RESEARCH PROGRAM ON
Dryland Systems

CGIAR

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Program Theory of change and Impact Pathway

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Food security and better livelihoods for rural dryland communities

Applying systems thinking to theory of change

A **theory of change** (ToC) describes how a research-in-development project or program induces expected outcomes and impacts by describing the causal interrelationships from the project/program's activities to outputs, outcomes and impacts, based on the underlying science for understanding the nature of change in the target systems. The ToC of the CGIAR Research Program on Dryland Systems (Dryland Systems) takes valuable aspects of contemporary systems theories - ranging from classical General System Theory (GST) to recently Complex Adaptive Systems (CAS) and Socio-ecological Systems (SES) theories - as the basis for understanding the nature of change in dryland **agricultural livelihood systems (ALS)**.

This new systems science knowledge together with a trans-disciplinary approach is designed to integrate interventions to leverage positive changes in human actors' systemic knowledge, skills and attitude, which are essential for the sustainable management of ALS.

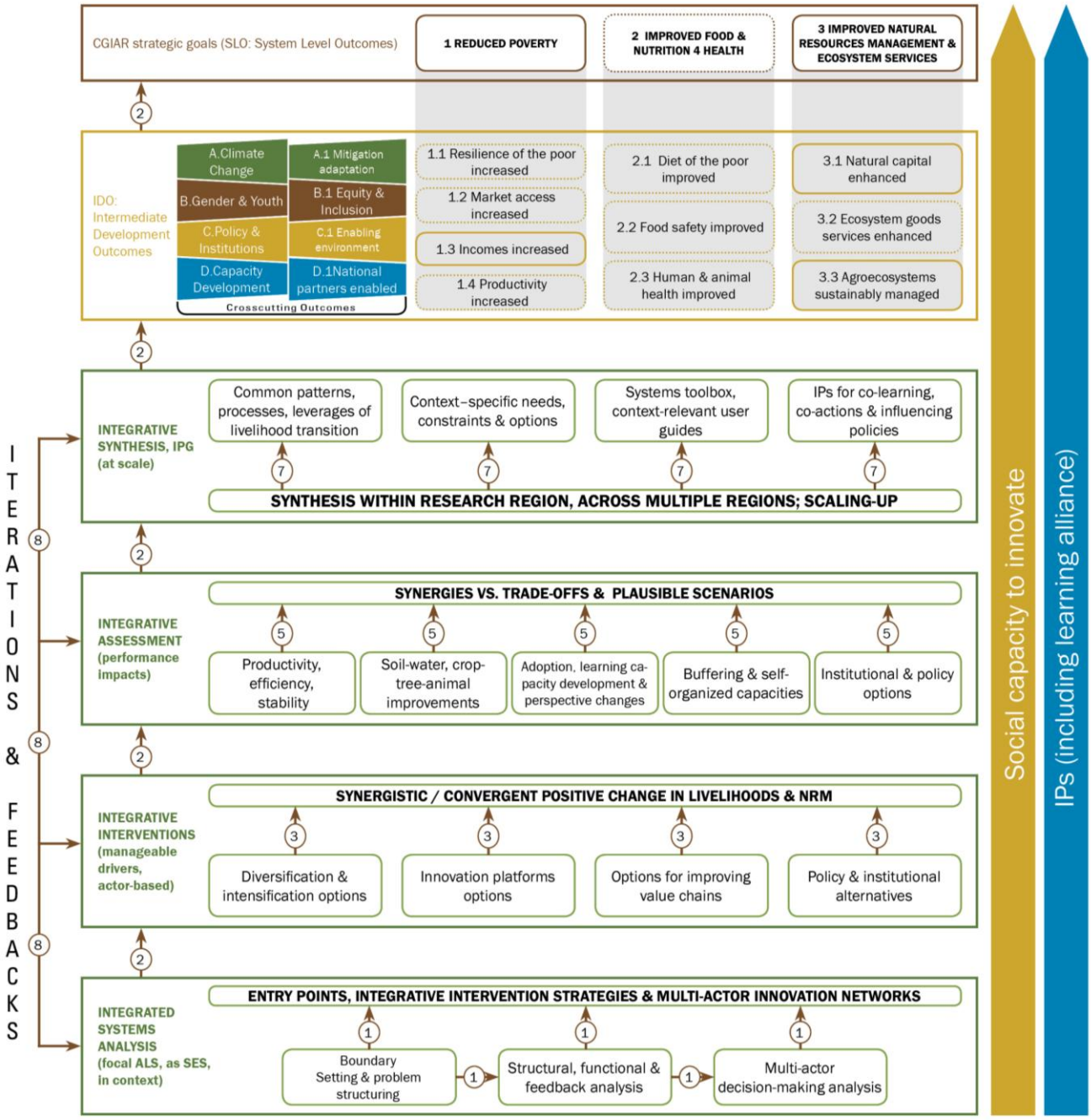
The Dryland Systems' *Integrated Systems Research-in-Development* approach focuses on the agricultural livelihood systems as the ***entry point*** *level* of socio-ecological system analysis. This is concerned with ***total-system performance***, which includes the aspects of total farm productivity, efficiency, social acceptability, robustness, equity and adaptability. The performance of the system therefore depends more on how its parts (material conditions and social construction) and external drivers interact than on how they act independently of each other.

