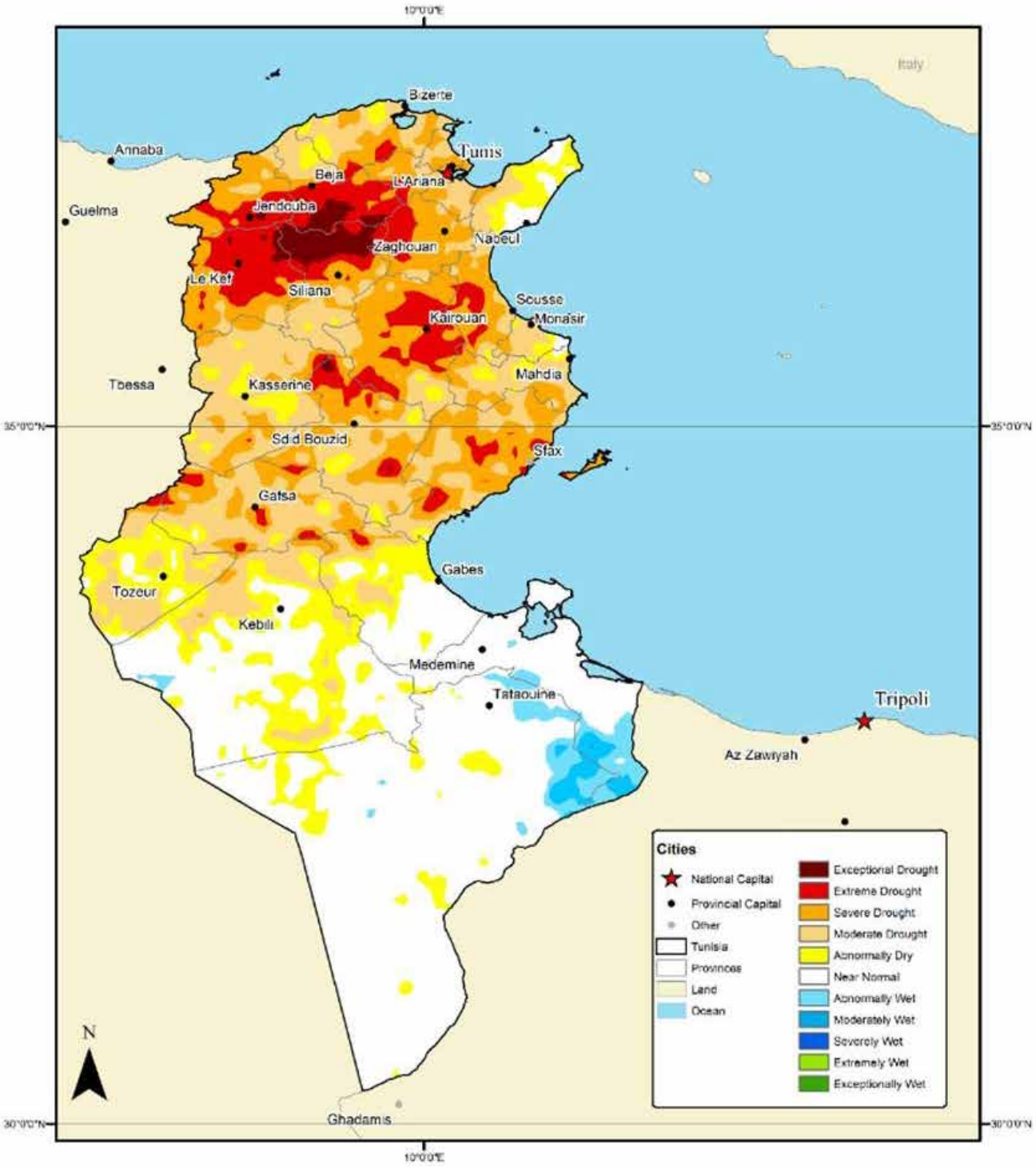
In 2016 severe drought affected both North Africa and parts of the Levant causing great hardship to many and economic and environmental challenges that can take years to recover from. With climate predictions indicating a likely increase in the areas affected and the severity of the events, drought is understandably a focus of current projects. To this end, a drought monitoring system was developed and tested for the MENA region under the MENA-RDMS project, undertaken by ICBA jointly with the Food and Agriculture Organization of the United Nations (FAO) and the University of Nebraska – Lincoln, and with complimentary input from the FAO drought[8] and drought monitoring[9] projects. These technical developments went hand in hand with an in-depth needs assessment of existing drought management systems and the needs of the many stakeholders involved. Through a series of stakeholder town hall meetings, focus groups and interviews in Jordan, Lebanon and Morocco, new insights on the challenges, opportunities and system needs of key stakeholders were gained and are now being used to steer the management system developments. These assessments showed how different the current drought management systems are in the four countries and the challenges national and local governments, businesses and civil society groups face in mitigating and managing the impacts.

In a new project started in 2016 for the World Bank, the links of past droughts and their impacts to large- scale atmospheric changes such as El Nino Southern Oscillation, the North Atlantic Oscillation and the Mediterranean Oscillation were explored for Morocco, Tunisia, and Lebanon. This analysis is important not only in terms of understanding past drought events and the devastating impacts they had had over the last 50 years, but it also starts to help in the development of early warning systems. These large-scale atmospheric oscillations are extensively monitored so that if their dynamics are found to be linked to drought occurrence, any changes can help alert governments of likely drought events from three to six months ahead. This work is at an early stage but the analysis so far is encouraging.

Using this data and resulting maps it was possible to understand better water consumption and productivity of current agricultural systems. These can then be used to focus water-saving activities in these areas. In 2016 severe drought affected both North Africa and parts of the Levant causing great hardship to many and economic and environmental challenges that can take years to recover from. With climate predictions indicating a likely increase in the areas affected and the severity of the events, drought is understandably a focus of current projects.

[7]Application of near-real time monitoring for irrigated agriculture in MENA – USAID NWC Program
[8]Support to the Water Scarcity Initiative Work Plan for Agricultural Drought Monitoring in the Near East and North Africa Region – FAO
[9]Drought monitoring for MENA: designing a regional system – USAID NWC Program

Tunisia Composite Drought Index
December 2015



Scientists at ICBA develop different maps to monitor droughts in the MENA region.

Crop Productivity and Diversification

ICBA's efforts under this theme contribute to:

Crop productivity and diversification is part and parcel of ICBA's initiatives in marginal environments. This is because one way to help smallholder farmers working in unfavorable agricultural conditions is to introduce alternative and non-traditional crops. To adapt to problems of growing salinity and water shortage, made worse by climate change, farmers need to diversify into other crops that are more tolerant of these conditions and learn to make better use of available land and water resources. ICBA works with national agricultural research systems (NARS), extension services and farmers to develop, test and introduce agricultural practices, technologies and crops that are most suitable for marginal agriculture. For example, drought-, heat- and salt-tolerant crops like quinoa have potential for improving livelihoods of smallholder farmers.

In 2016 ICBA continued its long-term program on quinoa targeting countries in Central Asia, and West Asia and North Africa (WANA). Researchers carried out pilot trials of five quinoa lines under different agro-climatic conditions in Uzbekistan, Tajikistan and Kyrgyzstan, with positive results on yield which were presented at an annual meeting in Kyrgyzstan. They also introduced quinoa lines through collaborative projects in the northern emirates of the UAE, Egypt and Lebanon with some promising results. For example, Egyptian farmers produced nearly 100 kg of seed, and two private food companies began contracting them to produce quinoa.

In collaboration with the MoCCaE, ICBA also continued to study the effect of sowing density on growth and productivity of quinoa in its experimental fields and the Al Dhaid Agricultural Innovation Center, the UAE.

ICBA convened an international conference on quinoa in Dubai, the UAE, from 6 to 8 December 2016. Titled "Quinoa for Future Food and Nutrition Security in Marginal Environments", the conference was co-organized by the MoCCaE, Zayed University, the IsDB, the Arab Bank for Economic Development in Africa (BADEA), with a technical contribution of FAO. More than 150 leaders, policy-makers, scientists, experts and professionals from over 48 countries came together to discuss and share the latest developments in quinoa research, production and trade around the world, and develop a set of recommendations for quinoa cultivation in marginal environments.
Following the conference, the delegates adopted the Dubai Declaration on the Production of Quinoa for the Future Food and Nutrition Security in Marginal Environments and agreed to form a global consortium on quinoa.

Under a project with the King Abdullah University of Science and Technology (KAUST), scientists began a field trial of 1,648 quinoa lines which had been collected from germplasm around the world in collaboration with KAUST, Kiel University, Germany, and Brigham Young University, USA. The trial aims to phenotype and genotype the quinoa lines under both saline and freshwater conditions.

ICBA's extensive work on quinoa served as a basis for an international conference in Dubai, the UAE, which brought together more than 150 participants from over 48 countries. One of the outcomes of the conference was the publication of the Dubai Declaration on the Production of Quinoa for the Future Food and Nutrition Security in Marginal Environments.

Another collaborative project with KAUST saw scientists conduct a series of trials that focused on barley. The study, which involved 1,875 barley accessions and was carried out in ICBA's experimental fields, looked at the crop's heat and salinity tolerance. Its findings were published in Scientific Reports. Under a project funded by Phosboucraa Foundation, Morocco, ICBA continued joint trials with the Halib Essaquia Al-Hamra Coop and the National Institute for Agricultural Research to evaluate the growth and productivity of several field crops with proven or potential salt tolerance. This work is aimed at studying their adaptation and yield potential before they can be introduced to farmers in marginal and salt-affected areas in Laayoune region of Morocco.

