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Science for resilient livelihoods in dry areas



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ICARDA's New Strategic Plan 2017-2026

Non-tropical dry areas cover over 40% of the world's land surface with a growing population of more than 2.5 billion people. These people grow 44% of the world's food and keep half of the world's livestock, yet one in six live in chronic poverty. Dry areas also face major challenges, including insufficient rainfall, climate variability and change, land degradation, desertification, recurring droughts, temperature extremes, high population growth, widespread poverty, and unemployment. Additionally, dry areas are home to many fragile and post-conflict states that rely on heavily agrarian economies.

What we do

To address these challenges and to achieve thriving and resilient rural communities, the International Center for Agricultural Research in the Dry Areas (ICARDA) provides innovative, science-based solutions for communities in the non-tropical dry areas of the developing world, particularly in West, Central, and South Asia and North and sub-Saharan Africa. We work together with a wide network of national agricultural research systems (NARS) and advanced research institutions to enhance their efforts and competencies so that they can drive their own research and development agendas. We also work closely with other CGIAR research centers, NGOs, governments, and the private sector. Our work advances scientific knowledge, shapes practices, and informs policy.

- Evidence shows that 4°C of warming is very likely in non-tropical dry areas by the end of the century. We conserve and use agrobiodiversity in our genebank and small ruminant breeding programs to develop new germplasm and breeds to adapt to this change.
- We lead integrated, rainfed, irrigated, and marginal farming systems for dry areas, using the diversity of crops and livestock to build profitable and sustainable farming enterprises.
- We develop sustainable value chains for non-tropical dry areas in our mandate crops – barley, chickpea, faba bean, grass pea, lentil, wheat – and small ruminant livestock.
- We develop innovative approaches to manage water, land, and soil resources to address water scarcity, enhance soil health and productivity, and neutralize land degradation.

ICARDA's research and development agenda through 2026 consists of five research priorities

Genetic resources. We mine crop diversity to develop superior germplasm that can withstand future climate- and market-related challenges. We identify novel traits including heat, drought, cold, and salinity tolerance, disease resistance, nutritional attributes, and water-use efficiency. Through open access initiatives, we make our data on genetic resources, breeding, and geo-informatics widely available as international public goods.

Adapting to climate change. We develop climate-smart crops and livestock for greater food and nutritional security. We use conventional and molecular breeding to develop highly adapted crops and livestock with resistance to pests and changing climates.

Building resilience. We build integrated crop-livestock farming systems that address economic, social, and environmental conditions in resource-poor areas. We optimize plant biomass for restoring soil health and providing livestock feed.

Promoting value chains and policies. We promote sustainable value chains and viable policies and off-farm activities to diversify incomes. We believe that agriculture can be an income-generating business for smallholder households. We will expand our work to create employment opportunities with a focus on women and young people who are particularly vulnerable.

Enhancing water and land productivity. We support sustainable use of water and land resources through rainfed, irrigated, and agro-pastoral farming. We focus on ecosystems and landscapes that offer opportunities to reverse environmental degradation, enhance intensification, and support livelihoods. Additionally, we take an integrated approach to managing soil, land, and water resources in rangelands across non-tropical dry areas.

ICARDA relies on four cross-cutting themes to pursue its research agendas

Scaling up proven technologies. Our research should have an impact on the lives of people, and we invest in partnerships to raise this impact to a larger scale. We seek engagement with research institutes, the private sector, NGOs, development agencies, financial institutions, and key change agents to put knowledge into action. We are sharpening our focus on South-South cooperation, and

ensuring that the knowledge we generate is demand-driven and addresses the challenges of smallholder farmers.

Empowering women and youth. Gender equality and youth engagement are essential in our mission. As women's roles in agriculture increase, we work with our partners to close gender gaps. Our focus is on improving women's access to land, water, seeds, financial credit, and knowledge. Youth represent another disenfranchised group, facing high levels of unemployment, and we seek ways to make the agricultural sector more attractive to young people using technology and the value chains of key commodities.

Building capacity. Core to ICARDA's mission, and key to delivering quality research and development impact, is capacity building. We are committed to building research capacity to develop an empowered cadre of young researchers and thriving institutions in dry areas. We build on our extensive network of partnerships to apply research in the field and engage closely with smallholder farmers through the practice of extension. We also make available access to scientific expertise and research funding opportunities.

Big data and information and communications technology (ICT). Geo-informatics, remote sensing, genomics and other big data approaches are revolutionizing the way we work. We use these to enhance research efficiencies and policy communications. Big data benefits our breeding programs, thereby ensuring a continuous supply of improved varieties to smallholder farming communities. We also build digital platforms to generate maps of crop productivity and water consumption. We have developed a geo-cyber facility to build a data repository and will maintain open access to this resource for all.

How did we arrive at these research priorities?

We arrived at these priorities through an extensive consultation process with a large number of stakeholders and partners – including NARS, CGIAR centers, donors, and our own staff. We were led by our mission to respond to the challenges of the dry areas of the developing world, in particular ICARDA's traditional sphere of operation in non-tropical dry areas. Aligning our work with CGIAR's Strategy and Results Framework and the Sustainable Development Goals also played a key role. Additionally, we considered where we are likely to have the greatest impact given our strengths and comparative advantages.

How we work

Central to the success of ICARDA's new Strategic Plan 2017-2026 is a diverse set of partners with common goals. We recognize the roles of different partners and clients. We engage with NARS, development partners, governments, and other change agents to ensure that the knowledge we generate is put into use.