Any agricultural livelihood system is embedded in larger socio-ecological systems (SES) that provide ***context*** containing external drivers (e.g., biophysical regime, politico-cultural environment and regional economic development) for ***decisions*** made about livelihood strategy and activities. A consideration of **context** implies that sustaining **agricultural livelihood systems** over time requires managing processes at multiple levels and multiple domains. This means that the entry point level process (agricultural livelihood system) needs to then be integrated into the higher level processes in order to capture cross-level relationships that shape livelihood outcomes.

The starting point of Dryland Systems' Generic Impact Pathway (Figure 1) is to analyze the problems of dryland **agricultural production and livelihoods** and establish integrative intervention strategies in a holistic, yet structured way. This is a fundamental difference between the analytical-reductionist approach in commodity-based agricultural research programs and the systems approach in the Dryland Systems. The ***integrated systems analysis*** involves the identification of performance gaps of representative agricultural livelihood systems across dryland regions, and key drivers including constraints and opportunities for closing the performance gaps. This analysis further identifies interactions between material/technical farm components and the human/social construction (human actor roles, social relations and adaptive decision-making) determining the system behavior and performance.

The result of this integrated system analysis is to identify context- and system-specific entry and leverage points for initiating positive system transitions, and to envision ***integrative intervention strategies***. The envisioned integrative intervention strategies involve the identification of not only complementary interventions themselves, but also of ***multiple human actor innovation networks*** that engage with the development, testing and adaptive dissemination of viable options.

Figure 1. Generic Program Impact Pathway



LEGEND:

ALS = agricultural livelihood systems, **IP** = innovation platforms, **SES** = socio-ecological systems. **NRM** = Natural Resources Management, **IPG** = International Public Goods. **Boxes in green:** activities and outputs of interrelated phases of integrated systems research. **Boxes in yellow:** intermediary development outcomes driven research outcomes. **Boxes in brown:** development system level outcomes. **Dotted line boxes:** program focus and contribution to these outcomes is less than outcomes in **full line boxes** due to resource and capacity limitations of program researchers and partners. **Circled numbers:** risks and assumptions at each level of the Impact Pathway, described in Theory of Change, Table 1.

Table 1: Risks and assumptions in DS Impact Pathways (Figure 1)

