



Sustainable intensification of crop-livestock mixed farming systems in the Guinea/Sudan Savanna Zone of West Africa

Africa RISING Project Document

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The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation and impact assessment.



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Background and rationale

Africa RISING Program

As part of the Feed the Future Initiative, the United States Agency for International Development (USAID) is supporting an innovative multi-stakeholder agricultural research program, the Africa Research in Sustainable Intensification for the Next Generation (Africa RISING). The program's main objective is to identify and validate scalable options for the sustainable intensification of key African cereal-based farming systems to increase food production and improve the livelihoods of smallholder farmers and at the same time conserve or improve the natural resource base.

Africa RISING is a 5-year research program with three regional projects launched in 2011. It brings together a wide range of research and development partners from the CGIAR and the national agricultural research and extension systems, farmers, input and output dealers, and policymakers to develop management practices and technology combinations to better integrate crops (cereals, legumes and vegetables), livestock (including poultry), and trees and shrubs in mixed-farming systems with the aim of improving whole-farm productivity, nutrition, and incomes of small-farm families without degrading the environment. It will also develop innovations that effectively link farmers to markets and input suppliers.

The three projects are as follows:

- Sustainable intensification of crop-livestock mixed farming systems in the Guinea/Sudan Savanna Zone of West Africa – led by the International Institute of Tropical Agriculture (IITA),
- Sustainable intensification of crop-livestock integrated farming systems in the Ethiopian highlands – led by the International Livestock Research Institute (ILRI), and
- Sustainable intensification of cereal-legume-livestock integrated farming systems in East and Southern Africa – led by IITA.

The International Food Policy Research Institute (IFPRI) is responsible for monitoring, evaluation, and impact assessment across all three projects.

The program is organized around three research outputs that are logically linked in time and space, namely:

1. Situation Analysis and Program-wide Synthesis
2. Integrated Systems Improvement
3. Scaling and Delivery of Integrated Innovation

The first Research Output covers the activities necessary to ensure that best bet or best-fit technological interventions address farmers' priority constraints and to develop program-wide synthesis related to the lessons learnt across the three projects. Research Output 2 is delivered via a broad approach of participatory technology identification, adaptation, and effective combination aiming to improve farming systems in terms of productivity, income, and natural resource management. Research Output 3 consists of the development of approaches for scaling-out systems innovations to similar development domains.

This document outlines the 5-year multi-disciplinary and multi-institutional research plan being implemented by the Africa RISING project in West Africa. The document has been prepared as a collaborative effort among the participating International Agricultural Research Centers (The World Vegetable Center, AVRDC; International Center for Tropical Agriculture, CIAT; International Crops Research Institute for the Semi-arid Tropics, ICRISAT; International Food Policy Research Institute, IFPRI, International Institute of Tropical Agriculture, IITA; International Livestock Research Institute,

ILRI; International Water Management Institute, IWMI, and the National Agriculture Research and Extension Institutions NARES.

Rationale for Africa RISING West Africa project

The West African Guinea/Sudan Savanna area is dominated by nearly 70 million small-scale, resource-poor farmers whose livelihoods depend on rain-fed crop, livestock, and crop-livestock farming systems. Due to weak integration of the crop and livestock enterprises and several inter-related technical, institutional and policy constraints, the total productivity of the farming systems is generally low. As a result, undernourishment, poverty, and environmental degradation are widespread.

The main staple crops are cereals (maize, rice, sorghum, pearl millet), legumes (groundnut, cowpea, soybean, Bambara nut, pigeon pea), and vegetables (roselle, okra, pepper). The cereals are grown either in pure stands or intercropped/rotated with the legumes and a variety of vegetables. Crop yields are generally poor due to low and variable rainfall, drought, low and declining soil fertility, use of low yielding varieties, lack of quality seeds of improved crop varieties and land preparation equipment, high cost of inputs, postharvest losses, labor constraints that lead to poor growing conditions (late sowing, sub-optimal plant populations, inadequate control of weeds, particularly *Striga*, pests and diseases), and low use of organic or mineral fertilizers. About 40% of the cropland is left under weedy fallow with little or no improvement, e.g., planting of herbaceous and shrubby legumes to provide livestock feed, improve soil fertility, and suppress pests and diseases. Fallow periods have shortened because of high cropping intensity.

Cattle, sheep, goats, pigs, chickens, guinea fowls, turkeys, and ducks are reared for meat, milk, land preparation, transport, manure, and cash, as appropriate. In many communities, poor women and the youth derive their income from livestock keeping, especially sheep, goats, poultry, and pigs. The animals are mostly managed under extensive and semi-intensive systems with limited feed, shelter, health care, and breeding management. Productivity of the animals is therefore low and made worse by seasonal shortages in quality feed and by water points linked to the degradation of the environment. Available commercial feeds are expensive and thus unaffordable for many farmers. Inappropriate husbandry practices (feeding, health care, housing, and breeding) result in high mortality rates. Farmers have limited access to veterinary services and improved livestock breeds. Nearly 70% of all feed for cattle, sheep, and goats comes from grazing. High grazing pressure in some communities reduces plant biodiversity and biomass and soil vegetation cover, resulting in severe soil erosion and nutrient losses.

Because of low income, unsuitable food, and poor knowledge of healthy diets, the food intake of most poor rural farm-families is dominated by the basic staple foods (e.g., maize, rice, millet, and sorghum) which are usually deficient in micronutrients and vitamins. The nutritional status of most farm households, especially pregnant/breastfeeding women and children below 24 months of age, is therefore poor, leading to chronic malnutrition. Diversity in a farm household's food supply contributes to dietary diversification that can reduce under-nutrition. Nutritionally enhanced traditional foods and low-cost complementary foods, prepared with locally available nutrients using suitable small-scale production technologies in households, can help to meet the nutritional needs of women and young children.

Farmers have limited access to input and output markets. Enabling institutions and policies to improve farmers' access to markets are also lacking. Due to the inadequacies of traditional promotional and scaling-up/out pathways for improved practices, there is a large unmet demand for information and technology, especially by women. This has led to a low adoption of improved technologies and best practices by farmers.

Most research-for-development (R4D) projects in the region are focused largely on some aspects of the farming systems, such as few crop species and cropping systems, seed systems, soil fertility management, or few livestock species and husbandry systems, with little attention to the integrated management of the components of the farm, their interdependency and socio-economic impact on farm households and the natural resource base. We hypothesize that a farming systems approach which aims at integrating the key components of the production systems (e.g., crop, soil/water and livestock) with household nutrition and capacity building can raise and sustain household food and nutrition security and income. Thus, the interactions among the main components of the crop, soil, and livestock components of the farming systems are considered to be the key R4D focus of the Africa RISING project in West Africa (Fig. 1).

