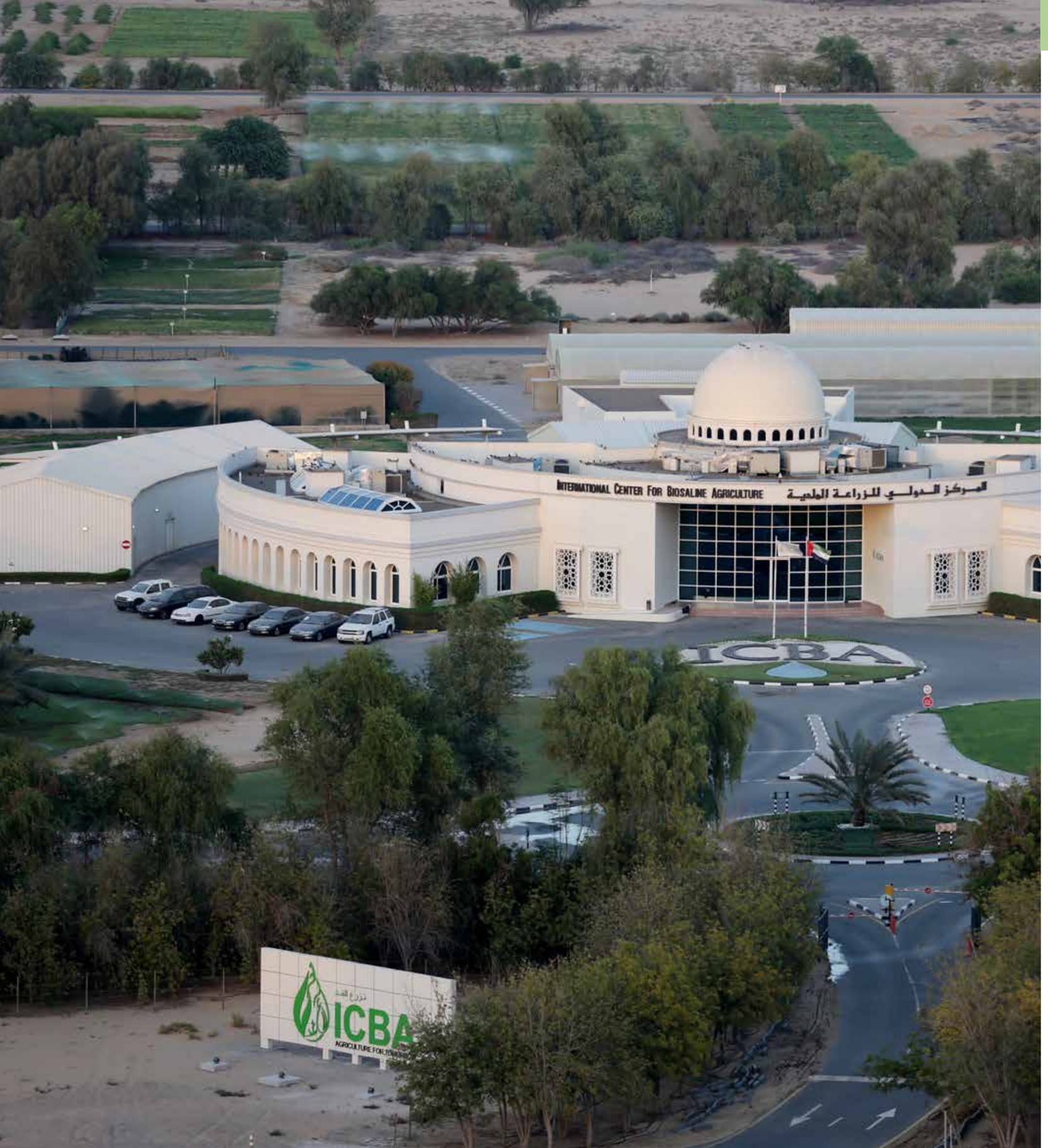
ICBA Annual Report 2014

Innovation—Impact—Partnership

نـزرع للغـد
ICBA
AGRICULTURE FOR TOMORROW



Vision

To be the global Center of Excellence for innovative agriculture in saline and marginal environments

Mission

To work in partnership to deliver agricultural and water scarcity solutions in marginal environments

Core Values

1. Professionalism and integrity
2. Partnership and teamwork
3. Excellence and innovation
4. Our people

Strategic Objectives

1. Improve generation and dissemination of knowledge (knowledge hub)
2. Expand food and bioenergy solutions
3. Facilitate competitive agri-business enterprises
4. Increase and enrich partnerships

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H.E. Dr. Ahmad Mohamed Ali Al-Madani,IDB President, and H.H. Sheikh Hamdan Bin Rashid Al Maktoum, Deputy Ruler of Dubai and Minister of Finance of UAE, during the ICBA agreement renewal in Jeddah, April 2014.

Acronyms and abbreviations

ADFSC	Abu Dhabi Farmers' Services Centre
BADEA	Arab Bank for Economic Development in Africa
CAP	Coordinated Agricultural Project
CODRA	Creating Opportunities to Develop Resilient Agriculture
CORDEX	Coordinated Regional Downscaling Experiment
CPET	Collaboration Program on Euphrates and Tigris
GCC	Gulf Cooperation Council
GCM	General Circulation Model
IAEA	International Atomic Energy Agency
ICBA	International Center for Biosaline Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDB	Islamic Development Bank
KIA	Kuwait Investment Authority
MAWRED	Modeling and Monitoring Agriculture and Water Resources for Development
MENA	Middle East and North Africa
MoEW	Ministry of Environment and Water
OCP	Office Chérifien des Phosphates
Sida	Swedish International Development Cooperation Agency
UAE	United Arab Emirates
USAID	United States Agency for International Development

Foreword

2014 was quite a busy year as our Center continued to implement its strategy for 2013-2023. We had several key events, including the Treated Wastewater Reuse Conference, Quinoa Science Forum, the 3rd International Salinity Forum, the 2nd International Conference on Arid Land Studies, the Global Crop Diversity Trust Seminar, and many training events on and off campus. All this helped us to disseminate our knowledge and messages on sustainable agricultural production innovations for marginal environments to a wider audience.

In October 2014, the Swedish International Development Cooperation Agency gave a very positive review of the “Collaboration Program on Euphrates and Tigris”, which resulted in the approval of the 4-year Phase II of the project. This was a major milestone for ICBA as we look ahead to diversifying our partners and donors, and expanding the scope and impact of our programs.

Impact of ICBA’s applied research work is our prime focus, and our Board has been increasingly encouraging the Center to move ahead with activities that increase the Center’s impact on the ground. We follow this course through the project called “Adaptation to Climate Change in West Asia and North Africa Marginal Environments through Sustainable Crop and Livestock Diversification”. In 2014, we continued to work with farmers and rural communities to develop successful modules for scaling up efficient seed production delivery systems, integrated forage production packages, and better dairy production and marketing options.

In line with ICBA’s research into neglected and underutilized species, scientists continued to screen new crops for food and fuel. In particular, work on quinoa shows great promise for this crop to become a viable alternative for marginal environments. Similarly, work on irrigating Salicornia with sea water to produce biofuel is now in advanced stages.

ICBA’s expertise on developing national strategies was once again acknowledged through the signing of an agreement with Kuwait Investment Authority (KIA) in August 2014. The seven-month study, led by ICBA, involved more than 25 international and Kuwaiti consultants from various institutions tasked with developing a Food Security and Investment Strategy for Kuwait along with road maps for implementation and monitoring.

In pursuit of our vision to become the global center of excellence for innovative agriculture in saline and marginal environments, we launched a number of internal institutional activities that aim to develop our capacity and institutional setup to meet the best international standards. Our new financial and administration system, once fully operational, will improve the monitoring and reporting of ICBA’s performance. Furthermore, the results of a comprehensive review of our human resources policies will be used to ensure that we are able to attract and retain the talent needed to achieve our strategic objectives. A new organizational structure that supports our strategy was approved by our Board during the past year.

Much was achieved, but more hard work lies ahead in our pursuit of ensuring increased food, nutrition and water security, more resilient environments and income for people living in marginal environments. We hope that we were able to capture in this report the diverse and exciting work that ICBA is carrying out.

Lastly, we would like to thank our donors and partners without whom none of this would have been possible.

Prof. Abdulrahman Alsharhan
Chair, Board of Directors

Dr. Ismahane Elouafi
Director General

Training women farmers in Egypt on how to maximize their income by producing yoghurt and cheese from milk

Key highlights of 2014

- Renewed support for ICBA for the next five years by the Government of the United Arab Emirates and the Islamic Development Bank
- ICBA launched its new brand image that conforms to its new strategy
- 20 ongoing projects in 27 countries
- Release of a promising local variety of pearl millet “Tamuz” and sorghum “Keshen” in Central Asia
- 84 new accessions of germplasm acquired by ICBA’s genetic resources team
- 4 high-yielding and heat-tolerant varieties of quinoa ready for moving to the next stage of expansion piloting in farms needed before scaling-up
- New hydroponic greenhouse facilities at ICBA headquarters were opened
- ICBA organized a regional treated wastewater conference that brought together 120 leading Arab and international experts to discuss the way forward
- ICBA scientists developed baseline climatology data sets for the whole Middle East and North Africa region to serve as references from which to measure future climate change conditions
- More than 1,223 people participated in ICBA organized training and knowledge-sharing events
- ICBA scientists authored and/or produced 81 publications during the year

Moving forward — renewed support

Quinoa growing at ICBA experimental sites in Yemen

2014 was an eventful year for ICBA in its stride forward

The main milestone achieved during the year was the renewed support for ICBA to deliver agricultural and water scarcity solutions in marginal environments by its two core donors and partners: the Islamic Development Bank (IDB) and the Government of the United Arab Emirates (UAE). A ceremony to renew the agreement, originally signed in 1996, took place during the 39th annual meeting of the IDB in Jeddah in the month of April. The agreement was extended for another five years. This will help ICBA to continue implementing its strategy and delivering on its mission, while looking into diversifying its donors in the future and attracting more funding sources.

