



# ICARDA Strategic Plan 2017-2026

Science for  
resilient livelihoods  
in dry areas





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# **ICARDA Strategic Plan 2017-2026**

Science for resilient livelihoods in dry areas

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# Acronyms

ARI	Advanced research institution
CCT	Cross-Cutting Theme
CIMMYT	International Maize and Wheat Improvement Center
CRP	CGIAR Research Program
CWANA	Central and West Asia and North Africa
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and communications technology
IPCC	Intergovernmental Panel on Climate Change
IWMI	International Water Management Institute
NARS	National agricultural research system
MEL	Monitoring, Evaluation, and Learning
MENA	Middle East and North Africa
RBM	Results-based management
RCP	Representative Concentration Pathway
SRP	Strategic Research Priority

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## Foreword

This document presents the Strategic Plan of the International Center for Agricultural Research in the Dry Areas for the period from 2017 to 2026.

ICARDA's mission is to enhance food, water, and nutritional security and environmental health in the face of global challenges, including climate change. Through preparedness for change and productivity gains in the rural economy, ICARDA will contribute to poverty reduction and social stability as our overarching goal. Innovative science, partnerships for impact, capacity development, and a fit-for-purpose organization are our tools.

Our Strategic Plan aligns with the CGIAR Strategy and Results Framework and eight of the United Nations' Sustainable Development Goals: Goal 1, No Poverty; Goal 2, Zero Hunger; Goal 3, Good Health; Goal 5, Gender Equality; Goal 6, Clean Water and Sanitation; Goal 13, Climate Action; Goal 15, Life on Land; and Goal 17, Partnerships for the Goals. It addresses the significant challenges facing the world's non-tropical dry areas: rising temperatures, critical water scarcity, fragile natural resources, and an insecure food and nutritional future under often-unstable social conditions.

We have listened to our partners in the national agricultural research systems, and we will take the

experience of years of consultations and cooperation forward into the next decade. Our staff have been invaluable in this process, along with our sister CGIAR centers and other partners. We are confident that the Strategic Research Priorities we have identified build on the knowledge and strengths of ICARDA and our partners and will produce the greatest impact, leaving an enduring legacy that will help rural communities in dry areas to weather future shocks, especially the impacts of climate change.

To ensure that ICARDA's research generates evidence-based science, technological innovation, policy dialogue, and knowledge sharing, thereby improving policies, practices, and livelihoods for rural communities and supporting agricultural transformation for future generations that harnesses the enormous potential of dry areas, we will abide by our core values of integrity and high ethical standards and hold ourselves accountable for our actions.

ICARDA's Strategic Plan is a living, dynamic, and evolving partnership approach that can proactively adapt to the constantly changing environment and the needs and priorities of rural communities. ICARDA will continue to adapt and evolve, responding nimbly to changes in the development landscape and the challenges faced in the regions where ICARDA works.

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## Message from the Board Chair and the Director General

Agricultural research for development in non-tropical dry areas remains as critical as ever, particularly in light of the actions set out by the international community to achieve the Sustainable Development Goals by 2030. Research will be indispensable in realizing the hopes and aspirations of millions of people in Africa and Asia for higher living standards and greater stability. Offering solutions to global challenges – continued reduction in poverty, coping with climate change and water scarcity, restoring degraded soils, providing food and nutritional

security – demands knowledge to take transformative actions at scale. ICARDA joins its 14 sister centers of the CGIAR in supporting such transformations.

ICARDA operates in a complex setting. Population pressures and increasing urbanization contribute to rapid social change; rising temperatures and increasing water scarcity threaten agricultural productivity; very high youth unemployment reinforces economic and social inequality and political risks. Reversing these trends

requires a huge national, regional, and international undertaking, to which ICARDA's 40-year history of interdisciplinary research can and will contribute.

The new Strategic Plan is fully aligned with the CGIAR Strategy and Results Framework 2016-2030 and many of the Sustainable Development Goals. ICARDA's research is relevant, demand-driven, and solutions-oriented, effectively responding to the real-world challenges faced by communities in non-tropical dry areas, and particularly women and young people. Their effective inclusion is a critical driving force for economic growth and poverty reduction. ICARDA's unique research assets are its vast network of partners across non-tropical dry areas and its decentralized mode of operation, which place ICARDA in a strong position to carry out innovative research and help transform agriculture for economic growth and sustainable development in non-tropical dry areas.

We believe that a +4°C climate change scenario for significant areas in non-tropical dry regions is highly likely. Components of our research will deliver climate-adapted genetic resources and contribute to strengthening the farming systems, markets, and institutions required to achieve thriving and resilient livelihoods in the face of climate change and other disruptors.

Over the past decades, the countries where ICARDA works have increased their investments in agricultural research, and their national institutions have made significant contributions to crop improvement, natural resource management, and environmental sustainability. This is an extremely positive development that signals an important change in ICARDA's role as a strategic research partner and provider of international knowledge to further enhance the efforts, skills, and competencies of our partners to shape and drive their own national and regional agricultural research agendas.

The new ICARDA Strategic Plan 2017-2026 charts a path to realize the vision of thriving and resilient rural communities in non-tropical dry areas. We have revisited our specific strengths, adjusted our research priorities, and redefined our business model and organizational structure. This sets in motion a comprehensive process of institutional change to guide the implementation of the Strategic Plan and to secure large-scale impact.

A renewed focus on strategic partnerships, innovative efforts for resource mobilization, new ways to enhance

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human capacity, and stronger internal and external communications will help ICARDA realize its strategic objectives. ICARDA looks forward to working with partners – old and new – to implement the new Strategic Plan with great passion and dedication.

The Board and the management team of ICARDA are grateful to its partners and ICARDA staff who gave their time to share insights, offer guidance, and comment on earlier drafts.

We take this opportunity to express our appreciation and deepest gratitude to our donors for continuing to put their trust in ICARDA, and for their invaluable support to our important research agenda. Our achievements to date, and those we hope to accomplish through the new Strategic Plan, would be impossible without their crucial support and proactive engagement.

We invite donors, partners, and smallholder farmers to join us on this journey.



Margret Thalwitz

Chair, ICARDA Board  
of Trustees



Aly Abousabaa

Director General

# PART I

## ICARDA at a glance

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is a non-governmental, non-profit CGIAR research center that focuses on delivering innovative solutions for sustainable agricultural development in non-tropical dry areas of the developing world.

ICARDA is headquartered in the Middle East, with regional offices across North and sub-Saharan Africa and West, Central, and South Asia. ICARDA works in partnership with national agricultural research systems (NARS), governments, civil society, and the private sector to develop scalable agricultural solutions that contribute to poverty reduction, food and nutritional security, and sustainable utilization of natural resources.

We provide innovative, science-based solutions to improve the livelihoods and resilience of resource-poor smallholder farmers in non-tropical dry areas. We do this through strategic partnerships, linking research to development and capacity development and taking into account gender equality and the role of youth in transforming non-tropical dry areas.

### Our vision

We envision thriving and resilient livelihoods in the dry areas of the developing world with adequate incomes, secure access to food, markets, and nutrition, and the capacity to manage natural resources in equitable, sustainable, innovative ways.

### Our mission

To reduce poverty and enhance food, water, and nutritional security and environmental health in the face of global challenges including climate change.

## Where we work: Non-tropical dry areas

Dry areas cover some 47% of the world's land area and are home to 30% of the world's population. The main feature that distinguishes non-tropical dry areas from tropical dry areas<sup>1</sup> is seasonality in temperatures: they are characterized by hot, dry summers and cool or cold winters, with precipitation falling primarily in the cool season (Figure 1). Rainfall is limited, from 250 to 350 mm annually, with the marginal dry areas receiving between 100 and 150 mm, and its distribution is highly variable, both within and between years.

These temperature and rainfall regimes delineate where ICARDA works and define the principal farming systems and associated crops that it works on. When ICARDA was established by CGIAR, it was assigned international responsibility for the improvement of barley, lentils, and faba beans and regional responsibility, in cooperation with other international agricultural research centers, for research in wheat,<sup>2</sup> chickpea, and other crops of major importance to the region, such as grass pea, pasture, and forage legumes, and associated farming systems. ICARDA is also mandated to undertake research into small ruminant (sheep and goat) production systems.

The largest single contiguous region of non-tropical dry areas stretches from Morocco across North Africa to West Asia, the dry areas of northern South Asia (Afghanistan, Pakistan, and northern India), the Central Asian Republics, and the dry areas of western and northern China (Figure 2). An immense and diverse region containing rainfed, irrigated, and pastoral agro-ecosystems, it encompasses vast steppe lands, formidable mountain ranges, major river networks, and fertile valleys and flood plains. It contains the centers of origin of many globally important cultivated crops, as well as the crossroads of ancient civilizations and trade routes. Today, in an era of turbulence and transition, the countries of this region stand at a new crossroads: how to maintain viable agricultural economies and food security for their burgeoning populations in the face of the unprecedented impacts of climate change.

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<sup>1</sup> The tropical dry areas are served by our sister center, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

<sup>2</sup> Wheat research is pursued in collaboration with the International Maize and Wheat Improvement Center (CIMMYT).

Figure 1. Tropical and non-tropical dry areas of the world

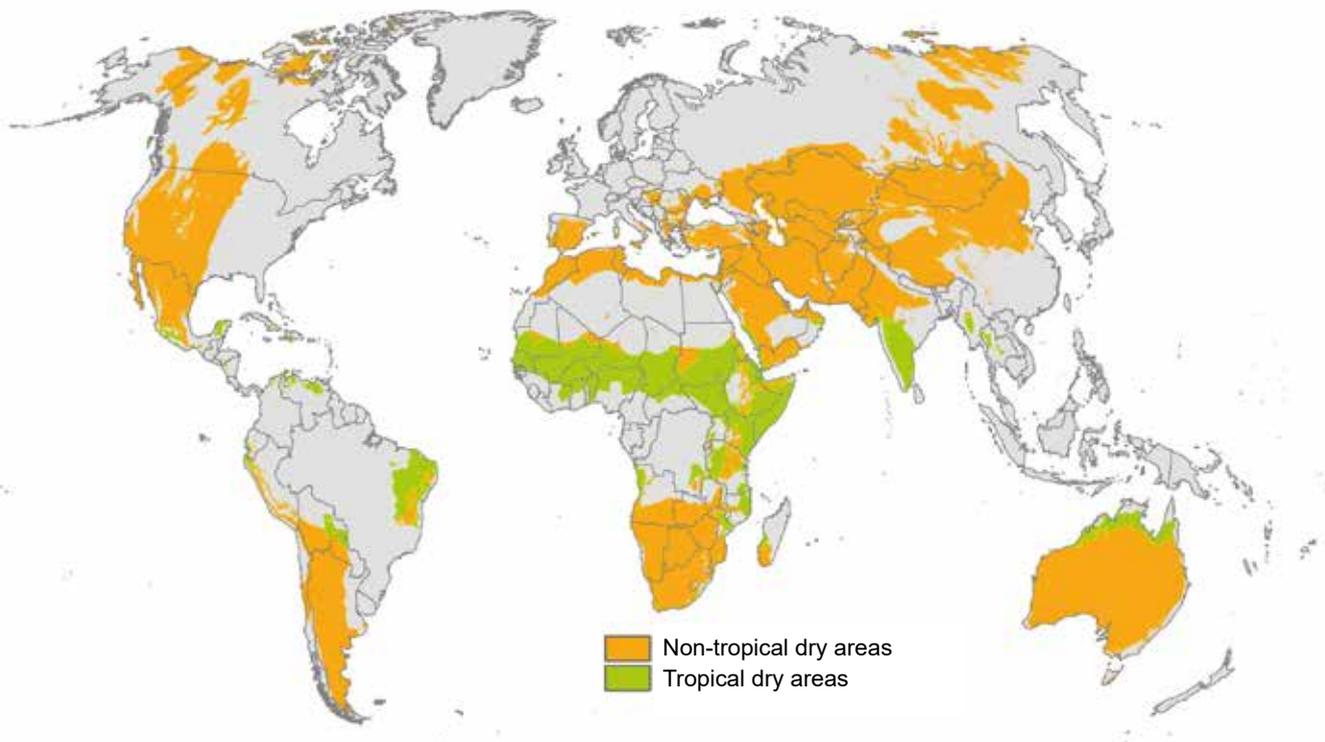
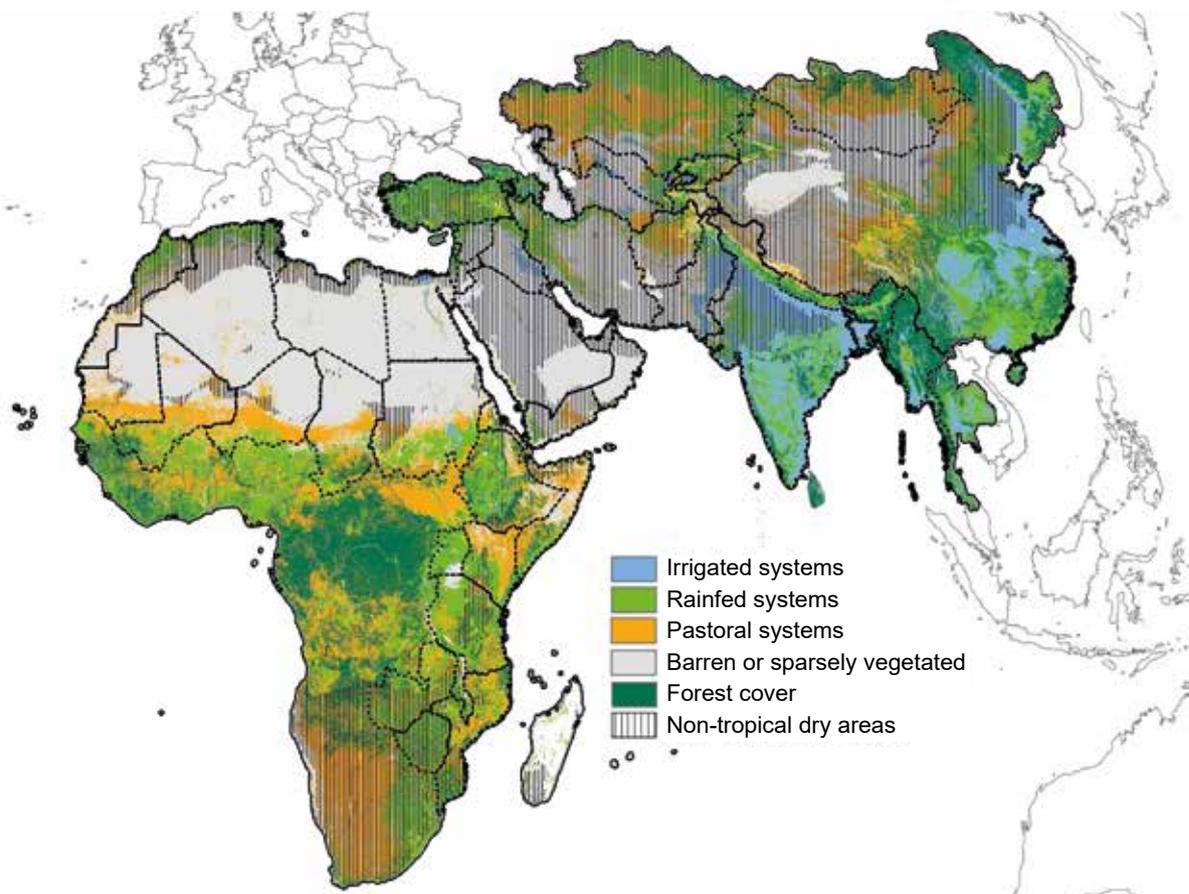