Pathways coded by circled numbers in Figure 1	Main risks	Main assumptions
①	The lacks of integrated systems researchers, and/or the commodity-based natures of mapped bilateral projects can make joint systems analyses difficult.	Dryland Systems core CG centers and partners aspire to and allocate adequate time and resources for systems research capacity building and implementation. Other commodity-based projects/program (mapped/bilateral and otherwise) are motivated to do systems analysis to understand system niche roles of their activities, and are open to cooperate with other disciplinary researches to jointly make system improvements.
②, ③	Actual factors leveraging systems improvement may be beyond the capacities of agricultural research organizations (e.g. geopolitical changes or infrastructure development), or not within their mandates. This can limit research efforts to improve ALS addressing problems identified through systems analysis.	Many of the solutions for improving dryland ALS concern land- and agriculture-based issues. Dryland Systems core CG centers and partners are open to cooperation with stakeholders at different organizational levels, possibly outside of the agricultural sector in order to make convergent positive changes in ALS.
④, ⑤	Fragmentation of research sites and data, together with short-term project durations do not support efficient multi-, inter- and trans-disciplinary assessments of systems behavior in response to interventions in terms of understanding trade-offs and visioning scenarios.	Duration of projects/program is long enough to realize impacts driven from interventions. Multi-, inter- and trans-disciplinary research processes are convergent at same sites for easy integrations. Common sampling frames are used for data collection. Researchers of different disciplines (especially social and natural) work closely each others. Stakeholders are involved properly throughout research processes.
⑥, ⑦	Different/non-coherent research designs among sites/regions cause difficulties for synthesis at scale. Limited study sites (due to limited funds and human capacity) and high socio-ecological diversity of global drylands reduce the plausibility of synthesis works. Three- or four-year duration is too short to creating scientific IPGs from research activities.	Research approach used and designs across sites and regions share common aspects of integrated systems research. Extrapolation domains (biophysical, economic and social context) are well identified from the beginning to guide site selections. Adequate fund for DS program is secured for at least 5 years.
⑧	Three- or four-year duration is too short to for adaptive learning and progressing with feedbacks among systems research phases.	Adequate fund for DS program is secured for at least 5 years. Annual revisions are done timely on a basis of adaptive learning.
⑨, ⑩	Three- or four-year duration is too short to for creating and monitoring impacts at scale. Achievements of IDO and SLO are dependent on societal efforts beyond the control of the CPR. This makes impact assessment difficult.	Regular Monitoring and Evaluation is done before (baseline), during and after the program. Adequate fund for DS program is secured for at least 5 years, Monitoring, and Evaluation continues after the program ends.

In the operational phase of integrated systems in-development research, ***integrative interventions*** (Figure 1) tests with farming households and development partners, feasible combinations of technical (e.g. diversification and/or intensification options), market (e.g. inclusive value chains), institutional (e.g. innovation platforms) and policy options capable of improving agricultural livelihood systems. The chief objective of the integrative intervention phase is to identify ***context-relevant, actor-targeted intervention agendas*** that result in ***synergistic, convergent changes*** of livelihoods at household-farm and community-landscape levels.

The ***integrated systems assessment*** (Figure 1) evaluates the results of **integrative interventions** in terms of **multi-aspect performance** of **agricultural livelihood systems** and impacts on the larger social-ecological environment. The focus is not only on total farm productivity including **closing yield gaps** with greatest relevance to small holder farmers, but also **efficiency, social equity and adaptability (learning capacity, perspective change)**, related **trade-offs/synergies** and **plausible scenarios of system development**. The assessment also requires further development of monitoring and evaluation methods with indicators that can show whether systems approaches are working, for whom, where, to what extent and if fast enough to support adaptive management and donors' needs.

Integrative syntheses within research regions and across regions (Figure 1) identify **common patterns, processes and leverages** of desirable livelihood transitions, and provides open-access options-by-context databases and systems methods/tools box. The **options-by-context** databases assemble technological, institutional, market and policy options over a wide range of socio-cultural, demographic and biophysical context (spatially explicit) providing a knowledge resource to enhance the targeting and relevance of potential systems interventions with an aim to scale these out to similar extrapolation domains. This **system-based knowledge** together with established functioning innovation platforms ***enhance societal co-learning*** in coping with trade-offs and synergies among grand problems (e.g. food insecurity, climate change, land degradation, gender inequities, and youth unemployment) to ***generate social coalitions of actions*** at the expected scale of impact (millions of farmers across millions ha of dryland areas). This will also ***strengthen the science-policy interface*** that has prevented governments and international bodies from delivering changes on the ground to rural people, by identifying diversified opportunities for the agricultural sector that can reverse the lack of investment in rural areas.

Applying systems thinking to development challenges in year 2015

Our integrated systems approach recognizes that in drylands everything is interconnected, as well as recognizing the interconnections between drylands and major global issues. Our pathways to impact contribute to the three CGIAR 'System Level Outcomes' (SLOs) defined under the CGIAR Strategic Framework to:

1. REDUCED POVERTY (SLO 1): making an impact means research to generate higher and more sustainable incomes, and a better standard of living for men, women, and children in drylands of the developing world
2. IMPROVED FOOD AND NUTRIENT SECURITY FOR HUMAN HEATH (SLO 2): making an impact means research to increase food and nutrient security, thereby improving human health for poor and vulnerable communities in drylands.