In March, after consultations with its stakeholders, ICBA launched its new brand image that reflects its commitment to searching out and implementing promising solutions for agriculture and food security in marginal environments using marginal water resources. The new feel and look of ICBA is well aligned with the new strategy and emphasizes the importance of innovation, sustainability and partnership as ICBA's slogan is "Agriculture for Tomorrow". The new logo, an important element of the new brand, represents a promise of a greener tomorrow, while calligraphy reflects the Center's Arabic origins and the Latin characters reflect the international nature of the Center.

In September, we began a process to review our internal structure and human resources with the objective to reorganize our organization and internal procedures and policies to improve management and realign them with our new strategy. In November, the new organizational structure was approved, and in 2015 we look forward to taking the necessary measures to ensure that the structure and policies permit us to undertake effective research and development programs.

Last but not least, new members from regional and international organizations joined ICBA's Board of Directors.

> "By signing this agreement today, we are renewing our support and commitment to ICBA and to our contribution to poverty reduction in the world via agriculture in marginal environments"

H.H. Sheikh Hamdan Bin Rashid Al Maktoum, Deputy Ruler of Dubai and Minister of Finance, UAE

Towards food, nutrition and water security

The need for ICBA's research results has never been more apparent. Today, already about 20% of the world's arable land is saline, and forecasts estimate that every year we lose 1.5 million hectares of agricultural land to salinity. Climate change is exacerbating this problem as droughts especially in arid and semi-arid regions increase in severity and duration. In many places this has resulted in the use of low-quality water for irrigation coupled with inappropriate cropping systems and farm management practices which pose a serious threat to the health of arable lands.

ICBA's programs seek to help some of the most vulnerable marginalized farmers trying to live off the available marginal quality land and water through innovation, impact and partnership. Our applied research focuses on innovations that could be deployed in marginal environments and improve sustainable agricultural production. This will improve food, nutrition and water security which will have a positive effect on the lives of communities living in these areas.

Throughout our activities, we work together with local, regional and international partners and strive to improve the generation and dissemination of knowledge. In doing so, we empower farmers, extension service workers, research fellows in regional and national agricultural research centers, government officials and decision-makers.

Resilient salt-tolerant crops for climate-smart agriculture

Dispersed throughout marginal lands across the globe is a range of native and underutilized species of plants that tolerate and even thrive in saline environments. The thrust of ICBA's applied research programs is focused on identifying, assessing, screening and introducing new genotypes of nutritious, stress-tolerant and water-use efficient crop species that can help sustain agricultural productivity in salt-affected areas.

The past year was eventful for our resilient forages and crop production system. Our Center has been developing this system over the past decade as a feasible alternative production option that helps to rehabilitate degraded lands. For the third year in a row, the halophytic grass, shrubs and field crops planted in the western region of Abu Dhabi through strong support of Abu Dhabi Farmers' Services Centre (ADFSC) demonstrated excellent yield potential under higher salinity levels with less irrigated water.

Rehabilitation of degraded land in the Western Region of Abu Dhabi Emirate

In fact, the trials showed that ICBA's alternative crop production system can produce the same amount of forages as Rhodes grass, a popular forage crop in the UAE, with 44% less water requirements. Furthermore, introduction of these systems in Egypt and Yemen progressed well in 2014 through developing farm-based seed production systems for 5 crops in Egypt where 22 farmers participated, and 7 crops in Yemen where 54 farmers participated. Under this project,

Pearl millet Hashaki 1 has proven to be a good alternative crop for salt-affected lands in Uzbekistan

Amaranth growing at ICBA research facility in Dubai

ICBA strived to build capacity at the community level to ensure sustainable supply of these high-quality and resilient seeds at affordable prices. In addition, 6 training courses were held for 45 women to improve dairy production in Sahl El-Tina and Ras Sudr in Sinai, Egypt, over 2 years (2013-2014).

Our program in Central Asia saw the release of new promising local varieties of pearl millet “Tamuz” and of sorghum “Keshen”. This is in addition to the pearl millet variety “Hashaki 1” released in 2013. These new varieties are resistant to both biotic and abiotic stresses and were developed from the ICBA-ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) breeding material. Efforts were also concentrated on multiplying seeds of the selected genotypes of the crops suitable for the marginal environments of the Aral and Caspian Sea Basin. By the end of 2014, three farmer/community-based seed multiplication units on salt-tolerant cereals, legumes and forage perennial plants were set up. Researchers began collaborative work to develop a manual on seed morphology and biology of seed germination of halophytes in Central Asia.

Within the UAE, ICBA scientists tested new plant species to evaluate their performance and yield under various salinity levels. These species included amaranth, oat, sesbania, mustard and citrullus. Amaranth, a highly nutritive leafy vegetable, proved to be a promising crop. Oat and sesbania demonstrated moderate tolerance to salinity. Trials on mustard helped to identify three accessions of mustard with high tolerance to salinity.

During the past year, 84 new accessions of germplasm were acquired by ICBA’s genetic resources team. Furthermore, seeds of 150 salt-tolerant germplasm accessions of barley, triticale, sorghum, pearl millet, cowpea and quinoa were multiplied and disseminated to research partners in 12 countries.

In January, a customized decision support tool for irrigation management was installed on a plot of elite date palm varieties to find out optimum water requirements and effect on production. Soil water measurements taken throughout the year indicate that excess water (from 150-300 L/plant per day) is being applied in most cases to irrigate date palm plants.

In the field of genetic research, our scientists successfully identified in barley the gene HKT1;5 that is most likely associated with salt tolerance as it seems to play a key part in regulating Na^+ transport within the plant cells, as more tolerant varieties of barley showed a high level of the HKT1;5 gene compared with less salt tolerant varieties.

Moving forward on quinoa promise as a new crop for marginal lands

ICBA researchers stepped up their research on quinoa in 2014. Quinoa is a multi-purpose agro-industrial crop that can thrive in extreme soil and climatic conditions with cultivars that can cope with salinity levels as high as those of sea water. Seeds of the five top-performing accessions of quinoa were multiplied in large quantities using special isolation on ICBA farms during the 2013-14 cropping season for conservation and dissemination purposes.

Results from the model farms in the UAE for the 2013-2014 cropping season were very positive. Four of the genotypes produced grain yields of 10.5 tons per hectare and forage yields of 40 tons per hectare, more than double the average yield in Latin America. These yields were obtained with salinity of the irrigation water in the range of 15-20 dS/m. While these results were achieved under closely monitored experiment conditions, it is safe to say that they clearly indicate that the four high-yielding salt- and heat-tolerant varieties have outstanding potential as an alternative

ICBA continues its research on identifying quinoa varieties that are most suitable for saline and marginal environments

food crop for salt-affected lands.

In addition to field trials conducted by ICBA in the UAE, some promising quinoa varieties were successfully tested in Yemen, Egypt, Jordan, Syria, Oman, Uzbekistan, Kyrgyzstan and Azerbaijan. These trials aimed to establish adaptation capabilities of quinoa varieties. For example, in Yemen, three quinoa varieties were evaluated and yields ranged between 1.5 and 2.8 tons per hectare. Furthermore, 73 accessions of these varieties were selected for further improvement and evaluation in different agro-ecological zones.

By July 2014, a total of 146 accessions of quinoa were distributed, including 41 accessions within ICBA and 105 accessions to researchers and partners in 10 other countries besides the UAE.

Technological innovations for marginal environments

In marginal environments where agricultural production becomes more difficult with each passing year as water resources diminish and land degradation increases, technological innovations are central to ensuring that agricultural productivity can be sustained. Since its establishment, ICBA has been actively testing and assessing new technologies and techniques that can be adapted to the conditions of marginal lands.

Following detailed farm surveys carried out in Burkina Faso, Gambia, Mali, Mauritania, Niger, Nigeria and Senegal to test various irrigation technologies, California drip irrigation systems were found to be water-efficient and preferred by farmers. However, since lack of knowledge of production and irrigation technologies is the main challenge that limits the spread of efficient irrigation systems in sub-Saharan

H.E. Dr. Rashid Ahmed Bin Fahad, Minister of Environment and Water of the UAE, giving the opening speech during the regional Treated Wastewater Reuse Conference on 14 January 2014

Challenges and opportunities of reusing treated wastewater

With only 1.3% of the world's renewable fresh water, the Middle East and North Africa (MENA) region is the most water-scarce region of the world. To meet its growing demand for water, it is becoming increasingly important to explore new unconventional water resources such as treated wastewater.

Wastewater has been reused indirectly throughout history but the past few decades have witnessed the spread of formal and planned reuse. In recent years, ICBA has been actively involved in exploring innovative, productive and safe treated wastewater reuse applications for agricultural production in marginal environments.

In January 2014, ICBA organized a regional Treated Wastewater Reuse Conference that brought together 120 leading Arab and international experts to discuss the challenges and opportunities of reusing treated wastewater for agricultural production in the MENA region, share lessons learned, identify gaps and needs, as well as future directions.

Subsequently ICBA prepared a report that highlights the main recommendations of the experts, and is working to raise funds to support programs that address the gaps and needs for safe and effective treated wastewater reuse in the MENA region. The conference report is available at www.biosaline.org

Africa, ICBA organized in 2014 various farmer field days and training sessions on irrigation technologies, soil and nutrient management, crop production technologies and crop agronomy; training farmers, extension workers and local project staff in Mali, Nigeria and Niger.

In 2014, ICBA opened at its headquarters hydroponic greenhouse facilities which use technologically sophisticated and commercially proven horticultural techniques. These were combined with unique energy-saving innovations to test and adapt these technologies and develop best management practices under local conditions. With more than 14,000 hectares under protected agriculture and steadily growing in the Gulf Cooperation Council (GCC), research into increasing agricultural productivity while reducing high energy and water consumption of these facilities is imperative. The most common greenhouses use a pad and fans which consume a high amount of water and energy. ICBA scientists suggest using a net house with a mist system instead. This will help save water and energy.