Figure 2. Non-tropical dry areas of Africa and Asia



Non-tropical dry areas vary climatically, topographically, environmentally, economically, socially, and culturally, but despite this diversity, they face common challenges. To deal with both the differences and the similarities, ICARDA conducts its work through key strategic regional hubs that include Egypt, Ethiopia, India, Jordan, Lebanon, Morocco, Sudan, Turkey and Uzbekistan.

Headquartered in the Middle East, ICARDA has focused on the Middle East and North Africa (MENA)<sup>3</sup> region as a platform for its research, the results of which are applicable across the range of non-tropical dry areas. We will continue to build a significant footprint across MENA, with additional activities in Central Asia and the Caucasus, South Asia, East Africa, and the West African Sahel and Dry Savannas, in the agro-ecosystems and associated production systems in which we have a comparative research advantage.

Non-tropical dry areas are defined as regions characterized by an aridity index between 0.03 and 0.65, encompassing the arid, semi-arid and sub dry humid zones, in which there is at least one month with mean temperature below 20°C.

### Responding to agricultural development challenges in dry areas

Agricultural production in non-tropical dry areas is dependent on a myriad of small-scale farmers and herders. They account for most of the staple food production. Most of the poor live in rural areas, where agriculture provides directly or indirectly for their livelihoods. Around 45% of the population of Central and West Asia and North Africa (CWANA)<sup>4</sup> lives in rural areas and 30% of the labor force is employed in agriculture.

The 2014 International Year of Family Farming highlighted the important role of family farming in providing food and nutritional security and enabling sustainable development. In MENA, more than 80% of some crops and livestock products is provided by small-scale family farming, and 75-85% of agricultural land holdings are held by family farmers. They face daunting

challenges: limited and variable rainfall; frequent drought, heat, and cold; limited land and water resources; pests and diseases; authorities and institutions that struggle to support them; poor market infrastructure and integration; and limited access to innovations and new technologies. The result is low agricultural productivity and limited livelihood opportunities that perpetuate a cycle of poverty and food and nutritional insecurity, particularly in the least developed countries.

Above and beyond these existing constraints, the dry areas of the developing world face the impacts of increasing climate variability and change. The aim of the Paris Agreement, negotiated through the United Nations Framework Convention on Climate Change (UNFCCC), is to keep global temperature rise this century well below 2°C and to pursue efforts to limit the temperature increase even further to 1.5°C. However, despite the global community's best intentions, higher levels of warming are increasingly likely in specific regions. The MENA region emerges as one of the hotspots for worsening extreme heat, drought, and aridity. Climate projections in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report show that under a moderate scenario, temperatures will increase by 3°C by the end of the century, while under a more severe scenario, temperatures will increase even further. ICARDA believes that a +4°C scenario is highly likely for a significant share of non-tropical dry areas.

Furthermore, projections also show decreases in precipitation of up to 20% at the end of the twenty-first century. Such changes will directly increase existing water scarcity and reduce agricultural production. Countries with rural populations predominantly dependent on dry area agriculture will be at most risk, as they are highly vulnerable to shifts in seasonal climatic patterns. Increased pressure on scarce resources and a decline in agricultural productivity and rural livelihoods will intensify rural poverty. Lack of alternative opportunities may drive migration to cities, creating further pressure on urban services and employment.

### Who benefits from our work?

ICARDA's efforts to address the challenges that face non-tropical dry areas are driven by the conviction that

<sup>3</sup> This region is also known as West Asia and North Africa (WANA); both names include the same countries.

<sup>4</sup> CWANA is a larger regional designation that includes all of the countries in MENA plus Central Asia.

the science and solutions we generate contribute to food security, economic growth, and social change and promote environmental sustainability.

Our research focuses on the needs and priorities of smallholder mixed-crop farmers and livestock producers and the rural communities that depend on them for their livelihoods, with a view to increasing agricultural productivity as well as developing opportunities for better market integration and economic growth. This includes identifying and developing options for adding value along the agri-food chain from producer to consumer, thereby increasing the productivity of the rural economy as a whole. In particular, we target women and young people who are in search of opportunities that will provide employment and improve their livelihoods.

We also develop technologies and innovations that promote the sustainable use of natural resources and biodiversity, creating greater resilience to climate change and providing ecosystem services that are of global benefit.

Ultimately, ICARDA's research and engagement with partners aim to reduce the constraints that rural economies face in adapting and transforming themselves into productive, efficient, and sustainable sectors of the economic and social structure of the region.

## Our core business

ICARDA's new Strategic Plan sets out a path to the multiple solutions that will help to break the cycle of poverty, improve food and nutritional security, and halt or reverse the alarming process of resource degradation in dry areas, while adapting to the impacts of climate variability. The Strategic Plan builds on 40 years of notable achievements, lessons learnt, and successful partnerships and investments at regional and global levels. It is aligned with the national development priorities of the countries and regions in which ICARDA works, with the CGIAR Strategy and Results Framework 2016-2030, and with the Sustainable Development Goals. It orients ICARDA's research activities to find innovative and demand-driven solutions to guide sustainable development and contribute to the wellbeing of communities that live in non-tropical dry areas of the globe.

Delivering this Strategic Plan will require a focus on four overarching key areas. ICARDA will:

- Play a crucial role in promoting the conservation and use of agrobiodiversity through our genebanks and small ruminant breeding programs, to develop new germplasm and breeds adapted to the +4°C scenario that will most likely prevail in many parts of non-tropical dry areas.
- Provide leadership in strategic research to develop integrated dry areas farming systems, using the diversity of crops and livestock to build profitable and sustainable farming enterprises.
- Contribute to developing and strengthening functional and demand-driven value chains, market opportunities, and supporting institutions in the crop and livestock systems that ICARDA focuses on.
- Develop innovative approaches to water, land, and soil resource management that address water scarcity, enhance soil health and productivity, and contribute to land degradation neutrality.

ICARDA's primary responsibilities are to maintain and build on advances in science and deliver rigor and excellence in research; to work with national partners in building capacity and institutionalizing research advances; and to intensify and expand strategic partnerships to achieve change and impact at scale. Working together in an integrated and supportive work environment with NARS and other partners will be a central element in ensuring that international research contributes to national development goals.

## Dry areas: Challenges and opportunities

Characterized by water scarcity, the non-tropical dry areas of Africa and Asia face major agricultural challenges including low and variable rainfall, frequent droughts, temperature extremes, land fragmentation, land degradation and desertification, excessive use of groundwater resources, and salinization of irrigated lands, all of which are likely to be exacerbated by climate variability and change. Given these constraints, agricultural productivity is generally low and agricultural livelihoods are precarious. In rural areas, there is widespread endemic poverty and unemployment (particularly affecting women and youth) and a history of political and economic exclusion.

The population of the dry areas is projected to double by 2050, which, together with anticipated climate impacts, puts these countries under enormous pressure for water, food, and other resources. Given their inherent resource constraints and low agricultural production potential, many countries, and particularly those in MENA, are already highly dependent on imports to meet their food needs. Population growth and rising urban incomes are projected to drive food consumption growth over the next 10 years. The non-tropical dry areas of Africa and Asia are extremely diverse, economically, socially, and in terms of their resource endowments. The region includes high-income oil-exporting nations, as well as some of the poorest and most conflict-affected countries in the world. While richer countries can benefit from their export earnings to meet their food demands, many other countries face increasing food insecurity unless they can increase their domestic production of staple food crops to meet demand. Evidence suggests that malnutrition could rise in the event of significant food price increases or sharp declines in yields.

In the MENA region alone, some 9% of the population – 33 million people – already lack access to adequate nutrition, and an estimated 24.5% of children under five suffer from stunting. The percentage of the population that is under-nourished is far higher in individual Asian and African countries: around 25% in Afghanistan and Sudan, and approaching 30% in Iraq, Tajikistan, and Yemen. Inaction in the non-tropical dry areas of Africa

and Asia will result in unacceptably high costs in terms of economic development, human suffering, and political insecurity.

Despite these challenges, dry areas also possess valuable and globally important assets: a rich agrobiodiversity, including the wild progenitors and landraces of globally important food crops that are of crucial importance in adapting to climate change; diverse landscapes with significant potential to sequester carbon; social capital, particularly a large population of young people capable of generating incomes and sustaining economic growth; and the potential to diversify and intensify agri-food systems, generating employment and market opportunities.

Throughout the rest of this Strategic Plan, we detail ways in which this fragile, yet enormous, potential may be utilized in achieving not only agricultural and rural development but far greater stability and security in the region.

Non-tropical dry areas have undergone tremendous changes since the launch of ICARDA's 2006 10-year Strategic Plan. New global, regional, and local drivers have given the efforts of ICARDA and its partners greater significance than in the past. On the following pages, we outline some of the key drivers that have informed the research responses and solutions that are part of ICARDA's new Strategic Plan.

### Climate change

Climate change has become, and will continue to be, a key disruptor of growth, particularly in the agricultural sector. Some of the highest temperatures and driest years on record globally have been recorded in these locations over the past 10 years – with notable impacts on food production.

Dry regions have emerged as hotspots for worsening extremes of heat, drought, and aridity. The potential effect of these changes is exemplified in the MENA region. Warming of 0.2°C per decade was observed in the region from 1961 to 1990, and since then the region has been warming at an even faster rate.

The future prospects for the region are taken from the Representative Concentration Pathways (RCPs) developed by the IPCC for its Fifth Assessment Report



### Adapting to climate change

We developed heat- and rust-tolerant, fast-growing wheat varieties in Sudan and Ethiopia as part of an initiative to boost wheat production across 12 sub-Saharan African countries. The varieties, together with a package of interventions including optimized land preparation and pest management technologies, reached around 7,500 farmers. These innovations tripled the farmers' wheat yields and convinced policymakers to invest in wheat production as a way of reducing dependence on imports.

(2014). The climate projections reported here are based on RCP 4.5 (moderate-case scenario) and RCP 8.5 (business-as-usual scenario with no policy changes).

According to the IPCC Fifth Assessment Report, projected temperature changes (compared to the reference period 1985-2005) for RCP 4.5 suggest an increase of about 2°C for most of MENA by mid-century, with stronger warming by the end of the century, to an overall increase of 3°C. Projections for RCP 8.5 show an additional 1°C temperature increase overall, with warming intensifying to an increase of 4.8°C by the end of the century.