3. IMPROVED NATURAL RESOURCES MANAGEMENT AND ECOSYSTEM SERVICES (SLO 3): making an impact means research to develop an equitable and sustainable management of land, water resources, energy, and biodiversity in drylands for generations to come.

These are complemented by 4 Cross Cutting Outcomes (CCO):

1. CLIMATE CHANGE (CCO A): making an impact means research to build in resilience of the poor and vulnerable people to climate shocks and a focus on adaptation to and mitigation of climate change
2. GENDER AND YOUTH (CCO B): making an impact means research to improve and promote gender equity – that is, it is research is adapted to meet the needs and the aspirations of women and young people as key vulnerable groups and provide empowerment and better socio-economic opportunities, including youth employment in agri-food supply chains.
3. POLICY AND INSTITUTIONAL INCENTIVES (CCO C): making an impact means research to improve institutional and policy incentives to increase sustainable agricultural production, natural resources management and resilience to climate and other unexpected global changes.
4. CAPACITY DEVELOPMENT (CCO D): making an impact means research to improve the capacity of the community of practice in agri-food and livelihood system research, and enhance innovation throughout the agri-food and livelihood systems, including farmers and other vulnerable groups along food value chains.

Given the availabilities of financial and human resources, in 2015 the percentages of CRP Dyland Systems activities targeting SLOs and CCOs, through intermediate development outcomes (IDOs) are shown in **Figures 2** and **3**.

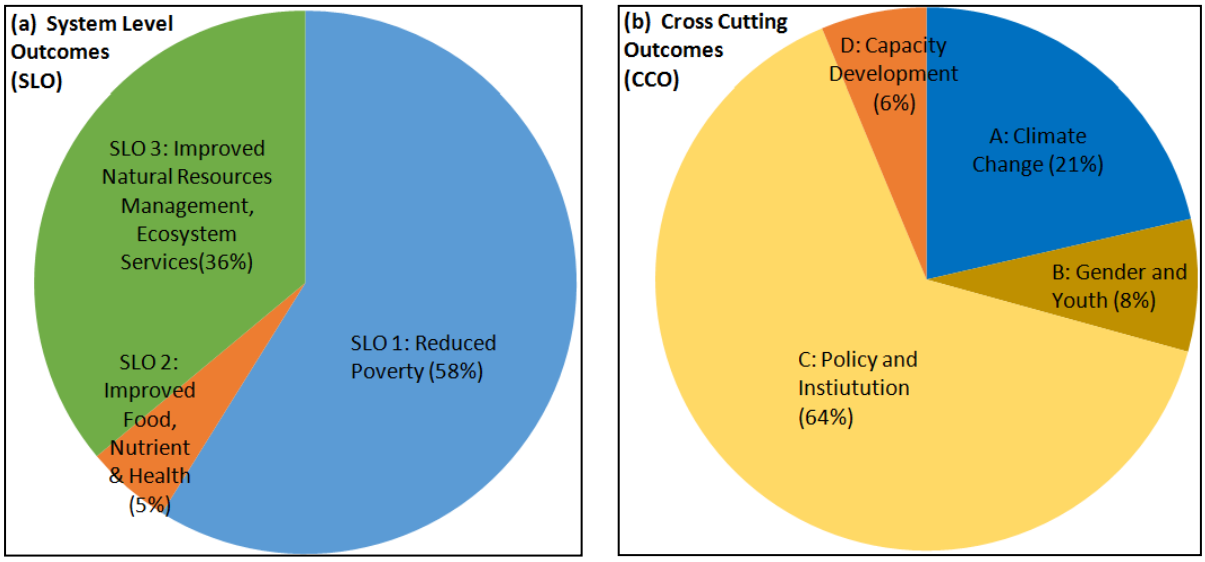


Figure 2. Percentages of Dryland Systems activities targeting of CGIAR SLOs (a) and Cross Cutting Issues (b) in 2015. Data source: extracted from Dryland Systems' Monitoring, Evaluation and Learning Online Platform.