Near real-time monitoring systems for managing irrigated agriculture based on soil-water content, salinity, leaf water potential and sap flow offer an innovative approach to drastically optimizing irrigation management. During 2014, ICBA launched a new program in the MENA region that aims to establish an innovative knowledge and data sharing platform that enables the dissemination of near real-time data. During the past year, 32 field sites in the UAE, Yemen, Tunisia and Jordan were retrofitted with weather stations and soil sensors that directly upload information to the internet using mobile telephone networks. Many farmers, young researchers, graduate students and extension staff were trained in using the technology.

Unconventional water sources are essential for marginal environments

The lack of adequate and sustainable water resources is the main constraint to improving agricultural production in most, if not all, marginal environments. In response to this challenge, ICBA scientists are exploring new unconventional water resources such as treated wastewater, industrial water, agricultural drainage and seawater.

Reuse of treated wastewater is of particular importance in many marginal environments, particularly the GCC countries, given steadily increasing volumes as the regional population grows. During 2014, ICBA continued its work in this area, undertaking experiments to evaluate the benefits and risks of reusing treated wastewater for agricultural production in Tunisia, Oman, Jordan and the UAE.

In Tunisia, Oman and Jordan, 44 experiments were carried out to evaluate 169 farm fields that are using treated wastewater. Additionally, 21 experiments were carried out to develop irrigation and soil management practices and delivery systems suitable for the safe and sustainable use of treated wastewater. Based on these experiments, appropriate guidelines for the safe use of wastewater in forage production are currently being developed by the partner countries.

In the UAE, experiments were carried out to compare the benefits and risks between using surface and subsurface drip irrigation systems when irrigating with tertiary level treated wastewater. Different crops including carrots, lettuce, eggplants, tomatoes, radishes, spinach, buffel grass, salvadora, fodder beet, barley, sorghum, triticale, pearl millet, and select

New greenhouse facility at ICBA

Using treated wastewater in agriculture in Jordan

date palm varieties were assessed. Preliminary results from laboratory tested products indicate the safe reuse of treated wastewater is possible in many crops except for leafy vegetables.

As freshwater sources decrease, farmers are looking for alternative waters. Brackish groundwater is increasingly being used. In many areas in the GCC countries, farmers are using small desalination units to desalinate brackish groundwater, which is generating highly saline brine that is jeopardizing the well being of the environment. During 2014, ICBA in collaboration with the International Water Management Institute has been examining the costs and potential revenue from a freshwater and brine-fed integrated aqua-agricultural system. The experimental system established at ICBA headquarters produces per day 100 m^3 of desalinated water and 150 m^3 of brine that is used for aquaculture followed by irrigating salt-tolerant forage grasses and halophytic plants.

New approaches to enhancing the property of soils in marginal environments

Soils are the basis of agriculture as they provide the medium upon which crops can grow. Soils in most marginal environments are prone to severe land degradation due to the desert and hot eco-environment in which they are found. ICBA scientists are actively working on assessing, identifying and adapting various organic and inorganic soil amendments that can improve soil health and subsequently agricultural production.

During 2014, ICBA researchers carried out field trials on maize and barley to evaluate the effects of applying four amendments for biomass production. Experiments were conducted under both open field and greenhouse conditions. Although the results are based on one season of cultivation, they show that there is a positive tendency for fresh biomass production to increase, sometimes twofold, when soil amendments are applied. ICBA scientists also evaluated the effect of using organic composting in improving seed germination of *Prosopis cineraria* and *Acacia tortilis*. This trial demonstrated that low-cost organic compost, prepared by farmers, can be successfully used to enhance soil properties, improve germination and agricultural production.

Experiments to evaluate the benefit of producing biochar from date palm and conocarpus waste and its effect on soil enhancement and subsequent biomass production were very successful. Plant materials were shredded and converted to biochar using low-tech, manual technology at ICBA. The produced biochar was then used in a comparative study on the use of biochar compost and biofertilizers for maize crop in sandy soils.

Results showed a 29% increase in fresh biomass of maize over the control sample.

Finally, in 2014 ICBA collaborated with the Ajman Sewerage Company to develop a comprehensive road map for proper utilization of sludge produced after treatment of wastewater in Ajman for soil enhancement as well as for the replacement or supplementation of fertilizer nutrients.

Bioenergy potential in marginal lands

For the past four years, ICBA scientists have been exploring ways to produce renewable bioenergy from salt-loving halophytes with saline water. Their trials focus primarily on very salt-tolerant plants that can thrive in unproductive lands where other food-producing crops cannot grow. Furthermore, many of the plant species the scientists test have a dual role of rehabilitating the land and producing bioenergy fuel.

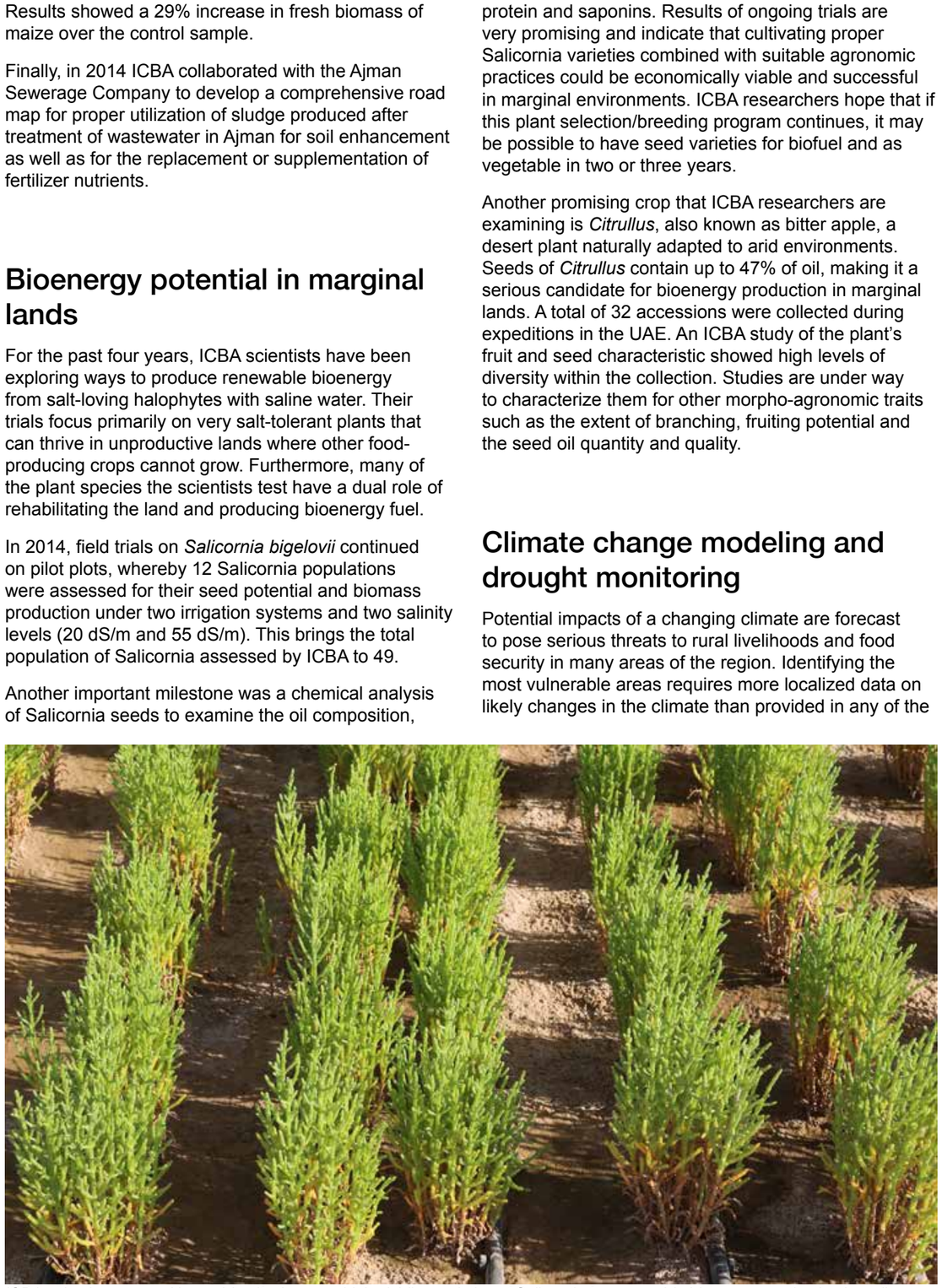
In 2014, field trials on *Salicornia bigelovii* continued on pilot plots, whereby 12 Salicornia populations were assessed for their seed potential and biomass production under two irrigation systems and two salinity levels (20 dS/m and 55 dS/m). This brings the total population of Salicornia assessed by ICBA to 49.

Another important milestone was a chemical analysis of Salicornia seeds to examine the oil composition, protein and saponins. Results of ongoing trials are very promising and indicate that cultivating proper Salicornia varieties combined with suitable agronomic practices could be economically viable and successful in marginal environments. ICBA researchers hope that if this plant selection/breeding program continues, it may be possible to have seed varieties for biofuel and as vegetable in two or three years.

Another promising crop that ICBA researchers are examining is *Citrullus*, also known as bitter apple, a desert plant naturally adapted to arid environments. Seeds of *Citrullus* contain up to 47% of oil, making it a serious candidate for bioenergy production in marginal lands. A total of 32 accessions were collected during expeditions in the UAE. An ICBA study of the plant's fruit and seed characteristic showed high levels of diversity within the collection. Studies are under way to characterize them for other morpho-agronomic traits such as the extent of branching, fruiting potential and the seed oil quantity and quality.