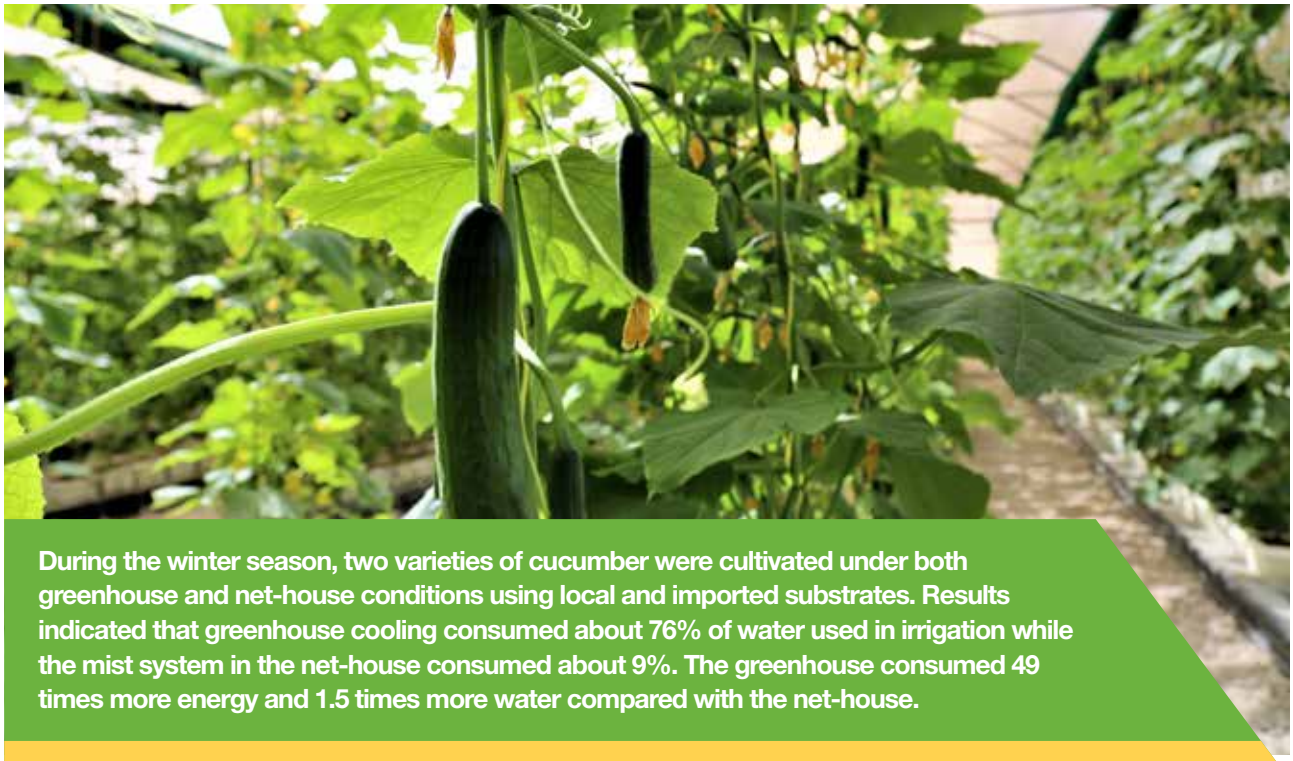
Trials on quinoa and other crops lay the groundwork for ICBA's seed production programs targeting smallholder farmers. In 2016 more than 1,800 kg of barley, triticale, pearl millet and sorghum seed were distributed to NARS partners in Egypt, Jordan, Mauritania, Lebanon and the UAE under the CODRA project. Moreover, some partners began seed propagation of quinoa, sunflower and safflower. As part of a USAID-funded project[10], ICBA also helped to install seed harvesting and processing units with a daily capacity of more than 10 tonnes, and carried out training events for technical and extension staff, and farmers in Egypt. This work resulted in the production of 2,500 kg of seed of various crops, which was given to an additional 300 farmers. Scientists also multiplied quinoa seed of five ICBA lines and distributed it

Leaders, scientists and experts from around the world gathered at one of the biggest international conferences dedicated to quinoa since 2013 was declared the International Year of Quinoa by the United Nations.

[10]Model for seed production of resilient salt-tolerant crop species for climate-smart agriculture in Egypt

Scientists located species belonging to different plant families in various parts of the UAE during a series of botanical explorations. Apart from collecting specimens of the plant species, data on their population and habitat, including their geographical locations, was also recorded.

Dr. Ismahane Elouafi, Director General, received the Khalifa International Award for Date Palm and Agricultural Innovation at a ceremony on 15 March 2016 in Abu Dhabi, the UAE, from H.H. Sheikh Nahayan Mubarak Al Nahayan, Minister of Culture and Knowledge Development of the UAE.



During the winter season, two varieties of cucumber were cultivated under both greenhouse and net-house conditions using local and imported substrates. Results indicated that greenhouse cooling consumed about 76% of water used in irrigation while the mist system in the net-house consumed about 9%. The greenhouse consumed 49 times more energy and 1.5 times more water compared with the net-house.

among different organizations in Morocco, Pakistan and the UAE.

As part of the center's efforts to document the flora of the UAE, researchers carried out a series of botanical expeditions in the emirates of Ras al-Khaimah, Abu Dhabi, Dubai and Fujairah. As a result, they discovered and documented 14 wild plant species that had not been reported to exist in the country before. Their findings were published in peer-reviewed journals.

ICBA also continued to work with different partners to study the impact of salinity on date palm varieties from the Arabian Peninsula. This work focused on evaluating the effects of salinity and irrigation management on water use and date palm production across different varieties. Its objective was to map the effect of salinity on the growth and productivity of date palms.

As a continuation of this effort, the center began a new project[11] in collaboration with the EAD, and a research team from Plant & Food Research, a New Zealand-based science company, and Massey University, New Zealand. The project investigated water use efficiency of irrigation of date palms with saline water. Results showed that considerable savings of water could be achieved with real-time irrigation. The project is aimed at developing a model of date palm irrigation management at different salinity levels. ICBA's long-running research on date palms was recognized with the Khalifa International Award for Date Palm and Agricultural Innovation.

Scientists also continued research on improving water and energy use efficiency in protected agriculture. They conducted a series of trials in greenhouse and net-house conditions to study the production of cherry tomato, round tomato, eggplant, sweet pepper, cucumber and sweet melon. Results showed considerable water and energy savings in net-house systems. They were presented to the Khalifa Fund and the MoCCaE. As a result, the net-house system was adopted by the Khalifa Fund for dissemination among farmers in the UAE.

[11]Estimation of water demands in date palm monitoring project (date palm sap flow) – EAD

Aquaculture and Bioenergy

ICBA's efforts under this theme contribute to:

Experiments are under way at the Marine Research Center in Umm al-Quwain, the UAE, to investigate Salicornia production with seawater in a coastal desert area.

As part of this project, preliminary environmental guidelines were also developed for the safe use of reject brine for crop and fish production. The project was a finalist under the category Farm Innovation Award - Agriculture at the AGRAME exhibition in 2016.

As water and other resources are scarce in marginal environments, it is important to find integrated solutions to make the most of what is available. ICBA works to develop production systems that combine agriculture and aquaculture so that water and nutrients are recycled and wastage minimized.

As conventional brine disposal systems are expensive and unproductive, ICBA has since 2014 been looking into the profitability of the freshwater- and brine-fed Integrated Aqua-Agriculture System (IAAS). An IAAS approach is implemented to make use of the reject brine produced from small-scale reverse osmosis units installed by farmers to desalinate water for irrigation. The reject brine is used to grow fish and then the aquaculture effluents are directed to cultivate halophytes.

In 2016 ICBA completed a USAID-funded project[12] to study the economics of using reject brine in arid and semi-arid areas through IAAS. Results showed that higher yields could be obtained in the net-house compared to the open field. In the net-house, multiple crop growth cycles were achieved resulting in higher profitability. What is more, irrigating salt-tolerant forages and other halophytic species with reject brine led to positive returns. For example, Salicornia biomass production increased by three times when water from tilapia farming was used for irrigation compared with the direct use of reject brine. As part of this project, preliminary environmental guidelines were also developed for the safe use of reject brine for crop and fish production. The project was a finalist under the category Farm Innovation Award - Agriculture at the AGRAME exhibition in 2016. Based on this research, ICBA submitted a proposal to EXPO2020 entitled “Inland and coastal modular farms for climate change adaptation in desert environments” in collaboration with the MoCCaE. The proposal was successful and got a grant of 100,000 USD for one year.

Under the project on Salicornia[13], scientists continued to evaluate 18 Salicornia bigelovii genotypes in pilot trials for potential large-scale cultivation. In collaboration with BITS Pilani University, ICBA started a new set of chemical analyses for Salicornia seeds to study the impact of salinity treatments on saponin, protein, ash and oil content. Part of the results were published in the Australian Journal of Crop Science.

In partnership with the MoCCaE, ICBA also launched a new project[14] to explore the possibility of growing Salicornia as a high-potential halophytic crop adapted to UAE climatic and soil conditions using seawater and drainage water from fish tanks. The project will specifically study the feasibility of seawater-based agriculture in coastal areas and the potential for scaling out Salicornia production. Initial results suggest that Salicornia plants grow well under highly saline conditions in coastal desert environments of the UAE.

[12]Improving Economics of Using Saline Water in Arid and Semi-Arid Areas through Integrated Aqua-Agriculture Systems
[13]Evaluation of Salicornia bigelovii at high salinity levels and management practices in the United Arab Emirates
[14]Establishment of Salicornia pilot field trials at the Marine Research Center (MRS) in Umm al-Quwain – ICBA and MoCCaE

Policies for Resilience

ICBA's efforts under this theme contribute to:

Policy support is an integral part of ICBA's efforts to improve agricultural production and ensure sustainable use of natural resources in marginal environments. The center's work is aimed at informing evidence-based policies and strategies. ICBA works with partners to carry out socioeconomic studies on food security and nutrition, as well as water and land management in marginal environments.

In 2016 ICBA continued its collaboration with the International Water Management Institute (IWMI) on a USAID-funded project[15] to support policy development for groundwater management in the MENA region. The relatively unchecked over-abstraction of groundwater is a serious issue in all MENA countries and this project aimed to examine the status of laws, regulations, enforcement and management of groundwater in six of them.

The work involved extensive reviews of existing local governance and legal frameworks in place and their implementation. Interviews were also undertaken with a large number and variety of groundwater users and managers to find out how effective the governance systems were and to highlight areas for further development. ICBA's work focused on groundwater governance in the emirate of Abu Dhabi and Oman. The project findings highlighted the relatively limited state of groundwater abstraction controls.

In brief: ICBA in the UAE

Throughout 2016 ICBA focused a number of efforts on research and development in the UAE. In cooperation with counterparts from the MoCCaE and EAD, scientists continued adaptive research on several plants, including Salicornia, quinoa and date palm, under different conditions. They assessed soil improvement technologies aimed at increasing fertility and reducing irrigation. The center also worked closely with many farmers. It continued collaboration to enhance, among other things, local forage production.