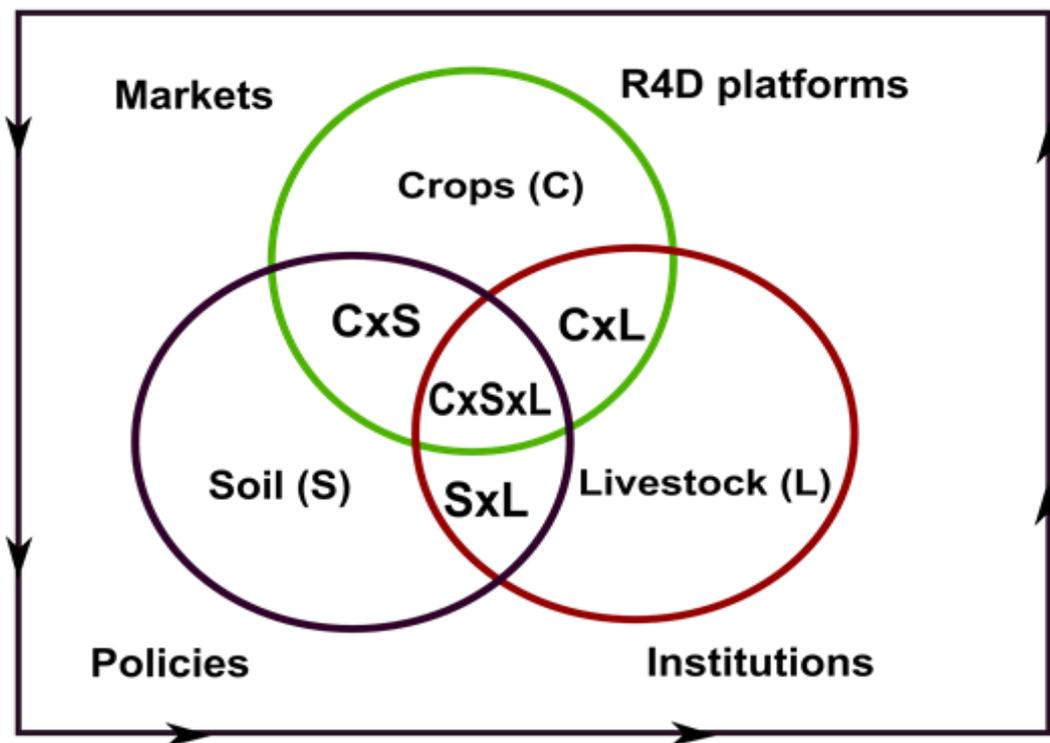


Fig. 1. The 'Africa RISING Project niche': Research-for-development on sustainable intensification that considers the crop, soil, and livestock interactions within the socio-economic environment (markets, policies, institutions, and gender).

Project description and work plan

Goal

Provide pathways out of hunger and poverty for smallholder farm households through sustainably intensified farming systems.

Purpose

Increase adoption of sustainable intensification (SI) innovations that improve productivity (crop, livestock, and water), product quality, nutrition, income, and market access, and conserve the natural resources (soil, water, and vegetation) by smallholder farm households in the Guinea/Sudan savanna zone of West Africa.

The widespread adoption of the SI innovations and/or community-based production or marketing enterprises will require support from micro-finance and credit services and other institutional support services which are beyond the scope of this program. Thus, the impact of the project will be achieved through the linkages with agricultural services support and other development projects funded by USAID (e.g., ATT and ADVANCE II) and other donors in the regions where the Africa RISING project is being implemented.

Objectives

1. Characterize the farming systems and identify constraints and opportunities for SI
2. Develop, test, and disseminate SI innovations and practices to increase farm household productivity and income
3. Develop, test, and disseminate SI options to improve off-farm and on-farm natural land, soil, and water resources management and use
4. Improve household food and nutrition through increased availability and consumption of diversified and nutritious foods
5. Improve knowledge exchange and information flow among project stakeholders
6. Build the capacity of project partners to develop, test, and disseminate SI innovations and practices

Expected outputs

1. Farming systems at the Africa RISING project sites (25 communities in Ghana and 10 villages in Mali) characterized and technological and institutional options for SI identified and documented
2. Smallholder farm households' crop and livestock yields per unit area of land and income from sale of crop and livestock products increased through the adoption of SI innovations
3. On-farm and off-farm soil physical (cover, infiltration rate, and moisture), chemical (organic carbon) and biological properties improved, run-off and erosion decreased, and biomass and diversity of plant species increased through the adoption of SI innovations
4. Dietary diversity of smallholder farm households, especially women and children, in the Africa RISING intervention communities improved through behavioral change and increased availability and consumption of a variety of nutritious foods.
5. Knowledge exchange and information flow among stakeholders enhanced through the use of appropriate media – research and demonstration plots, workshops, project reports, workshop proceedings, journal papers, media materials, farmers' field days, and exchange visits
6. Capabilities of national and private programs (NARES, 8; NGOs, 5), researchers, extension agents, farmers, students, and decision-makers (farmers, 4000; researchers, 200; extension staff, 60; graduate students, 10; and policymakers, 15) for SI research and development of SI options strengthened

Research Output 1 covers the activities that are necessary to ensure that project activities are able to characterize and stratify target communities effectively so that promising interventions are identified and inappropriate interventions rejected. It also relates to monitoring adoption and farmers' preferences, and assessing the economic and environmental impact of project activities: this is the responsibility of IFPRI.

Outputs 2-4 are delivered via a broad approach of participatory technology development and/or identification. This allows the project to identify existing sound practices within communities that might be more widely propagated, the adaptation of these and other exogenous innovations, and the more effective combination of innovations from multiple sources. They generate integrated technology combinations that are more effectively targeted on the farmers' real development needs.

Output 5 recognizes that, even where such technology combinations can be identified, the approaches used for scaling them out may not always be effective and seeks to redress this shortcoming. Output 6 aims at building individual and institutional capacity to achieve the first five outputs. Thus, the six outputs will help to achieve the project's purpose – increase the adoption of SI innovations by smallholder farm households in the Guinea/Sudan savanna zone of West Africa to improve productivity, product quality, nutrition, income, and market access, and conserve the natural resources.

Research hypotheses

The project contributes to the Africa RISING program research and development outputs. The key project hypotheses which will contribute to the testing of the program hypotheses on adoption, integration, and trade-off are as follows:

1. A combination of improved crops (cereals, legumes, and vegetables), tree/shrub varieties, and agronomic practices will increase food/feed yields, income, and household food security more than the use of single technologies.
2. Combinations of improved livestock and poultry breeds and management practices will increase animal productivity, income, and household food and nutrition security more than the use of single technologies.
3. Integration of soil, land, and water management practices into cereal-legume-livestock farming systems will increase food and feed outputs, improve human and livestock nutrition, increase household income, and conserve the environment.
4. Linking nutrition knowledge to agricultural innovations will lead to improvements in nutrition and more diverse integrated farming systems.
5. Participatory testing and evaluation of farming system innovations targeted to gender and farm types will increase farmers' experimentation and adoption of technologies.
6. Building social cohesion and local institutions for improved community land, water, and grazing management will lead to a reduction in land degradation, forest clearing, and conflict over natural resource use.

Activities to achieve the expected outputs

Output 1. Farming systems in the project area characterized and technological, institutional, and policy options for SI identified and documented

Workshops were organized to agree on project sites, components, and activities, and on key partners and their roles and responsibilities. Informal and formal surveys were conducted for a better understanding of smallholder farmers, their production systems, farm resources, current practices, production levels, constraints and opportunities, adaptation strategies, gender issues, and market access for both inputs and outputs. This is facilitating the development of relevant technologies and the identification of markets niches. The surveys provided baseline data to characterize the farming systems, guide the testing of appropriate technologies and institutional options, and to provide access to the impact of the technologies promoted by the project on household crop and livestock production, income, nutrition, and the natural resource base. Databases are being created and integrated into Geographical Information System (GIS) databases to characterize the intervention communities. GIS maps showing recommendation domains for the tested technologies are being produced. The maps and databases are being used for *ex-ante* economic and environmental impact assessment.

An inventory of existing technologies and current institutional arrangements related to marketing and SI of crop and livestock production is being compiled. Institutional options to link farmers to inputs and output markets are being explored. Socio-economic surveys and case studies are being carried out to assess the potential adoption of technologies and the impact on household income and the environment.

Activities

1. Organize international and national workshops to identify key partners and project sites
2. Sensitize communities and conduct community analysis
3. Conduct baseline surveys to generate baseline data for impact analysis
4. Model the efficiency of farm systems components and whole farms
5. Analyze key crop and livestock value chains at the intervention communities
6. Conduct market surveys and develop and test options that link farmers to input and output markets
7. Review existing institutions and make recommendations for institutional arrangements to promote the adoption of SI innovations and practices
8. Conduct adoption studies
9. Conduct cost-benefit analysis and ex-ante impact analysis on selected SI innovations and practices
10. Undertake trade-off analyses

Output 2. Smallholder mixed farm household productivity increased through the adoption of SI practices

Crop yields on farmers' fields are poor due to low and variable rainfall, low and declining soil fertility, the use of low yielding varieties, a lack of quality seeds of improved crop varieties and land preparation equipment, high cost of inputs, postharvest losses, labor constraints that lead to poor growing conditions (late sowing, sub-optimal plant populations, inadequate control of weeds, particularly *Striga*, pests and diseases), and the low use of organic or mineral fertilizers. SI innovations and practices to overcome the above constraints will be developed, tested/adapted, and disseminated. The options will be based on improved varieties of cereals, legumes, and vegetables and the options for agronomic/soil fertility management (ISFM) identified from other donor projects (e.g., Drought Tolerant Maize for Africa, N2 Africa, AGRA Soil, and Tropical Legumes).

