Generic Impact Pathway through Integrated Systems Research in-development Approach

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A **theory of change** (ToC) describes how a research-in-development project or program induces expected outcomes and impacts by describing causal interrelationships from the project/program's activities to outputs, outcomes and impacts, based on the state-of-the art of the underlying sciences for understanding the nature of change in the target systems. The ToC of 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 to understand the nature of change in dryland **agricultural and livelihood systems (ALS)**. This new systems science knowledge together with a transdisciplinary approach is based to design integrated interventions to leverage positive changes in human actors' systemic knowledge, skills and attitude being essential to manage sustainably ALS.

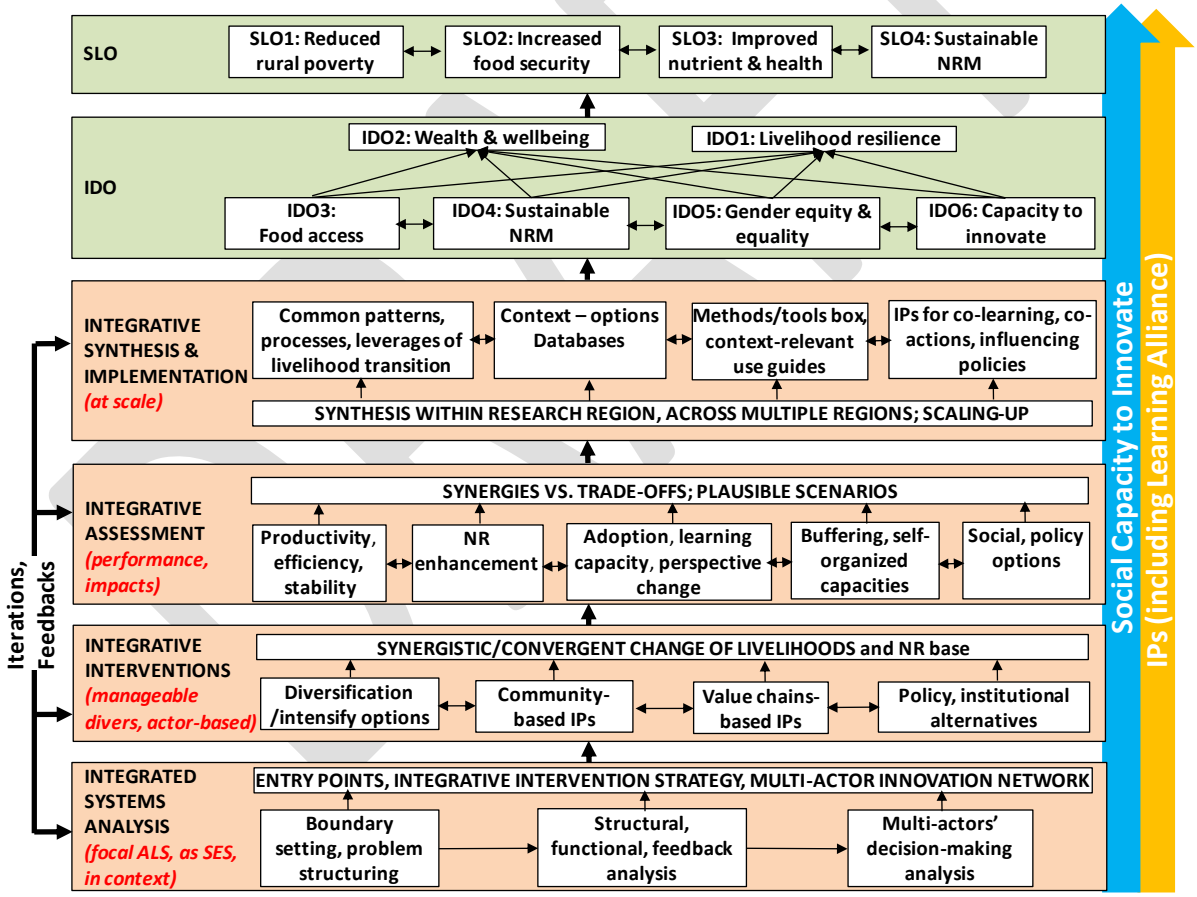

Figure 1. Generic Impact Pathway of Dryland Systems. Notes: ALS = agricultural livelihood systems, IP = innovation platforms, SES = socio-ecological systems. IDO = Intermediate Development Outcome, SLO = System Level Outcome. Boxes in sandy orange shows activities and outputs of interrelated phases of integrated systems research. Boxes in green show development outcomes driven from integrated systems research-in-development.

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** that 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 multi-levels and multi-domains. This means that the entry point level process (agricultural livelihood system) then needs to be integrated into the higher levels processes in order to capture cross-level relationships shaping 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. The 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 end 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.

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 (million of farmers across million 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.

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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.

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