Results are much more variable in terms of precipitation. Projections for the RCP 4.5 scenario at mid-century exhibit decreases in precipitation of about 10% over the MENA region, with a more pronounced reduction of up to 20% over North Africa at the end of the century. Under RCP 8.5, the region will likely experience more dramatic decreases in precipitation compared to the baseline period: up to 20% by mid-century and 30-40% by the end of the twenty-first century.

Such changes will put intense pressure on already scarce water resources. Changes in rainfall and runoff have implications for river flows and the recharge of groundwater resources. Importantly, a large portion of the freshwater resources used by MENA countries originates from outside their national borders. This high dependency on shared surface and groundwater resources in the region makes them of strategic importance. The impacts of climate change and climate variability projected over the coming years are expected to further complicate shared water resources management efforts. For instance, in the eastern Anatolian Mountains, which are the headwaters of the Euphrates and Tigris rivers, a runoff decrease of 25-55% is projected with 4°C of warming.

Agriculture, of which 70% is rainfed in MENA, is highly exposed to these changing climatic conditions. Lower rainfall and higher temperatures will shorten the growing period for wheat in MENA by about two weeks by mid-century. Crop yields are expected to decline by 30% with 1.5-2°C of warming and up to 60% with 3-4°C of warming, with regional variations and without considering adaptation.

Changes in rainfall and temperature patterns could also alter the rich biodiversity and genetic resources in the region, and may also change the occurrence, distribution, and severity of crop diseases and insect pests.

Climate change will impact livestock production through various pathways that include changes in the quantity and quality of available feed, changes in the length of the grazing season, heat stress, reduced drinking water, and changes in livestock diseases and disease vectors. The vulnerability of livestock production systems to droughts was demonstrated in northeastern Syria, where herders lost almost 85% of their livestock as a result of recurring droughts between 2005 and 2010.

In short, the MENA region in particular is very likely to experience a decrease in agricultural productivity unless effective climate change adaptation measures are taken. The impacts of climate change will aggravate water and land resource degradation, and in extreme cases agricultural land use and livelihoods may have to be abandoned. The decline in rural livelihoods will intensify rural poverty and could trigger further rural-urban and international migration and potentially exacerbate social unrest and political instability.

Combating the entirety of these climate change impacts is well beyond the scope of agricultural research. However, science and technology can provide pathbreaking innovations and options that demonstrate to policymakers, institutions, agricultural producers, and rural communities how farming systems can be adapted to a changing climate; how resilience to climate risks can be increased; and how to protect their natural resources. Without effective water demand management and policies that increase resource use efficiencies, as well as other supportive measures to enable populations to adopt adaptive innovations, the risks of instability may spread far beyond the region.

### Water scarcity

Water is the single most binding constraint in the agricultural sector of dry areas. Countries in non-tropical dry areas are the most water scarce in the world, with per capita water availability continuing to decline. In some cases (for example, Jordan), the per capita availability of fresh water has already declined to less than 150 m<sup>3</sup>/year, well below the internationally recognized chronic water scarcity threshold of 1,000 m<sup>3</sup>/year and the absolute water scarcity level of 500 m<sup>3</sup>/year. Recent IPCC computer models estimate that an additional 80-100 million people in the MENA region will be exposed to water stress by 2025, putting more pressure on already depleted groundwater resources.

Water scarcity and quality have become serious threats to food and nutrition security and challenge the functionality of river ecosystems in dry areas. There is a direct relationship between access to water and food and feed security, with consequences for wellbeing and economic development. Up to 80% of the population of dry areas are without access to reliable, uncontaminated water, which results in significant risks to livelihoods and health.

MENA uses more than 80% of its water resources for agriculture, but increasing competition from the domestic and industrial sectors is expected to reduce agriculture's share of water allocations in several MENA countries to about 50% by 2050, placing further limitations on agricultural production. Managing this resource from the farm to basin level will be critical in addressing the water scarcity challenges over the coming decade.



### Building resilience in marginal dry areas

With its high water efficiency and content, cacti can sustain livestock through the driest of seasons. A well-developed root system also allows these versatile plants to grow in marginal areas where other forage species often fail. Cacti are easy to establish, maintain, and utilize. They are also increasingly being cultivated for human consumption. We actively promote this high-energy, nutrient-rich plant as a versatile crop with multiple applications.

### Food security, agricultural productivity, and yield gaps

Non-tropical dry areas are highly dependent on imports of food to meet demand. For example, within the MENA region, which is the largest food importer globally, more than 50% of cereals consumed are imported. This dependency exposes these areas to the volatility of global food markets and potential failures, as witnessed during the 2008 global food crisis. High and unstable food prices, as well as food and nutritional insecurity, have in some cases led to social unrest and political instability. Hotter and drier climates will severely test food security in dry areas, and without significant increases in research and development within the agricultural sector these countries will remain exposed to the vagaries of global markets. However, the global food crisis had an important and positive impact in the region: governments are now placing investment in agriculture high in their national priorities, in an effort to ensure food security.

Although agricultural production has increased across the dry areas in which ICARDA works, cereal yields

across much of the region are well below the world average. Moreover, highly variable rainfall in areas that rely on rainfed agriculture contributes to large year-to-year swings in yields. It is likely that these swings will persist into the future due to increased climate variability and change. Yield gaps between world and regional average yields for all crops combined are estimated at 60% in North Africa and 49% in West Asia, suggesting considerable room for improvement through both technological improvements and policy reforms.

The water-limited yield gaps<sup>5</sup> in rainfed agriculture across MENA are large and variable (Figure 3). These measures, which show the gaps attributable to factors other than moisture, vary across landscapes and growing seasons, and they are not static. The maximum attainable yield in different regions is likely to shift as a result of increasing climate variability and change.

Both land and water are limiting constraints to the horizontal expansion of arable farming. The potential for expanding the area under irrigation is limited. Climate variability and change are expected to reduce water resources even further. A clear research objective is, therefore, to increase production and productivity through the more effective utilization of the limited

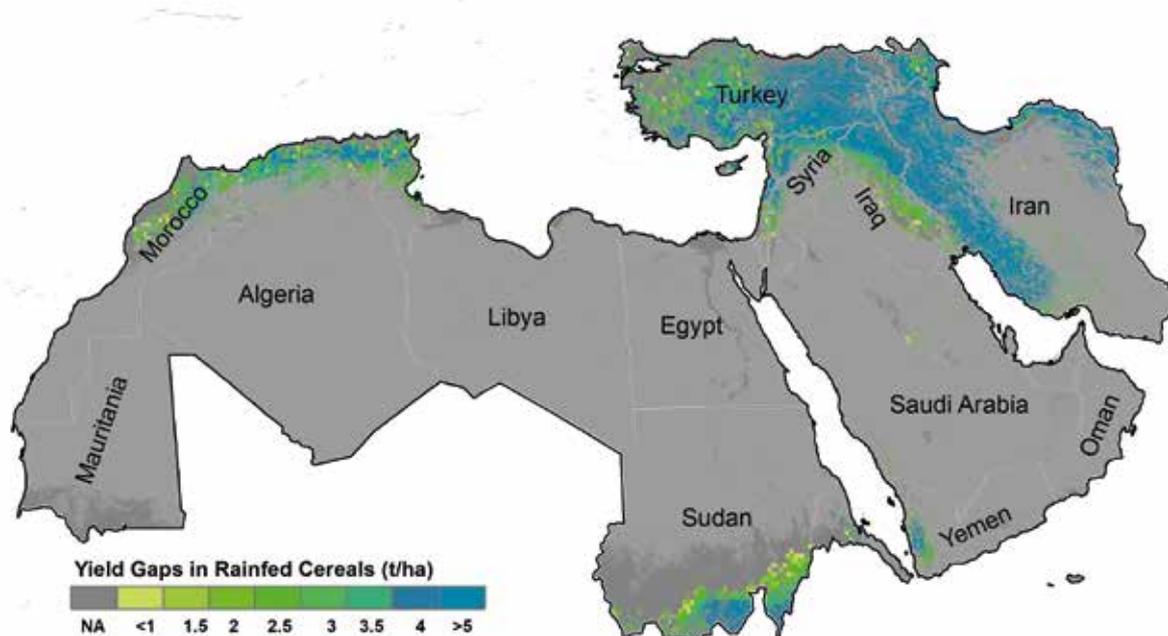
land and water resources. The agricultural sector must produce more food per hectare, and per unit of irrigation water, to feed MENA's expanding population.

ICARDA's experience in dry areas shows that such gaps can be reduced by productivity-enhancing interventions. Opportunities exist to substantially reduce or even close the yield gaps of major crops through optimal crop management practices, improved germplasm, better seed supply systems, and stronger support services. Furthermore, in full or supplemental irrigated systems, improved irrigation practices can improve water productivity (yield per unit of water used) without significantly affecting the overall production, contributing to savings in agricultural water use.

### Loss of agrobiodiversity

Dry areas encompass the major centers of diversity for crops and forages of global significance, including wheat, barley, chickpea, faba bean, grass pea, lentil, pea, and several temperate forage species along with fruit trees and horticultural species. This agrobiodiversity is subject to alarming losses despite its crucial importance in adapting to climate change. Concerted efforts are needed at community, national, regional, and global

**Figure 3. The water-limited yield gap for wheat in West Asia and North Africa: An opportunity to address**



<sup>5</sup> Water-limited yield potential is the yield of a crop when grown under rainfed conditions with best management practices to minimize growth limitations from nutrients, pests, and diseases, and reflects only the limitations of rainfall. The water-limited yield gap is the difference between the water-limited yield potential and actual farm yield.



### Building resilience in marginal dry areas

In Jordan, we developed micro-water harvesting techniques by merging a GPS-based guidance system with the Vallerani plow machine. This has ensured that the ecosystem in the Jordanian Badia (dry rangelands) is preserved. Our Vallerani rainwater-harvesting package has been implemented on around 3,900 hectares of rangeland in Jordan so far. Analysis suggests that it could be scaled up to an area of 300 million hectares across the Middle East and North Africa.

## Land degradation and desertification

The Economics of Land Degradation Initiative has calculated that 10-20% of dry areas and 24% of usable land on Earth is degraded, creating an estimated economic loss of US\$40 billion per year. More than one-third of the land in Africa is under threat of desertification due to erosion. Recurring droughts and desertification cause an annual loss of 12 million hectares, and the percentage of Earth's land area stricken by serious drought has more than doubled from the 1970s to the early 2000s. The productivity of rangelands, which dominate dry areas, has declined due to widespread overgrazing that is largely driven by inappropriate small ruminant management and alarming over-stocking. This in turn leads to land degradation, desertification, and biodiversity loss, further aggravating poverty. Through innovative approaches to tackle land degradation, which include technical interventions in landscape modification to retain water in catchments; the restoration of degraded landscapes through green and gray infrastructure; improved management of rangelands; and innovative institutional structures that promote the notion of ecosystems services and associated payments, ICARDA will ensure that it contributes to Sustainable Development Goal 15, which aims to halt and reverse land degradation.

## Population growth and employment

Between 2000 and 2015, the population of CWANA increased at an annual rate of 3.2%. It is projected to increase by a further 50% by 2050. In 2015, 40% of the population was aged 19 years or below.

Some 45% of this population lives in rural areas, and World Bank figures show that the poor are concentrated in rural areas: 60-80% of the poor in the MENA region live in rural areas. Poverty and lack of income-generating opportunities are driving migration from here to urban areas. In the coming decades, it is likely that the highest population growth will take place in cities, adding pressure to already stretched public services and water supplies. This demographic transition will impact all aspects of food security. We need to better understand how the growing constraints on agricultural production listed above will affect rural livelihoods and, at the same time, better understand to what extent rural outmigration will impact agricultural production and national food demand and supply.

levels to promote *in situ* and *ex situ* conservation and sustainable use of agricultural biodiversity. ICARDA, being in the heart of the West Asian mega-center of diversity, will continue to play a critical role in this endeavor.

ICARDA's germplasm collection of 155,387 accessions includes 1,370 taxa (780 species). These collections are unique, as 45% were collected by ICARDA during 245 collecting missions, and 67-85% are landraces and native species. Of this collection, 98% are safety duplicated and 80% are stored at the Global Seed Vault in Svalbard, Norway for long-term conservation. ICARDA distributes, on average, 20,000 samples annually. These genetic resources provide breeders with sources of novel diversity for resistance to major diseases and for tolerance to heat, drought, and salinity. The Center is thus well placed to use this germplasm to build resilience into its mandated crops to cope with future challenges, including climate change.

A notable characteristic, particularly of the MENA region, is the high rate of unemployment or underemployment among the young. Young people (15-24 years old) constitute 20% of the total population in MENA, and over the next 10 years their number is expected to grow by at least 7 million (IFAD 2011). At the same time, the percentage of young people in this group who are unemployed stand at 30%, nearly four times the adult unemployment rate in the region. Today's young people in MENA are better educated than their elders, yet represent the largest proportion of the unemployed. Unemployment of a large portion of the young population constitutes both a social and economic loss, and has been identified as potential fuel for civil conflicts.