Improved cultivars of introduced crops (cereals, legumes, and vegetables) and trees/shrubs with superior yields and quality will be identified through multi-locational trials. Special attention will be given to the selection of drought and disease tolerant varieties with high water productivity and nutrient use efficiency. Agronomic/ISFM options for the integrated and sustainable use of land, water, and nutrients will be tested, adapted, and promoted to optimize food and feed production from the existing cropping systems without degrading the natural resource base. Entry-points to be considered include as follows: cereal-legume rotations, intercropping, relay-cropping, border strips, improved fallows, and the integration of livestock into the cropping systems. Nutrient management options will include the use of organic and inorganic fertilizers.

Farmer participatory approaches will be used to test and disseminate a combination of livestock breeding and management practices (housing, feeding, breeding, and health care) to intensify production.

Activities

1. Test and disseminate improved crop varieties (cereal, legume, vegetable) and agronomic/integrated soil fertility management practices to intensify production
2. Test and disseminate agroforestry options for intensive production of trees/shrubs, fruit, vegetables and fodder
3. Test and disseminate technologies to reduce postharvest losses in cereal and grain legumes
4. Test options to add value to cereals and grain legumes
5. Test and disseminate options for feeding, health, housing, and breeding management to intensify sheep, goat, pig, and poultry production

Output 3. On-farm and off-farm management and use of land, soil, water, and vegetation resources improved through the adoption of SI innovations

Due to poor cropping and animal husbandry practices, the degradation of land, soil, water, and vegetation resources is widespread in most of the Africa RISING intervention communities/villages in Ghana and Mali. The existing farming systems in most of these communities entail the use of both individual land holdings for crop farming and communal natural resources, such as grazing areas for livestock. There is a need for technological, institutional, and policy options for sustainable and productive management of the common properties and natural resources (land, soil, water, fodder, grazing areas, trees, and livestock) for the benefit of the rural communities and farm families and to avoid conflicts. Well-managed common resources will ease tensions among communities and pressures on the natural eco-systems.

Activities

1. Characterize soil resources of the Africa RISING intervention communities
2. Determine soil and land health indicators, characterize land use changes and identify drivers of land use changes
3. Conduct trade-off analyses and develop different scenarios for land restoration
4. Study the productivity of grazing land and map the grazing itineraries
5. Document and validate existing local conventions and facilitate participatory conflict management and transhumance practices
6. Establish and characterize watershed areas for integrated crop-livestock research
7. Model SI and land use at the village level
8. Evaluate small-scale irrigation options for dry season vegetable production
9. Develop and test options to improve fallow lands for crop and livestock production
10. Design and pilot-test livestock management options for efficient nutrient cycling
11. Develop and test options for rain water management and use

Output 4. Dietary diversity of households in the Africa RISING intervention communities increased through changes in nutrition habits and the increased availability and consumption of a variety of nutritious foods

Africa RISING will adapt household-level processing techniques for the production of nutritionally improved legume- and cereal-based food products through improving the nutritional quality of traditional products, introduce and test the acceptability of legume-based food products, and promote the consumption of these products within the intervention communities through Training of Trainers workshops and food demonstrations with nutrition education embedded. The nutritional knowledge and dietary diversity of farm-families, especially women and children in the Africa RISING intervention communities, will be improved by using behavioural change communication (BCC) and linking agriculture to nutrition through home production and consumption of nutrient-dense crops (vegetables and legumes) and livestock products (sheep, goats, pigs, domestic chickens, and guinea fowls). In addition, women will be trained to add value to products from livestock (milk and meat) and crops to increase shelf-life, capture niche markets, and improve profit margins.

Activities

1. Organize an expert workshop to agree on relevant nutritional activities
2. Conduct a household nutrition survey
3. Improve the nutritional knowledge of women using the BCC approach
4. Improve household nutrition through the production and consumption of nutrient-dense crops (vegetables and legumes) and livestock (sheep, goats, pigs, and poultry), especially by women– an agriculture/nutrition-based approach (AGB)
5. Compare the effects of BCC, AGB, and both BCC and AGB in improving household nutrition
6. Develop, test, and disseminate training materials on nutrition

Output 5. Knowledge exchange and information flow among stakeholders enhanced through the use of the appropriate media

Knowledge sharing and information exchange among partners and other actors are an important component of the project. To facilitate and coordinate the dissemination of SI technologies, district-level R4D platforms will be promoted. The platform actors will depend on the local systems but will include farmers' groups, community-based organizations (CBOs), and public and private partners including agro-dealers. A wide range of supporting media will be used, including posters and pamphlets, radio, television, and video.

Activities

1. Promote CBOs and farmers' interest groups and facilitate the establishment of R4D platforms
2. Establish demonstration plots
3. Prepare annual interim and annual technical reports
4. Publish workshop proceedings and journal papers
5. Develop media materials (posters, policy briefs, leaflets, films) for stakeholders
6. Organize exchange visits for farmers and research and extension staff
7. Organize review and planning meetings
8. Organize workshops to disseminate project results

Output 6. Individual and institutional capacities to test/adapt and disseminate SI innovations strengthened

A key component of the project is strengthening the human capacity of partners at all levels, i.e., from farmers and their associations' officers, development workers, and field and laboratory technicians, to scientists and policymakers. Academic training at the MSc and PhD levels focuses on research to address important knowledge gaps and to develop 'second generation' technologies that may be suited specifically to particular recommendation domains. More than 10 graduate students are currently being sponsored by the project in both countries (Table 2).

Activities

1. Organize on-the-job training for farmers and development staff
2. Organize short courses on specific topics for research and development staff
3. Train undergraduate (BSc) and graduate (MSc and PhD) students
4. Build the institutional capacity of NARES

Implementation strategy

Geographic focus and project sites

The project is implemented in 25 intervention communities in northern Ghana (Northern, Upper West, and Upper East Regions) and 10 intervention villages in southern Mali (Sikasso Region) within the Guinea/Sudan savanna area (Figs 2 and 3).

In each country, the intervention communities were selected within larger recommendation domains with similar parameters, bio-physical (rainfall, length of growing period) and socio-economic (market access), identified by IFPRI in collaboration with IITA in Ghana and ICRISAT in Mali.

Participatory research and extension approaches

In each country, participatory approaches are being used by multi-disciplinary and multi-institutional R4D teams to raise awareness on the project and to mobilize and characterize communities. District-level R4D platforms are being established, consisting of a wide range of national and international research institutions, extension systems, farmers, CBOs, processors, service providers, input and output dealers, and policymakers. The PREA and R4D platforms facilitate the participatory identification and implementation of activities to address the constraints of the farming systems, facilitate farmers' experimentation and evaluation, ensure the ownership of the project by stakeholders, and the sustainability and effective scaling-out/scaling-up of technologies.