As part of climate change adaptation and mitigation activities, scientists converted global climate model data sets into national-scale information for the UAE. They combined the downscaled data from seven models to explore the likely impacts of climate change on temperature and precipitation in the country, identifying vulnerable agriculture and water management areas.

[15]Groundwater Governance in the Arab World: Taking Stock and Addressing the Challenges – USAID

In brief:
ICBA in IsDB member countries

As the IsDB is one of ICBA's main partners, the center strives to contribute to the bank's mission through wide-ranging activities in its member countries. In 2016 ICBA's research and development work covered regions like Central Asia, MENA, and Sub-Saharan Africa. In Uzbekistan, Kazakhstan, Tajikistan, and Kyrgyzstan, ICBA's efforts focused largely on improving land and water management, forage production and breeding programs for improved crop varieties, introduction and adaptation of quinoa, and capacity-building programs, through projects funded by the IsDB, USAID and the Government of Kazakhstan.

A set of separate projects in Egypt, Senegal, Lebanon, Mauritania, and Yemen looked at ways to improve forage production among smallholder farmers. In Egypt, for example, researchers ran a series of training courses for farmers and helped to establish local seed and dairy production units through a USAID project.

As part of a similar OCP Phosboucraa Foundation project in Morocco, scientists evaluated potential for forage production in highly salt-affected farms where maize yields are falling.

During the year, ICBA also placed a lot of focus on capacity building in IsDB member countries. For example, the center formed collaboration with the HSBC Bank and the American University of Cairo, Egypt, to initiate volunteering opportunities to support farmers in Egypt and the UAE. This capacity-building program enlists bank staff to work with farmers in the two countries.

A series of training programs throughout the year saw more than 200 farmers improve their knowledge and skills in Central Asian and Middle Eastern countries.
Under initiatives supported by IFAD and USAID and co-financed by the IsDB, ICBA trained researchers at institutes in Jordan, Tunisia, and Morocco in downscaling climate data and generating related local maps.
IsDB funding also helped to offer fellowships to six post-doctoral scientists to carry out research at ICBA. The center also provided internships to 12 students from leading universities around the world. In partnership with CRDF Global, IsDB co-financed a major grant competition linking young Arab women scientists from the MENA region with their US counterparts.
Thanks to the support of the IsDB and the Bill & Melinda Gates Foundation, ICBA also designed and piloted a novel leadership program for Arab women scientists in the region. Targeting Algeria, Egypt, Jordan, Lebanon, Morocco, Oman, Palestine, Tunisia, and the UAE, the Tamkeen program is aimed at empowering Arab women scientists to become future leaders in science.

Enabling Innovations

Strategic Alliances

Partnership is a keyword in the center's mission. In 2016 ICBA continued strengthening strategic alliances and building new ones.

One of the main achievements was the completion of the ICBA External Stakeholder Assessment. The document provided extensive analysis and evaluation of ICBA's position by different groups of stakeholders and identified two distinct groups of stakeholders such as funders and collaborators. It also provided a solid basis for partner engagement activities during the year.

As part of donor relationship efforts, the center held discussions with many organizations, including the Bill & Melinda Gates Foundation, ADFD, HSBC Bank, the World Bank, Expo 2020, Zayed University, and OCP Foundation. This work resulted in financial support by the Bill & Melinda Gates Foundation and the IsDB for the Tamkeen program, by ADFD for the Emirates Soil Museum, and by HSBC Bank for soil amendment research.

The center also carried on efforts to formalize its relationships with a wide range of partners. ICBA, for example, signed a memorandum of understanding with Zayed University, which was also a co-organizer of the international quinoa conference. The center also inked an agreement with the Islamic Organization for Food Security to cooperate in such areas as carrying out research, exchange of information, and addressing challenges in water, environment, income and food security.

Under its quinoa program, the center also partnered with two private companies from India and Pakistan to collaborate on quinoa seed production.

ICBA signed cooperation agreements with a wide range of partners in 2016

MERCY CORPS

Islamic Organization for Food Security

جامعة الملك عبدالله للعلوم والتقنية
King Abdullah University of Science and Technology

جامعة زايد
ZAYED UNIVERSITY

REZFREE
"We're curing the earth"

Vibha SEEDS
Passion. Purpose. Pride.

KINWA FOODS

وزارة التغير المناخي والبيئة
MINISTRY OF CLIMATE CHANGE & ENVIRONMENT

OFID
Uniting against Poverty

Republic of South Sudan
Ministry of Agriculture, Forestry, Cooperatives and Rural Development, South Sudan

صندوق أبوظبي للتنمية
ABU DHABI FUND FOR DEVELOPMENT

CRDF GLOBAL
INSPIRED BY PEOPLE | DRIVEN BY SCIENCE

THE AMERICAN UNIVERSITY IN CAIRO
الجامعة الأمريكية بالقاهرة

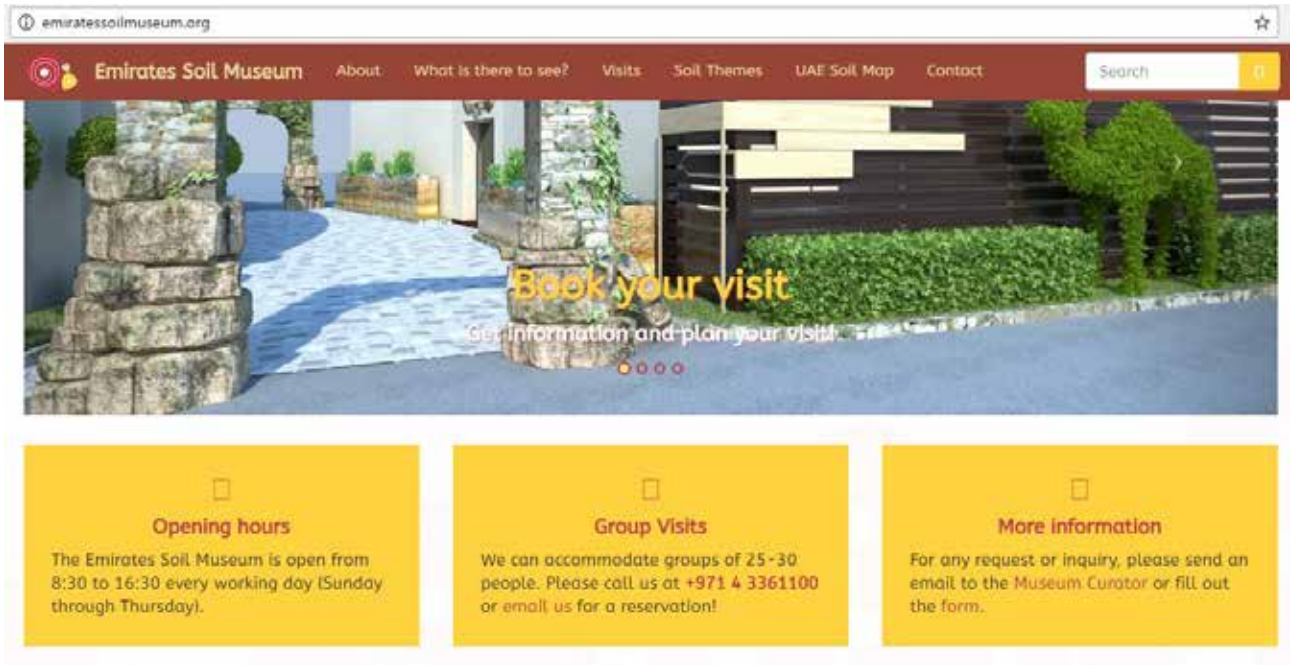
جامعة نيويورك ابوظبي
NYU | ABU DHABI

In 2016 ICBA partnered with Vibha Seeds, India, and Kinwa Foods, Pakistan, to promote quinoa production and processing in these countries. As part of this collaboration, ICBA will provide technical know-how and support to medium-sized farms.

Knowledge Hub

Knowledge generation and dissemination cuts across all ICBA's efforts. The center continued to make all information and knowledge available through its website and other communication channels.

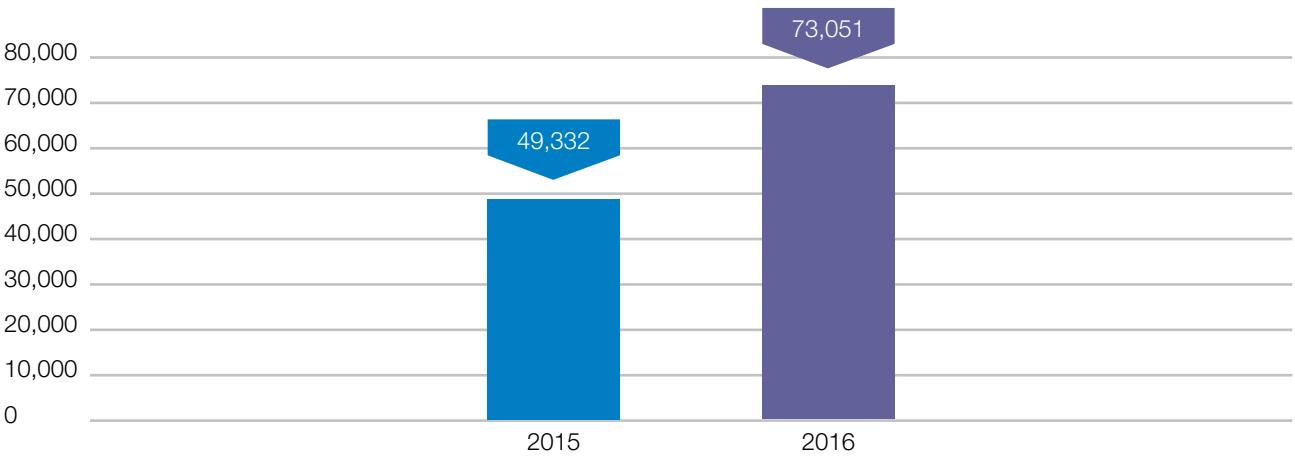
During the year, all scientific papers produced by researchers over the past five years, as well as corporate publications, were uploaded onto the website. The center also officially launched its redesigned website in English and Arabic. Moreover, ICBA developed websites for the international quinoa conference and the Emirates Soil Museum.



The Emirates Soil Museum website is available at www.emirtessoilmuseum.org. It has a number of features and visitors can book their visits to the museum online.

