

DRYLAND SYSTEMS

Science for better food security and livelihoods in the dry areas

CGIAR Research Program on Dryland Agricultural Production Systems

The global research partnership to improve agricultural productivity and income in the world's dry areas.

Low-potential and marginal dry

lands: strategies and tools to minimize risk and reduce vulnerability.

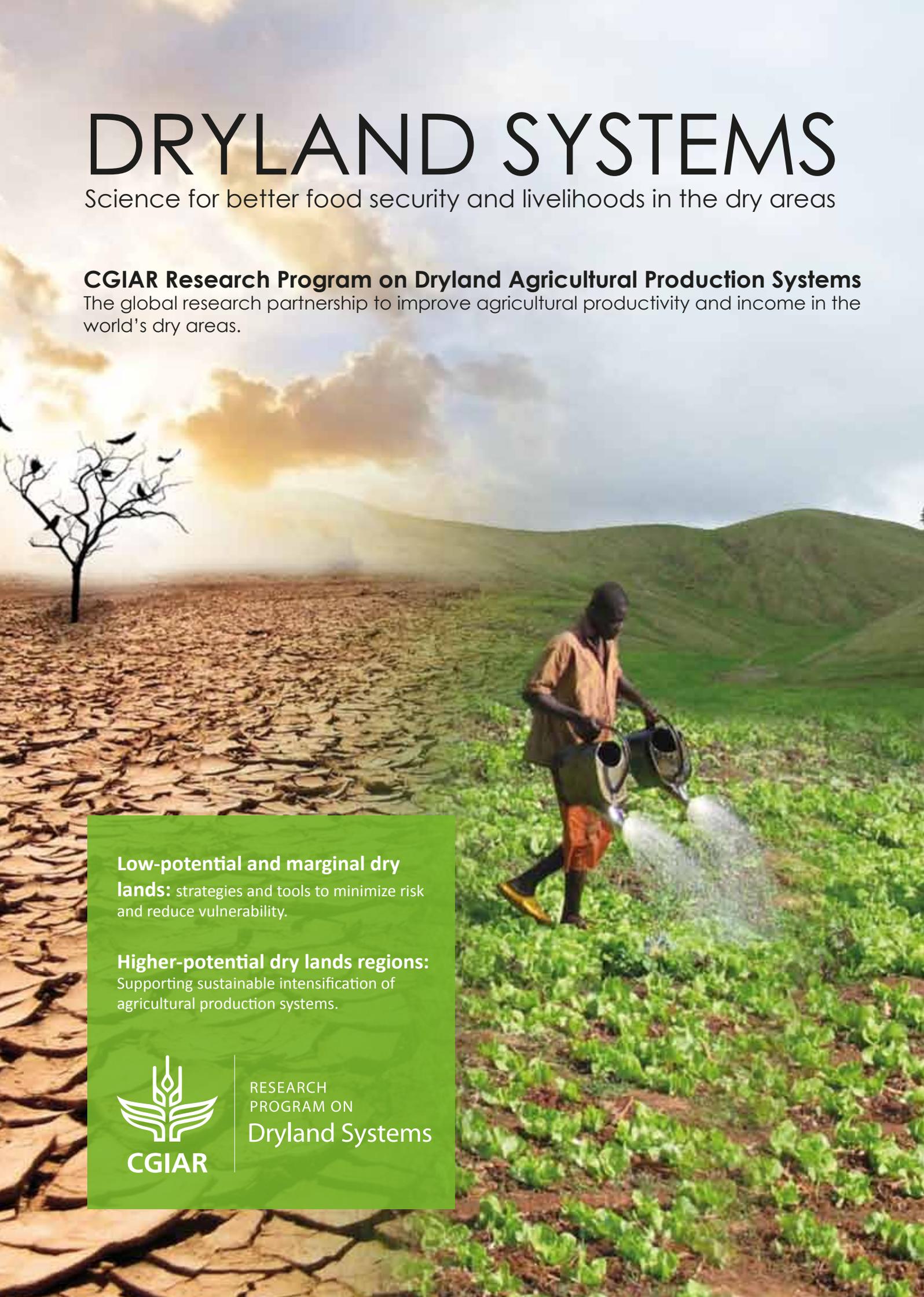
Higher-potential dry lands regions:

Supporting sustainable intensification of agricultural production systems.



CGIAR

RESEARCH
PROGRAM ON
Dryland Systems



Unleashing the productive potential of dryland agriculture

The **CGIAR Research Program on Dryland Systems** (known as Dryland Systems) embodies a new approach to integrated and 'holistic' agricultural research. It combines several research disciplines, including crop improvement, natural resources management, and socio-economics. The research will bring rural communities living in the world's dry areas practical solutions for improved livelihoods and food security. Dry areas are home to most of the world's poor, and some of its most vulnerable agro-ecosystems. The budget for the initial three years of this initiative is more than \$150 million.