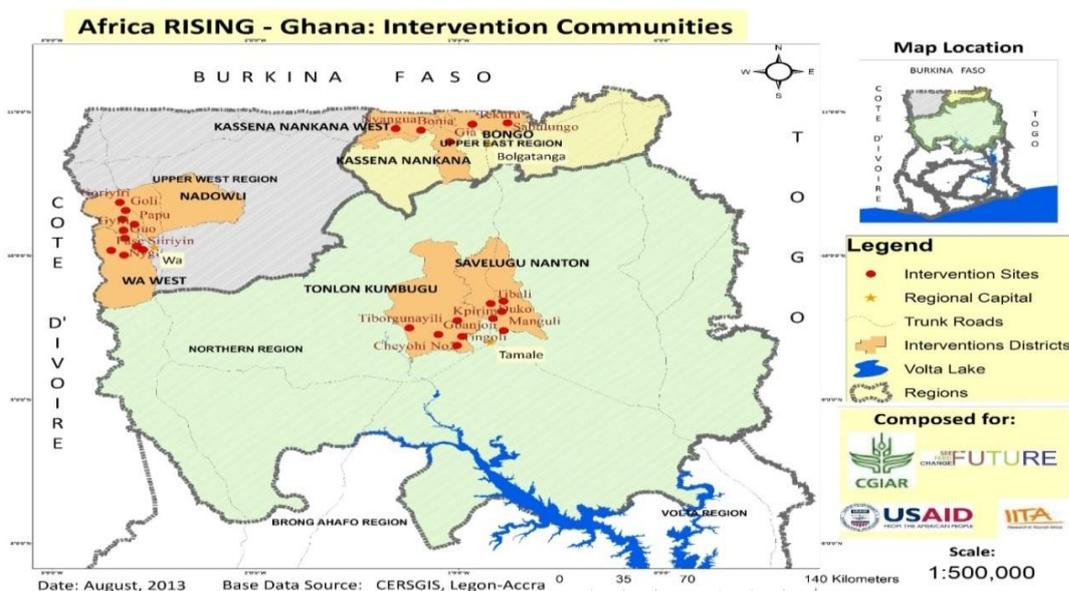


Fig. 2. Africa RISING intervention communities in northern Ghana



Fig. 3. Africa RISING intervention communities in southern Mali

Strengthening community-based organizations

The project works with existing farmers’ groups and CBOs, and encourages their formation where they do not already exist. It builds their capacity through technical, organizational, and leadership training. Training is underpinned by the principle that people learn from practical experience (experimental learning) and that learning from peers has been shown to be effective.

Gender mainstreaming

The roles and responsibilities, opportunities, and challenges of men and women differ according to region, crop, and livestock system. There is unequal participation of women and marginalized groups in areas that have better potential and scope to ensure equitable benefit. Women farmers have less access to agricultural inputs. The capacity of implementing partners and stakeholders to collect, analyze, and interpret sex/gender-disaggregated data is limited.

The project will conform to the Gender Strategy advocated by Humidtropics. Gender analysis – to identify, analyze, and inform action to address inequalities that arise from the different roles of men and women, or unequal power relations between them, and the consequences of these inequalities on them – will therefore be a cross-cutting thematic area that will be integrated into all research and development activities. This will be done through two approaches: 1) gender mainstreaming which includes the incorporation of relevant gender concerns into all the research objectives and activities, such as problem diagnosis, technology testing, improved food and nutrition security and income, market chain analysis, etc., and 2) a focus on strategic gender activities using multiple entry points to reduce drudgery and support emerging women farmers (including the youth) in adopting SI innovations.

The gender mainstreaming and analysis component focuses on understanding the production constraints that women face and their preferences of SI innovations (e.g., varieties and technologies, etc.,). Specific women-focused activities will include the following:

- Sensitize partners, farmers’ groups, and farming households; mainstream gender in farming and decision-making
- Assess business opportunities for women and the youth in agro-input supply and marketing, and value addition
- Conduct dissemination campaigns targeting women and young farmers
- Develop labor-saving pre- and postharvest tools for women farmers

- Build the capacity of implementing partners and stakeholders at community-, district-, and national levels on gender
- Strengthen the capacity to empower women and other disadvantaged groups

Value chain approaches

Based on an initial community analysis and market survey of processors, traders, and other actors along selected crop and livestock value chains in the project areas, strategic alliances are being established for the promotion of these at various levels through linking producers to traders and processors. A participatory market chain development approach to foster greater interaction and coordination among the various market actors is being adopted. The objective is to create the awareness, capacity, and opportunities for farmers to become more powerful and informed actors in the market chain, able to negotiate and work with other actors rather than being passive price-takers.

Scale of operation and research approach

The activities are implemented on-farm (80-90%) and on-station (10-15%) at the level of plot or field and are managed by researchers or farmers. On-farm activities are used to compare improved SI innovations with farmers' practices, to demonstrate and scale-out new technologies and/or a combination of technologies, and to train research and development partners.

The on-station trials are mostly implemented by graduate students to develop, test, and adapt new technologies as part of their dissertation research.

Scaling-out/up strategies

With research being the focus of the project, wide adoption and scaling-out of SI innovations will be achieved through close collaboration with development projects in the area of intervention, particularly other USAID FtF projects (e.g., ADVANCE II and ATT), which will include the research findings of Africa RISING in their programs.

Options for scaling-out and scaling-up will include the following: use of participatory approaches; establishment of R4D platforms to pursue broad partnership involving researchers, extension system, marketers, and policymakers; use of GIS tools and Remote Sensing techniques, modeling to scale-out workable technologies to broader areas; support to community seed production to enhance adoption; assessment of options for enhanced information flows among farmers, men and women, and among communities, using a range of new information technologies; a sustainable supply of seeds and planting materials for locally appropriate varieties and species; and the development of enterprises for production and distribution of livestock breeding stock and breeds for diversification and intensification of the production systems.

Where possible, the project activities will be linked with those of development projects to undertake joint activities, share information, and reach out to a larger number of poor farmers.

Partners

The project is being implemented by a multitude of stakeholders and institutions, including farmers' organizations and public and private sector actors (see table 1 below).

Name	Abbreviation	Ghana	Mali	Role/responsibility
Afrique Verte, Mali	¹ AMASSA		+	On-farm and household nutrition studies with ICRISAT.
Association Malienne d'Eveil et de Développement Durable	¹ AMEDD		+	On-farm field trials and household nutrition studies with ICRISAT.
Agricultural Development and Value Chain Enhancement Program	ADVANCE II	+		Assistance with market linkages, joint demonstration of technologies.
Animal Research Institute	ARI	+		R4D on livestock production (sheep and goats) with ILRI.
Agricultural Technology Transfer Project	ATT	+		Assistance with the introduction of new labor-saving technologies.
The World Vegetable Center	AVRDC	+	+	Lead R4D on vegetable production systems.
Community-based Organizations	CBOs	+	+	On-farm implementation of R4D activities.
International Center for Tropical Agriculture	CIAT	+		Lead R4D on land and soil management.
Compagnie Malienne de Développement des Textiles	CMDT		+	On-farm field trials and household nutrition studies with ICRISAT.
Crops Research Institute	CRI	+		Breeder seeds of improved cereals and legumes.
Food Research Institute	FRI	+		Household nutrition.
Grains and Legumes Development Board	GLDB	+		Production of foundation seeds.
Heifer International	¹ HI	+		On-farm livestock production with IITA.
World Agroforestry Center	ICRAF		+	Lead R4D on agroforestry systems.
International Crops Research Institute for the Semi-arid Tropics	ICRISAT	+	+	Sorghum/millet-groundnut R4D with IITA and SARI.
International Food Policy Research Institute	IFPRI	+	+	Lead site selection, baseline survey, and monitoring and evaluation.
Institut d'Economie Rurale	IER		+	Socio-economic and on-farm studies with ICRISAT.
International Institute of Tropical Agriculture	IITA	+	+	Project coordination and R4D research on cereals-legumes.
International Livestock Research Institute	ILRI	+	+	Lead R4D on livestock, especially ruminants.
Institute for Scientific and Technological Information	INSTI	+		Organization of training and publication of project documents with IITA.
International Water Management Institute	IWMI	+		Lead R4D on water management.
Kwame Nkrumah University of Science and Technology	KNUST	+		Graduate student training and R4D on rural pig production.
Mouvement Biologique du Mali	¹ MOBIOM		+	On-farm and household nutrition studies with ICRISAT.
Ministry of Food and Agriculture	MoFA	+		Scaling-out of SI technologies and establishment of R4D platforms.
Ministry of Health	MoH	+		Household nutrition R4D with UDS and IITA.
Presbyterian Agricultural Services	¹ PRA	+		SI technologies on soil fertility

				management with IITA.
Savanna Agricultural Research Institute	SARI	+		R4D on cereal-legume-veg. systems with IITA, ICRISAT, and AVRDC.
Seed Producers Association of Ghana	¹ SEEDPAG	+		Production of certified seeds and training on seed production.
Soil Research Institute	SRI	+		R4D on integrated soil fertility management with IITA.
University for Development Studies	UDS	+		Graduate training and R4D on rural poultry and pig production.
Wageningen University, The Netherlands	WU	+	+	R4D on farming systems characterization and graduate training.
Water Resources Institute, Ghana	WRI	+		R4D on water management with IWMI and CIAT.