As part of this work, the MAWRED knowledge hub went live and was updated to reflect changing drought conditions in the MENA region. Monthly data on climate, vegetation and water variables was generated and then combined to develop drought maps for the key countries and the region as a whole.

Website visitors per year

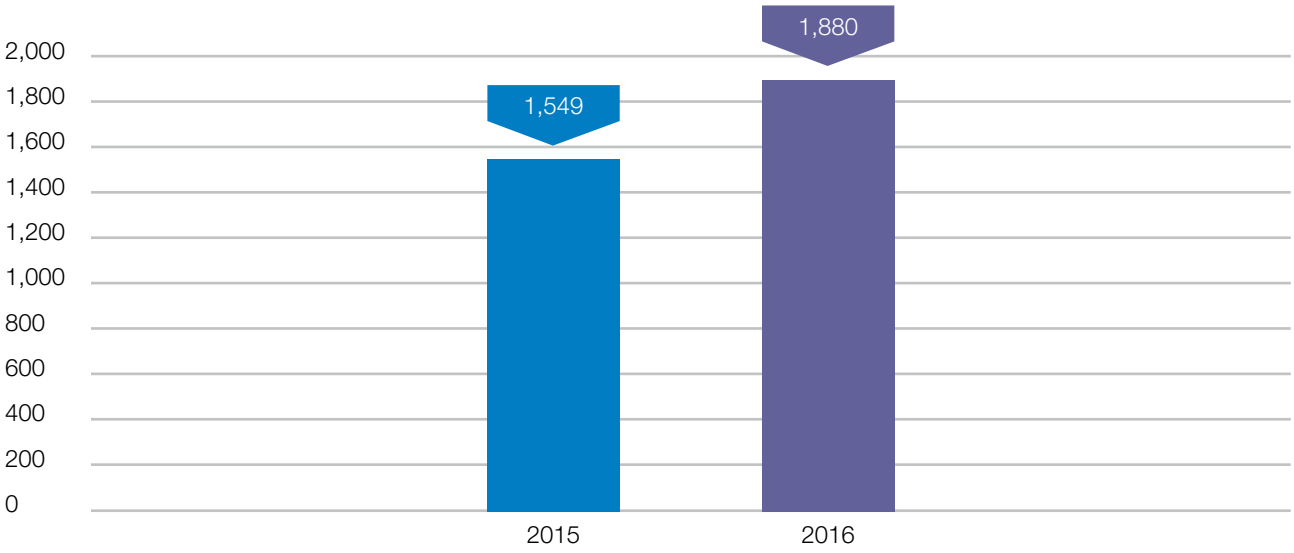


The center also worked to increase stakeholder awareness of its work through internal and external communications and media channels. Throughout the year, the center's work received considerable coverage in different media outlets, including news websites and TV. In particular, ICBA's quinoa program was featured in an article in the Guardian.

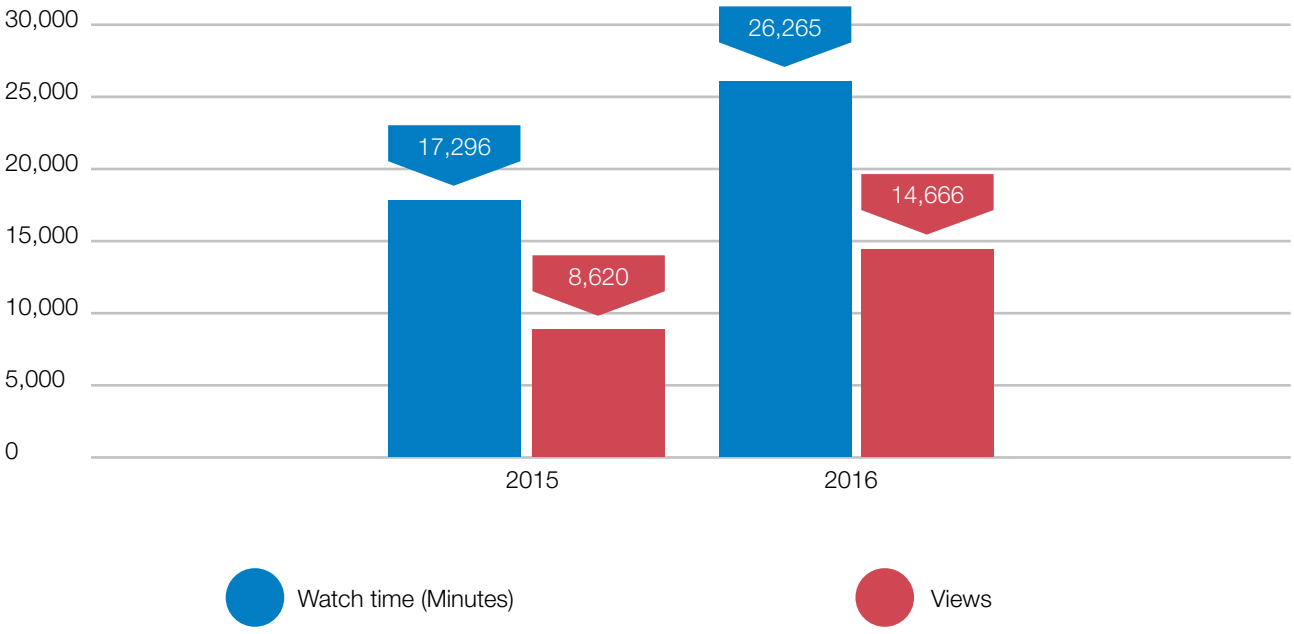
As part of this effort, the center carried out several communication campaigns that were reported by national, regional and international media outlets, including the National, Gulf News, Nature Middle East, Al Arabia, Yahoo.

Moreover, ICBA launched a new electronic newsletter to increase the reach and effectiveness of its communication and outreach efforts.

Facebook followers



YouTube views



Capacity Building

Capacity building is an essential component of most ICBA's activities. The center focused considerable efforts and resources on identifying capacity-building needs of different stakeholders, and creating capacity-building opportunities for, among others, young scientists with a particular focus on women, decision-makers, leaders and farmers in the MENA and other regions.

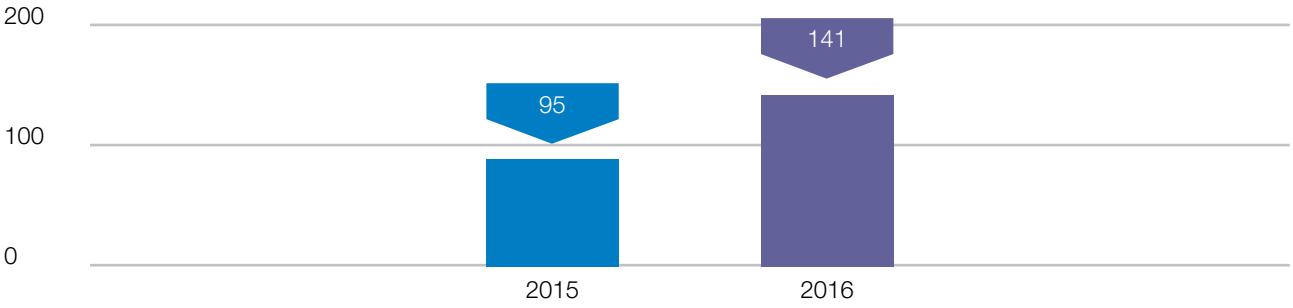
ICBA continued to work on strengthening the capacities of institutions, researchers, students, and farmers through short- and medium-term training courses, workshops, field days, internships, master's, doctoral and post-doctoral research programs.

Scientists conducted two BADEA-funded regional training courses in Ethiopia and Senegal on land degradation and soil management in salt-affected areas for a combined 52 participants from non-Arabic-speaking African countries.
In Central Asia, ICBA organized a training workshop and a field day jointly with the International Maize and Wheat Improvement Center (CIMMYT) office in Kazakhstan and the Kazakh Scientific Research Institute of Water Management. More than 45 participants from the region shared their knowledge on the reclamation of saline marginal lands through best biosaline technologies and practices at farm and community levels.

In Kazakhstan, an IsDB-funded regional training course on crop diversification and adaptation under climate change brought together 29 participants from five Central Asian and Caucasus countries.

The center also partnered with the International Atomic Energy Agency (IAEA) to conduct a training course for 11 participants from the Middle East. IAEA also supported on-the-job training on soil and water analysis and data interpretation for an expert from the Seychelles. Another capacity-building initiative saw 60 farmers, technical and extension staff learn about improving productivity of salt-affected lands and seed production of salt-tolerant crops in Egypt. The initiative engaged around 200 farmers in planting during the year. One of the highlights in 2016 was the launch of a grant competition targeting young

Total number of people trained

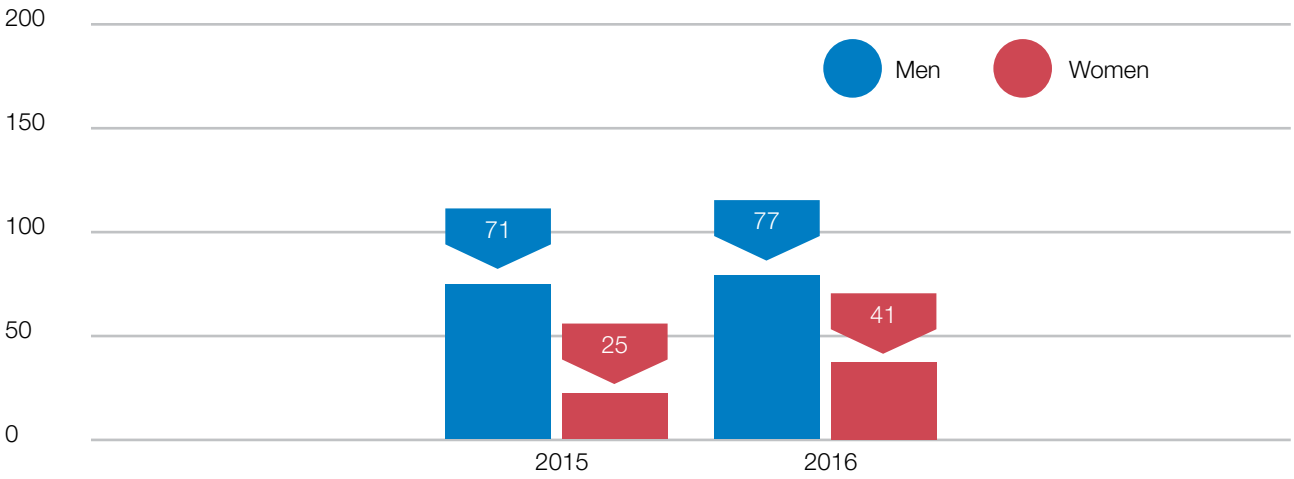


The total number of participants who took part in ICBA-organized specialized training courses.