Targeted outcomes

Dryland Systems research will result in:

- **Improved crop and livestock productivity** and reduced variability in agricultural production in target systems.
- **New agribusiness and market opportunities** and increased employment from the diversification of production systems and adding value to agricultural products.
- **Increased capacity of vulnerable smallholder farmers to adapt to climate change** by adopting natural resource management options that improve the resilience of their livelihoods.
- **Equitable access to natural resources** and better resources management.
- **Innovation platforms. Access to new knowledge for policy makers in target areas** about agro-ecosystem development, or better focused investment in drylands.

Dryland Systems is a partnership of several dozen actors, including national agricultural research systems from 28 countries, universities, extension agencies, civil society organizations, advanced research centers, CGIAR partners, the Food and Agriculture Organization of the United Nations (FAO) and other development partners. Dryland Systems is led by the International Center for Agricultural Research in the Dry Areas (ICARDA).



The program engages in large-scale action research to identify innovative intervention packages - developed together with stakeholders - to sustainably improve agricultural productivity. The aim is to reduce the vulnerability of rural communities and entire regions across the world's dry areas.

To develop solutions, together with rural communities and countries, research teams will validate the effectiveness of interventions in specific agro-ecosystems, and promote their scaling-out in the dry areas of five target regions:

- West Africa Sahel and the Dry Savannas
- East and Southern Africa
- North Africa and West Asia
- Central Asia and the Caucasus
- South Asia

Innovation platforms: testing and scaling out technology and policy packages

Agricultural research has helped countries improve the livelihoods of many smallholder farmers in dry areas over the past three decades. But much more intense, systems-based efforts are needed to get useful technologies into the hands of communities on a wider scale. The need for systems-based research is more urgent than ever, given several 'mega trends' - including water shortage, land degradation, urbanization, recurrent commodity price shocks, and climate change, which will hit dry areas hardest.

The research will validate and propose a series of integrated technology and policy interventions. These packages will combine improved plant and animal varieties, and diversification of agricultural systems as a means of mitigating risk and increasing income. This includes approaches for sustainable land and water management, integrated disease and pest management, socio-economic considerations (particularly for women and youth) and policy and institutional options needed to scale-out these solutions across countries and in rural communities.

The program will use innovation platforms to engage a range of stakeholders to understand what interventions work best where, and to encourage their adoption. The Dryland Systems systems approach is based on sound principles of the biophysical and socioeconomic sciences, development theory, and project management. This will create the right mix of partnerships, technologies, and policies to improve targeted dryland systems in major dry areas of the developing world.

Targeted outcomes – more secure income and stable food security for 87 million people

Dryland Systems aims to improve food security and generate higher and more secure incomes for 87 million people in the research program's action sites over 15 years. It aims to raise the productive capacity of natural resources, and reduce environmental degradation across 11 billion hectares. Larger impact still is expected as a result of out-scaling.

- In the program's higher-potential agro-ecosystem sites, where emphasis is on sustainable intensification, within six years, scientists predict that agricultural production will increase by 20 to 30 per cent; production will increase 10 to 20 per cent in low-potential or marginal lands.
- These impacts within action sites will improve the lives of 20 million sub-Saharan Africans, 65 million South Asians, half a million central Asians, and 1.1 million people living in North Africa and West Asia.
- Advancements in sustainable land management will also mitigate the effects of severe degradation across arid and semi-arid lands: up to 600,000 km² in Sub-Saharan Africa, 465,000 km² in South Asia, and 2,900 km² in Central Asia and the Caucasus.
- The out-scaling of proven technologies and the improved use and dissemination of existing know-how will drive global impacts – impacting the livelihoods of those living dry areas and strengthening the planet's future security.



Managing crop diseases and pests: Climate change brings more temperature extremes, and with them, the spread of disease and pests to areas where they were not previously a problem. Yellow rust (pictured), a chronic disease of wheat, threatens vast areas of the Africa, Asia and the Middle East. Sunn Pest (round photo) and other damaging insects are now arriving in new agricultural areas where farmers are unprepared to deal with them.

'Systems' thinking

The program applies state-of-the-art 'systems thinking' that takes research-for-development ideas much further than traditional research approaches. The underlying premise of systems thinking is that successful dryland agricultural systems have evolved through an integrated approach that includes the right mix of innovative partnerships, diverse technologies, and appropriate policies.

For example, the continuous development of new crop varieties is vital to the world's future food security, but they need to be delivered in a context that meets the daily reality of smallholder farming communities. For rural communities living in low-rainfall areas and marginal lands, these realities include lack of access to water, in fertile soil and unpredictable climate patterns that cause drought and bring new kinds of crop pests and diseases that have not previously existed in many of these regions.