Climate change modeling and drought monitoring

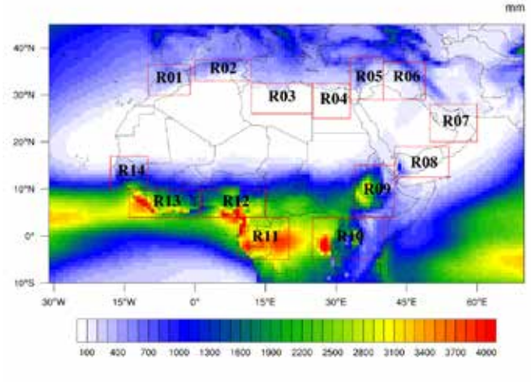
Potential impacts of a changing climate are forecast to pose serious threats to rural livelihoods and food security in many areas of the region. Identifying the most vulnerable areas requires more localized data on likely changes in the climate than provided in any of the major General Circulation Model (GCM) outputs as the resolution of the information in the GCM is around 200 km x 200 km for each grid square.



ICBA scientists are working to identify the most high-yielding varieties of Salicornia for renewable bioenergy production in saline conditions

In 2014 ICBA scientists focused on building up data sets of the climatology over the region for the last 30 years. Analyzing and synthesizing this data helps to set a baseline of the climatology for each region and country against which future conditions could be compared to highlight the nature of any changes. This baseline data was also used to compare with the data from each of the different models for the same period.

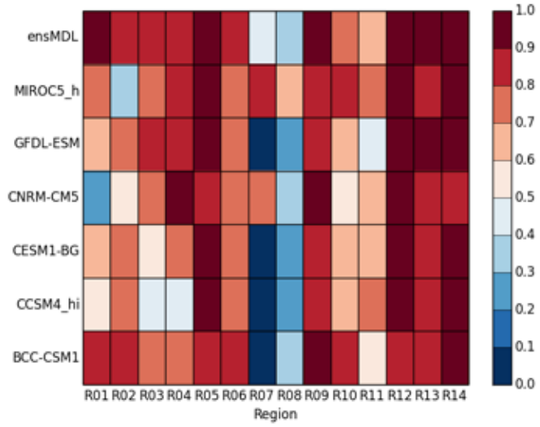
Comparing the outputs from many different models involves analyzing many terabytes of data. ICBA researchers used NASA Jet Propulsion Laboratories' Regional Climate Model Evaluation System (https://rcmes.jpl.nasa.gov/), an open-source analytical tool, to compare various models' outputs with observation data. At three different levels in the atmosphere, data on precipitation, geopotential height, temperature and humidity from six of the major GCM from international research centers (CCSM4; CESM1-BGC; GFDL-ESM; BCC-CSM1-M; CNRM-CM5; MIROC5) was compared with the data at 14 different locations on the land (Figure below).



ERAI mean total precipitation 1979-2013

In addition, sea surface temperatures, a major driver of climate, for 10 different locations around the region were compared between the observations and model outputs. Many different climatic comparisons were used to capture both seasonal and annual cycles. The following figure highlights the correlation of the annual cycle between model and observation data with the red highlighting a stronger match.

Not all models represent different parts of the MENA region equally. For example, the Gulf States and Yemen prove particularly difficult. Using many outputs from this analysis, the MIROC-5 model from Japan was then downscaled, with each set of activities taking over a month to complete. The results of these ongoing



Annual cycle CORR COEF

activities highlighted some of the likely impacts of climate change and these, when combined with other experiments shared through the Coordinated Regional Downscaling Experiment (CORDEX) website (http://wcrp-cordex.ipsl.jussieu.fr/) for the MENA domain, showed that decreasing temperatures and increasing evapotranspiration are likely to result in the next 30 years in many areas of the region.

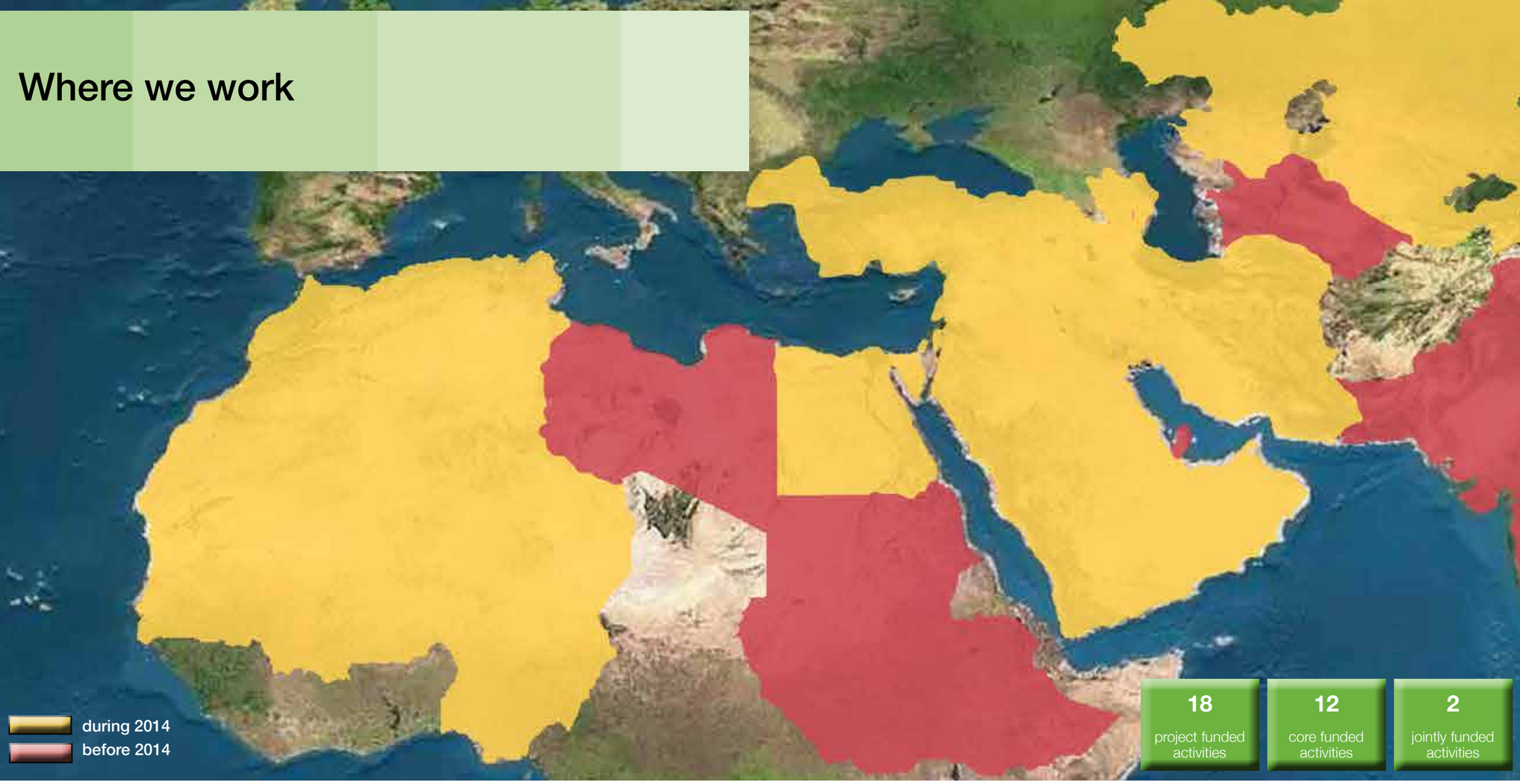
Policies for resilience

The Ministry of Environment and Water (MoEW) of the UAE commissioned ICBA to prepare the UAE Agricultural Strategy. The strategy included many key areas, including strategic challenges and opportunities for crop and livestock productivity, food security, economic and marketing, environmental sustainability, extension services, governance and regulations. ICBA developed the strategy in consultation with national stakeholders and leading international experts. In 2014, the strategy was presented and discussed at the Policy Council of MoEW. A follow-up meeting with ICBA's team was held at the ICBA headquarters to discuss the comments raised by the Ministry's Policy Council. ICBA submitted the final version of the strategy report and is awaiting final official approval from the MoEW.

In August 2014, KIA commissioned ICBA to lead an initiative that involved more than 25 international and Kuwaiti consultants from various institutions (ICBA, Stewart Routledge & Associates, University of Sydney, Pan Arab Research Center) and independent consultants, to develop:

1. A Food Security and Investment Strategy that aims to provide a comprehensive plan that enables Kuwait to ensure food security
2. A road map for Implementation and Monitoring