¹Non-governmental organization

Beneficiaries

- Farmers' groups, including the youth and women: At least 6000 farmers will learn by experience through direct involvement in participatory testing and dissemination of improved SI innovations in both countries. An additional 5000 farmers will be made aware of SI innovations and practices through participation in field days and exchange visits in both countries. At least 10000 farmers will adopt the SI innovations to increase crop and livestock yields by 15-30%.
- Researchers: At least 100 male and 50 female scientists will strengthen their research skills in SI.
- Extension workers: At least 40 male and 20 female extension workers will be trained.
- Private sector actors: 80 male and 40 female agro-dealers will be trained.
- Policymakers: At least 20 policymakers in each country will be sensitized on SI.
- Small-scale agricultural machinery manufacturers: At least 4 manufacturers in each country will fabricate small-scale machinery for SI.
- Students: A minimum of 6 MSc (4 male and 2 female) and 3 PhD students will be trained in research projects related to SI.
- Institutions: At least 8 NARS, 6 CGIAR centers, and 4 NGOs will be sub-contracted for R4D research.

Monitoring and evaluation (M&E) plan

IFPRI has the responsibility for M&E, a critical component of the project, for several reasons. It supports effective project management, provides data for timely reporting to project funders, and helps all stakeholders to learn about the project's successes and failures. A reliable M&E system will also provide learning opportunities about what did work and what did not. In turn these should inform the design and implementation of new interventions, as well as catalyzing adjustments to ongoing activities that might enhance efficiency and effectiveness.

Although they are highly complementary, M&E activities are separate in both purpose and implementation. Monitoring the FtF indicators in Africa RISING conforms to M&E standards, best practices, and the core indicators established for the entire FTF initiative. The M&E team for Africa RISING has developed an open-access, data management and analysis platform, the Project Mapping and Monitoring Tool (PMMT), to serve the needs of research scientists and other stakeholders. The PMMT is intended to help users to understand where and how Africa RISING activities are taking place, and improve project strategies and partnerships for better impact in their work. Its features and functions have been designed to provide the following benefits: (a) inform strategic and project management decisions; (b) communicate programmatic projects to key stakeholders; and (c) understand how programmatic efforts relate to other projects as well as to useful agricultural information. A 2-day training session on the use of the PMMT was organized in Tamale at the end of July 2014 that involved the research teams for Ghana and Mali.

Beyond its formal monitoring obligations, the M&E activity in Africa RISING is generating data and information for a range of farming system and livelihood outcome indicators to provide for enhanced research management and outcome mapping needs. To provide information for planning and longer-term projections of potential innovation impact at scales beyond the actual action research sites, forward-looking analysis will soon explore the productivity and sustainability consequences of a range of adoption scenarios and geographic/system spillover pathways across broader landscapes in West Africa.

Programs such as Africa RISING provide great opportunities to learn about what works and what does not, along with the 'why' and 'how'. Information collected as part of the program can support various types of evaluation, especially if assessment designs are carefully considered at the onset of the program. To this end, baseline data have been collected in the intervention and control communities in the Africa RISING districts of Northern Ghana (with a sample size of 1250 households from 50 communities) and Southern Mali (with a sample size of 700 households from 20 communities) to enable the West Africa project's impact to be assessed on a range of socioeconomic and agricultural indicators at the household and community levels.

A properly and scientifically designed impact evaluation is also necessary for well-informed decisions about scaling up. Unlike project monitoring, which examines and tracks whether targets have been achieved, impact assessment examines how the outcomes of beneficiaries of Africa RISING have changed as a direct (and, if modelled explicitly, indirect) effect of the program. It seeks to provide cause-and-effect evidence and quantifies changes in development outcomes that are *directly or indirectly attributable* to Africa RISING and not to other confounding factors. To provide credible evidence about Program attribution, the M&E team devised a quasi-experimental evaluation design. The main steps are as follows.

1. Stratification of geographic areas and creation of development domains based on agroecological potential and
2. Selection of action sites from the development domains, in collaboration with research.

3. Identification of control sites that are in the same development domain as selected action communities.
4. Household listing to compile the list of all agricultural households in action and control communities.
5. Random sampling of households in control sites (control households). Control households will serve as a valid counterfactual to program beneficiary households.
6. Purging of beneficiary households from the household list for action communities discussed under (4).
7. Random sampling of non-beneficiary households in action communities. Data from non-beneficiary households are used to examine potential spillover effects.¹
8. Using structured questionnaires to gather baseline and follow-up data from program beneficiaries, control households, and non-beneficiary households.
9. With the use of baseline and follow-up data, comparing various socioeconomic and environmental outcomes of interest among beneficiaries, non-beneficiaries, and control households, through regression analysis (e.g., matching).

¹ Spillovers refer to a situation where farmers not eligible to receive AR intervention, or who are eligible to receive the intervention but have not received it, benefit from the intervention indirectly through a variety of ways – such as externalities (e.g., when channeled by successful AR farmers), general equilibrium effects (e.g., depressed maize price through increased maize production due to AR interventions), social and economic interactions (e.g., neighbors and relatives interacting with and learning from a successful AR farmer), and behavioural changes.

Potential impact

The project is expected to reach out directly with the best SI innovations to nearly 10,000 crop-livestock farm households in each country. Adoption of the improved SI innovations will reduce household food insecurity, poverty, and environmental degradation.

Household food security will be achieved through the improvement of crop and livestock production. Increased productivity will result from the enhanced capacity of farmers to manage their systems in a sustainable manner, improved crops and livestock varieties and management practices, increased investment in soil fertility management, better labor-use efficiency, improved animal feed and manure supply, better system resilience to severe shocks, such as drought, and a decrease in farmers' reliance on cereal mono-cropping, reduced drudgery from weeding and postharvest processing, especially for women, improved soil, water, and land management.

The incomes of households will be increased by reducing the cost of production through more efficient use of inputs, increased marketing, and value-added primary product processing and options, more employment opportunities, and improved farm-gate prices.

The nutritional status of households in the intervention communities, particularly in vulnerable groups such as children and women, will be improved by widening agricultural biodiversity—crops and livestock varieties and products. Dietary diversification that can contribute to efforts to address under-nutrition will be achieved through the increased availability and consumption of a variety of nutritious foods from both crop and livestock sources.

The environment will benefit in various ways. Using grain or shrubby legumes as cover or companion crops in cereal-legume intercropping and/or cereal-legume rotations will improve soil chemical (organic matter, nitrogen, and phosphorus), physical (e.g., structure, infiltration rate, and bulk density) and biological (e.g., population and diversity of soil macro- and micro-fauna) properties. The SI innovations could also reduce over-grazing and the associated loss of plant biodiversity, soil and water erosion and nutrient losses, and increase ground cover.

Project management and coordination

The project is part of the management and coordination structure of the entire Africa RISING program which has two basic levels: the three regional projects and the complete entities for program coordination, communication, monitoring and evaluation, and scientific advice (Fig. 4) Each regional project has its own Steering Committee. The Terms of Reference of the West African Steering Committee are as follows:

- Provision of advice and oversight on project activities:
 - ✓ Scientific guidance to the project implementers to ensure conformity with the Program Research Framework and objectives
 - ✓ Guidance on project planning and activities
 - ✓ Approval of the annual work-plan and budget
 - ✓ Oversight of coordination among project components and partners
- Liaison with program M&E Team to oversee M&E
- Information of Program Coordination Team via Project Coordinator
- Review of and suggestions to the Project Coordinator on the semi-annual technical progress reports to USAID
- Planning of yearly stakeholder meetings

The Project Coordinator is the contact point for the donor on all project matters and the official representative of the project on behalf of the implementing institution, IITA. S/he provides leadership and the long-term project vision. S/he is ultimately responsible for the implementation of the project by all participating partners. S/he is in charge of partners' contracts and monitors partners' reporting and compliance with agreements. The Project Coordinator acts as Secretary of the Steering Committee, and is a member of the Program Coordination team. S/he oversees the implementation of the project in both countries, reviews work-plans before approval by the Steering Committee to ensure alignment with the program frame work, assigns budgets for country-level research, and coordinates the strategic direction with the other two regional projects in East/Southern Africa and Ethiopia. S/he is the link to the M&E team at IFPRI and the Program Communication Group at ILRI. S/he is also responsible for the financial management of the project. Technical and financial reporting to the donor, Steering Committee, PCT, Science Advisory Group (SAG), and Humidtropics CRP are part of her/his duties. Together with the Chief Scientist s/he identifies national and international staff needs and coordinates international recruitments. S/he facilitates communication among project partners and acts as mediator in conflict situations.