The Dryland Systems research program looks at four themes:

- Strengthening innovation systems
- Reducing vulnerability and managing risk
- Sustainable intensification and market linkages
- Impact assessment and cross-regional synthesis

Dry Areas

The dry areas of the developing world occupy some 3 billion hectares, or 41% of the earth's land area, and are home to 2.5 billion people – 30% of its population. Some 16% of this population lives in chronic poverty.

These areas face several demographic challenges - rapid population growth, high urbanization, large youth populations, and the world's highest unemployment rate.

Dry areas have limited natural resources and face serious environmental constraints that are likely to worsen as a result of climate change.

Drylands agricultural systems

Drylands agricultural systems are found where precipitation is low and erratic, and water supply is often the most limiting factor to agricultural production.

They are characterized by persistent water scarcity, frequent drought, high climatic variability, and various forms of land degradation, including desertification and loss of biodiversity.

Reducing risk in vulnerable areas; improving productivity in higher-potential areas

Research in each target region will cover two types of areas:

- Highly vulnerable, poverty-endemic areas, where the aim is to reduce risk and vulnerability
- Higher-potential areas, where the program will help farmers to sustainably intensify production, diversify the farming system, and connect to profitable markets

Dryland agricultural systems struggle to provide productive livelihoods and food security for poor rural communities. Problems faced by these populations include: extreme water scarcity, severe land degradation, persistently high unemployment, and rapid urbanization and population growth. They also have limited access to new technologies and typically have under-developed markets that restrict productivity gains.



Improved crops for dryland conditions: Farmers in Iraq participate in trials (round photo) to identify best-adapted sorghum and pearl millet, compared with their local varieties.



Climate change and variability are likely to multiply many of these problems. Scientists predict worsening climate scenarios for North Africa, West Asia, and sub-Saharan Africa. This will intensify biophysical and socio-economic stresses, and increase pressures on already vulnerable production systems.

The CGIAR Dryland Systems Research program aims to improve the wellbeing of the rural poor, conserve vital natural resources, and empower smallholder farmers and pastoralists, and in particular women and youth, to cope with inherent climatic variability and climate change.

Bringing together scientists, development practitioners, farming communities and investors throughout Africa and Asia, the initiative uses a multi-stakeholder, integrated agro-ecosystem approach to manage dryland resources – the first of its kind on a global scale.

Beneficiaries will benefit from the expertise of ICARDA and its partners who have developed proven interventions aimed at boosting sustainable productivity.



Income resilience and nutrition: Sheep and goats provide resilience to communities in dry areas – for the production and sale of wool, cheese and milk or meat. Here, a researcher and farmer measure milk yield in a research trial with a new breed of sheep in Syria.



Action Sites for Drylands Systems' Research

The Dryland Systems' research focuses on Action Sites in five agro-ecological regions: the West African Sahel and Dry Savannas, East and Southern Africa, North Africa and West Asia, Central Asia and the Caucasus, and South Asia – covering some 11 billion hectares.

Action sites have been selected to be representative of larger Target Areas within each agro-ecological region. The Target Areas are characterized by two main drylands system types:

- Low potential - Drier, marginal areas where production losses require risk minimization strategies
- Higher potential regions with greater production potential that can benefit from sustainable intensification



Practices to save labor and energy cost: Conservation agriculture (zero tillage) reduces the cost of farming and conserves water and fertility in soil. A women's group learns about new practices at a farmer field school in Tanzania.

West African Sahel and Dry Savannas - Agriculture in these areas faces considerable constraints: drought, poverty, soil erosion, poor infrastructure, and a lack of institutional support. Restricted livestock mobility and the loss of marginal lands to crop cultivation also threaten the viability of pastoral and agro-pastoral systems. Interventions such as increasing smallholder linkages to regional livestock markets, and facilitating access to new technologies, have the potential to improve resource management and productivity.

East and Southern Africa - Large swathes of land in this region are under arid or semi-arid agro-ecosystems, and suffer from frequent droughts. Vulnerability to drought is exacerbated by poor infrastructure, limited ability to serve poor communities, and restricted market engagement. With soil inputs and effective extension services, however, farmers could better adapt to adverse environmental conditions.

North Africa and West Asia – Here, on-going aquifer degradation is likely to worsen due to climate change. Out-migration, farm fragmentation, and the abandonment of agro-pastoral lifestyles are also threatening the sustainability of farming in the region. Given the close proximity to Europe, however, farmers have the potential to exploit European markets and raise their incomes.

Central Asia and the Caucasus – This region requires improved mechanization for the region's relatively large-scale farms. Often inexperienced, farmers require specialized irrigation training to utilize the region's significant saline water resources.