Investments in sustainable agri-food systems development to drive economic growth provide major opportunities for generating employment and livelihoods, particularly for the young. Developing opportunities in rural areas, for instance in agricultural services or adding value to agricultural products through processing and marketing, is one strategy that offers alternatives, particularly for women and the young unemployed.

### Political instability and conflict

Beyond the structural causes of food insecurity, conflicts and political instability have been the single most important driving factor of food insecurity in the region in recent years. At the same time, World Food Day 2017 recognized that food insecurity is a contributor to what has now become one of the world's most vexing problems: forced migration. More people have been forced to flee their homes than at any time since the Second World War due to increased conflict and political instability. The MENA region alone hosts more than 53% of all refugees and 37% of displaced populations in the world.

The ongoing impacts of the conflicts in Iraq, Libya, Syria, and Yemen are self-evident. But a recognition of the challenges of living in dry areas may contribute to a better understanding, at least in part, of the underlying causes that contribute to conflicts. The challenges discussed in the previous sections – water scarcity, climate change, declining production of staple food crops, population growth, and unemployment – are likely to drive further competition for limited resources, a decline in livelihoods and incomes, rising inequality

between rural and urban populations, and further migration by those seeking better opportunities.

The consequences of civil instability are long-term: economic growth declines; people leave, and with them critical knowledge and skills; infrastructure deteriorates or is destroyed; agricultural production systems collapse, causing food and nutritional insecurity; hunger intensifies poverty; investments in agricultural research and development cease; and natural resource degradation is further aggravated. Any post-conflict investments must contribute to restoring the agricultural sector if a country's natural resource base and food production capacity are to recover.

One of ICARDA's strengths has been its ability to work effectively in fragile states and post-conflict countries in re-establishing NARS and farmers' production capacity, through partnerships and active engagement on the ground. For instance, we have continued to engage with NARS and development systems in Afghanistan, Iraq, Libya, and Syria throughout their prolonged conflicts, linking them into regional projects and programs and providing opportunities for further capacity improvements. And since the independence of the Central Asian Republics from the Soviet Union, we have worked with these countries as they have adjusted to major structural transformation and development of their agricultural economies.

## Opportunities for development in dry areas

In order for millions of smallholder farms to develop into profit-making enterprises and for rural communities to transform into vibrant hubs of economic activity, the solutions and options offered must be proven, cost-effective, sustainable, and adoptable by smallholder farmers and associated communities. This goal has been central to ICARDA's mission in the past, but the necessity of achieving these development outcomes, and doing so more effectively and efficiently, is more urgent today than ever before. Substantial opportunities exist to reverse the current trends and turn agriculture and associated diversified livelihoods into an engine for economic growth in non-tropical dry areas.

### Science opportunities

Agricultural research for development has changed substantially over the past 10 years. Innovations in breeding, genomics, informatics, information and communications technology (ICT), environmental and behavioral economics, gender analytics, and the management and use of big data have important implications for how agricultural research is conducted and what impact it can have on development.

There is tremendous scope to build profitable farming systems that are climate resilient by tapping into the knowledge and enthusiasm of farmers and into dry areas' rich heritage of plant biodiversity, which contains the inherent adaptive traits that are key to adaptation to climate change. Strong pre-breeding research will allow genes for adaptive and complex traits to be brought into breeding populations from wild species and landraces. Molecular and other biotechnological tools and applications to characterize and efficiently mine the diversity in the ICARDA genebank and to enhance and complement conventional crop breeding offer new prospects. Increased yield per unit of water; improved tolerance to heat, cold, frost, and salinity; and better resistance to a wide range of pests and diseases are within reach. Gene mining and *in situ* germplasm conservation will be vital to efforts to meet the challenges of a changing climate.

There are also prospects to diversify and intensify crop and livestock mixed production systems and thereby close existing yield gaps, especially under rainfed conditions. Fertilizer micro-dosing, micro-irrigation and sustainable land management practice options can be combined with geo-informatics to facilitate the scaling out of proven technologies.

### Opportunities to develop professional skills

There are ample opportunities to build scientific skills and support a cadre of well-trained researchers and innovators. ICARDA uses a mix of approaches to capacity development, including enhancing long-term capacity in partner organizations through graduate and postgraduate training; formal short-term training combined with on-the-job training of trainers on specific technical skills; and new approaches and methods that are required within the context of research-for-development projects. These approaches are particularly

relevant in the post-conflict countries (i.e. Afghanistan, Iraq, Syria, and Yemen) in which ICARDA works.

In addition, there is an unmet need to boost the skills of rural communities – particularly women and youth – to engage in efficient, profitable, new, and better job opportunities, directly in farming and also in agricultural services and functional value chains and markets. FAO estimates that more than 40% of the labor force in agriculture in non-tropical dry areas comprises women.

### Opportunities resulting from ICARDA's decentralized mode of operation

ICARDA's decentralized institutional model, with a lean headquarters and the majority of the scientific and technical strength strategically located in research hubs spread across different agro-ecologies, enables the Center to better meet local and regional needs. The recent consolidation of the Center's administration, communication, and finance functions may further strengthen this decentralized approach and more effectively sustain the research agenda.

### Opportunities related to ICARDA's proven record in successful partnerships for impact

ICARDA's close partnerships with national research and extension programs, national universities, and advanced research institutions (ARIs) have been crucial for our past successes. ICARDA has worked closely with these partners in identifying problems, setting priorities, and addressing those problems through science and technology. ICARDA's role has included coordinating and facilitating regional programs of collaboration with and between NARS as well as building economies of scale in agricultural research for development by reducing duplicative research. Increasingly, national and regional institutions in the countries where ICARDA works have emerged as centers of innovation in crop improvement, natural resource management, and policy reform. This positive development signals an important change in ICARDA's role as a strategic research actor, whereby we will work to enhance the efforts, skills, and competencies of our partners to shape and drive their own national and regional agricultural research agendas.

These well-established partnerships will be expanded to include collaboration with other partners that have the knowledge and resources to open new avenues for

the development of dry areas and to reach impact at scale: development agencies, which have a potential role in the up- and out-scaling of innovations through their engagement in development programs; grassroots, community-based, and non-governmental organizations in testing and adapting innovations and market linkages; and the private sector in identifying and developing value-added options, market opportunities, and linkages for out-scaling innovations.

## ICARDA's unique proposition

### Why ICARDA?

ICARDA's added value and comparative advantage in working in non-tropical dry areas are founded on five core attributes and approaches.

- **Delivering science for impact:** ICARDA's diversity of international scientists with a range of specialized skills allows us to mobilize multi-disciplinary teams that generate evidence-based solutions grounded in science and in-depth knowledge of the environments and countries in which we work.
- **Strength in relationships:** ICARDA is the go-to organization for linkages in the region where we operate. Our longstanding presence in the region has given us an understanding of the cultures and environments in which we work. Our insights and access, together with our independence and non-political status, enable ICARDA to leverage a network of partners. We are able to convene regional science fora and bring researchers, decision-makers, stakeholders, and other actors around the table to make effective collaboration possible.
- **Working in environments difficult for development:** ICARDA has a history of effectively operating in fragile states and post-conflict countries, contributing to the rebuilding of agricultural research capacity and the sector as a whole. This history includes a strong focus on taking research outputs and outcomes to scale by partnering with development practitioners.
- **The genes we hold in trust:** Through its unique collections of the major crops, held in trust in genebanks, ICARDA is a world leader in the collection and characterization of plant genetic diversity and the

provision of this material to breeding programs globally. Key to our comparative advantage is the use of this genetic material to provide traits needed to cope with the biotic and abiotic stresses that will become more prevalent with climate change.

- **Organizational structure:** ICARDA's success is founded on its resilience as an organization and its ability to innovate and adapt to change. The decentralized approach to managing our research agenda ensures that we respond to local and contextual issues on the ground, where they arise. This contextual understanding and geographic presence strengthens our ability to support donors and manage grants in volatile contexts. We intend to strengthen it further.

*"ICARDA has a history of effectively operating in fragile states and post-conflict countries, contributing to the rebuilding of agricultural research capacity."*



### Enhancing food security

Our improved wheat varieties now grow in hotter and drier agro-ecological zones of Africa and Asia. We work actively with farmers to help them overcome the challenges of water scarcity and land degradation. In Nigeria, participating households increased their wheat productivity from 1-2 tonnes/hectare to 5-6 tonnes/hectare. In Sudan, the government has adopted our approach as part of its national agricultural technology extension program. In Ethiopia, national wheat production has increased by 45%, surpassing 4 million tonnes in 2016.

# PART II

## Strategic priorities

Five Strategic Research Priorities (SRPs) and four Cross-Cutting Themes (CCTs) reflect the core research and development agenda of ICARDA over the next 10 years. These priority areas build upon our core expertise and competencies to respond to the pressing issues presented by a +4°C future, which ICARDA believes is unavoidable in many non-tropical dry areas. To ensure that these strategic efforts remain relevant and respond to the challenges of a +4°C future, ICARDA will partner with key ARIs that can provide downscaled scenarios to inform the research agenda's goal of building resilient and sustainable agri-food systems in target areas.

### Strategic Research Priorities (SRPs)

1.  **Collect, conserve, and use agricultural biodiversity** in non-tropical dry areas in order to meet future climate- and market-related challenges.
2.  **Develop climate-adapted crops and livestock** for greater food and nutritional security in the face of increasing water scarcity, climate change, and changing markets.
3.  **Build climate-resilient, integrated crop-livestock farming systems** for improved and resilient livelihoods in order to optimize economic, social, and environmental co-benefits in areas with high concentrations of poor people.
4.  **Promote sustainable value chains, supportive policies, and viable off-farm activities** for diversified incomes and improved livelihoods in non-tropical dry areas.

5.  **Support sustainable use and management of scarce water and land resources**, focusing on ecosystems, landscapes, and farm levels that offer significant opportunities to reverse environmental degradation and enhance sustainable intensification.

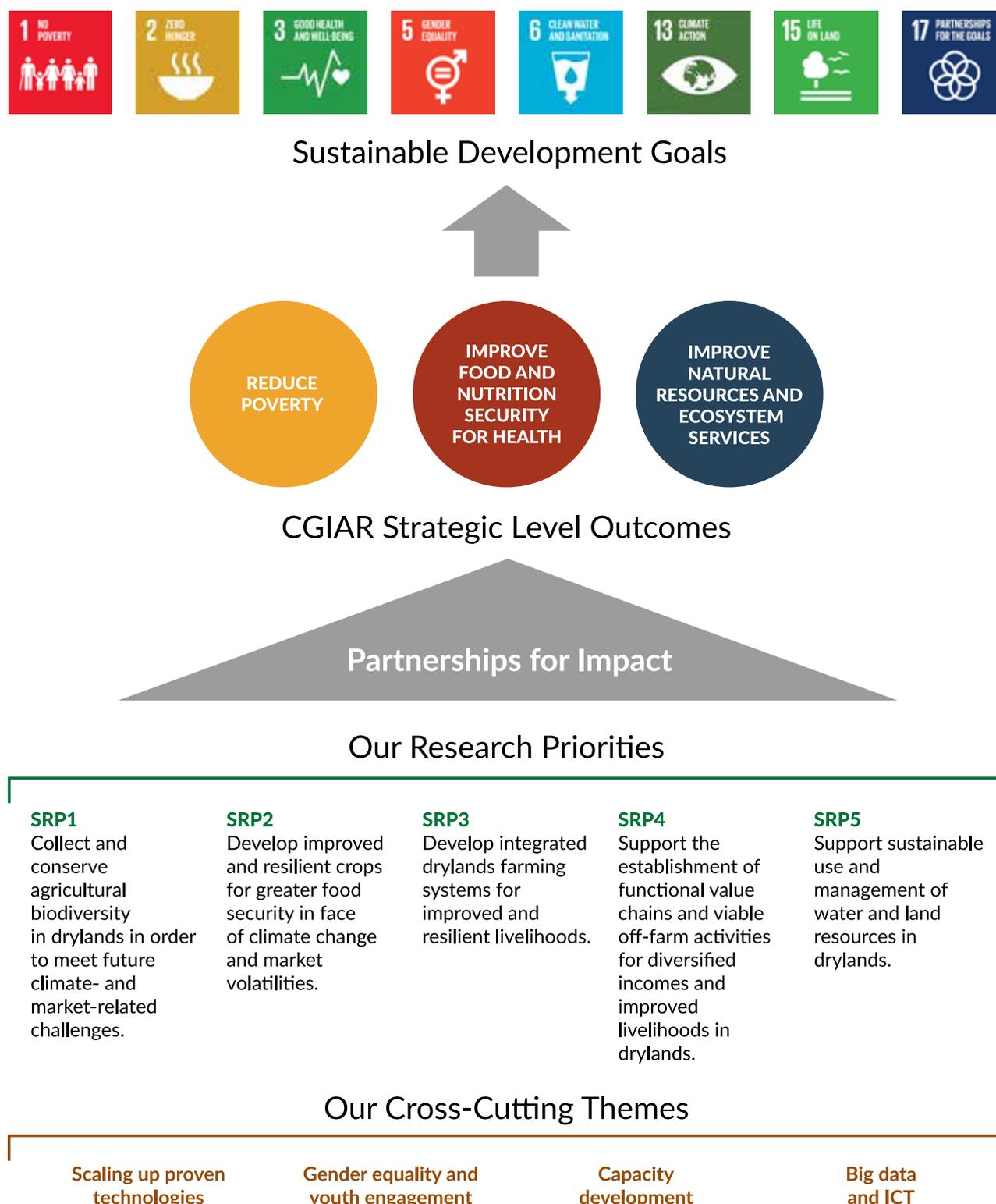
### Cross-Cutting Themes (CCTs)

1.  **Scaling up of proven technological packages** to realize impact at scale through innovation systems that improve links between research and development and expanded partnerships along well-designed impact pathways.
2.  **Gender equality and youth engagement** to meet the needs and the aspirations of women and young people as key vulnerable groups, and to provide empowerment and better socio-economic opportunities to address inequality, including youth employment in agricultural services and agri-food supply chains.
3.  **Capacity development** to build a strong and empowered cadre of young and talented researchers and thriving institutions. Equipping future leaders with the skills needed to be effective in research management and administration will be crucial to long-term success.
4.  **Big data and ICT** to offer innovative solutions that meet the demands of future smallholder farmers for information critical for their production systems and decision-making.