All internationally recruited IITA project staff are under the supervision and guidance of the Project Coordinator.

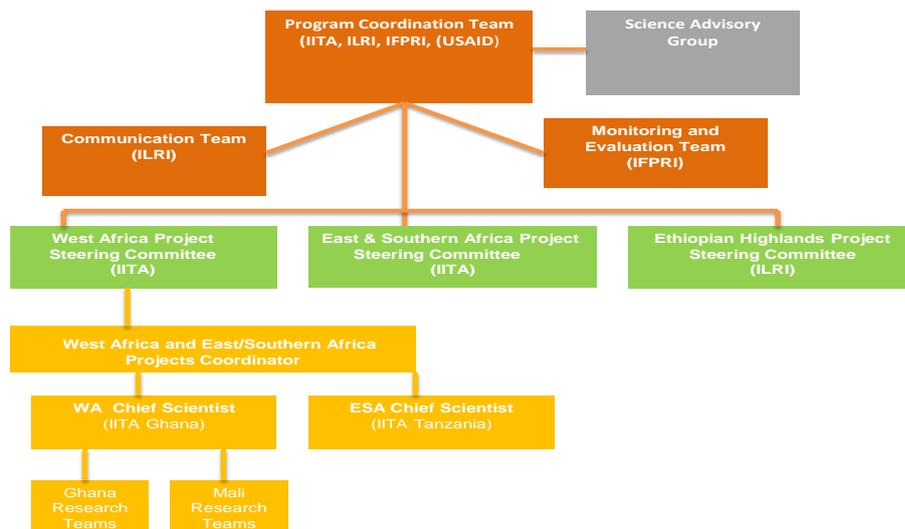


Fig. 4. Africa RISING program and project management structure

The Chief Scientist is responsible for the planning and implementation of research in Ghana and also oversees research in Mali and advises the Research Coordinator in Mali.

S/he leads the development of the work-plans of all research partners in Ghana to ensure compliance with the research strategy. S/he allocates the country research budget to the various partners according to the proposed and agreed activities. S/he assist the implementers in Mali to develop their research plans to ensure cross-country alignment and is also responsible for compiling the country work-plans into a single regional work-plan. During implementation, s/he monitors progress and assists partners in problem solving. S/he supervises all IITA national project staff in Ghana and national staff working on behalf of international institutions not present in the country.

S/he is the first contact point for the USAID mission and related research and development projects in Ghana. The Chief Scientist manages the project office in Tamale.

Table 2. Graduate students sponsored by Africa RISING West Africa, 2013-2014.

Student	Sex	Country	University	Degree
Mary Awuni	Female	Ghana	University for Development Studies	MSc
Fatouma Traore	Female	Mali	University of Ghana	MSc
Clarisse Umutoni	Female	Mali	Cheik Anta Diop University, Dakar, Senegal	PhD
Martha Agyri	Female	Ghana	¹ KNUST	MSc
Richard Amponsah	Male	Ghana	KNUST	MSc
Joseph Clottey	Male	Ghana	University of Ghana	MSc
Emmanuel Gyakah	Male	Ghana	University of Ghana	MSc
Mohammed Shaibu	Male	Ghana	University of Ghana	MSc
Daniel Agbetiameh	Male	Ghana	University for Development Studies	MSc
Shaibu Mellon	Male	Ghana	University for Development Studies	MSc
Henry Alagma	Male	Ghana	University for Development Studies	MSc
Salifu Eliasu	Male	Ghana	KNUST	MSc
Raphael Azayiga	Male	Ghana	KNUST	PhD
Abdul R Nurudeen	Male	Ghana	KNUST	PhD
Sarfo K Goodman	Male	Ghana	KNUST	PhD
Solomon Konlan	Male	Ghana	University for Development Studies	PhD
Peter Agbetiameh	Male	Ghana	KNUST	PhD

¹KNUST: Kwame Nkrumah University of Science and Technology

Table 3. Logframe for the Africa RISING West Africa project

	Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Risks and Assumptions
Goal	Provide pathways out of hunger and poverty for smallholder farm households through sustainably intensified farming systems.	<ul style="list-style-type: none"> Development indicators for income, nutrition, education, and health improved in response to increased farm productivity and marketing of grain and livestock products. 	<ul style="list-style-type: none"> International Agencies and country reports. National statistics. Survey in targeted countries by national and international agencies. 	<ul style="list-style-type: none"> Appropriate pro-poor policies and institutions promote rural development, equity, and economic growth in target countries.
Purpose	Increase adoption by smallholder farm households of SI innovations that improve productivity (crop, livestock, and water), product quality, nutrition, income, market access, and conserve the natural resources (soil, water and vegetation) in the Guinea/Sudan savanna zone of West Africa.	<p>By the end of the project in 2016,</p> <ul style="list-style-type: none"> At least 9000 farmers at the intervention communities adopt SI innovations, resulting in at least a 15% increase in crop and livestock yields. Degradation of the natural resources is reduced - 15% decrease in run-off; 15-20% increase in soil cover and plant diversity; water productivity (kg/unit of rainfall) increased by 20%. Average income of participating households increased by at least 15%. Nutritional status of farm households, especially women and children, improved – dietary diversity increased by 25%. 	<ul style="list-style-type: none"> Africa RISING website. Impact assessment reports. Adoption studies reports. Project reports and publications. 	<ul style="list-style-type: none"> National policies and institutions support technology adoption and SI. Agriculture will remain an important sector for rural development. Markets for crop and livestock products continue to grow and smallholders will participate in the market. Institutional and policy environment does not preclude functional partnerships. Government policies and institutions support smallholders' access to inputs (seeds, fertilizer, etc.) Access to study sites is not constrained by factors outside the control of the project. Project partners including farmers collaborate effectively. Project is well funded and staffed. Project activities are not affected by natural disasters such as drought and infectious diseases, e.g., Ebola. Effective endogenous dissemination channels can be identified and utilized for disseminating SI innovations.

<p>Outputs</p>	<ul style="list-style-type: none"> Farming systems at the Africa RISING intervention communities characterized and technological, institutional and policy options for SI documented. 	<ul style="list-style-type: none"> At least two international workshops to conceptualize the project organized – February 2012. At least two national workshops held in Mali and Ghana to agree on project sites – June 2012. At least 25 communities in Ghana and 10 communities in Mali sensitized and analyzed – March 2013. At least 30 farmers’ groups promoted at the project communities: Ghana, 20; Mali, 10. District-level R4Ds established to facilitate project implementation – May 2014: Ghana, 2-4; Mali, 1-2. List of available technologies available – March 2012. A report on the farming systems at the intervention communities available – December 2013. Farm typologies at the intervention communities identified by December 2014. Parameterized models for farm system components and different farm types in the Africa RISING villages in Mali – December 2014. Matrix of data and models available in Mali – December 2014. Report on livestock value chain in Ghana –end of 2014. Report on value chain analysis in Koutiala and Bougouni – March 2014. Report on feed markets in Ghana –end of 2014. At least 100 farmers linked to markets –end of 2014 in Ghana. Database on market prices and agricultural inputs updated monthly in Mali Existing institutions at the Africa RISING intervention communities in Ghana and Mali are reviewed – December 2015. Adoption studies on at least 3 SI innovations are completed in Ghana and Mali – March 2016. Cost-benefit analysis of two interventions completed in Ghana– October 2014. Trade-off analysis report prepared –March 2015. 	<ul style="list-style-type: none"> Workshop reports. Africa RISING website. Annual work plans, interim. and technical reports. Baseline survey reports. Memorandum of Understanding signed with partners. Number of sub-contracts with partners. Farming systems report. Interim and annual reports from partners. Technology adoption assessment. Research data, scientific reports and papers by NARES. National press and TV. 	<ul style="list-style-type: none"> Effective and timely coalition established. Effective collaboration with change agents established. Markets for crop and livestock products continue to grow and smallholders will participate in the market. Institutional and policy environment does not preclude functional partnerships. Government policies and institutions support smallholders’ access to inputs (seeds, fertilizer, etc.) Access to study sites is not constrained by factors outside the control of the project. Project partners including farmers collaborate effectively. Project is well funded and staffed. Project activities are not affected by natural disasters such as drought and infectious diseases, e.g., Ebola. NARES participate in the capacity building program. Effective endogenous dissemination channels can be identified and utilized for disseminating SI innovations.
	<ul style="list-style-type: none"> Smallholder mixed farm household productivity is increased through adoption of SI innovations. 	<ul style="list-style-type: none"> Quality seeds of improved cereals, legumes and vegetables distributed to at least 2000 farmers in Ghana and Mali each project year. 	<ul style="list-style-type: none"> Africa RISING website. Annual work plans, interim and technical reports. 	