We work together with a core group of partners in joint initiatives. We also work with clients that directly use the outputs from our research agenda, including government decision-makers, development partners, investment banks, NGOs, and private companies. Finally, we work with the ultimate beneficiaries of our work: smallholder households, value chain actors, and rural communities. Our work with the partners and clients produces a range of outcomes that include the adoption of climate-resilient and water-efficient crops and livestock, better management practices, evidence-based policies, interventions to improve value chain performance, and more nutritious diets. We link with a plethora of players to scale up these outcomes and achieve thriving and resilient communities in dry areas.

To measure progress, ICARDA uses the Monitoring, Evaluation, and Learning Platform, a customized database developed jointly with other CGIAR research centers. CGIAR's Strategy and Results Framework 2016-2030 provides indicators to evaluate our progress.

Why choose ICARDA?

Our unique scientific expertise, our vast network of partners across dry areas, and our decentralized model of operation put us in a strong position to deliver the innovative solutions needed to transform agriculture and achieve sustainable development in non-tropical dry areas.

Failure to rise to meet the challenges of dry areas will result in high costs, setting back economic and human development and adding to political instability. Research that contributes to sustainable development in dry areas is essential in meeting the Sustainable Development Goals, and ICARDA's work directly contributes to their advancement. We are well positioned to deliver climate-adapted genetic resources, farming systems, markets, and livelihoods.

ICARDA's comparative advantages

- We deliver science for impact. Our internationally-renowned scientists with a range of specialized skills work in multi-disciplinary teams, generating evidence-based solutions for non-tropical dry areas.
- We are a trusted partner and a go-to organization in West, Central, and South Asia as well as North and sub-Saharan Africa. We understand the cultures, languages, and environments and we have access to wide networks of partners with whom we are able to convene forums that bring together decision-makers and actors.
- We have a long history of working in fragile post-conflict countries. We can play a key role in rebuilding the agricultural sector, boosting food and nutritional security, supporting job creation, and building human capacity.
- We hold crop genetic diversity in trust. With unique collections of the major food crops in our genebank, we are a global leader in plant genetic diversity collection. We use this genetic material to provide traits needed to cope with diseases and changing climates.
- We enhance the sustainable use of water and land resources. Our research targets agricultural production systems that deliver "more with less," against a backdrop of increasing land degradation, scarce water resources, and the impacts of climate variability and change.
- We respond to issues on the ground through our decentralized structure. We are headquartered in the Middle East with regional offices across North and sub-Saharan Africa, as well as in Central and South Asia.
- Founded on our own resilience as an organization to innovate and adapt to change, our capacity helps ensure that our donors and partners work effectively together and with us to support resilient livelihoods in dry areas.

Investing for impact

Strengthening resilience in dry areas requires increased investment in agricultural research that combines modern science and technology with traditional knowledge.

We generate impact with support from our donors and partnership with national and international agencies. Some of our key achievements are detailed below.

Producing more food with less water. In Egypt, we further developed raised-bed planting technology for small- to medium-sized farms in order to increase water productivity. Between 2011 and 2014, the technology resulted in a 30% increase in grain yield, 25% saving in irrigation water and 74% increase in water-use efficiency. The technology was adopted on 280,000 hectares across Egypt in six years. The Egyptian government's national campaign targets 730,000 hectares by 2020.

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 ensured the preservation of the ecosystem in the Jordanian Badia (dry rangelands). Our Vallerani rainwater-harvesting package has been implemented on about 3,900 hectares of rangeland in Jordan so far. Analysis suggests that a total area of 2.7 million hectares in Jordan has the potential for adopting this package. Additionally, it could be scaled up to an area of 300 million hectares across the Middle East and North Africa.

Enhancing nutrition security. To fight malnutrition, we developed hundreds of crosses using high-micronutrient-content germplasm, breeding lines, and popular cultivars. In Bangladesh alone, about 956,000 farmers adopted new lentil varieties high in iron and zinc, covering 86% of lentil cultivation area. As more farmers adopt the new varieties, production is increasing – an additional 33,000 tonnes of harvest worth US\$30 million annually. In Nepal, almost 60% of farmers adopted new varieties, with an additional lentil production of over 36,000 tonnes worth US\$29 million annually.

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, with a package of interventions including optimized land

preparation and pest management technologies, reached about 7,500 farmers. These tripled the farmers' wheat yields and convinced policymakers to invest in wheat production to reduce their countries' dependence on imports.

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 adopting improved goat management practices. Milk production increased by 30% and goat mortality dropped by 90%.

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 and ability to produce offspring, the program has benefited over 3,000 farming families in the country with an average 20% income increase. The sheep and goats have shown increased productivity and reduced mortality. Farmers have created formal cooperatives to participate in the program, building capital of as much as US\$60,000. The program is also being implemented in Uganda, Malawi, Tanzania, and South Africa.

Enhancing food security. ICARDA's improved wheat varieties now grow in hotter and drier agro-ecological zones of Africa and Asia. While developing these varieties 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 per hectare to 5–6 tonnes per hectare. In Sudan, the government has adopted ICARDA's Innovation Platform approach as its national agricultural technology extension program. In Ethiopia, national wheat production has increased by 45%, surpassing 4 million tonnes in 2016.

Greater investments will help ICARDA and its partners enhance the development, promotion, and adoption of proven technologies and practices, thereby enhancing the resilience of the communities that depend on dry areas for their livelihoods.

For more information, please visit: www.icarda.org