The results framework that embeds these strategic and cross-cutting priorities, detailed in the later section *Pathways to impact*, aligns with the CGIAR Strategy and

Results Framework 2016-2030 and responds directly to eight of the Sustainable Development Goals (Figure 4).

Figure 4: ICARDA's Strategic Results Framework for thriving and resilient dry areas



# The research agenda

## Strategic Research Priority 1: Collect, conserve, and use agricultural biodiversity

**Focus:** Conserving genetic diversity and using it by introgressing novel genes into breeding populations adapted to the agro-ecologies of dry areas, future climates, and markets.

Dry area agrobiodiversity is key to ensuring further genetic gains and adaptation to climate change. ICARDA plays a crucial role in promoting the conservation and sustainable use of dry area agrobiodiversity. Its genebanks hold important and unique collections of global significance in trust. The collections total more than 155,000 plant accessions and 1,380 strains of rhizobia, collected predominantly from four major Vavilovian centers of diversity (Mediterranean, Central Asia, West Asia, and Abyssinia). SRP1 will contribute to introgressing multiple key traits into the breeding populations of the mandated crops that are the focus of SRP2.

Under SRP1, ICARDA will:

- 1.1 Collect, conserve, and mine genes and distribute genetic resources through the reconstruction of our base and active collections, which include plant and rhizobium resources. We will add novel diversity to the collection through new, joint collecting missions and by judiciously acquiring genetic stocks and breeding germplasm.
- 1.2 Focus on phenotyping and genotyping plant genetic resources in order to identify critical traits of resistance that can be used within our breeding programs on drought and heat tolerance, disease resistance, and nutritional attributes. With partners, we will explore the use of next-generation sequencing technologies.
- 1.3 Undertake pre-breeding initiatives to introgress adaptive traits from wild relatives and landraces into elite germplasm of mandated crops emphasizing diseases, insect pests, heat and drought tolerance, and water-use efficiency. We will undertake research into nitrogen fixing for hotter and dryer future climates.

- 1.4 Contribute to the development of new open access tools for electronic data capture, data analysis, and decision support, thereby making available data on genetic resources and bioinformatics. Produced in partnership with Bioversity International, CIMMYT, and ICRISAT, this information will be accessible to breeders as a global public good.
- 1.5 Join efforts with NARS to assess the status and threats to dry areas agrobiodiversity and recommend management plans for the conservation of biodiversity-rich areas.
- 1.6 Increase yields by sustaining indigenous pollinator biodiversity and enhancing pollination services, using the Farming with Alternative Pollinators approach. We will develop a policy strategy that will allow low-income countries to protect native pollinators and thus simultaneously enhance climate change resilience.

## Strategic Research Priority 2: Climate-adapted crops and livestock

**Focus:** Improving crops and livestock for current and emerging biophysical constraints and markets, adapted to the agro-ecologies of dry areas and future climates.

The crop and livestock breeding programs at ICARDA have the overall objective of developing resilient plant and animal resources that meet current and future challenges faced by non-tropical dry areas. Working through partners and networks, we will apply conventional and molecular breeding in order to develop highly-adapted crops and livestock with resistance or tolerance to major biotic and abiotic constraints and current and future climates. SRP2 will build upon the outputs of SRP1, which involves introgressing new alleles from landraces and wild relatives into elite germplasm. Mainstreaming nutritional quality (including biofortification) in current breeding programs and widening the genetic base will be pursued as major breeding strategies to realize the full potential of yield, yield stability, quality, and nutrition. Because water scarcity is a key driver of yield instability in non-tropical dry areas, ICARDA will identify genotypes with better water-use efficiency to minimize yield losses during drought and maximize yield gains during good seasons.

*“Sustainable intensification of non-tropical dry area crop and livestock production systems, with a strong market orientation, is a key driver of increasing agricultural productivity.”*

ICARDA will play an important role in the surveillance, identification, and characterization of wheat rust diseases, in collaboration with CIMMYT and in partnership with other stakeholders. Collaboration with the Regional Cereal Rust Research Center (RCRRC) and biocontainment facility in Izmir, Turkey, a state-of-the-art research facility for the identification of rusts using the latest advances in molecular biology, will be core to this work. The focus of the Research Center will be to improve regional cooperation for cereal rust in general, and the wheat stripe rust monitoring systems in particular, and to strengthen collaboration and capacity development on crop breeding for durable rust resistance and resistance management.

Delivering on our agreement with CIMMYT to develop a One Global Wheat Program, and engaging ARIs, will be promoted in order to ensure that the breeding programs use cutting-edge technologies with increased efficiencies.

Under SRP2, ICARDA will:

- 2.1 Widen the genetic base through introgression of new variability (from SRP1) to ensure yield stability, quality, and nutritional attributes along with tolerance to heat, drought, and biotic and abiotic stress. We will explore novel approaches to ensure that this superior germplasm reaches farmers' fields.
- 2.2 In order to use precision breeding to accelerate genetic gains, develop genetic stocks that include association panels, mapping populations, Targeting Induced Local Lesions in Genomes (TILLING), Nested Association Mapping (NAM), and Multi-parent Advanced Generation Inter-Cross (MAGIC) populations.
- 2.3 Understand the mechanisms of resistance to key pests of cereals and food legumes and identify alleles associated with this resistance.

- 2.4 Develop dual-purpose barley and legumes that provide nutritious feed for livestock and grain; improve the malting quality of barley; and ensure the accessibility of this material.
- 2.5 Use cutting-edge research on the genomics of small ruminants as part of a program to enhance breeding efficiencies and identify key traits that will be critical in coping with climate change.
- 2.6 Generate new insights in our understanding of the range of plant adaptive mechanisms underlying crop water usage under stressed environments. New tools will then permit efficient selection of parental material and breeding germplasm.
- 2.7 Undertake research into seed delivery systems through increased private-sector participation, including institutional and policy options to improve the availability of improved varieties of mandated crops.

### **Strategic Research Priority 3: Building resilient integrated crop–livestock farming systems**

**Focus:** Building resilient, integrated, mixed, multi-enterprise land use systems adapted to key non-tropical dry area agro-ecologies (rainfed, agro-pastoral, and irrigated) and markets.

Sustainable intensification of non-tropical dry area crop and livestock production systems, with a strong market orientation, is a key driver of increasing agricultural productivity and is crucial to addressing livelihoods, food security, and the sustainable use of natural resources under changing climate conditions. This intensification requires addressing significant water-limited yield gaps in rainfed areas through improved agronomic practices and the scaling up of conservation-based farming practices. To support adoption of conservation agriculture, SRP3 will develop solutions to optimize the use of plant biomass for restoring soil health and livestock feed. We will develop integrated crop–legume–livestock systems that move towards carbon neutrality and increased resilience to cope with climates of the future.



**Improving livestock through community-based breeding programs**

In Ethiopia, we have introduced more than 30 community-based sheep and goat breeding programs since 2009. Combining selective breeding programs based on production parameters, such as body weight, the program has benefited over 3,000 farming families by increasing incomes by 20% on average. These families' sheep and goats have shown increased productivity and reduced mortality. The program is also being implemented in Uganda, Malawi, Tanzania, and South Africa.

- 3.4 Continue our research to improve the governance and productivity of rangelands through a range of interventions that include policy and institutional innovations and sustainable rangeland restoration in collaboration with SRP5.
- 3.5 Analyze drivers of agricultural transformations in dry agro-ecologies to maintain the relevance of research to changing environments.
- 3.6 Embed comprehensive technology adoption studies and impact assessments in all programs to ensure that livelihood outcomes are empirically measured.
- 3.7 Develop frameworks and modeling approaches for multi-criteria assessment (environment-economy-equity) of integrated system development as decision support systems. Assessment will specifically address risk and gender inclusiveness.

**Strategic Research Priority 4: Sustainable value chains, supportive policies, and viable off-farm activities**

**Focus:** Supporting the development and establishment of multi-enterprise farming systems in key non-tropical dry area agro-ecologies and associated markets.

Our premise is that agriculture can act as a business and income generator that provides financial stability for many poor smallholder households and allows them to meet their aspirations and goals. This potential is not met because agri-food systems are not yet fully developed, and in the absence of targeted investments in agronomic technologies, infrastructure, and markets, risks are perceived to be high. Therefore, value chains underperform. ICARDA will contribute to building resilient and vibrant farming systems and communities in non-tropical dry areas along with creating employment opportunities for youth and women.

ICARDA views partnerships with key stakeholders along the value chain as critical in this endeavor and we see our role as a catalytic agent in this process.

Under SRP4, ICARDA will:

- 4.1 Assess, assist, and evaluate with strategic partners the creation of sustainable value chains for durum wheat, barley, legumes, seed, and small ruminants in the MENA region and elsewhere. This will be

Under SRP3, ICARDA will:

- 3.1 Focus on agronomic elements of production systems to address the increasing water-limited yield gaps observed across dry areas. We will promote the up-scaling of conservation agriculture and low-cost smallholder mechanization with strategic partners.
- 3.2 Undertake research on farmer- and community-based breeding programs using the outputs on small ruminant genomics from SRP2, with the goal of increasing sheep and goat productivity and the sustainable use of indigenous genetic resources.
- 3.3 Promote climate-smart feed production and precision feeding systems. Linked with SRP5, the safe use of marginal-quality water in feed and forage production will be promoted to address water scarcity in the urban-rural interface.

based on the evaluation of local and new markets and may require novel policies and the creation of enabling environments.

- 4.2 Expand our work on decent and attractive employment opportunities – with a focus on women and youth – along dry area crop, feed, small ruminant, and camel value chains and develop research on local food systems.
- 4.3 Develop monitoring, evaluation, and learning systems for investment programs that support the development of agricultural commodities in non-tropical dry areas. These will include tools that will be critical to guide scaling-up decisions.

### Strategic Research Priority 5: Sustainable use and management of scarce water and land resources

**Focus:** Enhance water and land productivity in key non-tropical dry area agro-ecologies (rainfed, irrigated, and agro-pastoral).

Water resources are the most limiting component of agricultural production in dry areas. ICARDA will therefore continue to improve agricultural water productivity and, in collaboration with our sister center the International Water Management Institute (IWMI) and others, develop its framework further for wider adoption. Core to the research effort of SRP5 is enhancing and restoring the provisioning, regulating, and supporting ecosystem services in dry areas. SRP5 will build upon past achievements, which range from rainwater harvesting using landscape modification to supplemental and deficit irrigation.

We will take a more integrated approach to managing soil, land, and water resources across the extensive rangelands of non-tropical dry areas through links with the rangeland, livestock, and value chain expertise embedded in the Center. Further, with partner ARIs we will investigate alternative opportunities to diversify the livelihoods of the communities in rangelands, for example in renewable energy.

Under SRP5, ICARDA will:

- 5.1 Maximize *in situ* storage of water in rainfed agriculture and rangelands through conservation interventions, which will contribute to addressing water-limited net primary production.

- 5.2 Improve on-farm water use and management for higher water and land productivities.
- 5.3 Support the safe use of treated wastewater in the urban–rural interface for the production of feed and forages for livestock and quantify the potential contribution of these sources to managed aquifer recharge.
- 5.4 Contribute to achieving land degradation neutrality and enhance the provisioning, regulating, and supporting ecosystems services with green and gray infrastructure.
- 5.5 Increase our capacity in soils research with a focus on soil fertility and health and the development of effective indicators to support assessing change.
- 5.6 Contribute to the restoration of degraded dry agro-pastoral ecosystems through understanding the implications of landscape modification, for example through rainwater harvesting.