		<ul style="list-style-type: none"> • At least 10 high-yielding cereal and legume genotypes with potential for food and feed production identified – March 2015: Ghana, 6; Mali, 4. • At least 5 on-farm trials to compare single versus combined technologies on SI completed – December 2015: Ghana, 3; Mali, 2. • At least 5 farmer-preferred cereal-legume rotation and intercropping options for SI identified and in use by farmers in Ghana and Mali – June 2016. • Recommended fertilizer rates for cereals and legumes identified – December 2015. • Agronomic packages for SI of vegetable production in pure and mixed stands with cereals identified and disseminated to at least 500 farm households in both countries – October 2015. • A report on fruit trees, fodder/fertilizer trees and leafy vegetables from baobab and moringa made annually. • Strategies for integrating livestock into fruit tree plantation tested on-farm – December 2015. • Fodder shrub-based options for fallow management are tested on-farm – December 2015. • Farmer-preferred options to reduce on-farm cowpea and maize grain losses by 15% – March 2014. • Efficacy of biocontrol products for the reduction of aflatoxin in maize and groundnuts demonstrated – May 2015. • Increased public awareness and sensitization of aflatoxin as a health menace in food and feed crops – August 2015. • Efficacy and product data available for pre-registration of atoxigenic strains as biopesticides – July 2016. • An aflatoxin biocontrol product, GH01 available for registration and use in Ghana – August 2016. • Options to add value to crop and livestock products disseminated to at least 500 households in Ghana and Mali – December 2015. • Rural pig and poultry production systems in the intervention communities in Ghana characterized and reported – December 2013. • Feed and health interventions for improvement of sheep and 	<ul style="list-style-type: none"> • Interim and annual reports from partners. • National press and TV. • Results from farmers' fields. • Experimental protocols, plans, and field layouts in the intervention communities. • Data on increased crop and livestock yields. • Research data, scientific reports and papers by NARES. • Survey report on farmers' participation in research and technology transfer. 	
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		<p>goats tested and disseminated to at least 400 households at the project sites in Ghana and Mali – December 2015.</p> <ul style="list-style-type: none"> • Feed, housing, health and breeding management options to improve rural poultry and pig production tested with at least 200 households in Ghana – December 2015. • Improved options for nutrient cycling by small ruminant tested and disseminated to at least 100 households in Ghana – January 2015. 		
	<ul style="list-style-type: none"> • On-farm and off-farm management and use of land, soil, water and plant resources improved through adoption of SI innovations. 	<ul style="list-style-type: none"> • Soil physical and chemical characteristics of at least 25 intervention communities in Ghana characterized – March 2013; and at least 6 villages in Mali – December 2015. • Soil and land health indicators and land use change dynamics at the Africa RISING intervention communities in Ghana documented – December 2015. • Land and water management options for SI tested and disseminated to at least 400 farmers in Ghana and Mali – December 2015. • A report on trade-off analyzes for land restoration in Ghana produced – March 2015. • A report on seasonal variation in grazing land biomass production and forage quality and grazing itineraries and pasture use in Mali produced – December 2015. • A report on local conventions and conflict management practices at the project sites in Mali documented – December 2015. • A watershed for integrated crop-livestock research identified and characterized in Mali – June 2015. • Model exploration and development workshops completed and model code available – June 2016. • At least 4 water and soil management options tested on-farm in both countries – December 2015. • Fallow management options for integrated crop-livestock production tested with households in at least 4 communities in Ghana – March 2016. 	<ul style="list-style-type: none"> • Africa RISING website. • Annual work plans, interim and technical reports. • Interim and annual reports from partners. • Results from farmers’ fields. • Site maps, plans and designs of water harvesting systems in the intervention communities. • Data on increased vegetative cover and increased crop yields. • Research data, scientific reports and papers by NARES. • Survey report on farmers’ participation in research and technology transfer. 	
	<ul style="list-style-type: none"> • Dietary diversity of smallholder farm households, especially women and children is improved through change in nutrition habits and 	<ul style="list-style-type: none"> • At least two workshops organized in Ghana to define relevant household nutrition activities – June 2012 and October 2014. • A report on household 	<ul style="list-style-type: none"> • Annual work plans, interim, and technical reports. • Household nutrition survey report. 	

	<p>increased availability and consumption of a variety of nutritious foods.</p>	<p>nutrition survey at the Africa RISING intervention communities in Ghana produced —December 2013.</p> <ul style="list-style-type: none"> • A booklet and at least two journal papers are drafted from the household nutrition survey —December 2014. • At least 1000 pregnant and nursing women in Ghana and Mali trained on improved infant nutrition —December 2014. • At least 3 nutrition modules developed, revised, and in use by project partners in Mali — December 2014. • A report on a study comparing the effect of BCC and AGB alone and their combination on household nutrition produced —June 2016. • At least 2 nutrition modules revised and in use by 2-3 partners in Mali —December 2014. • Dietary diversity of smallholder farm households, especially women and children, in the Africa RISING intervention communities in Ghana increased by at least 15% —June 2016. 	<ul style="list-style-type: none"> • Memorandum of Understanding with partners. • Interim and annual reports from partners. • National press and TV. • Results from farmers' fields. • Research data, scientific reports, and papers by NARES. • Survey report on farmers' participation in research and technology transfer. 	
	<ul style="list-style-type: none"> • Knowledge exchange and information flow among beneficiaries is enhanced through the use of appropriate media. 	<ul style="list-style-type: none"> • At least 30 farmers' groups (Ghana, 20; Mali, 10) established at the project communities —March 2013. • At least 5 (Ghana, 2; Mali, 2) district level R4D platforms established to facilitate knowledge exchange — December 2014. • At least 50 demonstration plots established annually per country to show-case new technologies. • At least 15 field days organized annually at the community level in Ghana and 10 in Mali. • One interim and one technical report published each year. • At least 2 workshop proceedings and 8 journal papers published —June 2016. • At least 2 on radio discussions and one TV discussion aired annually on the project activities in Ghana. • At least 6 posters, 2 policy briefs, 4 leaflets, and 3 films prepared —December 2015. • At least 2 in-country exchange visits for scientists and farmers in Ghana organized — November 2014 and 2015. • At least one international exchange visit for scientists organized —October 2013, 2014, and 2015. • At least one regional review 	<ul style="list-style-type: none"> • Africa RISING website. • Annual work plans, interim and technical reports. • Interim and annual reports from partners. • National press and TV. • Research data, scientific reports, and papers by NARES. • Demonstration and research plots on farmers' fields. • Number of farmers, decision-makers, extension agents, and researchers participating in field days and exchange visits. • Number of posters and leaflets. • Participation in workshops. 	