Where we work



18 project funded activities

12 core funded activities

2 jointly funded activities

2014 Projects

- Collaboration Program on Euphrates and Tigris (CPET); Turkey, Iran, Iraq, Syria
- Potential cooperative projects for farming systems, technology transfer and capacity building; UAE
- 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; UAE, Bahrain
- Plant genetic resources for marginal environments: identification, multiplication and dissemination; UAE, Uzbekistan, Kazakhstan, Tajikistan, Egypt, Jordan, Oman, Palestine, Syria, Tunisia, Yemen
- Modeling and Monitoring Agriculture and Water Resources for Development (MAWRED); Jordan, Tunisia, Palestine, Iraq, Morocco
- Protected agricultural production for maximum water and energy use efficiency in hot arid climates; UAE
- Sludge valorization feasibility study; UAE
- The genetics of salinity tolerance in barley: leveraging the US barley CAP project in saline environments; UAE, USA
- Municipal wastewater: importance, feasibility, and use; UAE
- Model for seed production of resilient salt-tolerant crop species for climate-smart agriculture; Egypt
- Evaluation of *Salicornia bigelovii* under high salinity levels and management practices; UAE
- Mapping agricultural communities vulnerable to the impact of climate change (CC) and enhancing their livelihood in selected countries of MENA and SSA regions (CODRA); Egypt, Lebanon, Senegal, Mauritania and Yemen
- Molecular mechanisms involved in tolerance to salinity: towards selection of candidate genes for plant breeding in two cereals; Tunisia, Algeria, Morocco, Egypt, Oman, UAE, Saudi Arabia
- Improving agricultural soil properties using soil amendments to enhance water and nutrient use efficiency for crop production; UAE
- Automated sensor-based control and monitoring of irrigation for research, demonstration & capacity building; UAE
- EAD date palm water use monitoring project; UAE
- On-farm demonstration of seed production and adaptation to biosaline agriculture production systems; UAE
- Resolving water salinity and shortages in Gaza workshop; Palestine
- Adaptation to climate change in WANA marginal environments through sustainable crop and livestock diversification; Egypt, Jordan, Oman, Palestine, Syria, Tunisia, Yemen
- Towards a sustainable food production on marginal saline lands in Aral and Caspian sea basins; Uzbekistan, Kyrgyzstan, Azerbaijan
- The sustainable use of treated wastewater in agriculture in the Arab world; Jordan, Oman, Tunisia
- Evaluation of sub-surface drip irrigation technology; UAE
- Evaluation of castor (*Ricinus communis*) and colocynthis (*Citrullus colocynthis*) for bioenergy seed stock production in marginal environments; UAE
- Improving economics of using saline water in arid and semi-arid areas through integrated aqua-agriculture systems (IAAS); UAE, Saudi Arabia, Oman
- Integrated crop and seed production systems under water/irrigation management in Sub-Saharan Africa; Burkina Faso, Senegal, Nigeria, Mauritania, Mali, Gambia
- Application of near real-time monitoring systems for irrigated agriculture in MENA; Jordan, Oman, Tunisia, UAE
- Potential benefits and environmental risks associated with using treated municipal wastewater on vegetables, landscaping plants, forages and fruit trees; UAE
- Sorghum and pearl millet for crop diversification improved crop-livestock productivity and farmers' livelihood in Central Asia; Uzbekistan, Kazakhstan, Tajikistan
- Halophytes domestication for food and feed; UAE, Saudi Arabia, Oman
- Investment strategy for food security in Kuwait; Kuwait
- Reclamation of degraded agricultural lands through integrated approach to enhancing resource capacity for crop production; UAE
- Mentoring to prepare competitive research proposals for agricultural and climate change in MENA; Egypt , Yemen, Algeria, Morocco, Lebanon, Palestine, Iran
- Utilization of low quality water for halophytic forage and renewable energy production (PEER); Kazakhstan, Tajikistan, Uzbekistan

Generating and sharing knowledge

Regional training at ICBA in collaboration with IAEA

Building capacity across marginal environments

With the help of its partners, ICBA innovates, builds human capital and encourages learning that is fundamental for change. Throughout 2014, ICBA continued its activities to share and disseminate new knowledge and skills among its partners and beneficiaries by organizing training courses, workshops, seminars and field days.

During the past year, ICBA conducted 19 specialized technical training programs attended by 240 participants from 38 countries. Of these, 16 programs took place at the ICBA headquarters in Dubai, two in Tunisia and one in Egypt. These training programs covered a diverse range of subjects from ICBA's core course on biosaline agriculture technologies to climate change and remote sensing. Each course included detailed case studies in addition to hands-on training and practice.

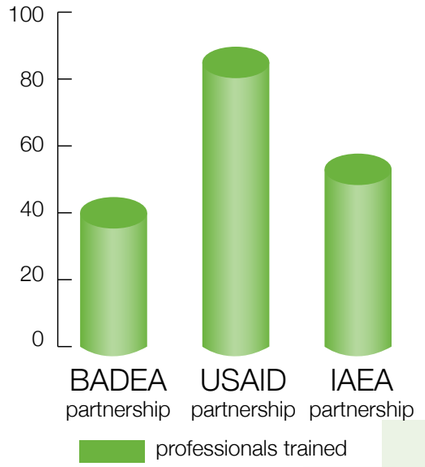
In 2014, ICBA conducted various seminars and field days to build the capacity of more than 700 farmers and extension agents from the United Arab Emirates, Jordan, Uzbekistan, Tajikistan, Kazakhstan, Mali, Nigeria and Niger. These mainly focused on biosaline agriculture production and management, introduction of alternative salt-tolerant crops, irrigation technologies, and soil and nutrient management. What is specifically interesting about farmer school field days is that even illiterate farmers can benefit from them.

Additionally, ICBA organized a road show to Tunisia that involved transferring knowledge and working with ten different government and research organizations over a two-week period on climate change downscaling, crop mapping and crop modeling.

Conferences, conference side events and forums organized throughout the year disseminated knowledge among 330 practitioners and specialists. These events included:

- Use of treated wastewater in agricultural production in the Arab world
- The role of plant genetic resources in food security and sustainable agriculture in the Middle East
- Sustainable intensification is key to food security and nutrition in drylands
- ICBA as a success story of collaboration between IDB and UAE
- Drought monitoring and early warning systems: the possibilities and challenges in harnessing the data revolution

Key capacity building partners



Women farmers participating in the ICBA training roadshow in Tunisia

The 2nd International Conference on Arid Land Studies

Climate change is widely believed to intensify desertification globally. This process will have serious implications worldwide for biodiversity, socioeconomic stability and sustainable development. But drylands, in particular arid and semi-arid regions, home to some 2 billion people, are considered to be most vulnerable. As they become degraded, the impact on people, livestock and environment can be devastating.

People living in arid and semi-arid regions are already struggling to make an adequate living. Poverty and malnutrition are endemic and population growth is making things worse. The Central Asian region is facing similar challenges as large swathes of land are classified as arid and semi-arid. As water gets scarcer, risks are growing. Livelihoods of pastoral and other communities are at stake.

All this calls for prompt collaborative and integrated efforts by policymakers, scientists and international development organizations. New approaches and policies are urgently needed. With this purpose in mind, the 2nd International Conference on Arid Land Studies (ICAL 2) on 'Food Security and Innovations in Arid and Semi-arid Agro-ecosystems' convened in Samarkand, Uzbekistan, on 9-13 September 2014, where ICBA was a co-sponsor with other international organizations.

The 3rd International Salinity Forum

The 3rd International Salinity Forum, held in Riverside-California on June 16-18, brought together scientists and managers from several countries concerned with salinity problems. The forum, the third in a series, was co-sponsored by ICBA and other international organizations. It drew attention to a lot of salinity management issues and touched on such topics as interdisciplinary salinity issues; the interactions between research and development, practice, and policy; soil salinity reclamation; and recycled treated water. Dr. Shoaib Ismail led the ICBA delegation that presented several scientific thematic papers both in the plenary and parallel sessions on its experience with economics and management, plant salt tolerance and social impacts of salinization.

resources can contribute to increasing agricultural productivity, food production and food self-sufficiency in the Middle East. Participants discussed how agriculture can adapt to a changing climate so as to build sustainable and resilient food production systems in the region by drawing on available crop diversity.

Crop diversity forum

In November 2014, participants from 17 national and regional agricultural research centers and government institutions gathered to discuss how plant genetic

ICBA operates a genebank to preserve biodiversity of indigenous and salt-tolerant crops

Lasting partnerships for impact

In our quest to become the partner of choice for delivering agricultural and water scarcity solutions in marginal environments, ICBA focused in 2014 on strengthening its existing partnerships with regional partners through the on-going projects, both related to research areas and capacity building. Within the UAE, ICBA continued to work with MoEW on quinoa and protected agriculture; and with the ADFSC on integrated forage-livestock production system. We also fostered new partnerships and signed memorandums of understanding/project agreements with Palestinian Water Authority, King Abdullah University of Science and Technology, Kingdom of Saudi Arabia; Ministry of Environment, Yemen; The Hashemite Fund for Development of Jordan Badia, Jordan; Office Chérifien des Phosphates (OCP) and OCP-Phosboucraa, Morocco.

Additionally, during 2014, seven memorandums of understanding were signed with national and regional organizations opening up new partnership opportunities with Oman, Morocco, Ethiopia, Jordan, Yemen, Palestine and Australia.

Ensuring that our partnerships are effective and on target is critical to ICBA's expanded growth and increased reach and impact. During 2014, three of our projects were evaluated positively:

ICBA works to build the capacity of national partners in climate change modeling under the MAWRED project

- Mid-term evaluation of Modeling and Monitoring Agriculture and Water Resources for Development (MAWRED) was carried out by the United States Agency for International Development
- Inception phase review of Collaboration Program on Euphrates and Tigris (CPET) was carried out by the Swedish International Development Cooperation Agency
- End of project evaluation by the ADFSC

Achievements of Phase 1 of Collaborative Program Euphrates and Tigris

CPET is a five-year project led by ICBA in collaboration with a team of partner institutions and funded by the Swedish International Development Cooperation Agency (Sida). The objectives of the CPET are to improve dialogue and trust in the Euphrates and Tigris region on water management and increase information and knowledge based on ground-truth data to provide evidence on water use, services and impacts in the Euphrates and Tigris region.

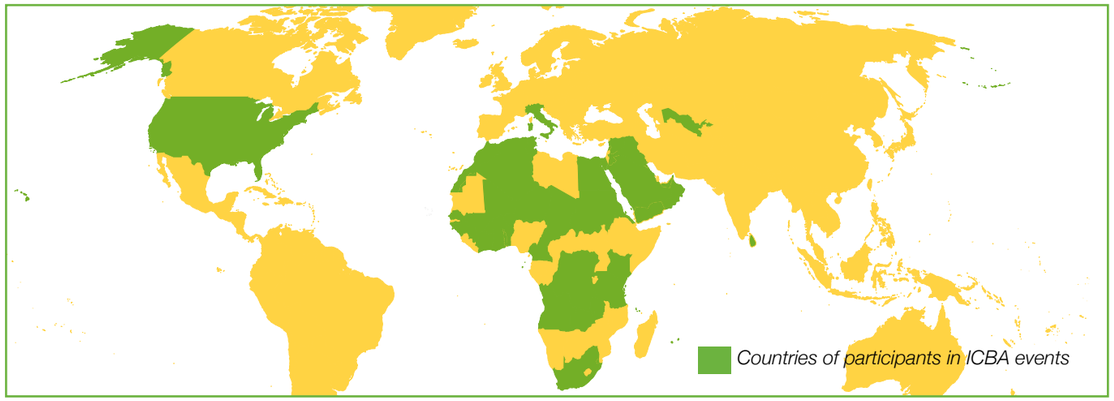
The inception phase (1 September 2013 - 30 September 2014) consisted of two main components and resulted in two main outputs.