### Cross-Cutting Theme 1: Scaling up of proven technological packages

Taking technological innovations to scale can only be achieved through cooperation and strategic partnerships with key stakeholders and actors. Effective and complementary partnerships, however, are much more than a numbers game; we believe that the most effective partnerships and capacity strengthening efforts are those that target a clear research-for-development agenda.

ICARDA will grow its partnership base to further include more ARIs, non-traditional partners, private-sector partners, non-governmental organizations, development agencies, financial institutions, and key change agents, seeking greater engagement especially with ARIs and public–private partnerships. The Center will sharpen its focus on South–South cooperation, already successfully developed through a number of initiatives. Key to the success of scaling is the need to ensure that the research we undertake and the knowledge we generate is demand-driven and relevant and addresses the challenges of smallholder farmers, particularly women and youth.

**ARIs:** ICARDA will partner more strategically with ARIs to develop products that support development

partners in taking research outputs to scale. Decision support platforms, jointly developed with ARIs, will provide development organizations and practitioners with necessary tools to ensure the highest probability of success in scaling. Through such partnerships, we will undertake comprehensive assessments and develop opportunities in building functional and viable value chains for our key commodities, to generate employment for young entrepreneurs. This will also include further research into business models associated with service delivery systems for smallholder farmers and entrepreneurs.

**NARS:** We will enhance our partnerships with NARS, extension services, and governments to undertake research into scaling up for impact. These partners are the co-creators of new knowledge that will be packaged in a manner that is contextual and demand-driven as a result of our outreach activities, which will continue to play an important role in taking innovations to scale. Outreach activities provide a channel for research partnerships, foster an integrated approach to address challenges of dry areas, and enhance capacity development of the management and staff of the relevant NARS in gaining experience and a broader view of issues.

**Private sector and development agencies:** ICARDA will encourage greater engagement between the public and private sectors to improve opportunities to take technological innovations to scale through public-private partnerships and innovative business models. Similarly, ICARDA will build its partnerships with in-country development agencies and support their programs. The research on scaling will focus on innovative, cost-efficient scaling approaches using new technological approaches (e.g. ICT and social media).

It is crucial to get improved varieties, livestock, and associated technologies into the hands of farmers to ensure they have the right products to meet their needs. Through collaborative and synergistic approaches, we will develop new and innovative business models to ensure the delivery of superior genetic resources to farmers' fields. We will explore opportunities to engage more effectively with the private sector to support the delivery of improved germplasm, working with seed companies that specifically target smallholder farmers. We will continue to engage small-scale entrepreneurs, predominantly women and youth, in seed production and

delivery. Through the knowledge that we have generated in innovation platforms as a conduit to getting research outputs into farmer fields, we will continue to grow and refine this approach to support large-scale impact.

We will further enhance our interaction with development partners, national extension systems, and non-governmental organizations as delivery mechanisms to accelerate the adoption of new technologies. This will also include engagement with decision-makers through dialogue, advocacy, and regional fora to create a conducive enabling environment through policies and policy reform.

### Cross-Cutting Theme 2: Gender equality and youth

As the role of women in dry area agriculture increases, and their workloads become heavier with the migration of men to urban areas and abroad, they face financial, cultural, and legal constraints in accessing knowledge, innovation, finance, markets, institutions, and resources, particularly land and water resources. We will identify how specific gender gaps and priorities in targeted regions have important implications for gender-equitable, demand-driven development and identify effective gender-responsive and transformative ways to increase production, food security, incomes, and women's share of these benefits.

Our focus will be to improve women's access to land, water, seeds, credit, and other productive resources and to knowledge and innovation. We will acknowledge and build upon their traditional knowledge in adapting to climate change; in livestock, land, and water management; and in breeding and preserving seeds of food crops. ICARDA's research will seek to empower women through capacity development and to facilitate their role as leaders and active agents of change. Understanding their needs will allow ICARDA to support ways to enable women to access, own, control, and benefit from productive resources as well as improve their working conditions in the agricultural wage sector, which is largely dependent on the labor of women. In addition, we will explore cultural, ideological, normative, and institutional factors, as well as emerging changes and trends in these factors, and analyze how they affect gender relations, gender roles, and decision-making processes.



### Empowering women

We trained 1,400 women in rural areas in the northern and eastern provinces of Afghanistan to help them improve dairy production. The women also received training in a community-based health care system linked to the Afghan Ministry of Agriculture, Irrigation and Livestock. The number of goats distributed increased fourfold to over 7,000 in four years, and 60% of beneficiaries reported that they had adopted improved goat management practices. As a result, milk production increased by 30% and goat mortality dropped by 90%.

Projects will ensure that women and men directly participate in and benefit from ICARDA research by setting gender-inclusive objectives from the onset. We will go beyond collecting and analyzing gender-disaggregated data to exploring factors and processes through which gender relations are shaped and possibly refigured, so that women as much as men participate and benefit from the development process.

Youth are an additional target group because they too represent a large disenfranchised group facing high levels of unemployment. Yet they have tremendous capacity to innovate and engage meaningfully and lucratively in the agricultural sector. In order to make agriculture more attractive and lucrative for this group, we will address research questions around youth and their engagement and empowerment in the agricultural sector with a specific focus on service provision and the value chains of key commodities. The Center will explore new and innovative ways of attracting youth into agriculture through the development of entrepreneurs that use and benefit from technology. With our partners taking innovation to scale, we will ensure that gender and youth are comprehensively active in and benefit from all of ICARDA's projects and initiatives.

### Cross-Cutting Theme 3: Capacity development

Capacity development is core to ICARDA's mission and an essential element for the delivery of quality research and sustainable development impact. Over the coming decade we will build on our extensive network of long and enduring partnerships with universities and ARIs, which share our unique approach to applied practical research and enable our close engagement with smallholder farmers through the practice of extension.

We recognize that in order to successfully address agricultural challenges in non-tropical dry areas, the countries we work in need a strong and empowered cadre of young women and men who are talented scientists as well as effective institutions to house them. We will support and strengthen our effective and efficient "ecosystem" of science and research with a focus on building capacities at individual, institutional, and community levels.

We will address broader questions of empowerment, leadership, institutional change, and greater public-private collaboration. This will largely be achieved by

We will also investigate the need for gender-responsive and transformative action for effective agricultural research for development under changing climate conditions and the implications for technology development and adoption. We will explore promising formal and informal institutional arrangements to increase women's voice and power in dry area communities and agricultural organizations coping with climate change, to ensure more sustainable and equitable community resource management and use. We will use technologies and knowledge to reduce the drudgery of agricultural work to free up time and energy; support women to engage in more lucrative economic activities through agricultural diversification, intensification, and value-addition; and investigate promising practices for women to purchase, operate, and benefit from such technologies at individual, household, and community levels. Because labor is such an important asset for women and youth, it is critical that we pay attention to improving wages and working conditions and eradicate gender-based inequalities to realize decent work for rural women and youth.

fostering South–South partnerships with selected national and regional institutions that are known for their advanced knowledge and high-tech facilities on specific applied agricultural research solutions. This will ensure that we are building the capabilities that will lead to an enduring legacy.

We will seek opportunities to develop accredited courses in partnership with ARIs and universities to ensure the quality and relevance of our capacity development programs. We will take advantage of new approaches and the ICT revolution to enhance the web portal of ICARDA's Capacity Development Unit, e-learning, and other interactive tools that offer improved sharing and exchange of knowledge and experience, and access to sources of scientific expertise, training, and research funding opportunities.

ICARDA will continue to use a mix of training approaches, including group courses and individual short- and long-term courses. The Center will continue to assist in upgrading the skills of female and male national scientists by actively engaging partners in jointly developing and implementing demand-driven research-for-development projects and initiatives, and continue to make our non-degree training programs available to research associates and assistants. In addition to increasing the pool of trained personnel, these activities will also help build strong bonds to facilitate continuous research collaboration and sharing of knowledge and experience.

### Cross-Cutting Theme 4: Big data and ICT

The advent of big data, which incorporates geo-informatics, remote sensing, and the large volumes of data being generated by technological advances in genomics, will revolutionize the way we work in the future. The use of this information to increase research efficiencies and decision-making, from the farm level to the policy level, is beginning to take place. Using big data in an effective manner will be a key element in addressing the challenges facing research programs and dry areas as a whole. We intend to capitalize on big data to the benefit of our breeding programs, thereby ensuring a continuous supply of improved varieties to smallholder farmers. We will also build digital platforms to generate maps of crop productivity and water consumption in near real time, which can be used for water accounting and agro-ecosystem assessment. In

order to make full use of big data and ICT, we will partner with other CGIAR centers, CGIAR Research Programs (CRPs), ARIs, and the public and private sectors.

ICARDA's geo-informatics research focuses on knowledge-based prioritization of agricultural landscapes for improved interventions, implementation, and impacts through the use of multi-sensor, multi-scale observations of agro-ecosystem productivity, resource use efficiency, land potential, and associated drivers to assist addressing issues related to food and nutritional security, natural resource management, and resilience.

We will develop advanced analytics (machine learning, artificial intelligence) for research, development, and outreach in collaboration with research programs, partners, collaborators, and citizen science.

We will support the work in the SRPs by working on quantification of yield gaps and land potential for better targeting developmental interventions towards bridging the yield gaps in dry areas.



### Enhancing nutrition security

To fight malnutrition, we developed hundreds of genetically crossed varieties using high-micronutrient-content germplasm, breeding lines, and popular cultivars. As a result, in Bangladesh alone, around 956,000 farmers adopted new lentil varieties high in iron and zinc, covering 86% of the lentil cultivation area and producing an additional 33,000 tonnes of harvest worth US\$30 million annually. And in Nepal, almost 60% of farmers adopted the new varieties, resulting in additional lentil production of over 36,000 tonnes worth US\$29 million annually.

We will continue to explore opportunities to build collaborative tools and approaches to assess the risks and impact of climate change. We will develop spatial tools and technology for scaling up and scaling out the proven technology and package of sustainable land management options best suited for the local context.

We will continue to develop a geo-cyber facility to build and enhance a research data repository and contribute to Center- and CGIAR-level international public goods and open access initiatives.

## Pathways to impact

### ICARDA's contribution to CGIAR: Collaborating with sister centers

CGIAR's mission is to advance agricultural science and innovation to enable poor people, especially women, to better nourish their families, and improve productivity and resilience so they can share in economic growth and manage natural resources in the face of climate change and other challenges.

In 2015, CGIAR announced a new Strategy and Results Framework 2016-2030 for designing and implementing a new approach to undertaking research through the establishment of CRPs focusing on agri-food systems. This document guides agricultural research towards practical solutions and innovations to reduce poverty, increase food and nutrition security, and improve natural resources and ecosystem services; these are commonly known as the three CGIAR System-Level Outcomes. The Strategy and Results Framework sets out common goals and strategic direction to guide delivery of the shared CGIAR mission by all 15 CGIAR centers.

The CGIAR research portfolio includes 12 CRPs. Eight programs focus on innovation in agri-food systems while four are global integrating efforts. The CRPs are supported by three research platforms designed to manage genetic resources, to accelerate research on breeding, and to manage rapidly growing volumes of scientific data. The programs and platforms are designed to align the work of the 15 CGIAR centers and their partners through various multi-disciplinary research initiatives to address the world's most pressing agricultural development challenges.

ICARDA will contribute to the CGIAR portfolio through active participation in the WHEAT, LIVESTOCK, Water, Land and Ecosystems (WLE), and Policies, Institutions and Markets (PIM) CRPs, as well as through its engagement in all three platforms: Genebanks, Excellence in Breeding, and Big Data.

The CGIAR Strategy and Results Framework and ICARDA's strategic vision for "thriving and resilient livelihoods" lend themselves to the exploration, with sister CGIAR centers, of new opportunities and partnerships for innovative research to address complex agriculture and development challenges faced in non-tropical dry areas. ICARDA will create and nurture strategic partnerships with sister centers. With CIMMYT, we will help to build a One Global Wheat Program. We will develop modern bioinformatics breeding systems and partner on strategic initiatives within CRP WHEAT. We will continue to strengthen our longstanding partnership with ICRISAT, which is responsible for tropical dry areas, by collaborating and sharing chickpea material and using their high-throughput genomics facility. We will also work closely with ICRISAT in the CRP for grain legumes and dry areas cereals. We will collaborate with the International Rice Research Institute (IRRI) to explore opportunities to intensify and diversify rice-based systems in South and Southeast Asia through the strategic introduction of legumes into rice fallows. We will partner with IWMI, the International Food Policy Research Institute (IFPRI), and WorldFish to develop joint initiatives in CWANA, bringing each organization's comparative advantages to bear on the challenges of water resources. We will continue our engagement and enhance our collaboration with the International Livestock Research Institute (ILRI) in the area of small ruminant genetics. In our research into rehabilitating the vast rangelands of non-tropical dry areas and enhancing their productivity, we will explore opportunities to engage with the World Agroforestry Centre (ICRAF) in the development of agroforestry options.