South Asia - Greater levels of mechanization will help this region more effectively manage its extensive areas of hyper-arid land. Although salinity is a major problem in irrigated agricultural areas, increasing productivity is possible in regions where groundwater resources are not being over-exploited.

The Dryland Systems for Development Partnership

The Dryland Systems Research for Development Partnership

The CGIAR Dryland Systems research program builds on partnerships with the major stakeholders in the research for development continuum including:

National Research and Extension Systems

The research centers supported by the CGIAR

Advanced research institutions

Farming communities

The Global Forum for Agricultural Research and sub-regional organizations

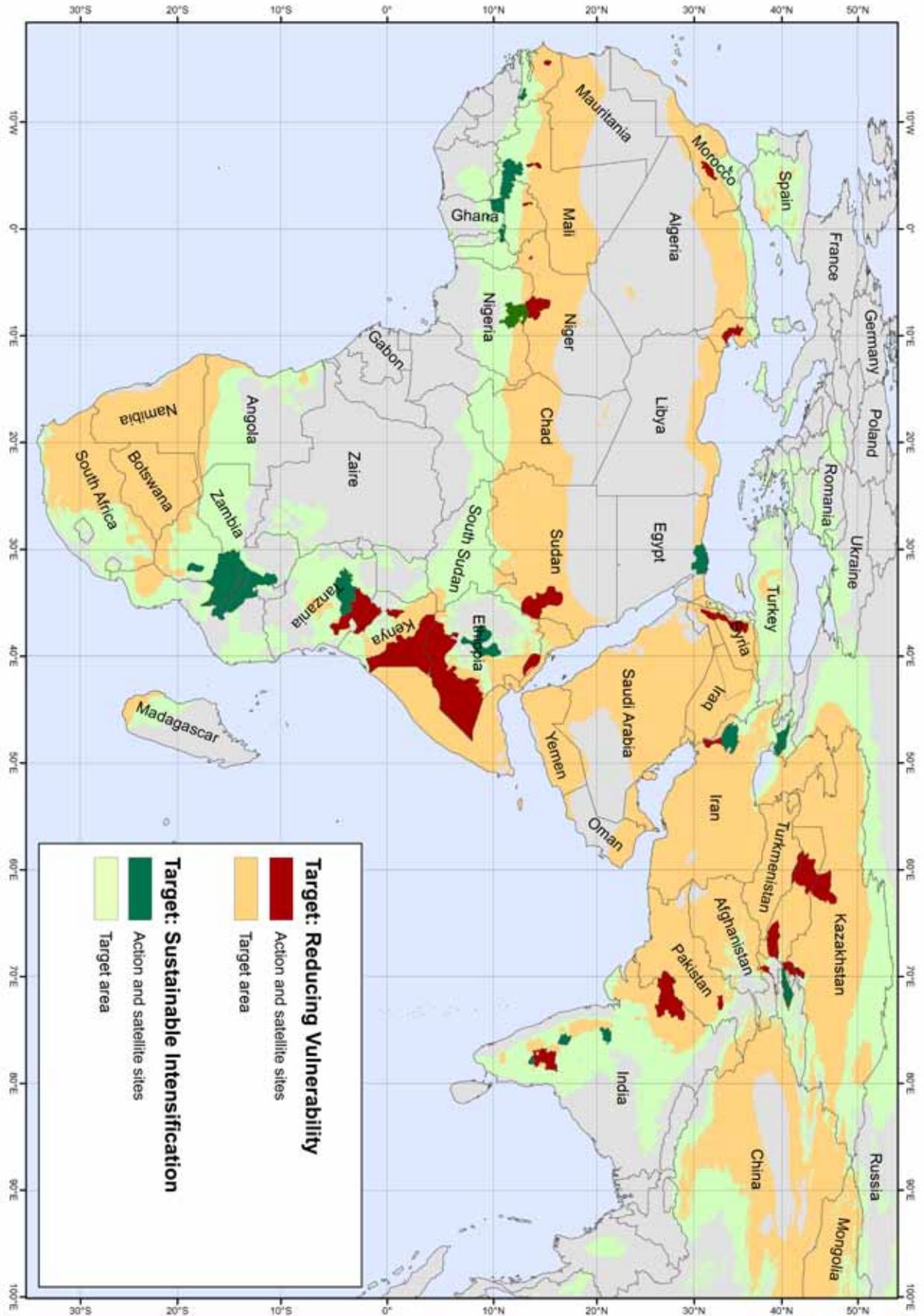
Development agencies

Sub-regional organizations

Civil society organizations

Private sector

Research Sites: CGIAR Dryland Systems Research Program





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www.icarda.org/dryland_systems/teaser

<http://www.cgiar.org/our-research/cgiar-research-programs/cgiar-research-program-on-dryland-systems/>

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