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Drylands and Mission Critical Research Areas for the CGIAR:
A report to the CGIAR Fund Council from the Dryland Systems Task Force

Submitted by:
Dryland Systems Task Force

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Food security and better livelihoods
for rural dryland communities

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A. Why Drylands?

Drylands occupy 41% of global land surface and are inhabited by more than 2.5 billion people, living mainly in developing countries with about 16% living in chronic poverty. Shockingly 42% of children less than 5 years of age in drylands of Asia and 27% in drylands of Africa are malnourished leading to stunted growth[1].These are the poorest, hungriest, least healthy and most marginalized people in the world[2]. Converging factors including poverty and unemployment related to high population growth rates, weak governance, low inherent agricultural productivity, low levels of investment, climate change and land degradation, result in resource scarcity and the undermining of agricultural livelihoods.

The economic and human costs of inaction or delayed action on the links among the multiple drivers of dryland dynamics are likely to be substantial. The resulting misery, deprivation and desperation extend beyond the boundaries of dryland countries via civil unrest and migrations. Notwithstanding these perils drylands possess valuable assets such as abundant solar energy, rich plant biodiversity, 50% of the world's livestock and opportunities to diversify and intensify agriculture and increase soil carbon storage[3,4]

Small holder agriculture remains the main driver of development and underpins food security in developing countries, generating employment and contributing a significant percentage of GDP in many drylands[3,5]. Improving the benefits and profitability of smallholder farming remains one of the most important development pathways for dryland communities[5] and success will contribute to the achievement of the SDG on poverty alleviation amongst others. Despite efforts to introduce holistic approaches, such as farming systems research and integrated natural resource management, the focus of agricultural research has been dominated by the search for technical innovations.

A production-based focus on single commodities has paid insufficient attention to environmental, social, governance, institutional capacity, gender relations and aspects of context specificity. This has resulted in low adoption rates of innovations, and challenges in scaling-up. This narrow focus has also tended to overlook other income-generating elements of production systems, investment opportunities, externalities and trade-offs, non-linearity and tipping points in the relationships among the social, natural, economic and production environments. These considerations are vital for vulnerable dryland communities and must be addressed if the potential impacts of donor and government funding are to be delivered.

Agricultural livelihoods in drylands are characterized by risks and complexities associated with water scarcity, climatic variability, land degradation and the governance and social systems that have developed to cope with uncertainty. For example, drylands are the most vulnerable ecosystems to climate change according to recent World Bank reports[6]. In the MENA region rainfall will decline by 20-40% in a +2°C world with a decrease in growing season of up to 30 days in a +4°C scenario. Climate change is a threat multiplier to civil unrest in drylands, imposing additional pressures on scarce resources and likely exacerbating human migrations.

Reinforcing local capacities to increase the resilience of production systems is therefore paramount. Dryland communities moreover, typically depend on mixed livelihood portfolios with livestock and non-agricultural ecosystem services playing important roles. Solutions designed elsewhere need to be adapted to the local context if they are to deliver socially, economically and environmentally sustainable intensification[7].

The SRF indicates that agricultural production systems are a key CGIAR research priority. For drylands the dominant agricultural production systems are:

1) pastoral and agro-pastoral; 2) tree-based; 3) rainfed cereal-based; and 4) intensive irrigated systems.

These will be the units of analysis for future work.

B. The Value Proposition of Drylands Research

Dryland systems research can in the medium-long term improve agricultural livelihoods, nutrition and the environment of over 100 million dryland inhabitants and enable the wise use of ecosystem services valued at several hundred $/ha [8,9] on up to 300 million ha (10% of drylands) or 190 million ha of degraded drylands. The value proposition is based on integrated systems research, which develops and tests, with farming households and development partners, feasible combinations of technical, market, governance and policy options. Together these options improve agricultural livelihood systems. To achieve the impact targets above, systems research is best embedded and integrated in on-going development where it;

- Fosters partnerships that better target social, institutional and technical options
- Creates hybrid knowledge that builds science onto local knowledge to reduce yield gaps and enhance value chains
- Improves capacities of households and institutions to innovate
- Improves the effectiveness of development spending (RinD)
- Realizes social, economic and environmental co-benefits
- Creates platforms where outputs of other CRP's can be delivered at scale
- Identifies diversification opportunities in agriculture for investments

Achieving these impacts through research in development requires a novel and inclusive systems-based approach to co-produce new knowledge that can address dryland-specific challenges. Table 1 summarizes the approach taken in drylands systems research.