### Achieving impact

There has been significant progress in addressing endemic poverty and ensuring food and nutritional security in non-tropical dry areas. However, these gains and achievements are threatened by current and long-term climate variability and climate change and the unsustainable use of natural resources. Over the next decade, and looking further ahead, we will need

to redouble efforts to ensure that the global dry areas are transformed into thriving and resilient entities contributing to sustainable economic growth.

ICARDA's contribution to meeting this vision is predicated on our ability to develop and deliver international public goods through innovation in scientific excellence, knowledge generation, problem solving, expertise, and advice as well as technological packages that will support the building of resilient and profitable farming systems in the global dry areas. These international public goods will be available to everyone and will complement the work of our partners in both the public and private sectors.

Core to our success – all of which supports the CGIAR System-Level Outcomes – will be a continuous internal learning process that will require frequent monitoring and course corrections over the next decade. We will document outputs, outcomes, and impacts rigorously through our Monitoring, Evaluation, and Learning (MEL) Platform and critically evaluate our progress in achieving clear targets in each of the three goals with appropriate indicators embedded in all projects. Impact assessments will be key in informing stakeholders of our achievements and the effective use of investments.

### Impact pathways

Our vision of vibrant and resilient non-tropical dry areas contests the notion that these regions are irretrievable, a notion based on the complex nature of the challenges facing dry areas, the endemic poverty that portrays a sense of hopelessness and powerlessness, and the belief that in order to address these challenges, there will be a need for significant investments that are beyond the means of national governments. ICARDA is convinced that by empowering communities and the poor through their own actions, supported by innovation and an enabling environment, we can reverse this downward spiral of hopelessness. By enhancing people's livelihood options, going beyond just agriculture to functional and sustainable value chains, we can improve incomes as well as provide work opportunities, especially for women and youth. Improved circumstances will ensure re-investments in farming enterprises that improve overall performance and resilience. This kind of change would help communities move towards diversified, resilient, and sustainable farming systems and enterprises for dry areas. National governments, the

private sector, investors, NARS, and civil society all have roles to play in creating the enabling environment for this transformation, which will be steered primarily by poor people and their communities.

We recognize that for transformation to take place local, regional, and national governments need to demonstrate leadership and the political will to support the changes. Comprehensive local, regional, and national plans that target poor people and rural communities that depend on the agricultural sector, accompanied by action plans and the financial resources to support tangible and implementable opportunities on the ground, are a prerequisite for success. Without the creation of an enabling environment by governments, it will be difficult to attract development agencies, banks, donors, and the private sector to invest. We assume that the political will to transform the agricultural sector into a climate-proof endeavor and to develop vibrant, prosperous communities is present. We also assume that donors and investors are willing to continue to support the research effort that generates the associated knowledge that underpins the desired changes.

### The how

Central to the success of this Strategic Plan is the recognition that we serve a diverse set of interest groups with different objectives and roles throughout the research-for-development continuum. ICARDA's research agenda focuses on a range of resolvable issues that are relevant across dry areas and that have the highest probability of success at scale, while addressing the overall challenge of climate variability and change. Our work contributes, engages, and influences several core groups: partners that we engage with in joint initiatives and that are key in the generation of innovative science and solutions; clients that directly use the outputs from our research agenda, including government decision-makers, development partners, investment banks, non-governmental and civil society organizations, and the private sector; and finally, the ultimate beneficiaries who reap the benefits of our research – the smallholder farmers, households, communities, women, youth, and other direct users of the scientific knowledge we generate.

ICARDA's theory of change has been modeled on the CGIAR Strategy and Results Framework, which highlights three core stages:

- **Outputs** are the direct results of our research and the knowledge generated, which we are responsible for and accountable for to our donors and investors.
- **Outcomes** are the effective use of the outputs generated by partners and clients. We are co-responsible for outcomes through training and capacity development, knowledge sharing, and dissemination through effective targeted communications.
- **Impacts** are the results of those outcomes that are taken up by beneficiaries. Our role in this arena is one of engagement with partners and clients that support their efforts.

The anticipated and desired outputs that lead to intended outcomes and impacts are contingent on each SRP and associated CCTs delivering on core researchable issues. Each of the SRPs will be required to deliver a specified number of quantifiable outputs that include novel tools and procedures, capacity development initiatives, improved varieties that are climate resilient, improved sheep and goat performance, increased water and nutrient efficiencies, new approaches to soil carbon sequestration, improved and functional value chains, and new and novel information resources.

With diverse partners and clients, these outputs, on their own or in combination, will produce a range of outcomes that include, but are not limited to: policies and an enabling environment that are evidence-based; new tools and approaches; the adoption of productive and climate-resilient crops and livestock; the consumption of more nutrient-dense and diversified diets; and improvement in on-farm water and nutrient use efficiency. As these outcomes are scaled out by a plethora of players, we will achieve the desired impact of thriving and resilient dry areas that demonstrate significant reductions in poverty, increased food and nutritional security, and improved resource management.

Measuring progress towards the delivery of outputs and to ensure that the outcomes and impact that we desire are achieved will require continuous monitoring and evaluation that will be established across each SRP. We will use the customized MEL Platform developed by the CRP Dryland Systems, ICARDA, and our sister centers

as the institutional mechanism by which we will assess progress towards achieving targets based on the CGIAR Strategy and Results Framework, and indicators to capture the necessary information to support attribution.

To achieve impacts, we recognize the roles and responsibilities of different partners and clients as well as the enabling influences of external drivers. Our ability to influence these drivers diminishes as we move from research outputs to impacts and hence roles and responsibilities change with development partners, governments, and other change agents having an increasing role. We will continue to engage actively with these parties, providing them with the knowledge and expertise they need to affect the greatest impact. This will be through joint initiatives, knowledge sharing, and the newly formed Service Delivery Unit within ICARDA.

### The results we seek

To assess progress we must have a robust tracking process for the targets set and adequate indicators embedded in each research and development project. We also need to monitor how our partners use and disseminate the knowledge products generated.

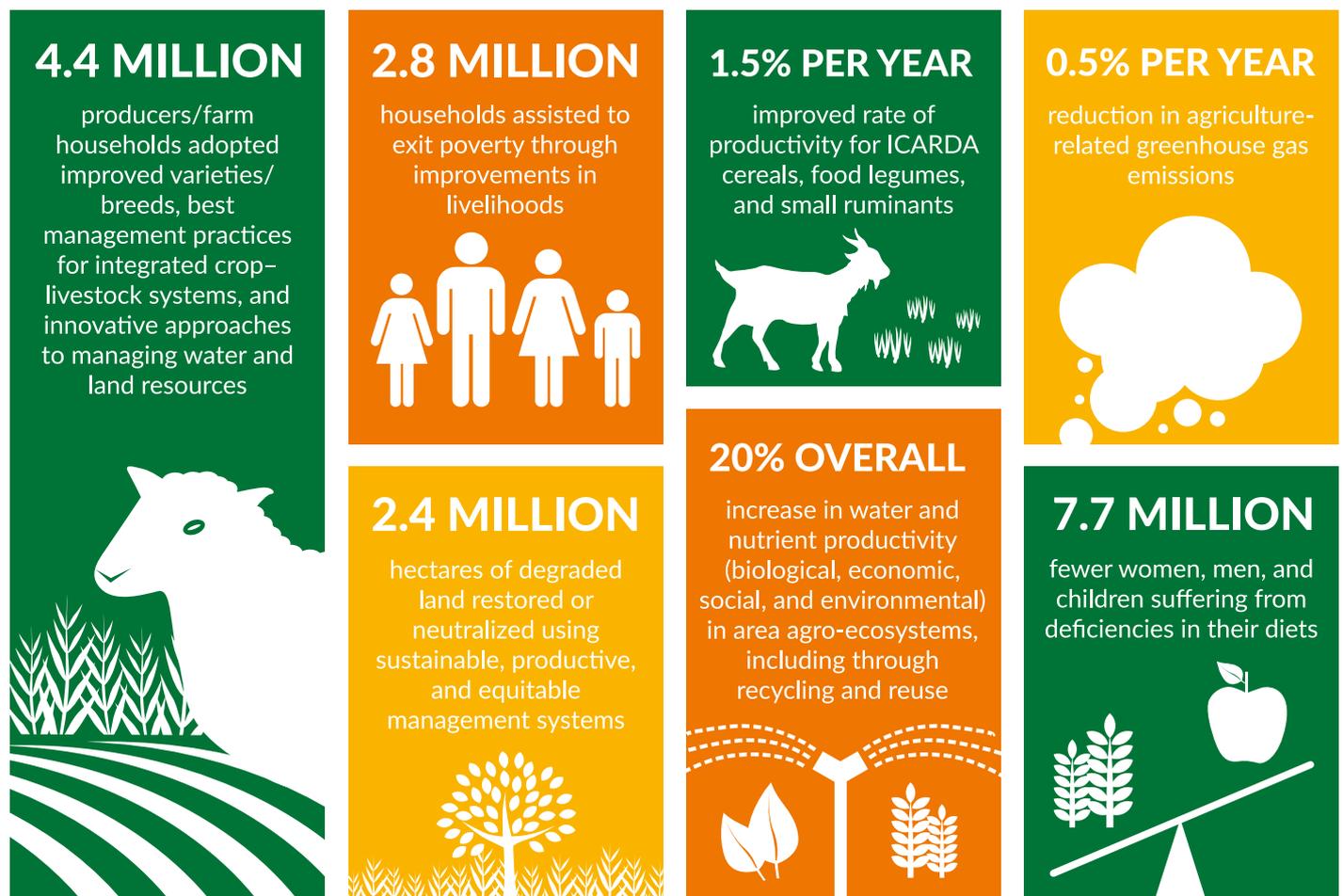
This effort will include support for the MEL Unit that forms the basis of overall project management. The web-based MEL Platform enables better results-based management (RBM), including planning, reporting, coordination, risk management, performance evaluation, and the management of legal mechanisms among partners, as well as knowledge sharing and learning among different groups of stakeholders within and across CRPs, CGIAR centers, and bilateral projects. The MEL Platform captures all the information required to ensure effective RBM and implementation of research and is designed for Project and Program Managers to facilitate and automate technical and program implementation and financial processes, thereby enabling timely and informed decision-making, transparent reporting to donors, and reduced time and costs. It will also be used to aggregate data from the project level up to the institutional level, allowing the Center to demonstrate performance, value for money, and progress towards a clearly defined set of key targets (Figure 5).

These targets were developed using data from outcomes of previous research that include both internal and external impact evaluations, and expert knowledge

of staff within ICARDA and its partners. ICARDA has similarly drawn on past experience to develop the necessary comprehensive set of indicators and processes that will generate robust, quantifiable outcomes

associated with our research and demonstrate support for the CGIAR Strategy and Results Framework. The indicators are based on the harmonized list developed by CGIAR centers and CRPs.

Figure 5: Impacts by 2026



# PART III

## Fit for purpose through improved organizational effectiveness

Over the coming five years, we seek to maximize organizational efficiency and cost-effectiveness. This will include the redesign of our institutional structure to match our overall resource envelope. The redesign will deliver high-quality research programs through excellence in research; communicate our success; ensure our financial integrity and stability; and embed an RBM framework across the organization to ensure accountability at all levels. Our overall focus is to improve the efficiency, effectiveness, and responsiveness of the organization to a changing and evolving operating environment. Over the next five years we have set ourselves the following institutional goals in support of our science:

1. **Enhance scientific quality**
2. **Implement a new business model**
3. **Strengthen our resource mobilization model and financial stability**
4. **Manage for results through the implementation of an RBM system**
5. **Invest in human resources**
6. **Communicate for impact**

### Organizational Goal 1: Enhance scientific quality

Over the next five years we will double, compared to 2016, the number of scientific research papers listed in the Web of Science with an impact factor of  $\geq 5$ . We will then double the number again by 2026.

ICARDA, along with its partners, is committed to producing science of the highest quality and delivering knowledge that is driven by demand from smallholder farmers, to enable them to improve their livelihoods and increase their resilience to challenges and shocks. This will be achieved through a culture of scientific excellence, greater integration and teamwork, and capacity building with our partners. To succeed will require an enabling environment in which the delivery of innovation, critical thinking, and questioning are paramount and supported. We will value, encourage, and reward innovations while using failure as a learning opportunity.

To ensure scientific excellence, the Center's annual work plans will be closely reviewed and scrutinized by the Program Committee of the Center's Board of Trustees for quality, relevance, and consistency with ICARDA's overall mission and objectives, CGIAR priorities, and the wider 2030 Agenda for Sustainable Development. ICARDA will continue to enforce and promote quality control for material leaving the Center through rigorous internal review and assessment. Our partners will continue to be closely involved in the development of our research work plans and will provide critical feedback to ensure the work is effectively aligned with their needs and priorities and responds to particular national and regional challenges.