Component 1: Development and production of the Political Economy and Governance Analysis report which provided baseline data and information based on regional cooperative analysis of the political, economic, and social and governance policies and strategies.

Component 2: During several meetings of country partners, priority interests of the country partners were reconfirmed, agreed, consolidated and converted into a working program. The results were encouraging in terms of re-commitments of the country partners to continue dialogue.

During the annual review meeting in October, Sida reviewed the outcomes and achievements of the inception phase and subsequently approved the implementation phase that runs till 2018.

1,223 participants attended ICBA events in 2014



	ICBA organized training and knowledge-sharing events	Location	Number of participants
Technical training	• Rehabilitation and restoration of vegetation cover on desert ecosystem	UAE	1
	• Rehabilitation of coastal and desert ecosystems	UAE	1
	• Biosaline agriculture technologies	UAE	35
	• Crop mapping & modeling	UAE	6
	• Statistical downscaling of climate change scenarios	UAE	8
	• Dynamical downscaling of climate change scenarios	UAE	4
	• Enhancing small-scale irrigation technologies and management in saline areas in Africa	UAE	20
	• Efficient water and fertilizer use using new techniques	UAE	15
	• Crop mapping and modeling	UAE	2
	• Enhancing small-scale irrigation technologies and management in saline areas in Africa	UAE	20
	• Investigation of seawater intrusion and interrelationships between aquifers using integrated approach of isotopes and conventional techniques	UAE	19
	• Crop mapping and modeling	Tunisia	34
	• Crop and evapotranspiration mapping and modeling	Tunisia	12
	• Fellowship for IAEA project RAS5068 on biosaline agriculture	UAE	3
	• Separating evapotranspiration (ET) into evaporation (E) and transpiration (T) using isotopic and conventional techniques	UAE	16
	• Internship in research and innovation division	UAE	1
	• Standard, specifications and utilizations of non-conventional water resources	UAE	12
	• Production and utilization of forage crops in marginal environments	UAE	12
	• Modeling and mapping water, climate and crop dynamics in MENA	Egypt	19
Seminars and conferences	• Conference on the use of treated wastewater in the agricultural production in the Arab World, 14-16 January 2014	UAE	116
	• Training seminar on biosaline agriculture for farmers in Khorasan	Uzbekistan	62
	• International Science Forum "Quinoa as a new crop in the Middle East and North Africa"	UAE	20
	• Training seminar of "Innovations in agriculture as a bases for protection and rational use of natural land and water resources"	Uzbekistan	180
	• Seminar: ICBA as a success story of collaboration between IDB and the UAE	Saudi Arabia	100
	• Seminar with the Crop Trust: the role of plant genetic resources for food security and sustainable agriculture in the Middle East	UAE	30
	• AgTalk by IFPRI DG: sustainable intensification is key to food security and nutrition in drylands	UAE	30
Field days	• Abu Dhabi Farmers' Services Centre field day	UAE	40
	• Farmer and extension workers field days in Mali	Mali	220
	• Farmer and extension workers field days in Nigeria	Nigeria	170
	• Farmer and extension workers field days in Niger	Niger	15

2014 Publications

Scientists at ICBA authored and/or produced 81 publications in 2014. These include 25 published papers in peer-reviewed journals, 3 published books and 9 published articles in scientific newsletters and magazines. This research output reaches a broad readership and helps to promote knowledge on biosaline agriculture. It also draws attention to the challenges facing arid and semi-arid regions around the world.

Two books, however, merit special mention: Developments in Soil Salinity Assessment and Reclamation and Developments in Soil Classification, Land Use Planning and Policy Implications. Both are available as ebooks on SpringerLink. In 2014 there were **26,191 chapter downloads** of Developments in Soil Salinity Assessment and Reclamation and **20,041 chapter downloads** of Developments in Soil Classification, Land Use Planning and Policy Implications. Below is a detailed list of all publications produced by ICBA research staff.

A. Peer-reviewed journals

Published

1. Akinshina, N., Toderich, K. N., Azizov, A., Saito, L. & Ismail, S. (2014). Halophyte biomass: a promising source of renewable energy. *Journal of Arid Land Studies*, 24 (1), pp. 215-219.

2. Ayadi, M., Mieulet, D., Fabre, D., Verdeil, J. L., Vernet, A., Guiderdoni, E. & Masmoudi, K. (2014) Functional analysis of the durum wheat gene *Td*PIP2;1 and its promoter region in response to abiotic stress in rice. *Plant Physiology and Biochemistry,* 79, pp. 98-108.

3. Belgaroui, N., Zaidi, I., Farhat, A., Chouayekh, H., Bouain, N., Chay, S., Curie, C., Mari, S., Masmoudi, K., Davidian, J. C., Berthomieu, P., Rouached, H. & Hanin, M. (2014). Over-expression of the bacterial phytase US417 in Arabidopsis reduces the concentration of phytic acid and reveals its involvement in the regulation of sulfate and phosphate homeostasis and signaling. *Plant & Cell Physiology.* doi: 10.1093/pcp/pcu122

4. Belhaj, F. M., Al-Dakheel, A. J., McCann, I. R., Gailani, A. A. M. & Shabbir, G. (2014) Selection of salt-tolerant triticale (*X triticosecale Wittmack*) genotypes for grain and forage end-uses. *Am.-Eura. J. Agric. and Env. Sci.,* 14 (5), pp. 445-454.

5. Ben Amar, S., Brini, F., Sentenac, H., Masmoudi, K. & Véry, A. A. (2014) Functional characterization in *Xenopus oocytes* of Na^+ transport systems from durum wheat reveals diversity among two HKT1;4 transporters. *Journal of Experimental Botany,* 65 (1), pp. 213-222.

6. Feki, K., Brini, F., Ben Amar, S., Saibi, W. & Masmoudi, K. (2014).

Comparative functional analysis of two wheat Na^+/H^+ antiporter SOS1 promoters in *Arabidopsis thaliana* under various stress conditions. *J. Appl. Genetics.* doi 1001007/s13353-014-0228-7

7. Feki, K., Quintero, F. J., Khoudi, H., Leidi, E. O., Masmoudi, K., Pardo, J. M. & Brini, F. (2014). A constitutively active form of durum wheat Na^+/H^+ antiporter SOS1 confers high salt tolerance to transgenic Arabidopsis. *Plant cell reports,* 33 (2), pp. 277-288.

8. Hussain, M. I. & Reigosa, M. J. (2014). Evaluation of herbicide potential of sesquiterpene lactone and flavonoid: impact on germination, seedling growth indices and root length in *Arabidopsis thaliana*. *Pakistan Journal of Botany,* Vol. 46, pp. 995-1000.

9. Hussain, M. I. & Reigosa, M. J. (2014). Higher peroxidase activity, leaf nutrient contents and carbon isotope composition changes in *Arabidopsis thaliana* are related to rutin stress. *Journal of Plant Physiology,* Vol. 171, pp. 1325-1333.

10. Hussain, M. I., Reigosa, M. J. & Al-Dakheel, A. J. (2014). Biochemical, physiological and isotopic responses to natural product *p*-hydroxybenzoic acid in Cocksfoot (*Dactylis glomerata* L.). *Plant Growth Regulation*. doi 10.1007/s10725-014-9981-1

11. Jaradat, A. A. and Shahid, M. (2014). How diverse a farmer-managed wheat landrace can be? *Emirates Journal of Food and Agriculture,* 26 (1), pp. 93-118. doi: 10.9755/ejfa.v26i1.16753

12. Khujanazarov, T., Toderich, K. N. & Tanaka, K. (2014). Utilization of marginal water and land as part of a climate change adaptation strategy. *Journal of Arid Land Studies,* 24 (1), pp. 101-104.

13. Madhumitha, B., Jyotsna, L. K., Rao, N. K., Sood, N., Gokhale, T., Rajeswari, S., Belhaj Fraj, M. & Mishra, S. (2014). Stress-tolerance of *Sinorhizobium* spp. nodulating sesbania and cowpea in desert soils. *Journal of Pure and Applied Microbiology*, Vol. 8, pp. 323-331.

14. McDonnell, R. A., Bergaoui, K., Khalaf, A., Zaaboul, R. & Belhaj Fraj, M. (2014). Impacting policy: harnessing science on climate change and water through partnerships with decision-makers in the Middle East and North Africa - Reflections. *Aquatic Procedia,* Vol. 2, pp. 3-8.

15. Menon, K., Jayakumar, A. P., Shahid, M., Sood, N. & Rao, N. K. (2014). Seed dormancy and effect of salinity on germination of *Citrullus colocynthis*. *International Journal of Environmental Science and Development,* Vol. 5, pp. 566-568.

16. Qureshi, A. S. (2014). Reducing carbon emissions through improved irrigation management: A case study from Pakistan. *Journal of Irrigation and Drainage,* Vol. 63, pp. 132-138.

17. Qureshi, A. S. (2014). Conjunctive water management in the fixed rotational canal system: A case study from Punjab Pakistan. *Journal of Irrigation and Drainage Systems Engineering,* 3 (122). doi:10.4172/2168-9768.1000122

18. Rao, N. K., Shahid, M., Al Shankiti, A. & Elouafi, I. (2014), Neglected and under-utilized species for food and income security in marginal environments. *Acta Horticulturae,* Vol. 1051, pp. 91-103.

19. Shahid, M. (2014). New records for two alien Asteraceae species in the United Arab Emirates. *J. New Biological Reports,* 3 (2), pp. 115-119.

20. Shahid, M. & Rao, N. K. (2014). *Datura ferox* and *Oldenlandia corymbosa*: New record to the UAE flora. *Journal on New Biological Reports,* Vol. 3, pp. 170-174.