Table 1: Previous and proposed approaches for drylands

Conventional approach	Systems research approach for drylands
Focus on single commodities and single livelihood components	Focus on farming *systems* and livelihood *portfolios*
Aimed at improving productivity and closing yields gaps, regardless of risk	Explicit consideration of trade-offs among multiple aims—improving productivity, reducing risk, and social, economic and environmental sustainability. Targets multiple wins where possible; balances trade-offs where not.
Focus on discrete value chains, overlooking externalities	Attention to interactions between value chains, explicitly considering externalities
Focus on innovations and investments responding to specific drivers of change within sectors at discrete scales	Focus on interactions between multiple drivers of change and innovation and investment options across sectors and scales
Linear, research *for* development approaches	Iterative research *in* development approach
Mono- or multi-disciplinary	Inter- or trans-disciplinary
Scientific knowledge transferred to stakeholders	Local and scientific knowledge combined, co-generated and embedded in the broad community
Gender equality and social justice as isolated outcomes of the research process	Disadvantaged groups involved and empowered throughout

The CRP fosters systems innovation platforms that add value to livelihoods by encouraging diversification and local income generation, harnessing local and 'scientific' knowledge and developing partnerships that better target social, institutional and technical systems innovations. Combined with responsible private sector investment, this results in local clusters of economic activity incorporating other livelihood options such as added value products, renewable energy, ecotourism, artisanal goods and biodiversity for pharmaceuticals. The systems approach and focus on knowledge sharing, institutions and governance, enables the CRP to support other CRPs to deliver impacts and better target their interventions, so enhancing the value of research across the CGIAR.

C. Mission Critical Research Areas

Three mission critical research areas are required under this CRP. How they relate to the SRF and its SLOs and IDOs is summarized in **Table 2** (see **Annex I** of this document).

Mission Critical Research Areas

1. **Anticipating** dryland futures

2. **Co-producing** knowledge for win-win options

3. **Facilitating** policies, institutions and governance for scaling and enabling innovation

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C1. MISSION CRITICAL RESEARCH AREA ONE

Anticipating dryland futures

Why: It is essential to understand how drylands are likely to change in future, in order to adapt effectively, but little is known about how different drivers of change interact to affect development outcomes in drylands.

What: Mapping and predicting the vulnerability, resilience and improvement of dryland systems to drivers of change including climate change and land degradation over the short to medium term. It identifies how drivers interact with one another to affect food and nutrition security, incomes and employment, agricultural productivity, natural capital and ecosystem service provision*. An illustrative outcome would be plausible future scenarios for investment plans.*

How: This requires an understanding of context through the use of existing (historical) and collection of new (present) data to address gaps. Visioning and foresight methods will explore potential futures.

Priority research actions for the short to mid-term (S= short term, <5years; M= Medium term, 10 years)

    a) Identify critical **drivers** and **interactions** that lead to social and environmental stresses that result in degraded lands and livelihoods, decreased resilience and reduced capacity to cope with change in action sites/transects (S, M)

    b) Identify the **innovations** and **investments** that increase the resilience of vulnerable systems to these drivers of change, maintaining and enhancing livelihoods and ecosystem services, and the sustainability of agro-ecosystem management (S, M)

c) Through foresight analyses identify the likely **outcomes** of adaptations, innovations and investments over **multiple time frames** and scales, for food and nutrition security, incomes and employment, especially for women and youth,, agricultural productivity, natural capital and ecosystem service provision (S), and overall vulnerability/resilience (M)

C2. MISSION CRITICAL RESEARCH AREA TWO

Co-producing knowledge for win-win options

Why: In the face of complex and future change, there is an urgent need to develop co-ordinated bundles of options that can address multiple development challenges together while minimizing trade-offs. This work builds on CGIAR achievements to improve livelihoods by intensifying efforts to work together with communities in the deployment of appropriate technologies at larger scales.

What: This research engages stakeholders in identifying and testing multiple-win, crop-tree-livestock options for dryland agro-ecosystems, developing pathways to reduce trade-offs and harness synergies to alleviate poverty and achieve food security. It considers responses to interacting drivers of change and how innovations, investments, including for example, PES schemes, social, institutional and policy options may interact to create trade-offs and synergy, enabling the creation of bundles of complementary options. It develops tools, frameworks and indicators to support decision making. *An illustrative outcome would be the use of a validated methodology for assessing the sustainability of intensification options.*

How: This requires adaptive management, system-based participatory and action research, building and deploying decision support tools. It draws in and deploys outputs from other CRP's in shared sites and platforms, enhancing the value of CGIAR commodity research.

Priority research actions for the short to mid-term

a) Analyze **trade-offs and synergies** among production, social, economic and environmental factors over **multiple** temporal and spatial scales, **including ways of ensuring the sustainability of intensification** (S,M)
b) Compile and disseminate an inventory of existing interventions in the **context** of what works where (S), better targeting portfolios of more complementary options (M)
c) Assess the **sustainability** of interventions in view of environmental and other stresses and drivers (S, links to work undertaken in mission critical research area 1)
d) Identify factors shaping farmer decision-making, processes and strategies that enhance the **uptake** of innovations (S) and how social, gender and cultural factors shape possible **options** (M)
e) Build and deploy **tools, frameworks and indicators** to support decision making in dryland systems, considering the complexities of multiple use ecosystem services, trade-offs and synergies (M)

C3. MISSION CRITICAL RESEARCH AREA THREE

Facilitating policies, institutions and governance for scaling and enabling innovation

Why: There is an urgent need to better understand barriers to the widespread adoption and scaling of innovations in dryland agriculture, in order to realise the full benefits of previous and future investments by the donor community at the scales necessary to tackle global poverty.