		<p>and planning workshop organized each year.</p> <ul style="list-style-type: none"> • At least mid-term (2015) and end of project (2016) workshops organized to disseminate project results. 		
	<ul style="list-style-type: none"> • Individual and institutional capacities to test/adapt and disseminate SI innovations are strengthened. 	<ul style="list-style-type: none"> • Capacities of at least 5000 male and 2000 female farmers, 40 male and 20 female extension staff, and 10 male and 5 female policymakers on SI enhanced through direct and indirect participation in farmer participatory on-farm trials, field days, traveling workshops, and exchange visits —June 2016.. • At least 100 male and 50 female early career research scientists in both countries trained on SI —December 2015. • At least 7 MSc students (4 male and 2 female) and 3 PhD (male) with research on SI graduated —March 2016. • Institutional capacity of at least 8 NARES and 4 NGOs strengthened —June 2015. 	<ul style="list-style-type: none"> • Africa RISING website. • Training materials and evaluation reports. • Research data, scientific reports, and papers by NARES. • Survey results on farmers' participation in research and technology transfer. • Project reports - annual work plans, and technical reports • Annual reports from partners. • National press and TV. • MSc dissertation. • PhD dissertation. • Results from farmers' fields. 	

		Milestones	Means of Verification	Risks and Assumptions
Output 1. Farming systems at the Africa RISING intervention communities characterized and technological, institutional, and policy options for SI identified and documented.				
Activities	1.1 Organize international and national workshops to identify key partners and project sites.		<ul style="list-style-type: none"> • Africa RISING website. • Annual work plans, interim and technical reports. • Workshop reports. • Memoranda of Understanding signed with partners. • Number of sub-contract agreements with partners. • Baseline survey reports. • Farming systems reports. • Interim and annual reports from partners. • Technology adoption assessment. • Research data, scientific reports, and papers by NARES. 	<ul style="list-style-type: none"> • Effective and timely coalition established. • Effective collaboration with change agents established. • Markets for crop and livestock products continue to grow and smallholders participate in the market. • Institutional and policy environment does not preclude functional partnerships. • Government policies and institutions support smallholder access to inputs (seeds, fertilizer, etc.) • Access to study sites is not constrained by factors outside the control of the project. • Project partners including farmers collaborate effectively. • Project is well funded and staffed. • Project activities are not affected by natural disasters such as drought and infectious diseases, e.g., Ebola. • NARES participate in the capacity building program. • Effective endogenous dissemination channels can be identified and utilized for disseminating SI innovations.
	1.2 Sensitize communities and conduct community analysis.			
	1.3 Promote CBOs and farmers' groups and facilitate establishment of district-level R4D platforms.			
	1.4 Document and rank available technologies.			
	1.5 Analyze the farming systems and identify farm typologies.			
	1.6 Model efficiency of farm systems components and whole farms.			
	1.7 Analyze key crop and livestock value chains at the intervention communities.			
	1.8 Conduct market surveys and develop and test options that link farmers to input and output markets.			
	1.9 Review existing institutions and make recommendations for institutional arrangements to promote adoption of SI innovations.			
	1.10 Conduct adoption studies.			
	1.11 Conduct cost-benefit and ex-ante impact analysis on selected SI innovations			
	1.12 Undertake trade-off analysis.			
Output 2. Smallholder farm household productivity increased through adoption of SI innovations.				
Activities	2.1 Test and disseminate improved crop (cereal, legume and vegetable) varieties and agronomic/integrated soil fertility management practices for SI of the production systems.		<ul style="list-style-type: none"> • Africa RISING website. • Annual work plans, interim and technical reports. • Interim and annual reports from partners. • National press and TV. • Results from farmers' fields. • Experimental protocols, plans, and field layouts in the intervention communities. • Data on increased crop and livestock yields. • Research data, scientific reports, and papers by NARES. • Survey report on farmers' participation in research and technology transfer. 	
	2.2 Test and disseminate agroforestry options (tree/shrub, crop, and livestock) to increase farm productivity.			
	2.3 Test and disseminate a combination of technologies to reduce postharvest losses in cereals and grain legumes on-farm.			
	2.4 Evaluate and disseminate options to add value to, and improve the quality of crop (cereals and grain legumes), and livestock (milk and			

	meat) products.			
	2.5 Test and disseminate feed, health, housing and breeding management options to intensify sheep, goat, pig, and poultry production by rural households at the intervention communities.			
Output 3. On-farm and off-farm management and use of land, soil, water and plant resources improved through adoption of SI innovations.				
Activities	3.1 Characterize soil resources at the intervention communities.		<ul style="list-style-type: none"> • Africa RISING website. • Annual work plans, interim and technical reports. • Interim and annual reports from partners. • Results from farmers' fields • Site maps, plans, and designs of water harvesting systems in the intervention communities. • Data on increased vegetative cover and increased crop yields. • Research data, scientific reports and papers by NARES. • Survey report on farmers' participation in research and technology transfer. 	
	3.2 Determine soil and land health indicators, characterize land use changes/drivers of land use, and conduct trade-off analysis for land restoration options.			
	3.3 Conduct trade-off analyzes and develop different scenarios for land restoration.			
	3.4 Determine grazing land productivity and map the grazing itineraries.			
	3.5 Document local conventions and facilitate participatory conflict management.			
	3.6 Establish and characterize watershed area for integrated research.			
	3.7 Model land use intensification at the village level.			
	3.8 Develop and test/adapt water management options for intensive crop and livestock production.			
	3.9 Develop, test/adapt, and disseminate options to intensify integrated crop-livestock production and nutrient cycling.			

Output 4. Dietary diversity of smallholder farm households, especially women and children, improved through changes in nutritional habits and increased availability and consumption of a variety of nutritious foods.				
Activities	4.1	Organize expert workshop to identify relevant household nutrition activities in Ghana.		<ul style="list-style-type: none"> • Annual work plans, interim and technical reports. • Survey. • Memorandum of Understanding with partners. • Interim and annual reports from partners. • National press and TV. • Results from farmers' fields • Research data, scientific reports, and papers by NARES. • Survey report on farmers' participation in research and technology transfer.
	4.2	Conduct household nutrition surveys in Ghana.		
	4.3	Improve nutritional knowledge of women through behavioral change communication (BCC) in Ghana and Mali.		
	4.4	Develop, test, and disseminate training materials on nutrition in Mali.		
	4.5	Compare the BCC; improve household nutrition through home production and consumption of nutrient-dense crop (vegetable and legumes), livestock (sheep, goats, pigs) and poultry products (AGB), and a combination of BCC and AGB in improving household nutrition.		
	4.6	Develop and disseminate training materials on household nutrition.		
Output 5. Knowledge exchange and information flow among stakeholders enhanced through the use of appropriate media.				
Activities	5.1	Promote CBOs and farmers' groups, and facilitate establishment of R4D platforms.		<ul style="list-style-type: none"> • Africa RISING website. • Annual work plans, interim and technical reports. • Interim and annual reports from partners. • National press and TV. • Research data, scientific reports, and papers by NARES. • Demonstration and research plots on farmers' fields. • Number of farmers, decision-makers, extension agents, and researchers participating in field days and exchange visits
	5.2	Establish demonstration plots.		
	5.3	Prepare annual interim and technical reports.		
	5.4	Publish workshop proceedings and journal papers.		
	5.5	Develop media materials for stakeholders.		
	5.6	Organize exchange visits for farmers and researchers.		
	5.7	Organize review and planning workshops.		
	5.8	Organize workshop to disseminate project results		
Output 6. Individual and institutional capacities for SI research and development are strengthened.				
Activities	6.1	Organize on-the-job training for farmers, research, and development staff.		<ul style="list-style-type: none"> • Africa RISING website. • Training materials and evaluation reports. • Research data, scientific reports, and papers by NARES. • Survey results on farmers' participation in research and technology transfer. • Project reports - annual work plans, and technical reports • Annual reports from partners • National press and TV. • MSc dissertation. • PhD dissertation. • Results from farmers' fields.
	6.2	Organize short-courses on specific topics for research and development staff.		
	6.3	Train undergraduate and graduate (MSc and PhD) students.		
	6.4	Build institutional capacity of NARES		