21. Shahid, M. & Rao, N. K. (2014). New records of two species of *Caryophyllaceae* in the flora of the United Arab Emirates. *Tribulus,* Vol. 22, pp. 66-68.

22. Shahid, M. & Rao, N. K. (2014). Diversity of *Citrullus colocynthis* (L.) Schrad. (Cucurbitaceae) in the United Arab Emirates. *Journal on New Biological Reports,* Vol. 3, pp. 145-150.

23. Shuyskaya, E. V., Li, E. V., Rahmankulova, Z. F., Kuznetsova, N. A., Toderich, K. N. & Voronin, P. V. (2014). Morphophysiological adaptation aspects of different *Haloxylon aphyllum* (*Chenopodiaceae*) genotypes along a salinity gradient. *Russian Journal of Ecology,* 45 (3), pp. 181-187.

24. Toderich, K., Ismail, S. & Rao, N. K. (2014). Quinoa: a climate-proof multi-purpose crop to increase productivity of marginal lands and farmers' livelihoods in the desert areas of Uzbekistan. *Uzbek Journal Genetic Resources of Agricultural Crops,* Vol. 2, pp. 65-68.

25. Rakhmankulova, Z. F., Voronin, P. Yu., Shuyskaya, E. V., Kuznetsova, N. A., Zhukovskaya, N. V. & Toderich, K. N. (2014). Effect of NaCl and iso-osmotic PEG stress on CO_2/H_2O exchange in shoots of the C4 *xero-halophyte Haloxylon aphyllum* (*Chenopodiaceae*). *Photosynthetica* (in press)

Accepted

1. Hussain, M. I. & Reigosa, M. J. (2014). Characterization of xanthophyll pigments, photosystem II photochemistry, heat energy dissipation, reactive oxygen species generation and carbon isotope discrimination during artemisinin-induced stress in *Arabidopsis thaliana. Plos One.*

2. Krupnik, T. J., Santos Valle, S., Islam, M. I., Hossain, M. A., Gathala, M. K. & Qureshi, A. S. (2014). Energetic, hydraulic, and economic efficiency of axial flow and centrifugal pumps for surface water irrigation in Bangladesh. *Journal of Irrigation and Drainage.*

Submitted

1. Al-Dakheel, A. J., Hussain, M. I. & Al-Gailani, A. Q. M. (2014). Genotypic variation in growth and biomass yield among a collection of forty Buffel grass (*Cenchrus ciliaris* L.) accessions under various salinity levels. *Agriculture Water Management.*

2. Al-Shankiti, A. & Gill, S. (2014). Mineralization dynamics of composts in Entisols and realization of fertility improvement. *Pakistan Journal of Agricultural Sciences.*

3. Asem, S. O., Shahid, S. A., Misak, R. F., Roy, W Y., Oskui, G. P. & Almutairi, M. (2014). Impact of crude oil-filled trenches on the ground cover and soil of Wadi Al Batin, *Kuwait. International Journal of Environment and Pollution.*

4. Gill, S. & Al-Shankiti, A. (2014). Priming of *Prosopis cineraria* and *Acacia tortilis* Seeds with Fulvic Acid Extracted from Compost to Improve Germination and Seedling Vigor. *The Journal of Agricultural Sciences, Sri Lanka.*

5. Lyra, D., Kalivas, D. & Economou, G. (2014). A large-scale analysis of abiotic factors affecting the infestation level of tobacco (*Nicotiana tabbacum* L.) by *Phelipanche* species. *Journal of Crop Protection.*

B. Conference proceedings/book chapters

Published

1. Abdelfattah, M. A. & Shahid, S. A. (2014). Spatial distribution of soil salinity and its management options in the Northern Emirates, UAE. Chapter 2 In: M. A. Khan et al. (Eds.), *Sabkha Ecosystems: Volume IV: Cash Crop Halophyte and Biodiversity Conservation, Tasks for Vegetation Science,* 47, (pp. 1-22), © Springer Science + Business Media Dordrecht, 2014, doi 10.1007/978-94-007-7411-7_1

2. Al-Dakheel, A. J, Al Bakri, A. and Ismail, S. (2014). Impact of salinity on agricultural productivity and water resources at a regional scale: A case study from Oman. *Proceedings of the Third International Salinity Forum*, Riverside, CA, USA (June 16-18, 2014). pp. 54-55.

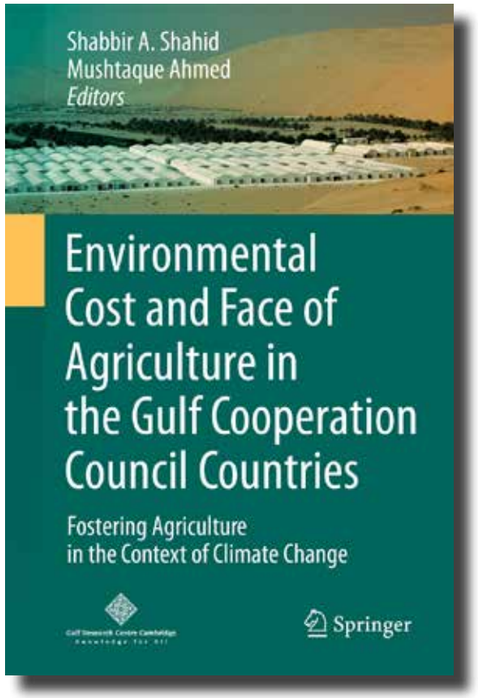
3. Baig, M. B. & Shahid, S. A. (2014). Managing degraded lands for realizing sustainable agriculture through environmental friendly technologies. In: Behnassi, M., Shahid, S. A., Mintz Habib, N. (Eds). *Science, Policy and Politics of Modern Agricultural System: Global Context to Local Dynamics of Sustainable Agriculture,* Chapter 10, (pp. 141-164). Springer Dordrecht Heidelberg: New York - London.

4. Behnassi, M., Shahid S. A. & Gopichandran, R. (2014). Agricultural and food system - Global change Nexus: Dynamics and policy implications. In: Behnassi, M., Shahid, S. A., Mintz Habib, N. (Eds). *Science, Policy and Politics of Modern Agricultural System: Global Context to Local Dynamics of Sustainable Agriculture,* Chapter 1, (pp. 3-13). Springer Dordrecht Heidelberg: New York - London.

5. Brini, F. & Masmoudi, K. (2014). Biotechnology for drought and salinity tolerance of crops. In: P. Ahmad and M. R. Wani (eds), Physiological mechanisms and adaptation strategies in plants under changing environment, Vol. 1, (pp. 97-113). Springer Sciences + Business Media. doi: 10.1007/978-1-4614-8591-9_5

6. Menon, K., Ahmed, I. S., Sood, N. & Rao, N. K. (2014). The potential of castor as a biodiesel feed stock crop for the Arabian Peninsula. *ICREGA' 14 - Renewable Energy: Generation and Applications, Springer Proceedings in Energy*, 2014, pp. 1-9.

7. Shahid, S. A. & Ahmed, M. (2014). Changing face of agriculture in the Gulf Cooperation Council countries. In: Shahid, S. A. & Ahmed, M. (Eds) *Environmental Cost and Face of Agriculture in the Gulf Cooperation Countries: Fostering Agriculture in the Context of Climate Change*, Chapter 1, (pp. 1-25). Springer Dordrecht Heidelberg: New York - London.



8. Al-Dakheel, A. J. & Ismail, S. (2014). Enhancing food security for smallholder farmers in arid environments through scaling-up of adapted resilient crop-livestock models: ICBA's achievements and lessons learnt. *Proceedings of the Second International Conference on Arid Land Studies* (Innovations for Sustainability and Food Security in Arid and Semi-arid Lands) Samarkand, Uzbekistan (September 10-14, 2014). p. 26.

9. El Shaer, H. M. & Al-Dakheel, A. J. (2014). Sustainable diversity of salt-tolerant fodder crop-livestock production system through utilization of saline natural resources: a case study from Egypt. *Proceedings of the Second International Conference on Arid Land Studies* (Innovations for Sustainability and Food Security in Arid and Semi-arid Lands) Samarkand, Uzbekistan (September 10-14, 2014). p. 33.

10. Hussain, M. I., Souza, P. & Reigosa, M. J. (2014). Growth, leaf nutrient contents and carbon isotope discrimination during artemisinin-induced stress in *Arabidopsis thaliana*. *The 4th international symposium on environmental weeds & invasive plants*, Montpellier, France (May 18-23, 2014). p. 134.

11. Hussain, M. I. & Reigosa, M. J. (2014). Herbicide potential of sesquiterpene lactone and flavonoid on germination and root length in *Arabidopsis thaliana*. *The 7th World Congress on Allelopathy* (Complex interactions in a changing climate), Vigo, Spain (July 28-Aug 1, 2014). p. 159.

12. Hussain, M. I. & Reigosa, M. J. (2014). Chlorophyll pigments, photosynthetic performance and reactive oxygen species generation during artemisinin-induced stress in *Arabidopsis thaliana*. *The 7th World Congress on Allelopathy* (Complex interactions in a changing climate), Vigo, Spain (July 28-Aug 1, 2014). p. 199.

13. Qureshi, A. S. (2014). Reducing carbon emissions through improved irrigation management: A case study from Pakistan. In: K. Etingoff (ed.). Agricultural Resource use and Management. CRC Press. Taylor and Francis Group. pp. 215-230.

14. Sanchez-Moreiras, A. M., Martinez-Penalver, A., Hussain, M. I. & Reigosa, M. J. (2014). Past, present and future of Benzoxazolin-2(3H) - phytotoxic studies. *The 7th World Congress on Allelopathy* (Complex interactions in a changing climate), Vigo, Spain (July 28-Aug 1, 2014). p. 216.

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1. Shahid, S. A. & Behnassi, M. (2014). Climate change impacts in the Arab region: Review of adaptation and mitigation potential and practices. In: M. Behnassi, M. Syomiti, R. Gopichandran & K. Shelat (Eds). *Vulnerability of Agriculture, Water and Fisheries to Climate Change: Toward Sustainable Adaptation Strategies*. Springer.