Arab women scientists, organized jointly with CRDF Global, a US non-governmental organization. It was the first grant competition implemented by ICBA since the center's establishment. The competition encouraged collaboration between scientists in the MENA region and the US. Following the selection process, four joint teams of scientists were each awarded grants of 100,000 USD over three years for research projects.

ICBA also initiated the design phase of a new regional program to empower young Arab women scientists and leaders in agricultural research and development. Funded by the IsDB and the Bill & Melinda Gates Foundation, the design phase laid the foundation for the Tamkeen program, the first of its kind in the MENA region. The program will help to build and improve skills and capacities of a new generation of young Arab women scientists and leaders, contributing to the SDG on gender equality and women's empowerment. It will target women scientists and leaders in the UAE, Oman, Egypt, Jordan, Lebanon, Palestine, Algeria, Morocco and Tunisia.

People Trained Genderwise



ICBA pays special attention to involving women participants in specialized training courses.

As part of the preparation of the fully-fledged program, ICBA organized a series of workshops with young Arab women scientists in Jordan, Morocco and the UAE. Twenty-one women researchers from the nine target countries attended these workshops. As a result, three reports were produced on the current situation of the young women researchers in the Arab region. The first report is on Arab women scientists in agriculture and discusses characteristics, challenges and perspectives. The second one presents a review of capacity-building programs for Arab women researchers, while the third report highlights education, scientific research and development, and agricultural academic programs in the MENA region. As part of this exercise, a database of potential women researchers from the nine countries was developed.

In 2016 ICBA also provided internships to twelve (five men and seven women) students from different universities around the world. During the year, four (three men and one woman) fellows also joined the center as post-doctoral scientists.

Publications

One element of ICBA's knowledge generation is research papers. In 2016 ICBA continued to contribute to the advancement of agricultural research on marginal environments through a wide range of publications. Scientists produced to the tune of 50 articles, including 19 in international peer-reviewed journals.

A. Published in Peer-Reviewed Journals

1. **Alshankiti, A. & Gill, S**. (2016) Integrated Plant Nutrient Management for Sandy Soil Using Chemical Fertilizers, Compost, Biochar and Biofertilizers - Case Study in UAE. Journal of Arid Land Studies, 26 (3), pp. 101-107
2. **Chamekh, Z., Karmous, C., Ayadi, S., Sahli, A., Belhaj Fraj, M., McCann, I., Trifa, Y., Slim-Amara, H., & Araus, J.L.** (2016) Comparative performance of δ13C, ion accumulation and agronomic parameters for phenotyping durum wheat genotypes under various irrigation water salinities. Annals of Applied Biology doi: 10.111/aab.12332
3. **Choukr-Allah, R., Nanduri, K.R., Hirich A., Shahid, M., Alshankiti, A., Toderich, K., Gill, S., & Butt, K.U.R.** (2016) Quinoa for marginal environments: Towards future food and nutritional security in MENA and Central Asia regions. Frontiers in Plant Science, 7, pp. 1-11 (Available at: www.frontiersin.org)
4. **Al-Dakheel, A. & Hussain, M.I.** (2016) Genotypic Variation for Salinity Tolerance in Cenchrus ciliaris L. Frontiers in Plant Science, 7, article 1090
5. **Gill, S., Alshankiti, A. & Shahid, S.A.** (2016) Fate of Composted and Non-Composted Sewage Sludge in Sandy Soil in terms of Nitrogen Mineralization and Recovery of Organic Matter. International Journal of Advanced Research Foundation, 3 (11), pp. 4-10
6. **Hammami, Z., Sbei, H., Kadri, K., Jmel, Z., Sahli, A., Belhaj Fraj, M., Naser, H., Teixeira da Silva, J. A. & Trifa, Y.** (2016) Evaluation of performance of different barley genotypes irrigated with saline water in South Tunisian Saharan conditions. Environmental and Experimental Biology, 14, pp. 15-21
7. **Hirich, A., Fatnassi, H., Choukr-Allah, R. & Ragab, R.** (2016) Prediction of climate change impact on sweet corn grown in the south of Morocco using the SALTMED model. Irrigation and drainage, 65 (1), pp. 9-18
8. **Karamanos, A., Economou, G., Sotirakoglou, K., Lyra, D. & Papastavrou, A.** (2016) Assessing drought resistance strategies in bread and durum wheat landraces. Crop Science, 57, pp. 1-11
9. **Lyra, D., Ismail, S., Rahman Butt, K. & Brown, J.J.** (2016) Evaluating the growth performance of eleven Salicornia bigelovii populations under full strength seawater irrigation. Australian Journal of Crop Science, 10, pp. 1429-1441
10. **Malki, M., Choukr-Allah, R., Lhoussaine, B., Yassine, A.B., Hirich, A. & Reichert, B.** (2016) Evolution of groundwater quality in intensive agricultural zone: case of Chtouka-Massa Aquifer, Morocco. Arabian Journal of Geosciences, 9 (10), pp. 1-14 doi:10.1007/s12517-016-2592-6 (Available at: www.springer.com)
11. **Massimi, M., Al-Rifaee, M., Alrusheidat, J., Al-Dakheel, A., Ismail, F. & Al-Ashgar, Y.** (2016) Salt-tolerant Triticale (X Triticosecale Witt) Cultivation in Jordan as a New Forage Crop. American Journal of Experimental Agriculture, 12 (2), pp. 1-7
12. **Massimi, M., Al-Rifaee, M., Alrusheidat, J., Al-Dakheel, A., Al-Qawaleet, B. & Haddad, S.** (2016) Validating Farmers' Adoption for Salt-tolerated Crop Seeds in Jordan. Asian Journal of Agricultural Extension, Economics & Sociology, 10 (2), pp. 1-5
13. **Qureshi, A.S., Iftikhar, M.I., Ismail, S. & Khan, Q.M.** (2016) Evaluating heavy metal accumulation and potential health risks in vegetables irrigated with treated wastewater. Chemosphere, 163, pp. 54-61
14. **Qureshi, A.S. & Ismail, S.** (2016) Improving agricultural productivity by promoting low-cost irrigation technologies in Sub-Saharan Africa. Global Advanced Research Journal of Agricultural Science, 5 (7), pp. 283-292
15. **Qureshi, A.S. & Ismail, S.** (2016) Evaluating health risks of using treated wastewater for vegetables under desert conditions. Journal of Arid Land Studies, 26 (3), pp. 111-119
16. **Saade, S., Maurer, A., Shahid, M., Oakey, H., Schmöckel, S. M., Negrão, S., Pillen, K. & Tester, M.** (2016) Yield-related salinity tolerance traits identified in a nested association mapping (NAM) population of wild barley. Scientific Reports, 6: 32586, doi: 10.1038/srep32586
17. **Seif-Ennasr, M., Zaaboul, R., Hirich, A., Caroletti, G.N., Bouchaou, L., El Morjani, Z.E.A., Beraaouz, E.H., McDonnell, R.A. & Choukr-Allah, R.** (2016) Climate change and adaptive water management measures in Chtouka Aït Baha region (Morocco). Science of The Total Environment, 573, pp. 862-875 (Available at: www.sciencedirect.com)
18. **Shahid, M. & Rao, N.K.** (2016) New records of three Convolvulaceae species to the flora of the United Arab Emirates. Journal New Biological Reports, 5 (3), pp. 114-121


Land Use Planning and Policy Implications
Plants of the United Arab Emirates
Fawzi M Karim & Abdullah J Dakheel
Emirates Water Conservation Strategy
2010
Science, Policy and Politics of
Modern Agricultural System
United Arab Emirates Keys to Soil Taxonomy
Environmental Cost and Face of Agriculture in
the Gulf Cooperation Council Countries
Free Flow Reaching Water Security Through

19. **Shahid, M. & Rao, N.K.** (2016) Three new Malvaceae species to the flora of the United Arab Emirates. International Journal of Biodiversity and Species Research, 1 (1), pp. 39-44

B. Accepted in Peer-Reviewed Journals

1. **DeClerck, F.A.J., Jones, S.K., Attwood, S., Bossio, D., Girvetz, E., Chaplin-Kramer, B., Enfors, E., Fremier, A., Gordon, L.J., Kizito, F., Lopez Noriega, I., Matthews, N., McCartney, M., Meacham, M., Noble, A., Quintero, M., Remans, R., Soppe, R., Willemen, L., Wood, S.R. & Zhang, W.** (2016) Agricultural ecosystems and their services: the vanguard of sustainability? Current Opinion in Environmental Sustainability
2. **Qureshi, A.S., Akhund, N. & Ismail, S.** (2016) Heavy metal accumulation and microbial loading in vegetables grown with treated wastewater. Journal of Agricultural Sciences. Cambridge University: UK.
3. **Shuyskaya, E.V., Rakhamkulova, Z.F., Lebedeva, M.P., Kolesnikov, A.V., Safarova, A., Borisochkina, T.I. & Toderich, K.N.** (2016) Different mechanisms of ion homeostasis are dominant in recretohalophytes T. ramosissima under different soil salinity. Acta Physiologia Plantarum.
4. **Shuyskaya, E.V., Gismatullina, L., Rajabov, T., Khohlov, S. & Toderich, K.N.** (2016) Genetic diversity of two annual Salsola species (Chenopodiaceae) in relation to habitat type in desert plant communities. Biologia.