What: This mission critical research area analyses and develops institutional, policy and economic mechanisms to promote and upscale sustainable dryland agriculture, and to sustainably improve the profitability and viability of dryland farming. It facilitates new science-

policy interfaces that enhance the scaling of innovations, through dialogue between governments, regional and international bodies, researchers and land managers. *An illustrative outcome would be institutional, policy and economic incentives to increase agricultural production and resilience.*

How: This requires adaptive, systems-based participatory and action research, policy analysis, scenario studies, and policy dialogues. Progress builds on existing efforts and strengthens partnerships with national and international development agencies,

Priority research actions for the short to mid-term

a) Review and improve processes to design institutional arrangements for more inclusive management of agriculture, livelihoods and ecosystem services, identifying critical research gaps to institutionalize and scale beneficial impacts (S, M)
b) Identify public-private partnerships for investments in dryland agriculture including NRM, inputs, markets and value chains (S)
c) Identify ways to provide incentives for uptake of agricultural innovations and sustainable land management technologies especially by women and youth (M)
d) Identify and design agricultural insurance mechanisms appropriate to developing world contexts considering existing risks and social safety nets (M)
e) Evaluate pathways for knowledge intensive IPs/learning alliances to scale up interventions (S, M)
f) Engage in policy dialogues with national, regional and international bodies in agriculture, rural development and environment sectors e.g. CAADP, various environmental conventions (platforms addressing cross sectorial aspects) (M)

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Annex I – Missions Critical Research Areas and SRF

Table 2: How mission critical research areas relate to SLOs and IDOs of the SRF

SLOs/IDOs	Mission critical research areas		
	1. Anticipating futures	2. Co-producing options	3. Facilitating policies, institutions, governance
SLO1: Reduced poverty	**	***	***
IDO 1: Increased resilience to climate change and other shocks	**	**	**
IDO2: Enhanced small holder market access	**	*	***
IDO3: Increased incomes & employment	**	***	***
IDO4: Increased productivity	**	***	**
SLO2: Improved food & nutrition security for health	**	***	***
IDO4: Increased productivity	**	***	***
IDO5: Improved diets for poor/vulnerable	*	**	**
IDO6: Improved food safety	*	*	*
IDO7: Improved human & animal health thru better agricultural practices	*	**	**
SLO3: Improved natural resource systems & ecosystem services	**	***	***
IDO8: natural capital enhanced & protected	*	***	***
IDO9: Enhanced benefits from ecosystem goods & services	*	***	***
IDO10: More sustainably managed agro-ecosystems	*	**	***
Cross cutting themes			
Climate change	**	***	**
Gender & youth	**	**	**
Policies and institutions	*	**	***
Capacity development	**	**	**

Relevance: * minor; ** significant; *** high

Annex II - Members of the Task Force

Role in Task Force	Name	Institution
Chair	Professor Lindsay Stringer	Professor in Environment & Development, Sustainability Research Institute, University of Leeds, UK
Member	Professor Mark Reed	Professor of Interdisciplinary Environmental Research Director, Knowledge Exchange Research Centre of Excellence, University of Birmingham, UK
Member	Dr. Luuk Fleskens	Assistant Professor in Sustainable Land Management, Soil Physics & Land Management Group, Wageningen University, Netherlands
Member	Dr Bernard Faye,	Livestock & Crop System Modelling, CIRAD, France
Member	Dr. Lance Robinson	Environmental Governance and Resilient Specialist, ILRI
Member	Dr. Everisto Mapedza	Senior Social and Institutional Scientist, IWMI
Member	Dr. Anthony Whitbread	Research Program Director Resilient Dryland Systems, ICRISAT
Member	Dr. Jan de Leuw,	Senior Scientist Drylands Systems, ICRAF
Member	Dr. Richard Thomas	CRP-DS Director, c/o ICARDA

RESEARCH PROGRAM ON
Dryland Systems

CGIAR

The CGIAR Research Program on Dryland Systems aims to improve the lives of 1.6 billion people and mitigate land and resource degradation in 3 billion hectares covering the world's dry areas.

Dryland Systems engages in integrated agricultural systems research to address key socioeconomic and biophysical constraints that affect food security, equitable and sustainable land and natural resource management, and the livelihoods of poor and marginalized dryland communities. The program unifies eight CGIAR Centers and uses unique partnership platforms to bind together scientific research results with the skills and capacities of national agricultural research systems (NARS), advanced research institutes (ARIs), non-governmental and civil society organizations, the private sector, and other actors to test and develop practical innovative solutions for rural dryland communities.

The program is led by the International Center for Agricultural Research in the Dry Areas (ICARDA), a member of the CGIAR Consortium. CGIAR is a global agriculture research partnership for a food secure future.

For more information, please visit

drylandsystems.cgiar.org

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