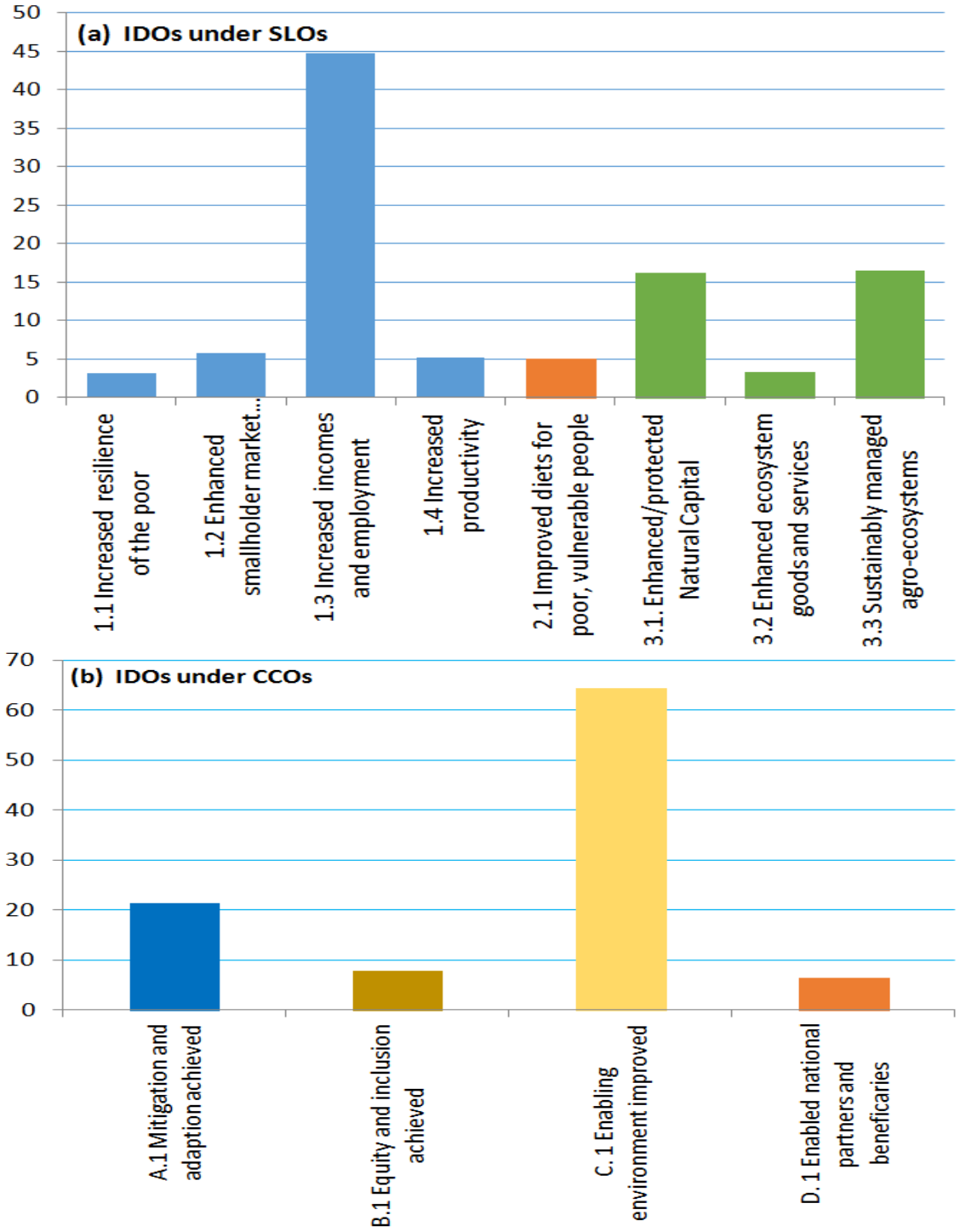


Figure 3. Percentage of Dryland Systems activities targeting of (a) IDOs under SLOs and (b) IDOs under CCOs. Data source: extracted from Dryland Systems' Monitoring, Evaluation and Learning Online Platform

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RESEARCH PROGRAM ON

Dryland Systems

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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