C. Published Conference Proceedings/Book Chapters

1. **Alirzayeva, E., Ali-zade, V., Shirvani, T. & Toderich, K.N.** (2016) Evaluation of wild halophytes of Aralo-Caspian flora towards soil restoration and food security improvement. In: Münir Öztürk, Muhammad Ashraf Ahmet Aksoy, M.S. A. Ahmad Khalid Rehman Hakeem (eds.) (2016) Plants, Pollutants and Remediation. Springer: 63-99.
2. **Aralova, D., Toderich, K.N. & Gafurov, D.** (2016) Impacts of climate anomalies on the vegetation patterns in the arid and semi-arid zones of Uzbekistan. LPS 2016 under European Space Agency, Prague, Czech Republic.
3. **Aralova, D., Toderich, K.N., Jarihanic, A., Gafurov, D., Gismatulina, L., Osunmadewa, B.A. & Abualgasim, M.R.** (2016) Environmental resilience of rangeland ecosystems: assessment drought indices and vegetation trends on arid and semi-arid zones of Central Asia. Proceedings of SPIE Meeting, 26 September 2016, Edinburgh, United Kingdom. doi:10.1117/12.2242563
4. **Aralova, D., Toderich, K.N., Jarihani, A., Gafurov, D. & Gismatulina, L.** (2016) Monitoring of vegetation condition using the NDVI/ENSO anomalies in Central Asia and their relationships with ONI (very strong) phases. Proceedings of SPIE Meeting. Edinburgh, United Kingdom. doi:10.1117/12.2242164
5. **Aralova, D., Kariyeva, J., Menzel, L. & Toderich, K.N.** (2016) Environmental resilience of rangeland ecosystems: Assessing climate driven land degradation in arid and semi-arid zones of Central Asia. Proceedings of the 10th International Rangeland Congress. Saskatoon, Canada, 16-22 July 2016. (Available at: http://www.irc2016canada.ca)
6. **Bekchanov, B., Rabbimov, A., Toderich, K.N. & Mukimov, T.** (2016) Processing technology of stalks of Tamarix and their practical application to improve the productivity of saline lands. Forming and development of agricultural science in the XXI century: selected scientific articles of Sherbakova N. A., pp. 240-244 (in Russian)
7. **Choukr-Allah, R,, Nghira, A., Hirich, A. & Bouchaou, L.** (2016) Water Resources Master Plan for Sustainable Development of the Souss-Massa River Basin. In: Choukr-Allah, R., Ragab, R., Bouchaou, L., Barceló, D. (eds.) The Souss-Massa River Basin, Morocco. The Handbook of Environmental Chemistry. pp 1-26, Springer: Berlin. doi:10.1007/698_2016_67
8. **Choukr-allah, R., Rao, N.K., Azi, H., Shahid, M., Alshankiti, A., Toderich, K.N., Gill, S. & Butt., K.** (2016) Quinoa for marginal environments: Towards future food and nutritional security in MENA and Central Asia regions. Frontier in Plant Science, 7, pp. 346-359
9. **Bergaoui, K., Belhaj Fraj, M., Khalaf, A., Zaaboul, R., Caroletti, G. & McDonnell, R.** (2016) The impact of 1.5°C and 2°C warming on durum wheat production: case of Tunisia. HAPPI Conference 20-22 September 2016. Oxford University, Oxford, UK.
10. **Hirich, A,, Choukr-Allah, R. & Nrhira A** (2016) Groundwater-Dependent Ecosystems in the Souss-Massa River Region: An Economic Valuation of Ecosystem Services. In: Choukr-Allah, R., Ragab, R., Bouchaou, L., Barceló, D. (eds.) The Souss-Massa River Basin, Morocco. The Handbook of Environmental Chemistry. pp. 1-34, Springer: Berlin. doi:10.1007/698_2016_73
11. **Hirich, A., Choukr-Allah, R., Nrhira, A., Malki, M. & Bouchaou, L.** (2016) Contribution of Seawater Desalination to Cope with Water Scarcity in Souss-Massa Region in Southern Morocco. In: Choukr-Allah, R., Ragab, R., Bouchaou, L., Barceló, D. (eds.) The Souss-Massa River Basin, Morocco. The Handbook of Environmental Chemistry. Springer: Berlin, pp. 1-14, doi:10.1007/698_2016_78

12. **Lebedeva, M.P., Shuiskaya, Ye.V. & Toderich, K.N.** (2016) Soil forming processes and genetic diversity of Haloxylon aphyllum in the deserts of Uzbekistan. In: Pavel Krasilnikov, Mariya Konyushkova & Ronald Vergas (eds.). Land resources and food security of Central Asia and Southern Caucasus. FAO: Rome, pp. 370-391
13. **Lyra, D., Robertson, S., Usman Akhtar M.J. & Ismail, S.** (2016) Sustainable Integrated Farming Systems for climate change adaptation in salt-affected areas. International Conference on Sustainable Agriculture in Pakistan, 17-19 November 2016, Faisalabad, Pakistan
14. **Malki, M., Choukr-Allah, R., Bouchaou, L., Hirich, A., Ait Brahim, Y., Krimissa, S., Hssaisoune, M., Nghira, A. & Barceló, D.** (2016) Assessment of Groundwater Quality: Impact of Natural and Anthropogenic Contamination in Souss-Massa River Basin. In: Choukr-Allah, R., Ragab, R., Bouchaou, L. & Barceló, D. (eds.) The Souss-Massa River Basin, Morocco. The Handbook of Environmental Chemistry. Springer: Berlin, pp. 1-20, doi:10.1007/698_2016_72
15. **Massino, I.V., Boboev, F. G. & Toderich K.N.** (2016) Pearl millet in Uzbekistan. Fan va ta'lim bosmahonasi: Tashkent, 28 pages (in Uzbek)
16. **Massino, I., Boboev, F., Toderich, K.N., Gupta, Sh., Ismail. S., Dakheel, A., Zhapaev, R., Popova, V., Baizakova, A. & Kalashnikov, P.** (2016) A new early maturing pearl millet variety Hashaki 1 of high quality and forage yield resistance to salinity in Uzbekistan. Scientific Research on Melioration and Water Resources. Collection of Scientific Articles. Kazakh Research Institute of Water Resources: Taraz, pp. 92-101
17. **Pain, C.F., Abdelfattah, M.A., Shahid, S.A. & Ditzler, C.** (2016) Soil-landform relationships in the arid northern United Arab Emirates. In: Zinck, J.A., Metternicht, G., Bocco, G. & Del Valle, H.F. (eds.) Geopedology – An integration of geomorphology and pedology for soil and landscape studies, pp. 211-225
18. **Ragab, R., Choukr-Allah, R., Nghira, A. & Hirich, A.** (2016) SALTMED Model and Its Application on Field Crops, Different Water and Field Management and Under Current and Future Climate Change. In: Choukr-Allah, R., Ragab, R., Bouchaou, L., Barceló, D. (eds.) The Souss-Massa River Basin, Morocco. The Handbook of Environmental Chemistry. Springer: Berlin, pp. 1-48, doi:10.1007/698_2016_74
19. **19. Shuyskaya, E.V., Lebedov, M.P., Kolesnikov, A.B., Borisochkina, T.I. & Toderich, K.N.** (2016) Chemical composition of salts secreted/emitted by Tamarix (Tamarix ramosissima), growing under different soil salinity levels. Publication of Soil Science Institute named after V.V. Dokucheva (in Russian). (Available at: http://esoil.ru/publications/bulletin/82_2016_ns.html . с. 109-121)
20. **Toderich, K.N.** (2016) Desert – resource use & new management opportunities. International workshop "The future management of grazing and degraded lands in a high-tech world & farmer field day on promotion and seed production of dual-purpose crops", Delegate Handbook, Almaty, Kazakhstan, pp. 1-28.
21. **Zhapaev, R., Omarova, N., Nikishkov, A., Yushenko, D., Iskandarova, K., Paramonova, I., Nekrasova, N., Toderich, K.N., Akhmetova, A., Zelenskiy, Y. & Karabaev, M.** (2016) Sorghum Yield Potential Assessment in Different Agro-ecological Zones of Kazakhstan (for livestock feed and fuel). Second international congress on global climate changes and biodiversity. Almaty, Kazakhstan, pp. 216-219

D. Accepted Conference Proceedings/Book Chapters

22. **Qureshi, A.S.** (2016) Challenges and opportunities of groundwater management in Pakistan. In: Groundwater Systems of South Asia. Springer.

E. Published Scientific Newsletters and Magazines

1. **Shahid, S.A.** (2016) Earth is shrinking for ecosystem services – where do we stand? Landscape Middle East. April Issue, pp. 12-13
2. **Shahid, S.A.** (2016) Earth Overshoot Day-Humanity consumed 100 percent nature by 8 August 2016. Landscape Middle East. August Issue, pp. 8-9
3. **Shahid, S.A.** (2016) Evolution of World Soil Day. Landscape Middle East. December Issue, pp. 18-19

F. Monographs

1. **Boboev, H., Hirano & Toderich, K.N.** (2016) Conservation Agriculture Technologies and Policies in Uzbekistan. Springer Japan Book Series (in print).
2. **Butnik, A.A., Toderich, K.N., Matyunina, T.E., Japakova, U.N. & Yusupova D.M.** (2016) Manual on fruit morphology and biology of seed germination of desert plants of Central Asia. Bilik Print Publisher: Tashkent, Uzbekistan. 396 pages.

Where We Worked in 2016

In 2016 ICBA carried out research and development projects in 28 countries.