C. Scientific newsletters and magazines

Published

1. Al-Shankiti, A. & Gill, S. (2014). Biochar from date palm and conocarpus waste for improvement of soil quality and biomass production. *Biosalinity News* 15 (2), pp. 8-9.

2. Gill, S. & Al-Shankiti, A. (2014). Recycling green waste to compost for urban landscapes. *Landscape Middle East*, pp. 12-14.

3. Gill, S. & Al-Shankiti, A. (2014). Low-cost compost production technology, beneficial uses of compost and its product fulvic acid. *Biosalinity News* 15 (2), pp. 10-11.

4. Lyra, D., Ismail, S. & Butt, K. (2014). *Salicornia bigelovii*: a promising halophytic species for salinized coastal regions. *Biosalinity News* 15 (2), pp. 6-7.

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7. Rao, N. K. (2014). Bioenergy crop production: A case for creative use of reclaimed wastewater in the Arabian Peninsula. *Biosalinity News* 15 (1), pp. 4-5.

8. Shahid, S. A. (2014). Salt accumulation zones under different irrigation systems – technical note. *Biosalinity News* 15 (1), p. 2.

9. Shahid, S. A. (2014). The ICBA educational landscape design philosophy. *Landscape Middle East*, August, pp. 30-33.

10. Shahid, S. A. & Abdelfattah, M. A. (2014). A landmark in soil taxonomy - international recognition of new voice discovery in UAE. *Farming Outlook* (September Issue), p. 20-22.

D. Published books (Edited)

1. Behnassi, M., Shahid, S. A. & Habib, N. M. (Eds) (2014). *Science, Policy and Politics of Modern Agricultural System: Global Context to Local Dynamics of Sustainable Agriculture*. Springer, p. 379.
2. Shahid, S. A. & Ahmed, M. (Eds) (2014). *Environmental Cost and Face of Agriculture in the Gulf Cooperation Council Countries - Fostering Agriculture in the Context of Climate Change*. Springer, p. 186.
3. Shahid, S. A., Abdelfattah, M. A., Wilson, M. A., Kelley, J. A. & Chiaretti, J. V. (2014). *United Arab Emirates keys to soil taxonomy*. Springer. p. 108.

E. Abstracts

1. Akinshina, N., Toderich, K., Vereshagina, N. & Nishonov, B. (2014). Salt-tolerant plants for soil salinity control, sustainable fodder and bioenergy production in Central Kyzylkum. *The 2nd International Conference on Arid Lands Studies* (Innovations for Sustainability and Food Security in Arid and Semi-arid Lands) Samarkand, Uzbekistan (September 10-14, 2014). p. 9.
2. Al-Dakheel, A. J., Al Bakri, A. & Ismail, S. (2014). Impact of salinity on agricultural productivity and water resources at a regional scale: A case study from Oman. *Proceedings of the Third International Salinity Forum*, Riverside, CA, USA (June 16-18, 2014). pp. 54-55.
3. Al-Dakheel, A. J. & Ismail, S. (2014). Enhancing food security for smallholder farmers in arid environments through scaling-up of adapted resilient crop-livestock models: ICBA's achievements and lessons learnt. *Proceedings of the Second International Conference on Arid Land Studies* (Innovations for Sustainability and Food Security in Arid and Semiarid Lands) Samarkand, Uzbekistan (September 10-14, 2014). p. 26.
4. De Ruyter, T., Laurel, S., Nowak R., Toderich, K., Jeong, J. & Rossi, C. (2014). Modeling halophytic plants to improve agricultural production and water quality in arid and semi-arid regions. *AWRA International Conference on Integrated Water Resources Management (IWRM)*, Reno, NV., USA (June 30-July 02, 2014).
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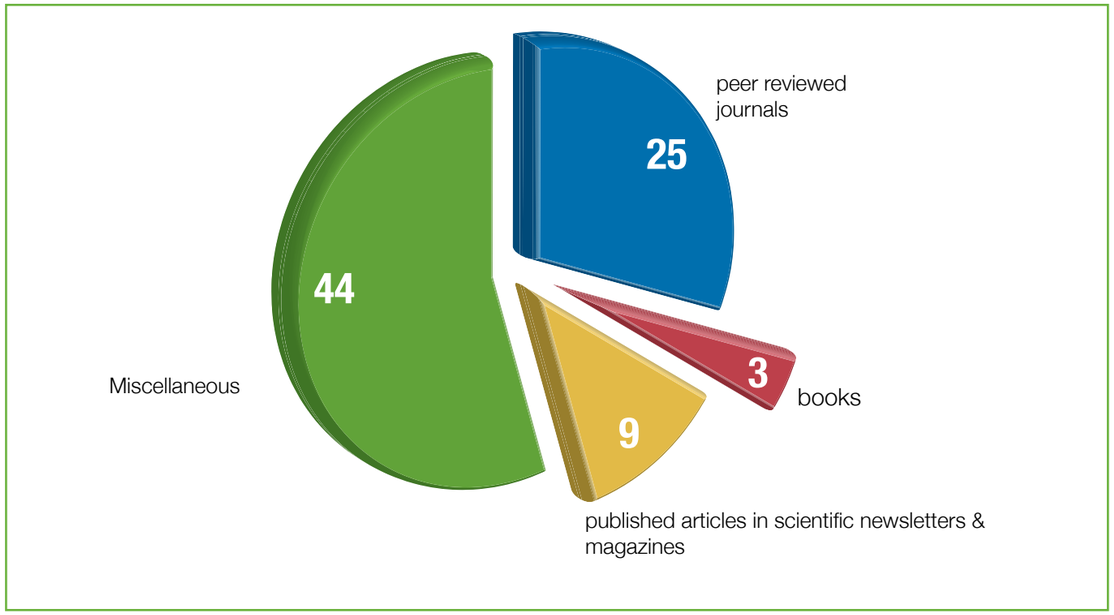
Breakdown of ICBA publications for 2014



Sustainability

Field day training for farmers in the Western Region of Abu Dhabi in partnership with ADFSC

ICBA's work on addressing the closely linked challenges of food, water, environment and income security in marginal environments is critical to developing innovations that address the agricultural challenges faced by an increasing number of farmers as the world annually loses more than 1.5 million hectares of agricultural land to salinity.

Much work lies ahead, which requires extensive efforts and resources.

Over the past months, ICBA launched an internal initiative to develop the long-term sustainability of ICBA which includes diversifying ICBA's revenue sources beyond the traditional core donors.

In 2014, the collective contributions of ICBA's three core donors: The Ministry of Environment and Water of the United Arab Emirates, Environment Agency - Abu Dhabi, and the Islamic Development Bank, covered 67% of the Center's 2014 operations budget.

Additionally, **the following organizations contributed to ICBA in 2014:**

- Ajman Sewerage Private Company LTD
- Arab Bank for Economic Development in Africa
- Arab Fund for Economic and Social Development
- Development Alternatives, Inc
- Abu Dhabi Farmers' Services Centre
- Global Crop Diversity Trust
- International Atomic Energy Agency
- International Development Research Centre
- International Fund for Agricultural Development
- International Water Management Institute
- King Abdullah University of Science and Technology
- Kuwait Investment Authority
- National Academy of Science
- Swedish International Development Cooperation Agency
- US Agency for International Development

ICBA wishes to thank all of them for supporting the critical work the Center does to address the food, water and nutrition security of those living in marginal environments and to help to enhance their economic and environmental resilience.

Financial statement

Statement of activities (USD)	2014	2013
Grants and contributions		
Grants unrestricted	7,000,000	7,000,000
Grants restricted	3,475,183	2,553,158
Interest income	272,997	245,883
Other income	52,037	10,753
Total grants and contributions	**10,800,217**	**9,809,794**
Expenses and losses		
Salaries and benefits	(5,555,097)	(5,554,119)
Operating expenses	(4,918,638)	(3,985,061)
Total expenses and losses	**(10,473,735)**	**(9,539,180)**
Surplus for the year	326,482	270,614

Expenditures by category (USD)

Salaries	27%	$	2,842,081
Employment benefits	26%	$	2,713,016
Collaborators and partnership costs	12%	$	1,227,077
Capacity building	6%	$	673,777
Depreciation	6%	$	646,522
Supplies and utilities	6%	$	611,737
Contract services	4%	$	448,524
Consultants and professional fees	3%	$	349,482
Travel	3%	$	303,075
Maintenance	3%	$	280,717
Board expenses	1%	$	92,057
Printing and publication	1%	$	76,084
Other expenses	1%	$	67,611
Staff training	0%	$	62,021
Fleet rental	0%	$	44,423
Staff recruitment	0%	$	35,531

Statement of financial position (USD)	2014	2013
Assets		
Current assets		
Cash and cash equivalents	3,783,237	3,865,657
Short-term deposits	10,597,826	9,239,130
Receivable from donor	105,445	57,450
Other receivables	3,065	108,164
Due from employees	88,883	38,209
Pre-payments	799,701	783,865
Inventory	-	25,570
Non-current assets		
Property and equipment	7,465,680	6,724,794
Total assets	**22,843,837**	**20,842,839**
Liabilities and net assets		
Current liabilities	1,413,343	698,907
Donors payables	3,008,168	1,928,937
Non-current liabilities	904,360	812,714
Total liabilities	5,325,871	3,440,558
Net assets unrestricted un-appropriated-property and equipment	7,465,680	6,724,794
Net assets unrestricted un-appropriated-others	2,706,273	4,048,824
Net assets unrestricted-appropriated	7,346,013	6,628,663
Total Net Assets	**17,517,966**	**17,402,281**
Total liabilities and net assets	22,843,837	20,842,839

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ABOUT ICBA

International Center for Biosaline Agriculture - ICBA is an international, non-profit 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.
ICBA's work reaches many countries around the world, including the Gulf Cooperation Council countries, the Middle East and North Africa, Central Asia and the Caucasus, South and South East Asia, and Sub Saharan Africa.

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