We will continue to use standard processes to ensure scientific excellence, quality and relevance of research outputs, including but not limited to annual performance assessments of research staff against internationally recognized quality indicators that include publications in high-quality and high-impact refereed journals. Our internal peer review process, supplemented with periodic reviews by independent external panels, will continue to provide objective evaluations and identify areas for further strengthening, adjustment, and improvement in the future.

### **Organizational Goal 2: Implement a new business model**

The current model for doing business at ICARDA has served its purpose. With the operational risks of moving to a decentralized organizational delivery structure, the associated increased cost of doing business in the region, security challenges, and the volatility and instability of funding sources, we need to reconsider the current business model to ensure efficiency, effectiveness, and results for impact.

We will review and assess the current organizational structure with a focus on utility, functionality, and fitness for purpose. This will include the devolution of decision-making, responsibilities, associated accountabilities, and the requisite governance structure required to support a fully decentralized organization. These changes will be made over the course of 2017 but a continual assessment of the business model over the course of the Strategic Plan will be required to ensure that ICARDA remains competitive, nimble, and responsive to change.

The Center's funding model is affected by significant risks resulting from the unpredictability of funds flow, which requires the Center to diversify sources of financing to maintain research continuity. As part of the new business model, we will develop and engage in revenue generating activities. To support these activities, ICARDA will create a Service Delivery Unit. This unit's remit will be to provide support services to clients interested in developing a research concept into an operational investment for those initiatives that have not yet reached mainstream practice; to provide consultancy services to clients; and to develop joint ventures with private- and public-sector actors. ICARDA is currently undertaking a market analysis to assess its niche, comparative advantage, strategic partnerships, audiences, risks, and resource requirements, which will be completed by mid-2018.

Based on the outcomes of this assessment and Board approval, a fully functional Service Delivery Unit is expected to be established by 2022. Concomitant with the new business model will be a drive to manage Center costs through efficiency gains associated with new automated approaches in finance, program management, and RBM, along with consolidating operations. As part of the drive for efficiency gains and effective services, consolidation of Financial, Human Resources,

Resource Mobilization, Project Development and Grants Management Unit, and Communications will take place over 2017 and the first quarter of 2018.

### **Organizational Goal 3: Strengthen our resource mobilization model and financial stability**

ICARDA will grow its funding base by an average of 5% annually over the coming five years to become a US\$51 million organization in 2022, and restore and grow its level of reserves to create space and invest in new initiatives to support the financial stability of the organization.

The current funding landscape has become more complex, unpredictable, and fragmented with a strong emphasis on investing for the short term on focused issues. Sustained and secure investments in agricultural research and development will be essential to ensure that we can build resilient and productive farming systems that will meet future climates and other disruptors that will emerge over coming decades. A comprehensive and diverse resource mobilization strategy is integral to the long-term financial viability of the Center and the fulfillment of our goals.

We will need to expand our funding base to include traditional and non-traditional donors. This will include seeking financial support from emerging economies where we work, engaging more effectively with the private sector, and investigating innovative financing models. At the same time, we will continue to pursue traditional avenues for funding collaborative research alongside our partnerships with NARS, sister CGIAR centers, development organizations, and ARIs.

The resource mobilization efforts will have an increased focus on enhancing our capabilities in donor intelligence, supported by internal systems to use this information to support strategic and targeted actions. We will increase our access to open calls for proposals and enhance ICARDA's opportunities in competitive grants by training staff and engaging professional grant writers. To better target fundraising efforts, we will conduct analyses to identify immediate (one-year), medium-term (three-year), and longer-term funding gaps.

To achieve the 5% annual target growth in financial resources, we will tap into the geographic reach and

priorities of development agencies with a strong focus on CWANA. We will undertake this in partnership with both the public and private sectors of these countries and will guarantee alignment with country national development agendas, offering them the opportunity to access new financing modalities and multi-lateral investment tools.

For example, we will partner with accredited countries in the development of joint initiatives for funding from the Green Climate Fund, and will continue to engage in global initiatives with partner organizations that address global issues such as water scarcity and desertification. We will also actively seek out new foundations and philanthropic entities in the regions in which we operate.

We will use our comparative advantage in supporting fragile states and economies and post-conflict countries. Dry areas are home to many fragile and post-conflict countries whose economies are agrarian based, and there will be a need to rebuild and strengthen food and nutritional security, support job creation, develop capacity and livelihoods, and reduce poverty. ICARDA is well placed to access reconstruction funds and will actively explore opportunities through strategic partnerships.

We will develop closer collaboration with development agencies whose role is crucial to up-scaling research results and ensuring the relevance and delivery of our research outputs and innovations. We are actively pursuing relationships with development agencies and decision-makers to drive our work forward and to ensure that the greatest number of smallholder farmers are impacted for the better.

#### **Organizational Goal 4: Manage for results through the implementation of an RBM system**

ICARDA will build institutional capacities and the requisite management systems to support functional and effective RBM. This system will provide a coherent framework for management that is based on learning and accountability. It will also form the basis for strategic planning and resource allocation.

The Center is in the process of finalizing the MEL Platform that will enhance planning, management, monitoring, evaluation, and learning processes at both

the research and corporate level (see *The how*, above). In 2017, we will complete the improved planning process for projects through the introduction of a quarterly Program of Work and Budget to link research results delivery with budget utilization at project level. This process will be enhanced in 2018 with the Center's outcome indicators.

We will continue to improve and refine functions within MEL to support our commitment to the CGIAR's Open Access and Data Management Policy. This will include the documentation of knowledge generated in the previous year and the production of advanced analytics for Management and the Board of Trustees. Our overall objective through the full operationalization of MEL is to enhance business analytics, increase productivity, reduce transaction costs, and enhance support to programs and projects.

#### **Organizational Goal 5: Invest in human resources**

We will develop a new Human Resources Strategy, informed by consultation with the Staff Association, managers, and staff at large. The new Strategy will be in place and implemented by the end of 2018.

We will address ICARDA's gender balance with targets of 30% of the Center's research and management positions and 35% of support positions occupied by women by 2026.

ICARDA's greatest strength is its staff – highly-skilled women and men who are strongly committed to achieving the organization's mission. Success in delivering this Strategic Plan is predicated on our ability to attract and retain staff with an appropriate mix of skills, talent, and experience that will provide the greatest probability of delivering on our goals.

Core to the development of the future Human Resources Strategy will be the need to take into account the new business model and a decentralized organization with the flexibility to address changing priorities and demands that will emerge over the coming decade.

ICARDA's Human Resources Strategy will be guided by the pursuit of three priorities that directly contribute to organizational performance:

- To develop a diverse, flexible, and high-performing workforce, with the right mix of skills and expertise, strategically deployed to maximize the impact of ICARDA's work.
- To develop excellence in leadership and management.
- To create a work environment and culture that are stimulating and rewarding for our staff.

In order to achieve these goals, we will use a participatory process to develop clear, concise, shared, and commonly understood core organizational values. These values will guide decisions, processes, priorities, and team and individual behavior, and they will set the tone of the kind of organization we want to be. We will translate our values into day-to-day actions and behavior, and embed them into the relevant human resources processes and behavioral competencies.

We will make investments in strategic sourcing of positions to ensure ICARDA enhances its ability to reach out to and successfully attract highly-qualified candidates, with special attention to attracting women. We will also strengthen our staff selection process through the use of assessment centers, starting with positions that have management or leadership responsibilities. We will invest in developing staff skills to upgrade existing capacities and provide opportunities for staff to grow as individuals. We will ensure that we offer our staff a competitive compensation package, as well as a stimulating working environment.

We will strengthen existing human resources planning practices and institutionalize a process through which we will analyze internal and external factors and assess how they impact our human resources needs and existing organizational composition. We will prepare an action plan to improve ICARDA's gender balance, particularly among senior positions.

We recognize that leaders and managers are drivers of change and that the quality of managers is one of the main factors affecting staff motivation, engagement, and turnover rate. We will strengthen our management capability through a series of training and coaching initiatives. We will also develop tools to identify and

develop potential among existing staff, and to provide them with growth opportunities.

We will review our policies and ensure that they align with ICARDA's values and with the Human Resources Strategy to attract and retain talent. The review of ICARDA's policies will be guided by the principles of clarity, equity, fairness, and transparency.

### **Organizational Goal 6: Communicate for impact**

ICARDA will increase investments in communications and outreach by 15% over the 2016 annual budget by 2022.

It is imperative that we communicate our success through impact on the ground. This will be the mantra of the new ICARDA Communications Strategy 2017-2026.

Two overarching objectives inform the Communications Strategy: for ICARDA to be recognized as a leading science partner and go-to organization for research for development in the agricultural sector in non-tropical dry areas; and to encourage political and financial stakeholders to invest in research for climate-resilient agriculture in non-tropical dry areas.

Complementary and integral to the success of our resource mobilization efforts, the Communications Strategy will support longer-term financial stability.

We will strengthen our Communications Unit with the skills and expertise to develop a diverse and effective communications platform that will be vital to bringing about the transformational change that we desire in dry areas. We will take full advantage of the advances in information and communications technology that continue to revolutionize the possibilities for raising public awareness. This effort will be led by the development, by the end of 2018, of a new website that will include multimedia digital products, including videos, infographics, and images, which will be shared via existing and new social media platforms.

We will use innovative concepts of marketing and branding to increase the visibility of the work that we undertake and to build a constituency of investors that have confidence in ICARDA's ability to deliver. We will engage more effectively with policy and decision-

makers through participation in policy fora and events, and through the regular production of science-based policy briefs, presentations, and other materials that call for political and financial investments in agricultural research. We will combine traditional media engagement activities (press releases, pitching stories) with strategic social media activities to target key journalists, decision-makers, and influencers.

We will develop a Training Strategy – including the use of online tools and webinars – to strengthen the communication skills of researchers and professional staff, and will support communication activities at ICARDA offices, sites, and programs across the decentralized organization.

## Conclusion: Fulfilling our promise

With this Strategic Plan, ICARDA is laying the groundwork for a new chapter of success that builds on our achievements, lessons learnt, and the strong network of partners established over the course of the four decades since the Center was first established in 1977. We take this opportunity to urge all our partners and stakeholders, including the CGIAR community, to join us in our efforts to fulfil our vision for thriving and resilient communities in non-tropical dry areas of the developing world.

The plan presented here will guide our research work and collaboration in the next decade as we continue our long and distinguished tradition of scientific excellence in the service of agricultural development in non-tropical dry areas. The ideas we have set forth here are bold and ambitious and enable us to anticipate, heed, and capitalize with confidence and passion on the future as it unfolds. We strongly believe that this Strategic Plan, underpinned by sufficient resources, will allow us to achieve the results our partners and stakeholders need and deserve. In doing so, we will design and deliver cutting-edge scientific research to help spur agricultural transformation and forge a bright future and better livelihood opportunities for millions of women, men, and young people living in non-tropical dry areas.

In creating this Strategic Plan, we recognize that innovation, adaptation, and resilience are key to our

future success. The challenge is to maintain momentum to ensure continuous improvement in the face of an ever-changing external environment. Thus, this Strategic Plan is a living document, subject to course adjustments along the way that are both expected and will be embraced. In order to achieve our strategic research and organizational objectives, we will set annual performance goals and three-year rolling work plans and budgets designed to make continual, measurable progress during each budget year. We will implement a review process for the Strategic Plan after five years (mid-term), to reflect on lessons learnt from its implementation and to adjust to new challenges and priorities. A comprehensive impact assessment will be performed in 2026, at the end of the Strategic Plan period, in order to evaluate impact and draw out lessons for the future.

Ours is an ambitious but manageable plan with many actionable elements. Not all good things can be done at once; some sequencing is inevitable, especially for elements that will require additional resources. We will need to seize on opportunities for efficiencies and savings in both time and money by scaling back some of our ongoing activities and making room for innovation. In this context, it is essential that the leadership commitment exhibited to date continues, and that managers and staff be provided with the support and guidance necessary to bring this plan to fruition. Such an ongoing commitment will provide ICARDA with the necessary dedication to stay abreast of the developments and challenges that lie ahead.

Ultimately, successful implementation of this Strategic Plan will empower and enable our staff and partners to demonstrate greater impact in the world through high-quality scientific research, as well as build robust revenue streams to support ICARDA's mission and sustain our research activities, bolster our reputation, diversify our partnerships, and attract the world's top talent – the next generation of science leaders.

We invite you to join us on this journey.



Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is a non-profit, CGIAR Research Center that focusses on delivering innovative solutions for sustainable agricultural development in the non-tropical dry areas of the developing world. We provide innovative, science-based solutions to improve the livelihoods and resilience of resource-poor smallholder farmers. We do this through strategic partnerships, linking research to development, and capacity development, and by taking into account gender equality and the role of youth in transforming the non-tropical dry areas.  
[www.icarda.org](http://www.icarda.org)



CGIAR is a global research partnership for a food-secure future. CGIAR science is dedicated to reducing poverty, enhancing food and nutrition security, and improving natural resources and ecosystem services. Its research is carried out by 15 CGIAR centers in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector.  
[www.cgiar.org](http://www.cgiar.org)