List of Projects in 2016

Externally funded

1. Rehabilitation and management of salt-affected soils to improve agricultural productivity; Ethiopia, South Sudan (2015-2019)
2. Collaborative Program for Euphrates and Tigris (CPET); Turkey, Iran, Iraq, Syria (2013-2018)
3. Groundwater governance in the Arab world: taking stock and addressing the challenges; Egypt, Lebanon, Jordan, Tunisia, UAE, Oman, Yemen (2014-2016)
4. Mapping agricultural communities vulnerable to the impact of climate change and enhancing their livelihood in selected countries of MENA and SSA region (CODRA); Yemen, Egypt, Lebanon, Senegal, Mauritania (2014-2016)
5. Assessing soil amendments for agricultural intensification in marginal lands/urban landscape; UAE (2014-2017)
6. Improving agricultural soil properties using soil amendments to enhance water and nutrient use efficiency for crop production in dry lands and assessing these efficiencies via remote sensing techniques; Arabian Peninsula (2014-2016)
7. Improving economics of using saline water in arid and semi-arid areas through integrated aqua-agriculture systems (IAAS); Arabian Peninsula (2014-2016)
8. Using reflectance sensing in precision irrigation management and scheduling under arid conditions; UAE (2015-2016)
9. Drought monitoring for MENA: exploring and designing a regional system to support decision-makers better prepare for and be more resilient to future drought episodes; Jordan, Lebanon, Morocco, Tunisia (2015-2016)
10. Development of the MENA Regional Drought Management System; Jordan, Morocco, Lebanon, Tunisia (2015-2018)
11. Establishment of agricultural technology field-testing facility in KAUST's Research and Technology Park (KRTP); Saudi Arabia (2015-2016)
12. Promotion of high yield forage crops in short-farming rotation system under sprinkler irrigation in marginal lands; Kazakhstan (2015-2018)
13. Use of non-conventional agricultural water resources to strengthen water and food security in transboundary watersheds of the Amu Darya river basin; Uzbekistan, Turkmenistan, Tajikistan (2015-2018)
14. CGIAR research program on integrated agricultural production systems for the poor and vulnerable in dry areas (CRP Drylands Central Asia); Aral Sea region (2015-2016)
15. Technical assistance to PHOSBOUCRAA for Foum El Oued – Laayoune: improvement of forage production system on salt-affected farms; Laayoune – Morocco (2015-2018)
16. Feasibility of nano-filtration for desalinization of saline/seawater used for irrigating vegetable crops in greenhouse under Qatar conditions; Qatar (2015-2018)
17. The impact of the rhizosphere microbiota on root system development and tolerance to environmental constraints in cereals; UAE (2014-2017)
18. Application of near real-time monitoring systems for irrigated agriculture in MENA; Jordan, Oman, Tunisia, UAE (2014-2016)
19. 19. Model for seed production of resilient salt-tolerant crop species for climate-smart agriculture in Egypt; Egypt (2015-2018)
20. FAO "Support to the water scarcity initiative workplan within the domains of protected agriculture in the GCC countries and of agricultural drought monitoring in the NENA region", Near East and North Africa region (2015-2016)
21. Soil salinity and properties mapping using remote sensing, geographical information system and field validation – a case study of Bahrain and the UAE; Bahrain, UAE (2015-2017)

22. Date palm water use monitoring project (date palm sap flow): estimation of water demands in three varieties under different salinity and irrigation levels; Arabian Peninsula (2015-2017)
23. Genetic studies of salinity tolerance in barley in field conditions; UAE, Saudi Arabia (2013-2016)
24. Cross-regional partnerships for improving food and nutritional security in marginal environments of Central Asia; Uzbekistan, Tajikistan, Kyrgyzstan (2015-2017)
25. Unlocking the potential of protected agriculture to improve nutrition, contribute to food security, and cut water consumption in the GCC countries; UAE (2014-2016)
26. Establishing Salicornia pilot field trials at Marine Research Center (MRS) in Umm Al Quwain; UAE (2015-2016)
27. Tree planting demonstration project using Cocoon; UAE (2016-2017)
28. Scaling up small-scale irrigation technologies for improving food security in Sub-Saharan Africa; Burkina Faso, Mali, Niger, Senegal (2016-2020)
29. Food for the future producing more per drop of water, saving resources, increasing food security; UAE (2016)
30. Feasibility of investments in Afghan saffron; Afghanistan (2016)
31. Drought impacts from climate variability in the MENA region from El Nino to climate change; Tunisia, Morocco, Lebanon (2016-2017)
32. Young Arab Women Scientists Leadership Program (Tamkeen) inception and design phase; UAE (2016-2017)
33. Soil Museum; UAE (2016-2018)

Core funded

1. Long-term evaluation of biochar application rate on field crop irrigated with saline water; UAE
2. Plant generic resources for marginal environments: identification, multiplication & dissemination; UAE
3. Potential benefits and environmental risks associated with using treated municipal wastewater on vegetables, landscaping plants, forages and fruit trees in the UAE; UAE
4. Protected agricultural production for maximum water and energy use efficiency in hot arid climates; UAE
5. On-farm demonstration of seed production and adaptation to biosaline agriculture production systems (aquaculture); UAE
6. Molecular mechanisms involved in tolerance to salinity: towards selection of candidate genes for plant breeding in two cereals; UAE
7. Evaluation of elite date palm varieties for salt tolerance at various salinity levels at ICBA; UAE
8. Evaluation of Salicornia bigelovii under high salinity levels and management practices in the UAE; UAE
9. Evaluation and development of quinoa as an alternative crop for marginal environments of the UAE; UAE
10. Automated sensor-based control and monitoring of irrigation for research, demonstration and capacity-building; UAE
11. Nutrient management trial using Acacia ampliceps, Sporobolous arabicus and Paspalum vaginatum at different salinity levels; UAE

Sustainability

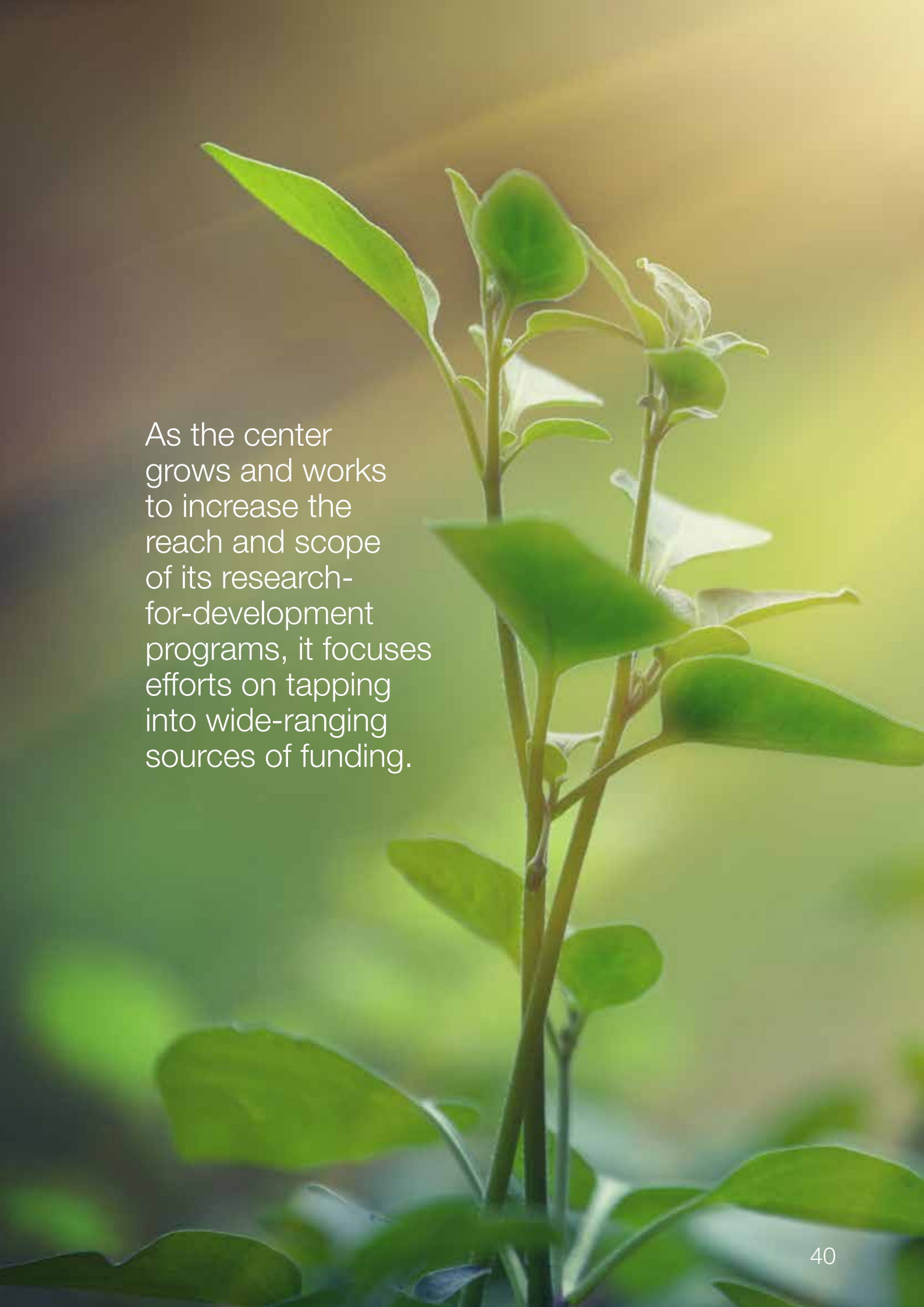
ICBA's work is supported by a large number of financial contributors and partners. This helps the center to continue to generate and spread much-needed knowledge and technology in marginal environments. As the center grows and works to increase the reach and scope of its research-for-development programs, it focuses efforts on tapping into wide-ranging sources of funding.

With a view to mitigating financial risks, strengthening its financial position and supporting the center's growth, ICBA's management worked on diversifying sources of funding and streamlining resource allocation within the center. It, thus, took more steps to establish an ICBA Waqf and the Endowment Fund in collaboration with the IsDB and the UAE Government. This work will help to ensure that ICBA continues to deliver on its mission of improving livelihoods of some of the most vulnerable communities around the world.
During the year, many donors contributed to the center's research and development efforts in different countries. And a considerable portion of the funding came from ICBA's core partners: the UAE Government (through MoCCaE and EAD) and the IsDB. This made it possible for the center to reach new heights and make progress in different areas of its work.

We would like to thank all financial contributors and partners for making this happen. In particular, we wish to thank the following organizations for their financial contributions to ICBA in 2016:

- Abu Dhabi Fund for Development
- American University in Cairo
- Arab Bank for Economic Development in Africa (BADEA)
- Arab Fund for Economic and Social Development
- Austrablend Pty
- Bill and Melinda Gates Foundation
- Development Alternatives, Inc.
- Flozyme Corporation
- Food and Agriculture Organization of the United Nations
- Green Good Ecotech
- Gulf Perlite LLC
- International Atomic Energy Agency
- International Center for Agricultural Research in the Dry Areas
- International Fund for Agricultural Development
- International Water Management Institute
- Kazakh Research Institute of Water Management
- King Abdullah University of Science and Technology
- Landlife Company
- Qatar Ministry of Environment
- National Academy of Sciences, USA
- OPEC Fund for International Development
- Phosboucraa Foundation
- Swedish International Development Cooperation
- United States Agency for International Development
- Zeoplant

With a view to mitigating financial risks, strengthening its financial position and supporting the center's growth, ICBA's management worked on diversifying sources of funding and streamlining resource allocation within the center. It, thus, took more steps to establish an ICBA Waqf and the Endowment Fund in collaboration with the IsDB and the UAE Government.



As the center grows and works to increase the reach and scope of its research-for-development programs, it focuses efforts on tapping into wide-ranging sources of funding.

Financial Statement

STATEMENT OF FINANCIAL POSITION
As at 31 December 2016

	Notes	2016 USD'000	2015 USD'000
ASSETS			
Current assets			
Cash and cash equivalents	5	**9,800**	9,699
Short-term deposits	5	**5,448**	7,609
Receivable from donors	6	**282**	288
Other receivables	7	**325**	57
Due from employees	8	**39**	54
Prepayments and other deposits	9	**10**	300
		15,904	18,007
Non-current asset			
Property and equipment	10	**6,619**	7,290
TOTAL ASSETS		**22,523**	**25,297**
LIABILITIES AND NET ASSETS			
Current liabilities			
Accounts payable to donors	11	**3,691**	5,260
Accounts payable to employees	12	**170**	446
Accounts payable to others	13	**917**	1,035
Accruals	14	**350**	181
		5,128	6,922
Non-current liability			
Staff terminal benefits	15	**442**	920
Total liabilities		**5,570**	7,842
Net assets			
Designated	16	**15,380**	15,224
Undesignated	16	**1,573**	2,231
Total net assets		**16,953**	17,455
Total liabilities and net assets		**22,523**	25,297

The financial statements were approved by the Board of Directors on May 4, 2017 and signed on its behalf by:

Dr. Ismahane Elouafi
Director General

Mr. Laksiri Abeysekera
Corporate Services Director

STATEMENT OF ACTIVITIES
For the year ended 31 December 2016

	Notes	**Unestricted 2016 USD'000**	**Restricted 2016 USD'000**	**Total 2016 USD'000**	Unrestricted 2015 USD'000	Restricted 2015 USD'000	Total 2015 USD'000
Revenue and gains							
Grants revenue							
Bilateral	17	**7,000**	**4,193**	**11,193**	7,000	4,745	11,745
Total grant revenue		**7,000**	**4,193**	**11,193**	7,000	4,745	11,745
Other revenue and gain	18	**7**	**-**	**7**	30	-	30
Total revenue and gains		**7,007**	**4,193**	**11,200**	7,030	4,745	11,775
Expenses and losses							
Research expenses		**(4,473)**	**(2,902)**	**(7,375)**	(2,824)	(2,494)	(5,318)
Collaborator expenses		**(222)**	**(1,259)**	**(1,481)**	(356)	(2,251)	(2,607)
General and administration expenses		**(3,179)**	**-**	**(3,179)**	(3,930)	-	(3,930)
Exchange gain or loss		**25**	**-**	**25**	-	-	-
Total expenses and losses	21	**(7,849)**	**(4,161)**	**(12,010)**	(7,110)	(4,745)	(11,855)
Financial income	19	**195**	**-**	**195**	214	-	214
Financial expenses	20	**(11)**	**(32)**	**(43)**	(17)	-	(17)
(Deficit)/surplus for the year		**(658)**	**-**	**(658)**	117	-	117

Performance Indicators

Publications	Number of externally peer-reviewed publications in 2016	19 publications in peer- reviewed journals
	Number of externally peer-reviewed publications accepted in 2016	4 publications in peer- reviewed journals accepted
	Percentage of scientific papers published with developing country partners in refereed journals, conference and workshop proceedings in 2016	60% of the total
Institutional Health	Percentage of women in senior management	50%
Financial Health	Long-term financial stability (adequacy of reserves)	292 days where the minimum benchmark is 90 days
	Cash management on restricted operations	0.08 where the benchmark is less than 1.00

2016 Board of Directors and Staff

Board of Directors

Professor Abdulrahman Sultan Alsharhan
Chairman; UAE

Mr. Adel Abdulla Al Hosani
Member; Abu Dhabi Fund for Development, UAE

Dr. Amit Roy
Member; International Fertilizer Development Center, USA

Dr. Jaber Eidha Al Jaberi
Member; Environment Agency - Abu Dhabi, UAE

Dr. Majid Sultan Al Qassimi
Member; Ministry of Climate Change and Environment, UAE

Mr. Mohammad Jamal Al-Saati
Member; Islamic Development Bank, Saudi Arabia

Ms. Roula Majdalani
Member; United Nations - Economic and Social Commission for Western Asia, Lebanon

Dr. Yvon Martel
Member; Canada

2016 Board of Directors and Staff

Management

Dr. Ismahane Elouafi, Director General
Mr. Laksiri Abeysekera, Director of Corporate Services
Ms. Seta Tutundjian, Director of Partnerships and Knowledge Management
Dr. Shoaib Ismail, Director of Research and Innovation

Scientists

Dr. Abdullah Al Dakheel, Principal Scientist - Field and Forage Crop
Dr. Abdullah Al Shankiti, Senior Scientist - Soil Management
Dr. Asad Sarwar Qureshi, Senior Scientist - Water/Irrigation Management
Dr. Dionysia Angeliki Lyra, Halophyte Agronomist
Dr. Kameswara Rao Nanduri, Plant Genetics Resources Scientist
Mr. Karim Bergaoui, Climate and Water Modeling Scientist
Dr. Khaled Masmoudi, Senior Molecular Biologist
Dr. Khalil Ammar, Principal Scientist - Hydrology/Hydrogeology
Dr. Kristina Toderich, Plant Scientist
Dr. Makram Belhaj Fraj, Agronomy Scientist
Dr. Muhammad Shahid, Geneticist
Dr. Muhammad Rahiz, Climate Change Modeling Scientist
Dr. Rachael McDonnell, Principal Scientist - Water Governance and Policy
Mr. Rashyd Zaaboul, Modeler - Climate Change
Dr. Redouane Choukr-Allah, Senior Scientist - Horticulture
Dr. Richard Willem Otto Soppe, Senior Scientist – Marginal Water Management
Dr. Shabbir Ahmad Shahid, Senior Scientist - Salinity Management
Dr. Susan Robertson, Senior Scientist - Agricultural Economist
Post-Doctoral Fellows
Dr. Abdelaziz Hirich
Dr. Amira Askri
Dr. Aweke Mulualem Gelaw
Dr. Hasan Boboev
Dr. Henda Mahmoudi
Dr. Giulio Nils Caroletti
Dr. Muhammad Iftikhar
Dr. Muhammad Junaid Usman Akhtar

Staff

Mr. AbdalQader M. AbdalRahman, Research Assistant - Field and Forage Crops
Mr. Abdumutalib Begmuratov, Senior Communications Specialist
Mr. Abdul Khaled, Senior Officer - Project Accounting
Mr. Ahmed Elsayed, Field Assistant
Mr. Ahmed Karim, IT Specialist
Mr. AlHareth AlAbdullah, Senior Technician - Irrigation Technology and Automation
Mrs. Amal A. Magzoub, Proposal Development Specialist
Ms. Alice Soliman, Senior Officer - General Accounting
Mr. Anil Kumar Vadakekundilil, Plumber
Mrs. Badryh Bochi, Office Manager - DG Office
Ms. Baedaa I. Khalil, Senior Officer - Human Resources
Mr. Balagurusamy Santhanakrishnan, Research Assistant - Halophyte Agronomy
Mr. Basel Al Araj, Research Assistant - Irrigation
Mr. Belal Abdel Rahman Wafiq Al-Salem, Officer - Admin and Government Relations
Mrs. Bindu Venugopal, Facilities Supervisor

Mrs. Celine Papin, Project Manager
Mr. Charbel El Khouri, Business Development Specialist
Ms. Diletta Ciolina, Project Specialist
Mrs. Dima Al-Kahhale, Senior Administrator
Ms. Elsy Melkonian, Journalism and Media Outreach Specialist
Mrs. Ereny Tawadrous, Senior Administrator
Mrs. Evelyn P. Reyes, Procurement Officer
Mr. Ghazi Jawad Al-Jabri, Capacity Building Specialist
Mrs. Imane Boujidane, Senior Executive - Procurement
Mrs. Irene Bolus, Finance Manager
Mrs. Jinky Viray Aglipay, Procurement Assistant
Mr. Jerson Songco Manalac, Storekeeper
Mr. Kaleem Ul Hassan Naeem, Laboratory Technician
Mr. Karam Elaraby Hafez Mohamed, Field Assistant
Mr. Khalil Mohamed Abdalla, Human Resources Manager
Mr. Khalil Ur Rahman Mohammad Bashir Butt, Senior Researcher - Halophyte Agronomy
Dr. Layla Al Musawi, Monitoring and Evaluation Advisor
Mrs. Lina Muneer Abu Baker, Officer - Human Resources
Ms. Marguerite de Chaisemartin, Project Officer
Mr. Mohy Eldin Mashael, Senior Officer – Admin and Government Relations
Mr. Muhammad Rahman Shah, Farm Machinery Operator
Mr. Murugan Veeran, Plumber
Dr. Mostafa Aboubakr, Visiting Scientist - Watershed Management
Mrs. Nada Kadhim, Knowledge Hub Specialist
Mr. Nazir Ahmed, Driver
Mr. Rafeek El-Madhoun, Senior Researcher
Mr. Richard Sulit, GIS and Database Researcher
Dr. Shagufta Gill, Research Associate
Mr. Saif Ul Islam, Field and Forage Crops Technician
Mr. Shahzad Ansari, Senior Assistant - General Maintenance
Mr. Showkat Nabi Rather, Journalism and Media Outreach Specialist
Mr. Sherzod Kosimov, Knowledge Hub Specialist
Mr. Sijimon Chamavalappil, Driver
Mr. Surya Gotame, Driver
Dr. Tesfaye Ertebo Mohammed, Project Officer
Mr. Thamer Abdulla Ahmed Abdulla, Museum Curator
Mr. Velmurugan Arumugam, Irrigation Technician
Mrs. Zharkynai Ashirbekova, Administrative Assistant
Mrs. Zeinab Chit, Receptionist

ABOUT ICBA

The International Center for Biosaline Agriculture (ICBA) is an international, non-profit research-for-development organization that aims to strengthen agricultural productivity in marginal and saline environments through identifying, testing and facilitating access to sustainable solutions for food, nutrition and income security.

For more information, please contact us at:

PO Box 14660, Dubai, United Arab Emirates
+971 4 336 1100
+971 4 336 1155
icba@biosaline.org.ae
www.biosaline.org

ICBAAgriculture

Proudly supported by:

UNITED ARAB EMIRATES
MINISTRY OF CLIMATE CHANGE
& ENVIRONMENT

هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI