CGIAR Research Program on
Dryland Agricultural Production Systems

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

Annual Plan of Work and Budget (POWB) for Dryland Systems 2014

CGIAR

RESEARCH PROGRAM ON
Dryland Systems

Plan of Work and Budget 2014

Name of the CRP: Dryland Systems

Official start date of the CRP (as per its PIA): May 24, 2013

A. Narrative of major planned work

Introduction
The POWB 2014 for the CRP on Dryland Agricultural Production Systems builds on the progress made over several years of design, inception, and implementation starting in 2013. The program progresses on solid foundations of the extensive characterization of the agro-ecosystems in the Target Regions, done with more than 200 partners. The program is being strengthened with new leadership planned to be in place in the first quarter of 2014. Two additional social scientists have been hired, with strong applied experience in gender research.

Research by Flagship and Activity
The five Target Regions, now Flagships, are located in North Africa and West Asia, West African Sahel & Dryland Savannas, East and Southern Africa, Central Asia and South Asia. Each Flagship includes two types of integrated dryland agro-ecosystems: one where decreasing vulnerability and increasing resilience to biophysical and socioeconomic shocks are crucial as the production and livelihood conditions are overall very marginal, and one where sustainable intensification and diversification are the prime focus as the production and livelihood systems are better endowed.

Details are presented in subsequent table. These will be either new or build on existing activities that have a system focus.

Flagship 1, North Africa & West Asia (NA&WA)
The sites in the NA&WA region are home to 320,000 households. The overall goal is to decrease vulnerability (Beni Khedache – Sidi Bouzid transect (Tunisia) and Tafilah – Salamieh transect (Jordan-Syria), and to improve the efficiency of more endowed production systems through sustainable intensification (Meknes-Sais (Morocco) and Nile Delta (Egypt)), or to tackle both of these objectives in tandem (Karkheh River Basin (Iran). The integrated activities in 2014 include: innovation platforms & scenarios, bio-economic farm modeling, water harvesting, soil conservation, water productivity, conservation agriculture, rangeland management, small ruminants, post-harvest, gender integration, value chains, market access, and policies.

Flagship 2, West African Sahel & Dry Savannas (WAS&DS)
The WAS&DS flagship is implemented in the Kano-Katsina-Maradi (Niger and Nigeria) transect for activities related to decreasing vulnerability, and in Wa-Bobo-Sikasso (Ghana, Burkina Faso, Mali) transect for activities related to for activities related to sustainable intensification. The integrated activities in 2014 include: innovation platforms, water & land productivity in tree-crop-livestock systems, agro-biodiversity improvement, conservation agriculture, policies on natural resources, value chains, diversification of production, and gender integration.

Flagship 3, East and Southern Africa (E&SA)
The E&SA 2014 activities will be implemented in the more vulnerable and better endowed locations of the Chinyanja Triangle (Zambia, Malawi, Mozambique (and Zimbabwe)) and northern Kenya, Uganda and the highlands of Ethiopia. The integrated activities in 2014 include: gender integration, participatory NRM frameworks, improved livestock breeds, market access, out-scaling technologies, and learning networks across value chains.

Flagship 4, Central Asia (CA)
The CA Flagship is implemented in the Aral Sea Region (Turkmenistan, Uzbekistan and Kazakhstan) for activities related to reducing vulnerability, in the Rasht Valley (Tajikistan and Kyrgyzstan) for activities related to improving resilience, and in the Fergana Valley (Kyrgyzstan, Tajikistan and Uzbekistan) for activities related to sustainable

intensification. The integrated activities in 2014 include: resilience options in pastoral system, optimizing water use, modernize staple seed systems, gender integration, and increased capacity in NRM.

Flagship 5, South Asia (SA)
The 2014 activities will be implemented in West Rajasthan (Jaisalmer, Barmer and Jodhpur districts), Karnataka (Bijapur district), and Andhra Pradesh (Anantapur and Kurnool districts). Related activities will be implemented in Chakwal (Pakistan). The integrated activities in 2014 include: resilience building and intensification options, targeting one million farmers on out-scaling and marketing, improve capacity of up to 300 women farmers to better negotiate new marketing options.

Gender
The Dryland Systems Gender Strategy was submitted to the CO in January 2014. Gender integration for all Flagships is both separately reported in Table 2, but also with activities as relevant in Table 1. 9% of Window 1+2 funding is targeted to gender integration. Activities in 2014 include: Analysis of gender empowerment in small ruminant production and marketing, comparing man- and women-headed households, implications of tradeoffs within households, role of women in conserving agro-biodiversity, effect of technologies on work load of women, enhancement of geoinformatics techniques for gender related activities, and training of women on marketing options to improve their skills to negotiate.

Intermediate Development Outcomes
Dryland Systems implements its 2014 activities and addresses it impact pathway through its eight Intermediate Development Outcomes **(**IDOs). To capture the integrated agro-ecosystems approach its IDOs are framed at two levels. The first four involve attitudes, knowledge, skills and behavior among stakeholders directly using research outputs. The second four takes these outputs to scale to achieve impact in terms of the four CGIAR System Level Outcomes.

The impacts of the first four IDOs are:

1. **More resilient livelihoods for vulnerable households** in marginal areas.
2. **More stable and higher per capita income** for intensifiable households.
3. **Year- round access to greater quantity and diversity of food sources for** women and children in vulnerable households have
4. **More sustainable and equitable management of land and water resources** in pastoral and agropastoral areas.

The Impacts of remaining four IDOs are:

5. **Better functioning markets** underpinning intensification of rural livelihoods.
6. **More integrated, effective and connected service delivery institutions** underpinning resilience and system intensification.
7. **Policy reform removing constraints and creating incentives** for rural households to engage in more sustainable practices that improve resilience and intensify production.
8. **Women and youth have better access to and control over productive assets**, inputs, information, market opportunities and capture a more equitable share of increased income, food and other benefits.

Statement
An integrated agro-ecosystems approach is the basis for all our work and features high in the 2014 Program of Work and Budget. As the Dryland Systems officially started May 2013, in some areas work will still be transitioning to that integrated approach. By the end of 2014, 90% of the activities will be fully agro-ecosystem-based.

B. Tables

	Budget			
Activity Cluster	**W1&2**	**W3**	**Bilateral**	**Total**
Governance & Director's Office	**1,225,000**			1,225,000
Regional Coordination	**1,075,000**			1,075,000
Strategic Gender	**700,000**			700,000
Total				**3,000,000**
NA&WA Flagship Project				
(NA&WA) 1.1 Conservation agriculture	299,889	600,000	759,297	1,659,186
(NA&WA) 1.2 Small ruminants productivity	425,099	-	637,993	1,063,093
(NA&WA) 1.3 Water & land productivity in irrigated	378,432	650,000	608,502	1,636,933
(NA&WA) 1.4 Policies on natural resources	88,378	-	936,632	1,025,010
(NA&WA) 1.5 System vulnerability	168,743	-	317,373	486,116
(NA&WA) 1.6 Bio-economic farm models	81,383	-	625,254	706,638
(NA&WA) 1.7 Innovation platforms & scenarios	411,875	-	948,622	1,360,497
(NA&WA) 1.8 High-value chain clusters	297,557	-	1,255,504	1,553,062
(NA&WA) 1.9 In-situ biodiversity	94,863	-	625,754	720,616
(NA&WA) 1.10 Water harvesting & soil conservatior	363,787	550,000	656,106	1,569,893
(NA&WA) 1.11 Water & land productivity in rainfed	220,837	-	837,835	1,058,672
(NA&WA) 1.12 Managing Salinity	210,346	-	370,768	581,114
(NA&WA) 1.13 Seed system & dissemination	60,910	-	313,376	374,287
(NA&WA) 1.14 Cereal & legume species adaptation	182,222	-	317,873	500,095
(NA&WA) 1.15 Cereral & legume system IPM	114,827	-	315,375	430,201
(NA&WA) 1.16 Managing agropastoral rangelands	430,625	237,000	646,982	1,314,607
(NA&WA) 1.17 Post- harvest & market access	121,821	-	626,753	748,574
Total	**3,951,593**	**2,037,000**	**10,800,000**	**16,788,593**
WAS&DS Flagship Project				
(WAS&DS) 2.1 Review past work on dryland system	586,355	-	610,666	1,197,021
(WAS&DS) 2.2 Coordinate and harmonize database r	205,000	-	70,000	275,000
(WAS&DS) 2.3 Develop and test value adding strateg	80,000	-	120,000	200,000
(WAS&DS) 2.4 Promote local and regional knowledg	83,000	-	50,000	133,000
(WAS&DS) 2.5 Induce intensification and improve re	396,907	230,000	192,000	818,907
(WAS&DS) 2.6 Establish reference situation / baselir	948,300	10,000	240,000	1,198,300
(WAS&DS) 2.7 Quantify resource use and associated	108,874	10,000	-	118,874
(WAS&DS) 2.8 Facilitate effective linkages and know	99,300	250,000	90,000	439,300
(WAS&DS) 2.9 Assess and monitor biomass and reso	348,000	-	345,000	693,000
(WAS&DS) 2.10 Review, analyse, develop and test co	112,467	-	-	112,467
Total	**2,968,203**	**500,000**	**1,717,666**	**5,185,869**
E&SA Flagship Project				
(E&SA) 3.1 Vulnerability frameworks	125,600	-	73,500	199,100
(E&SA) 3.2 Resilience - enhancing options	280,000	-	2,043,500	2,323,500
(E&SA) 3.3 Out scaling options for resilience	276,000	-	1,165,000	1,441,000
(E&SA) 3.4 Baseline surveys	388,832	-	283,500	672,332
(E&SA) 3.5 Gap filling	34,000	-	10,000	44,000
(E&SA) 3.6 Research entry points	46,183	-	10,000	56,183
(E&SA) 3.7 Youth and gender	-	-	127,500	127,500
(E&SA) 3.8 Technology transfer	50,000	-	15,000	65,000
(E&SA) 3.9 Research- extension links	150,000	-	875,000	1,025,000
(E&SA) 3.10 Test best bets	158,153	-	400,000	558,153
(E&SA) 3.11 Information dissemination	63,769	-	282,000	345,769
(E&SA) 3.12 Interventions for successful adoption	67,100	-	270,000	337,100
(E&SA) 3.13 Out scaling	11,183	-	-	11,183
(E&SA) 3.14 Food system characterisation	108,605	-	68,500	177,105
(E&SA) 3.15 Model ex-ante impacts	113,611	-	25,000	138,611
(E&SA) 3.16 Pilot proof of concept	107,000	-	-	107,000
(E&SA) 3.17 Participatory characterisation	275,000	-	105,000	380,000
(E&SA) 3.18 NRM and land use plans	331,000	-	-	331,000
(E&SA) 3.19 Value chain characterization	120,000	-	85,000	205,000
(E&SA) 3.20 Interventions to promote participation	80,000	-	113,500	193,500
(E&SA) 3.21 Meat quality standard	-	-	100,000	100,000
(E&SA) 3.22 Test extension approaches	45,449	-	804,000	849,449
(E&SA) 3.23 Farmer associations and cooperatives	-	-	184,928	184,928
(E&SA) 3.24 Costs and benefits of investments	-	-	100,000	100,000
Total	**2,831,486**	**-**	**7,140,928**	**9,972,414**

	Budget			
Activity Cluster	**W1&2**	**W3**	**Bilateral**	**Total**
CA Flagship Project				
(CA) 4.1 Marginal lands	117,849	168,000	-	285,849
(CA) 4.2 Livestock productivity	150,000	150,000	-	300,000
(CA) 4.3 Water use efficiency	395,774	44,000	67,000	506,774
(CA) 4.4 On-farm adaptive trials	320,698	138,000	50,000	508,698
(CA) 4.5 Seed system platform	166,849	61,000	-	227,849
(CA) 4.6 Innovation Platform	250,370	-	-	250,370
(CA) 4.7 Knowledge Management CACILM	50,000	50,000	470,000	570,000
(CA) 4.8 Geoinformatics capacities	-	188,000	-	188,000
Total	**1,451,541**	**799,000**	**587,000**	**2,837,541**
SA Flagship Project				
(SA) 5.1 Identification and demonstration of promis	304,740	-	3,489,039	3,793,780
(SA) 5.2 Pre project impact analysis	37,000	-	28,000	65,000
(SA) 5.3 Capacity building of stakeholders for up sc	293,193	-	104,360	397,553
(SA) 5.4 Adapting conservation agriculture for rapi	93,000	77,829	65,000	235,829
(SA) 5.5 Enhancing the use of cactus (Opuntia focus	84,667	-	-	84,667
(SA) 5.6 Establish reference situation / baselines fo	167,000	-	-	167,000
(SA) 5.7 Validate the household vulnerability mode	123,546	-	72,500	196,046
(SA) 5.8 Identification, validation, and out scaling o	185,000	-	115,000	300,000
(SA) 5.9 Identify and document options for systems	30,000	-	165,176	195,176
(SA) 5.10 EX-ante impact analysis	52,000	-	180,176	232,176
(SA) 5.11 Capacity building of stakeholders for up s	131,600	-	74,360	205,960
(SA) 5.12 Development of sustainability indicators	103,000	-	161,451	264,451
(SA) 5.13 Identifying, testing and piloting of options	74,000	-	-	74,000
(SA) 5.14 Establish reference situation / baselines f	133,765	-	-	133,765
(SA) 5.15 Identify key land and water management	205,667	-	309,750	515,417
(SA) 5.16 Pilot and demonstrating selected NRM op	151,000	-	478,802	629,802
(SA) 5.17 Analyse and monitor trade-off, ex-ante im	93,000	-	55,000	148,000
(SA) 5.18 Build capacity on collective actions and c	88,200	-	95,920	184,120
(SA) 5.19 Develop and assess mechanisms to impro	168,600	-	74,360	242,960
(SA) 5.20 Developing strategies for convergence an	222,201	60,000	103,000	385,201
(SA) 5.21 Identify policy options to fill policy gaps a	56,000	-	36,000	92,000
Total	**2,797,178**	**137,829**	**5,607,893**	**8,542,901**
Grand Total	**17,000,000**	**3,473,829**	**25,853,487**	**46,327,317**

Table 1 - Planned key activities for 2014 to produce IDOs and outputs, with associated planned budgets

Level n-1 Cluster of Activities	Description of planned key activities	Expected results of planned key activities	Planned budget ($ 000s)
1. North Africa & West Asia (NA&WA)	The target action and satellite sites in the NA&WA region cover a total area of 144,914.0 km^2 and are home to 320,000 households. The overall goal of 2014 activities is to increase resilience of vulnerable ecosystems (Beni Khedache – Sidi Bouzid transect (Tunisia) and Tafilah – Salamieh transect (Jordan-Syria) through diversification, to improve the efficiency of production systems through sustainable intensification ((Meknes-Saies (Morocco) and Nile Delta (Egypt)) or to tackle both of these objectives (*Karkheh River Basin (Iran)).* Working in partnership with communities and other key stakeholders 10-12 activities contribute to IDO1 and IDO2 in the areas of conservation agriculture, small ruminants productivity, water & land productivity in irrigated systems, policies on natural resources, system vulnerability, bio-economic farm models, innovation platforms & scenarios, high-value chain clusters, In-situ biodiversity, water harvesting & soil conservation. As an example: 100 ha of pastoral and agro-pastoral grazing lands were assessed and 150 farmers were trained on dryland agro-biodiversity 3 activities contribute to IDO4 : managing agropastoral rangelands and water harvesting and soil conservation There are two activities to contribute to IDO5 an IDO6 which are *p*ost-harvest & market access, and high-value chain clusters; and 2 activities contribute to IDO7, policies on natural resources and high value chain clusters.	Activities scheduled for 2014 were developed based on 2013 achievements and also on those issued from bilateral projects. More specific indicators for tracking progress towards achieving the IDOs will be developed in 2014. In 2013, we initiated five strategic innovation platforms in five sites which are: Meknes, Sidi Bouzid-Beni Khedache, and Nile Delta. These will be reinforced in 2014 by specific innovation clusters. Thus, the following results are expected in 2014: -Bio-economic farm models will be developed -Policy options to manage natural resources to produce some policy briefs -Options for irrigation and agronomic practices will be developed for effective management of different production systems and will be promoted to 200 farmers -Supplemental irrigation methods is expected to save 20% of water, and fertilizers management packages will be introduced in 50 farms in Meknes/Tadla and Karkheh -Conservation agriculture practice will cover more than 100 farmers in Sidi Bouzid, Tafilah-Salamieh and Karkheh. -Feeding, reproduction and health improved options will improve 300 small ruminant flocks in Sidi Bouzid, Beni Khedache, Meknes, and Karak. Management plans for in situ	*16,789*

		conservation will be developed and recommended for research sites in Jordan and Tunisia. -The developed lines of cereal and legume species with appropriate IPM will be developed to reduce production costs by 30 % and to train 200 farmers. Gender-differentiated analysis will lead to increased awareness by partners to take steps (at least 2 national partners and 3 civil society organizations) reducing gender gaps in knowledge and information on quality seeds, and good practices in water management and small ruminant, and increase women empowerment in the value chains.	
2 West African Sahel & Dry Savannas (WAS&DS)	The WAS&DS flagship is implemented in • ***Kano-Katsina-Maradi (Niger and Nigeria) transect*** for activities related to *increasing resilience and mitigating risk from biophysical and socioeconomic shocks* • ***Wa- Bobo-Sa (Ghana, Burkina Faso, Mali) transect for activities*** *related to* for activities related to sustainable intensification of production systems to improve livelihoods. In 2014, activities in WAS& DS will build on the past experience and achievements gained during 2013 from bilateral donor research funds as well as CRP funded activities. Strategic alliances will be constructed with various partners in a multidisciplinary approach to conduct research and development and dissemination of technologies. 2014 activities will deliver on conservation agriculture with trees, water & land productivity in tree-crop-livestock systems, policies on natural resources, innovation platforms, high-value chain development, agro-biodiversity improvement, tree domestication and improvement and diversification of production.	These activities are expected to set basis for the different IDOs delivery thereby contribute directly to the SLOs of the SRF of the CGIAR increase in food security, reduction of rural poverty and more sustainable management of natural resources, improving nutrition and health. It is also expected to contribute to gender and youth as well as play a significant role in awareness raising and capacity building. The indicators of progress being considered are, number and diversity of farmers, the size of the land being affected by on-farm testing of technologies, the number of households adopting smart agriculture technologies, the informal and formal training outputs (number of farmers and students recruited and trained at various levels, dissertations successfully completed and regular progress reports).	*5,186*

3 East and Southern Africa (E&SA)	Many activities in 2014 will be implemented as a result of the planning activities in 2013 and others will continue on or build on existing activities. The activities will focus on meeting the objectives of the CRP with key activities focusing on improving livestock breeding for small ruminants, identifying and out-scaling technologies to improve crop and livestock production, improving markets, and strategies and frameworks to inform and guide intervention. Some specific examples of activities are: Development of two vulnerability and resilience frameworks to guide interventions in Ethiopia and Northern Kenya. • Identification of six key sustainable intensification interventions in the Chinyanja Triangle (Zambia. Malawi, Mozambique) and Ethiopia • Development and validation of three participatory NRM frameworks to be used by stakeholders in Northern Kenya and Southern Ethiopia. • Implementation of three learning networks across value chains in Kenya, Zimbabwe, and Malawi. • Characterization and piloting of best-bet sheep fattening systems in Ethiopia • Scoping studies in several Action Sites, including Kilimanjaro, Same, Kongwa, Handeni, Chinyanja Triangle, Tanzania and the Ethiopian highlands, will be conducted to identify entry points for further gender-sensitive research and development opportunities which fit within the CRP Dryland Systems goals	Based on the activities implemented and/or planned in 2013, we expect the following results in 2014: • At least 100 farmers will benefit from on-farm demonstration of improved varieties of food and forage crops (2 bread wheat, 3 barley and 2 Kabuli chickpea)) and about one ton of breeder seeds will be produced to and contribute to scaling up technologies i in Ethiopia. • At least 2000 farmers will benefit from demonstration and extension of improved technologies, including improved varieties, breeding programs and best management practices across the Action Sites in E&SA A breeding program for small ruminants in Tanzania. Gender-differentiated data, analysis and options for reducing vulnerability and increasing the resilience of households, gender-sensitive interventions designed for sustainable intensification scaling out to men, women and youth; options considering gender differences in diet, food production and preparation, and enhancing women's participation in key value chains assessed.	*9,972*
4 Central Asia (CA)	The CA CRP-DS flagship is implemented in 3 sites: • Aral Sea Region (Turkmenistan, Uzbekistan and Kazakhstan) for activities related to improving resilience • Rasht Valley (Tajikistan and Kyrgyzstan) for activities related to improving resilience • Fergana Valley (Kyrgyzstan, Tajikistan and Uzbekistan) for activities related to sustainable intensification	-Improved resilience options in livestock and pastoral system -Options for intensifying water use and quality crop varieties -Modernize staple seed system to improve access to food sources Increased capacity and knowledge in NRM	*2,838*

		Engendered analysis of water management in agriculture, improved crop varieties, enhanced capacity of men and women farmers, increased awareness among national development partners about the role of gender in promoting farmer to farmer exchange and national partners initiating steps to bridge the gender gaps in knowledge and information on quality seeds of cereals, potato, vegetables, fruits, fodder and tree crops in the Action Site.	
5 South Asia (SA)	The 2014 activities in SA are built on 2013 achievements from both CRP and bilaterally funded projects. In 2013 we established the 15 action sites, characterized them with typologies, constraints and identified potential interventions for PR4D and established the innovation platform. The up scaling model of Bhoochetana established the proof of concept that through right partnerships and science based holistic approach benefitted 3.7 million farmers with increased crop yields by 20 to 66 percent with improved SWN& CROP management options. In 2014 we will operate in 15 DS action sites in West Rajasthan (Jaisalmer, Barmer and Jodhpur districts), in Karnataka (Bijapur district) in Andhra Pradesh (Anantapur and Kurnool districts) and in bilateral project sites in the above mentioned three states.	2014 activities will deliver more detailed characterizations of the action sites and drylands at large and more matrixes of resilience building and intensification options. In total we proposed to work with more than one million farmers on capacity building, demonstration, out-scaling and marketing. Particularly. This will help building the capacity of farmers and stakeholder alike which will lay a foundation for effective IDOs delivery. Improved capacity and knowledge of up to 300 women farmers to implement and monitor the performances of new technologies and their impacts on their livelihood, and skills and knowledge to better negotiate new marketing options; NARES partners identify strategies and entry points to empower women farmers; and development partners use information to engage women in the collective actions and CPR management in west Rajasthan, Anantapur and Kurnool.	*8,543*

Level n-2 Cluster of Activities	Description of planned key activities	Expected results of planned key activities	Planned budget ($ 000s)
(NA&WA) 1.1 Conservation agriculture	**Objectives:** Explore the profitability raised bed planting and alley-cropping systems package for low rainfall areas using zero-tillage cropping. **Locations:** Sidi Bouzid – Beni Khedache in Tunisia and Tafilah Salamieh in Jordan, Syria. **Methods:** On-farm trials; short courses for scientists and extension people; field demonstrations for farmers. **Gender:** Analysis of gender gaps for access to knowledge on good practices in conservation agriculture. **Links to other CRPs:** WHEAT,Grain Legumes, CCAFS	**Outputs:** 75 ha under zero-tillage system; Technical package for CA and alley-cropping delivered to extension people and farmers (3 leaflets, 6 field days for the benefit of 100 farmers). **Outcomes:** Acceptance by farmers of CA combined or not with alley –cropping.	*1,563*
(NA&WA) 1.2 Improve small ruminants productivity	**Objectives:** To increase the efficiency and sustainable use of natural resources (feed resources – water – animal genetic resources) for optimal small ruminant production and product quality; To improve water productivity for dual purpose (meat/milk cattle production) and quality of dairy goat products. **Locations:** Sidi Bouzid – Beni Khedache in Tunisia & Tafilah Salamieh in Jordan, Syria; Meknes site in Morocco (Bittit and Chefchaouane). **Methods:** Survey and baseline study; On-station seed multiplication; On-farm trials; On-farm assessment of local knowledge. **Gender:** Analysis of gender empowerment in small ruminant production and marketing; Analysis of gender differentiated access to knowledge for small ruminant production and recommendations to increase women's access to knowledge and information. **Links to other CRPs:** Grain Legumes, CCAFS	**Outputs:** Current feeding systems and gaps analyzed for 100 sheep flocks' owners in Sidi Bouzid (Tunisia); Animal performance recording, use of improved rams and artificial insemination for genetic improvement will be performed on 1000 sheep in El-Karak (Jordan) and Sidi Bouzid (Tunisia); Occurrence and epidemiology of enzootic diseases are screened and a prophylactic strategy set for 150 sheep flocks' owners in El-Karak (Jordan) and Sidi Bouzid (Tunisia); The forage/cattle based production system analyzed for 50 herds' owners in Meknes (Morocco); Improvement of small ruminants' products wholesomeness at 20 sheep milk processors in El-Karak (Jordan) and 10 local processors of goat milk in Chefchaouane (Morocco). **Outcomes:** Acceptance by community of a holistic approach to improve livestock profitability; -Awareness of water use efficiency for forage/dual purpose cattle production; Increased market competitiveness of small ruminants' dairy products.	*1,063*

(NA&WA) 1.3 **Water & land productivities in irrigated systems**	**Objectives: D**evelop test and disseminate irrigation and fertility packages to improve land and water productivities using fresh and marginal-quality waters in irrigated system. **Locations:** Nile River Delta of Egypt; Tunisia, Jordan, Karkheh river basin in Iran. **Methods:** Land and water productivity and irrigation assessments; Evaluation trials; Monitoring strategies for water use efficiency; capacity building. **Gender:** All proposed sub activities are gender responsive. This to include engaging female and younger researchers in developing the workplan for the sub activities and its implementation; promote the use of marginal-quality waters in uses that benefit women, elderly, and young end user. Greywater work for example, is targeting women. Improve the capacity of young female and male researchers in collecting and analyses of the research data. **Links to other CRPs:** WLE-RRR	**Outputs:** Options for improved sustainable intensification and diversification of agricultural production systems evaluated and scaled out; Analysis of trade-offs of sustainable intensification and diversification options, and knowledge-based systems for customizing options to sites and circumstances developed; Water use efficiency and monitoring strategies developed; Assessments of marginal-quality water availability; Three irrigation and agronomic options for effective management for different production systems developed and promoted; Irrigation management support system (IM2S) developed, validated and promoted to 30 farmers in the Delta and 20 farmers in Karkheh; 200 farmers exposed to developed technologies through travelling workshop and field days in Egypt and Iran sites; Simple and safe use of treated wastewater for agriculture production promoted; Small-scale affordable grey water system demonstrated and promoted in Egypt, Jordan and Tunisia. **Outcomes:** Human capacity and information-base of targeted regions improved.	*1,542*
(NA&WA) 1.4 **Policies on natural resources**	**Objectives:** To evaluate the impacts of water, energy and land policies on rangeland ecosystems, on use of farm resources and on livelihoods of small holder farmers. **Locations:** Béni Khedache-Sidi Bouzid (Tunisia); Meknès-Saies (Morocco); Tafilah-Salamieh (Jordan); Nile Delta satellite site (Egypt); Karkheh river basin (Iran). **Methods:** Literature surveys, household surveys, econometric analysis, General equilibrium. **Gender:** We will evaluate if policies have imposed unbearable burdens in a discriminatory manner to men and women. **Links to other CRPs:** PIM	**Outputs:** Empirical evidence, analysis and recommendations on water, energy and land policies for each site; working paper per site; peer reviewed journal paper (October 2015); Workshop in Morocco and Tunisia (early 2015), at least 2 policy briefs (mid-2015). **Outcomes:** Increased awareness of policy and decision makers on need for action to promote sustainable water use. Increased participation of stakeholders (farmer, professionals, and policy makers) in the dialogue on water management.	*966*

(NA&WA) 1.5 System vulnerability	**Objectives:** Establish baseline data on the socio-economic and biophysical indicators, determine the causes of system vulnerability and local coping mechanisms, and evaluate the feasibility of technologies, and monitor their adoption. **Locations:** Karak-Salamieh transect; Meknes (Morocco); Nile Delta (Egypt); Beni Khedache-Sidi Bouzid (Tunisia); Honam, Merek, Azadegan and Sorkhe in Iran. **Methods:** Literature and secondary data review; participatory and rapid rural appraisal; Household, livelihoods and production systems Formal survey; Descriptive statistics and livelihood analysis; Econometric analysis. **Gender:** Comparison will be conducted for access to input and information between man and women headed households; Utilization of labor by gender will be analyzed. **Links to other CRPs:** WHEAT, Dryland Cereals, and Grain Legumes	**Outputs:** Comprehensive description of the production systems and livelihoods, with major indicators of the socio-economic and biophysical aspects of production systems of 6 sites; Household and production baseline data set of baseline surveys and secondary data for selected sites; 6 Systems diagnosis briefs for different sites published. **Outcomes:** Greater awareness by stakeholders on the prevailing production and livelihood systems, sources of systems vulnerability and local coping mechanisms; Stakeholder (institutions and policy makers) increased awareness to address constraints facing small holder farmers.	*458*
(NA&WA) 1.6 Bio-economic farm models	**Objectives: D**evelop bio-economic models that connect field-farm-household and regional scales, accounting for diversity of economic agents including farm typologies in a systems context for assessing ex-ante and ex-post impacts of alternative social, economic, policy, institutional, market and technological interventions under different climate change scenarios. **Locations:** Karak, Jordan; Meknes, Morocco; Zoghmar, Tunisia; Karakhe, Iran; Nile Delta, Egypt. **Methods:** Climate downscaling scenarios. Bio-economic farm household models in a systems context. Modeling of production systems (basin, region and national levels). **Gender:** Simulation of gender disaggregated labor use under different interventions and climate change scenarios; Simulation of system outcomes under different gendered production, consumption and marketing decisions scenarios. **Links to other CRPs:** CCAFS	**Outputs:** Data sets for bio-economic modeling assembled; Crop simulation models operational for barley and wheat for two sites; First draft versions of the bio-economic model that mimics the decision making process of the farming households made available. **Outcomes:** Stakeholders (development partners) informed about the tradeoffs of different production and sustainability choices face farmers.	*666*
(NA&WA) 1.7 Innovation platforms & scenarios	**Objectives:** Foster collaboration among a wide range of (public and private) stakeholders and partners for more effective development and adoption of technologies and best practices within mutually identified pathways; Facilitate exchange of knowledge to enhance adaptation and adoption of technologies and best practices; Influence the policy reform, through lessons learned, research achievements that impact social development; To generate greater awareness, and a more comprehensive understanding of the	**Outputs:** At 6 innovation platforms (IPs) established (one in each site); Two participatory impact pathway analysis initiated in at least two IPs and documented; 3 outcome mapping process conducted in the IPs; Challenges and opportunities to agricultural knowledge sharing and dissemination completed in 2 countries with a working paper and article for peer	*1,282*

	process of innovation through participatory action. **Locations:** Bittit and Sidi Slimane (Morocco), Sidi Bouzid and Beni Khdeche (Tunisia); Nile Delta (Egypt) Irak, Wadi Karak, and Al Rabbah (Jordan); Karkheh Valley (Iran). **Methods:** 1. Participatory impact pathway analysis. 2. Outcome mapping. 3. Stakeholders participatory assessment of innovation analysis using problem trees; SWOT analysis. 4 Stakeholder perception surveys. **Gender:** Impact pathways will covered in participatory research at the household level, with particular attention paid to gender-disaggregated empowerment/disempowerment and wellbeing (environmental, human, social). **Links to other CRPs:** PIM	reviewed submission; Communication material illustrating the application of IPs as integral part of participatory impact oriented research for development. **Outcomes:** A better understanding of the concept of innovation platforms among development partners and researchers; Increased awareness of participation of stakeholders in joint learning to address constraints - active involvement and contribution of resources (monetary and non-monetary).	
(NA&WA) 1.8 High-value chain clusters	**Objectives:** (i) To better understand social, economic, policy and environmental challenges and constraints to production and marketing, (ii)To identify opportunities for enhancing value chain to increase productivity, profitability and household welfare particularly for small scale producers but involving all relevant stakeholders along the value chain through learning alliances, and (iii) To utilize the output from joint learning as an input into activity 1.17 on innovation platforms and scenarios in order to address identified constraints, which are of joint priority to the partners of the learning alliance. **Locations:** Morocco: Bittit and Sidi Slimane; Tunisia: Sid Bouzid and Beni Khdeche; Egypt: New Land (Nubaria), Old Land (Sharkia), Salt Land (Port Said); Jordan: Iraq, Wadi Karak, and Al Rabbah; Iran: Karkheh Valley. **Methods:** 1. Participatory action research. 2. Mixed method research 3. Learning cycles. **Gender:** Learning alliances to understand the role gender plays in agricultural production and marketing decisions on the welfare of women and children; assess fragility in women's empowerment; tradeoffs in the household, as a result of choices made; a better understanding of youth engagement in activities related to agriculture, and opportunities for enhancing beneficial engagement. **Links to other CRPs:** PIM	**Outputs:** Lessons learned from three value chain learning alliances initiated in the action sites - Tunisia, Meknes, Jordan; implications for agricultural research for development in the Middle East and North Africa; Peer reviewed article submitted on post-harvest and market access. **Outcomes:** At least two national institutions increased their participation and engagement and initiated a process for future learning alliances (through buy in and institutionalization); Institutions participating in at least one innovation platform have taken up the pathways identified for addressing constraints and challenges using the outputs from the joint learning process.	*1,463*
(NA&WA) 1.9 *In-situ* conservation of	**Objectives:** To assess the status and threats to dryland agro-biodiversity in selected natural habitats; To assess the contribution of protected areas and rangeland in conserving crop wild relatives, forage and range species and undertaking of gap analysis for *in situ*	**Outputs:** Report on status, threats and trends of dryland agro-biodiversity; Develop scientific basis and holistic approach to promote *in situ*/on-farm conservation of dryland agro-	*679*

dryland agrobiodiversity	conservation (Boumehda reserve in Tunisia);To survey the status and threats to landraces under traditional farming systems and in response to intensification (Meknes-Morocco, Beni Khdech and Zoghmar in Tunisia); To develop management plans for promoting *in situ*/on-farm conservation of dryland agrobiodiversity (Jordan and Tunisia); To strengthen the research capacity of NARS collaborators and increased awareness of key stakeholders. ***Locations:*** Majedeyah-Mohareb, Erak-Karak in Jordan; Meknes in Morocco; Karkheh river Basin in Iran; Beni Khdech and Zoghmar, and Bouhedma reserve in Tunisia. **Methods:** Farming systems surveys; Eco-geographic and botanic surveys; GIS/RS tools; Stakeholder group discussions; Gap analysis **Gender:** Role of women in conserving dryland agrobiodiversity will be documented and analyzed. **Links to other CRPs:** Genebanks, CCAFS	biodiversity; Developed databases on farming systems and species richness and threats to agro-biodiversity; Approaches for *in situ* conservation of agrobiodiversity explained to 20 persons (training course) and 150 farmers and stakeholders (field days). **Outcomes:** Increased awareness of more than 1200 farmers (including at least 300 women) to the importance of conserving dryland agro-biodiversity; Management plans for *in situ* conservation developed for sites in Jordan and Tunisia and recommended to concerned stakeholders.	
(NA&WA) 1.10 Water harvesting & soil conservation	**Objectives:** Introduce and promote soil conservation and water harvesting interventions to optimize the use of land and water resources, improve productivity and reduce land degradation. **Locations:** Tafila & Salamyieh (Karak and); Beni Khedache -Sidi Bouzid transect (Dahar plateau and Zoghmar); Karkheh river basin site (Honam watershed). **Methods:** Land management packages; Modeling and observatory systems. **Gender: -. Links to other CRPs:** WLE	**Outputs:** Two Soil conservation and water harvesting interventions implemented; One Observatory system established; One Model selected and prepared for setup. **:** Two Soil and water conservation practices fine-tuned, tested and disseminated to similar environments; One Calibrated model to optimize the utilization of land and water resources out-scalable to similar areas in the arid environment. **Outcomes:** Two soil and water conservation practices fine-tuned, tested, and dissimilated to similar environments; one calibrated model to optimize the utilization of land and water resources out-scalable to similar areas.	*1,479*

(NA&WA) 1.11 Water & land productivity in rainfed systems	**Objectives:** Evaluate the response of the major crops to different deficit/supplemental irrigation levels; Investigate the response of wheat varieties and faba bean to different fertility and fertilizers managements. **Locations:** Meknes-Sais (Morocco); Upper Karkheh River Basin (Iran). **Methods:** On-farm demonstration trials; On-station trials; Aquacrop model used for scheduling supplemental irrigation in wheat; Trials on soil quality and fertility; Field trials on fertilization management; Modeling for optimum cropping pattern for rainfed areas of KRB; **Gender:** … **Links to other CRPs:** CCAFS	**Outputs:** 50 farmers trained on supplemental irrigation and fertilizer management package in Meknes site; 10 technicians trained in Meknes site on improved supplemental irrigation scheduling; 10 on-farm demonstration trials in Meknes site; 4 trials on deficit supplemental irrigation of olive trees (2), potatoes (1) and Onion (1) implemented in Meknes site; 3 on-farm trials of 2 ha each (one in Meknes, one in Karkheh) implemented on fertility fertilizers management of wheat/food legumes; 20% irrigation water saved due to the application of deficit supplemental irrigation in the on-farm trials at harvest of the tested crops. **Outcomes:** At least a 30% adoption rate of supplemental irrigation package by farmers in Tadla location by September 2015.	*998*
(NA&WA) 1.12 Managing Salinity	**Objectives:** Improve agricultural production under saline conditions with minimal trade-offs within the basin, applying a farming systems approach. **Locations:** Nile Delta, Egypt; Lower Karkheh basin, Iran. **Methods:** Inventory of existing practices; Land preparation and cultivation methods; Irrigation application methods; Mixed farming systems methods. **Gender:** Gender aspects of decision making process for new introductions will be considered in the on-farm salinity management processes. Gender aggregated labor distribution and decision making processes for communities in salt affected agricultural production systems and marginal lands. **Links to other CRPs:** CRP WLE	**Outputs:** Series of "Ideas books for salinity management"; Develop field-based management strategies in the regional salinity management strategy; Gender aggregated labor distribution and decision making processes for communities in salt affected agricultural production systems**. Outcomes:** Increased knowledge and links between regional salinity management and field based interventions in high-producing and marginal lands; Improved interaction with policy makers in the region related to salinity management.	*548*

(NA&WA) 1.13 Seed system & dissemination	**Objectives:** Analysis of cereals and legumes seed system constraints and initiating alternative seed delivery systems using village-based seed enterprises (VBSE). **Locations:** Meknes, Morocco. **Methods:** Analysis of cereal and legume seed supply constraints through field level data collection; Establishing one pilot VBSE to engage in seed production and marketing; Training farmers in technical aspects of seed production and business management; Analysis of profitability and sustainability of VBSE. **Gender:** Women participation in seed production will be captured as members of farm households. **Links to other CRPs:** WHEAT, Grain Legumes and Dryland Cereals	**Outputs:** Report on seed system constraints and opportunities; 10 MT seed of legumes produced by one VBSE at action site and 40 MT seed of legumes by four VBSEs outside the action site; Training of 50 women, women technicians and pioneer farmers in 5 countries on quality seed production and enterprise management; Report on profitability analysis of on-farm seed production. **Outcomes:** Better access to quality seed of new cereal and legume varieties by farmers; Knowledge based local seed business for delivery of quality seed in 6 local communities with 600 farmers in 2013-14 in Morocco.	*353*
	Objectives: Associate farmers in the selection of desirable advanced lines of Bread and Durum Wheat, Faba bean, Chickpea and Lentil and provide seeds and information facilitating their registration and their seed increase. **Locations:** Nile Delta (Egypt) and Sais-Meknes (Morocco). **Methods:** Un-replicated demonstrations of the advanced lines and checks have been implemented with variable plot size. **Gender:** Selection of the lines will be done by men and women separately to avoid any influence. **Links to other CRPs:** WHEAT and Grain Legumes	**Outputs:** Farmers (men and women) identify the most desirable lines for submission by NARS breeders to registration authorities in Egypt and Morocco. **Outcomes:** Breeders consider the choice and requirements of farmers when they propose for registration of new varieties for better adoption; Selected lines by farmers produce at least 10% more or have better quality or resistance to diseases and pests.	*471*
(NA&WA) 1.15 Integrated Pest Management (IPM) in Cereal-grain legume based cropping system	**Objectives:** To promote IPM options increasing crop productivity at the farm level; To develop new IPM options for the management of emerging biotic constraints for the cereal and food legume systems; To improve human capacity. **Locations:** Meknes-Sais (Morocco) and Nile Delta (Egypt). **Methods:** Meknes-Sais site: 1. On-farm evaluation of chemical control of diseases and weeds of bread wheat. 2. Integrated management of weeds and diseases of faba bean. 3. Back up research (e.g. Test new pesticides for the control of weeds, diseases and insect pests of wheat and faba bean; Screening of wheat and faba bean germplasm for resistance to pest in wheat and faba bean; Annual survey of diseases, weeds, viruses	**Outputs:** 2 to 3 IPM options for wheat and faba bean be developed; A 30% decrease of production cost for pest control in Nile Delta and Meknes Action sites; 100 farmers and extension personnel trained and one flyer prepared; 1-2 new pesticides and 2-3 elite lines each of faba bean and wheat with high yield and pest resistance identified; 1-2 plant Growth promoting Rhizobacteria identified in managing diseases of wheat and faba bean in Nile Delta site. **Outcomes:** Reduction of the yield gaps of	*405*

	and insect pests). 4 Human capacity building: farmer field schools, leaflets and mass media. **Gender**: The technologies being tested in the action sites will consider youth farmers and reduce the work load of weeding by women. **Links to other CRPs:** WHEAT ;Grain Legumes	wheat (15%)and faba bean (30%) though technology adoption in the participating farmers; Reduced cost of production for purchasing pesticides up to 50% in the participating farmers; Trained farmers in IPM applied their knowledge in management pests affecting their wheat and faba bean.	
(NA&WA) 1.16 Managing agro-pastoral rangelands	**Objectives:** Increased efficiency and sustainability of use of rangeland resources in an integrated range-livestock production system. **Locations:** Sidi Bouzid – Beni Khedache (Tunisia) & Tafilah Salamieh (Jordan, Syria). **Methods:** On-station screening and seed/seedlings multiplication of forage (cactus) and range species; Trials for the rehabilitation and management of degraded rangelands; Documenting pastoral and agro-pastoral indigenous knowledge; GIS/RS analyses for mapping and inventorying vegetation cover; Workshop and training courses of stakeholders. **Gender:** Work related to cactus and seedlings production. **Links to other CRPs:** WLE and CCAFS.	**Outputs:** The pastoral & agro-pastoral production systems are characterized; New range/forage species including spineless cactus evaluated; New tools and protocols for rangeland vegetation monitoring and assessment developed; 2 ISI journal articles submitted/published. **Outcomes:** Awareness of less-known forage/range as multi-purposes species increased; Community acceptance of new technology aimed at sustaining the natural resource base; Skills of NARS partners enhanced.	*1,239*
(NA&WA) 1.17 Post- harvest & market access	**Objectives:** To assess the magnitude of post-harvest losses, along the value chain and contribute to the improvement of the locally appropriate postharvest handling and processing options; To facilitate the development of stakeholder-driven strategies for improving the marketing efficiency, postharvest management and value addition. **Locations:** Meknes (Morocco), Sidi Bouzid - Beni Khedache (Tunisia), Nile Delta (Egypt), Irak - Wadi Karak AlRabbah (Jordan). **Methods:** Participatory action research, Institutional innovation analysis, Pricing mechanism analysis, Market information system, Learning alliance methodology. **Gender:** All analyses and activities apply gender sensitive methods and involve both men and women in mixed and separate groups, to clearly show gender-differentiated constraints and solutions in value chain enhancement. **Links to other CRPs:** Policies, Institutions, and Markets.	**Outputs:** Marketing baseline database (on production, consumption, prices, and marketable surpluses in at least three selected action sites established; Analysis of the constraints to market access of smallholder producers for selected commodities and solutions in three action sites; Estimates of post-harvest losses of one commodity in each of the three action sites. **Outcomes:** Value chain actors are more aware of the constraints to market access and are willing to cooperate for increasing benefits in a win-win scenario and reducing post-harvest losses.	*705*

(WAS&DS) 2.1 Review past work on dryland systems in the region and draw lessons on successes, failures and gaps in knowledge for sustainable intensification and vulnerability reduction; and evaluate vulnerability and risk management strategies in the action sites	**Objectives:** Desk study on intensification and adoption options, review of past studies on agroforestry systems, agro-biodiversity and tree-crop-livestock integration in the region. To draw lessons on successes and failures from past systems research in the region and identify options for sustainable intensification of crop-livestock systems and reducing vulnerability. Investigate baseline conditions of existing land and water management practices. **Locations:** 1. Wa-Bobo-Sikasso Transect: Pobè Mengao, Tougouri Thiougou in Burkina Faso; 2. Kano-Katsina-Maradi Transect: Aguié, Angoua Doua and Kollo in Niger. Bomboro, Petaka, Somo, Bolimasso in Mali. **Methods:** Review, Desk study and write-shop; Literature review and analysis of secondary data. **Gender:** Engendered research and extension contributing to improving livelihoods at local level. Gender-focused intensification options e.g. example small ruminant fattening to increase income generation by women to improve household food security. **Link to other CRPs:** Forests, Trees and Agroforestry, CCAFS, Water Land and Ecosystems.	**Outputs:** Peer reviewed paper - status of agro-biodiversity management and conservation in major agro-ecosystems of in WAS&DS; Review report - agro-ecological intensification of sorghum and pearl millet production systems in the Sahel with agroforestry; Review report and policy brief - female and male farmer-led innovations and adoption; Journal article - nutrient management in livestock systems in West Africa Sahel; Compendium - development of successful stories and options to improve traditional land and water management practices. **Outcomes:** Skills of NARS partners enhanced and NARES told used, methods and processes to generate and customize improved resilience options for targeted groups of vulnerable households; Farmers, NGOs, policy makers, are aware of constraints and opportunities of dryland agriculture; fine tuning of innovative farming systems intensification that copes future needs; Synthesis of local ecological knowledge – smallholder preferences and science-based understanding of interactions at field level .	*1,179*
(WAS&DS) 2.2 Coordinate and harmonize database management and research methods	**Objectives:** Analyze and manage data, research methods and Monitor and Evaluate of program activities; Assess main factors of system and livelihood diversification options and incentives to preserve agro-biodiversity and the landscape, and how they vary across time and space. **Locations:** 1. Wa-Bobo-Sikasso Transect: Pobè Mengao, Tougouri Thiougou in Burkina Faso; 2. Kano-Katsina-Maradi Transect: Aguié, Angoua Doua and Kollo in Niger. Bomboro, Petaka, Somo, Bolimasso in Mali. **Methods:** Review, Desk study and write-shop; Participatory rural appraisal; group discussions, individual semi-structured interviews; farming system and crop modeling **Gender: - Link to other CRPs:** Forests, trees and agroforestry, CCAFS Dryland Cereals.	**Outputs:** Data deposited and archived in ICRAF institutional repositories accompanied with relevant metadata; A synthesis report on knowledge-based systems developed for NRM on Drylands systems. **Outcomes:** Knowledge-based systems developed for Natural Resource Management WAS &DS.	*275*

\ **(WAS&DS) 2.3 Develop + test value adding strategies: post-harvest management, processing, use of agricultural produce and by-products including forest products**	**Objectives:** Development and testing of gender-smart harvest and postharvest technologies, nutrition, crop residue management, post-harvest management and processing of forest and crop products, and grain storage. **Locations:** 1. Wa-Bobo-Sikasso Transect: Pobè Mengao, Tougouri Thiougou in Burkina Faso; 2. Kano-Katsina-Maradi Transect: Aguié, Angoua Doua and Kollo in Niger. Bomboro, Petaka, Somo, Bolimasso in Mali. **Methods:** Participatory rural appraisal, **g**roup discussions, individual interviews **Gender:** Engaging and empowering women, youth and disadvantaged people in all post-harvest handling processes. **Links to other CRPs:** Forests, trees and agroforestry, CCAFS.	**Outputs:** Technical note on small-scale infrastructure and equipment for storage and agro-processing of agriculture and tree products. **Outcomes:** Improved resilience options (components, interactions and their management; explicit consideration of buffer functions, managing trade-offs between production and risk; nested scale risk mitigation, including incentives to adopt them).	*170*
(WAS&DS) 2.4 Promote local and regional knowledge generation and exchange for scaling up and out of promising intensification options and strategies	**Objectives:** Communication and dissemination of promising intensification options and strategies, training of trainers. **Locations:** 1. Wa-Bobo-Sikasso Transect: Pobè Mengao, Tougouri Thiougou in Burkina Faso; 2. Kano-Katsina-Maradi Transect: Aguié, Angoua Doua and Kollo in Niger. Bomboro, Petaka, Somo, Bolimasso in Mali. **Methods:** 1. Develop and implement communication strategies; Develop and produce targeted training and extension tools 2. Facilitate creation of innovation platforms in Rural Resource Centers 3. Design an information, communication and education plan 4. Develop partnership with communication actors (local radio, video and printed media). **Gender:** Gender action research in benchmark site. **Links to other CRPs:** Forests, trees and agroforestry, CCAFS	**Outputs:** A synthesis book on synergies between farmers, practitioners and other agents of change; At least 20 farmer field schools and 5 rural resources centers established; At least 6 exposure trips organized for the poor farmers in the action sites; At least 60 research and extension agent capacities strengthened; At least 6 functional and sustainable scaling up mechanisms established. **Outcomes:** Better informed farmers and farmer to farmer, district to district and region to region links for information flow.	*110*
(WAS&DS) 2.5 Induce intensification and improve resource use efficiency through on-farm testing and evaluation of technologies	**Objectives:** Address options for sustainable intensification of orange-fleshed sweet-potato, including seed systems. Develop and implement high-value market garden and fruit-tree production. Introduce and evaluate new technologies: germplasm, agricultural inputs, livestock management options, fodder, domestication and promotion of fruit and fertilizer trees and options for mechanization. **Locations:** 1. Orodara, Burkina Faso + Tolon-Kumbungu Districts, Ghana 2. Wa-Bobo-Sikasso Transect: Pobè Mengao, Tougouri Thiougou in Burkina Faso; 3. Kano-Katsina-Maradi Transect: Aguié, Angoua Doua et Kollo in Niger. Bomboro, Petaka, Somo, Bolimasso in Mali. **Methods:** Participatory research at benchmark sites. On-station trial, on-farm	**Outputs:** One report on effects of cultural practices (water and fertility), evaluate 3 methods for healthy sweet potato seed (Ghana and Burkina Faso action sites); Manual on water buffering technologies and planning tools for watersheds; Toolbox on dissemination of an integrated approach of technologies aimed at increasing on-farm production; Manual on best options for intensification with agro-biodiversity; Report on multiplication, vegetable diseases and fertilization research. Manual on identification of	*800*

	experimentation on conservation agriculture with trees, modeling. **Gender:** Women targeted as appropriate. Testing and evaluating of: gender-smart options for improved livelihood, and water management. **Links to other CRPs:** Linked to Roots, Tubers and Bananas product lines related to "Developing tools for more productive, ecologically robust cropping systems," and to "Making available low-cost, high quality planting material to farmers". Forests, trees and agroforestry, CCAFS.	potential area and their characteristics for high-value market garden and fruit-tree production. One manual on development of appropriate cropping systems for improved quality and quantity of crop residue for livestock feeding and quality manure generation. **Outcomes:** Enhance crop diversification of farming systems with agroforestry for livelihood resilience; Nutrient management options identified for three regions in Niger; On-farm examples of evolution to more sustainable and productive farming; Wider adoption of methods to evolve from current farming systems to this goal; Multiple stakeholders in pastoral/ agropastoral areas, use evidence-based ecosystem management, at community level for governance of common and privately managed land and water resources.	
(WAS&DS) 2.6 Establish reference situation / baselines for the action sites to support systems approaches	**Objectives:** Establish community platforms for participatory wheat technology validation, demonstration, seed multiplication and promotion along the wheat value-chain. Survey status of sweet potato in farming systems at KKM benchmark sites. Agricultural Biodiversity Assessment to identify and quantify all useful plant, animal, aquatic, and insect species used by rural households and communities in the Dryland Systems CRP sites; information on markets and general socioeconomic household characteristics. Characterization of action sites for baseline of biophysical, socio-economic and institutional factors and documentation of agro-ecological knowledge on farming systems. **Locations:** 1. Kano-Katsina-Maradi Transect: Kadawa, Bagwai Alkamawa action sites. 2. Wa-Bobo-Sikasso Transect: Pobè Mengao, Tougouri Thiougou in Burkina Faso. 3. Kano-Katsina-Maradi Transect: Aguié, Angoua Doua andKollo in Niger. Bomboro, Petaka, Somo, Bolimasso in Mali. 4. Action sites in KKM transect **Methods:** Baseline survey of action sites, value chain analysis Review, Desk study and write-shop, Ethno biological surveys using Focus Group Discussions and questionnaire Plant specimen sampling and identification, Participatory rural appraisal, and feed assessment with	**Outputs** Review paper on the status of agro-biodiversity management and conservation in major agro-ecosystems; Review of agro-ecological intensification of sorghum and pearl millet production systems in Sahel with agroforestry; Report on female and male farmer-led innovations and adoption; Tools kit of methods, processes and capacity for NARES to customize intensification options to local circumstances across scaling domains; Baseline report on livelihood assets, production systems and agro-ecological local knowledge; Report on wheat value chain stakeholders adoption status of innovations for best integration, access to technologies, competitiveness and income sustainably. **Outcomes:** Enhanced impact of Dryland Systems action research from improved targeting methods at regional to farm scales; Repository of farmer knowledge and scientist	*1,179*

	FEAST (Feed Assessment Tool)**. Gender:** Involvement of women, youth and the disadvantaged in the process. Gender research and extension contributing to improving livelihoods at local level. **Links to other CRPs:** CRP 1.3, Forests, Trees and Agroforestry, CCAFS, Water Land and Ecosystems, Roots, Tubers and Bananas, Humid-Tropics, Aquatic Systems, Nutrition, Drylands Cereals.	interface for food-feed crops; Improved resilience options (components, interactions and their management; explicit consideration of buffer functions, managing trade-offs between production and risk; nested scale risk mitigation, including incentives to adopt them)	
(WAS&DS) 2.7 Quantify resource use and associated tradeoffs to optimize community-level decision making to promote SI and vulnerability reduction	**Objectives:** Assess status and threats to agro-biodiversity following on-going intensification of farming systems to recommend measures to promote conservation and sustainable use of biodiversity rich areas; Collect and analyze spatial data to identify current land-use and land-cover conditions and to analyze LU/LC change during the historical reference period in the area and site; Develop a knowledge platform for data and information storing and sharing; Calibrate and test the FARMSIM model using and on-farm trials; Assess the performance of innovative farming systems, combining different crops and livestock management technologies. **Locations:** 1. Kano-Katsina-Maradi (KKM) transect: Nigeria-Niger 2. Wa-Bobo-Sikasso (WBS) transect: (Ghana – Burkina Faso – Mali) **Methods:** Farming systems surveys, training on approaches to promote in situ conservation, systematic analysis of the satellite images (1960-present), combined with ground truthing, geometric and radiometric image correction, satellite images analysis using an algorithm. Modeling using FARMSIM and NUANCES developed by Wageningen University. Dynamic simulation of long-term productivity for future socio-economic conditions together with farmers, NGO, policy makers, etc. **Gender:** Involving women, youth and disadvantaged in the process. **Links to other CRPs:** CCAFS, Dryland cereals.	**Outputs:** Report on status and threats to local agro-biodiversity; Technical note on building capacity of key stakeholders as trainers for promoting in- situ conservation of agro-biodiversity; Report on development of Land Use / Land Cover map for the different sets of periods that is shared and centrally archived; Report on resource use and constraints, trade-offs at farm level; Report on enhancing impact of DS action research using a modeling tool for farm resource use efficiency and trade-offs for policy makers and NARES. **Outcomes:** Enhanced impacts of DS action research from improved ability to trade space for time across sites. Knowledge of local agrobiodiversity of crop/plants to support diversification.	*100*
(WAS&DS) 2.8 Facilitate effective linkages and knowledge exchange among different actors for improved system productivity and better market	**Objectives:** Establish and facilitate innovation platforms and their monitoring and evaluation. Create farmer field schools, field diversity forum, and rural resource centers. **Geographical Location (s) including the Action Sites:** -Orodara, Burkina Faso + Tolon-Kumbungu Districts, Ghana Kano-Katsina-Maradi action sites. **Methods:** Participatory Research and Extension Approach (PREA) in IAR4D. Value chains analysis, establishment of innovation platforms, tools for monitoring and evaluation of innovation platforms**. Gender:** Women targeted explicitly as appropriate and as possible. Ensure inclusiveness (Poor	**Outputs:** Functional innovation platforms are established and farmers have access to market information; Synthesis report on potential for developing markets for orange-fleshed sweet potato and enhancing household nutritional status; 4 Functioning innovation platforms established in the action sites, 2 in each of the action sites for 2 promising value chains; At least 2 rural resource centers established in the transect	*405*

access	and landless farmers, women, youth); Engaging and empowering women, youth and disadvantaged **Links to other CRPs:** Roots, Tubers and Bananas, Forests, Trees and Agroforestry, Livestock and Fish.	Wa-Bobo-Sikasso (Ghana, Burkina Faso and Mali); Manual on M&E tools for innovation platforms; 6 farmer field schools set up in action site villages; Manual on developing business plan for smallholder farmer;; Manual on options for better functioning markets for intensification for rural livelihoods. **Outcomes:** 12,000 farmers, (6,000 from each action site transect) have direct access to more and up-to-date information of farming methods and market linkages.	
(WAS&DS) 2.9 Assess and monitor biomass and resource flow in the action sites	**Objectives:** Develop effective and cost efficient carbon monitoring, reporting and verification systems; Evaluate biomass productivity and quality in various sorghum genotypes on-station to assess potential for dual purpose usage. Biomass assessment of perennial crops including woody vegetation, assessment of soil and land health conditions, and mapping of resource flows in the farm systems in the 3 KKM action sites. **Locations:** Wa-Bobo-Sikasso Transect: Cassou in Burkina Faso **Methods:** Field investigation and modeling. **Gender: - . Links to other CRPs:** Forests, Trees and Agroforestry, CCAFS.	**Outputs:** Manual on measurement and monitoring in action sites; Manual for above and below ground carbon; Manual on monitoring systems for stakeholder needs; Compendium on tools, methods, processes to customize improved resilience options for vulnerable households; Data and report on annuals + perennials biomass in 3 action communities of the KKM transect; Data collected from on-station trials and peer reviewed manuscript provided; Data and one report on annuals + perennials biomass in 3 action communities of the KKM transect; Data entry and analysis of samples and report writing**.** **Outcomes:** Improved knowledge and management of arborial resources at farm to landscape scales for continued delivery of ecosystem services.	*693*

(E&SA) 3.1 Vulnerability frameworks	**Objectives:** Develop tools to characterize vulnerability and resilience. **Locations:** Chinyanja Triangle. **Methods:** framework development. **Gender:** Gender in terms of vulnerability. **Links to other CRPs:** Water Land and Ecosystems.	**Outputs:** Develop one vulnerability framework and indicator protocol developed. **Outcomes:** Project partners and other stakeholders use vulnerability framework to guide intervention identification and ex-ante impact assessment.	*124*

(E&SA) 3.2 Resilience - Enhancing options	**Objectives:** Understand how to evaluate potential resilience enhancing options. **Locations:** Northern Kenya, Ethiopia, Uganda, Chinyanja Triangle. **Methods:** Economics, qualitative social science. **Gender:** Gender dimensions of resilience to be explored. **Links to other CRPs:** Developing indicators of adaptive capacity for CCAFS.	**Outputs:** Develop and test in framework for measuring impact of interventions on resilience 3 locations - in East and Southern Africa; Three papers published on resilience interventions: two on frameworks for M&E at national and local level on dryland trees and resilience. **Outcomes:** Ten project partners and other stakeholders in Ethiopia, Kenya and the Chinyanja Triangle use resilience framework and communication materials.	*2,310*
(E&SA) 3.3 Out scaling options for resilience	**Objectives:** To introduce and popularize improved cultivars of crops and forage legumes in the irrigation farming systems of Ethiopia, multiply seeds of proven technologies suitable to irrigation conditions of lowland areas and identify seed delivery constraints and opportunities**.** To produce maps of recommendation domains of small ruminants, cereals and food legumes**. Locations:** Ethiopia; Afar and Ethiopian Highlands and Lowlands**. Methods:** Demonstration, interactive farmer field days, capacity development, participatory action research. **Gender:** Gender will be mainstreamed into the activities as the roles of men, women and youth need to be considered in outscaling and adoption of technologies. **Links to other CRPs:** wheat, grain legumes, cereals & livestock and fish.	**Outputs:** High yielding, adapted and farmer preferred wheat, barley, chickpea and forage crop varieties identified (1-2 per crop) for Afar and Ethiopian highlands;10 tons seed of wheat, barley, chickpea and forage crops produced; two reports on constraints of barley/faba bean and forage seed systems; Knowledge transfer of new varieties and technologies to over 200 farmers; over 100 male and female farmers and Development Agents trained in 2 training courses; one map on recommendations domain developed **Outcomes:** Incomes of farmers improved through adoption of high yielding crop and forage varieties and access to seed; Knowledge and skills of farmers improved to maximize yield of food and forage crops.	*1,441*
(E&SA) 3.4 Baseline surveys	**Objectives:** Characterize the systems and select M&E indicators. **Locations:** Chinyanja Triangle and Zimbabwe (Mashonaland and Matabeleland). Ethiopia and Kenya. **Methods:** surveys, cost-benefit analysis, simulation modeling. **Gender: -. Links to other CRPs:** To bring direct benefits to the people living in the program's actions sites and the wider populations of the world's dryland production systems, Water, Land and Ecosystems.	**Research Outputs:** Baseline survey results based on 600 households in Chinyanja Triangle used to identify entry points for intensification interventions, including water harvesting structures. Report on technology adoption and coping strategies in the Chinyanja Triangle. Baseline data from 480 men and women in Zimbabwe used to develop farmer typologies in crop-livestock systems. Simulation modeling used	*609*

		to identify interventions for 2015 in Zimbabwe. Participatory characterization and dialogue with at least 2000 farmers and ten service support partners to plan for development of inclusive and integrated approach. **Research Outcomes:** Project stakeholders agree on priority interventions for sustainable intensification in Chinyanja Triangle. In Ethiopia and Kenya five implementing partners use information to develop an inclusive and integrated approach.	
(E&SA) 3.5 **Gap filling**	**Objectives:** understand research gaps. **Locations including the Action Sites:** Chinyanja Triangle, Zimbabwe**. Type of methods used:** FGDs, literature review. **Gender: - . Links to other CRPs:** Water, Land and Ecosystems.	**Research Outputs:** Report on gaps in knowledge: Report on knowledge gaps for at least one district in each of Chinyanja Triangle counties. Synthesis report on priority research gaps for Zimbabwe. **Outcomes: N/A 2014.**Three NARES using typologies to better target improved intensification options in Chinyanja Triangle and Zimbabwe. In the Chinyanja triangle this will benefit 1000 farmers.	*44*
(E&SA) 3.6 **Research entry points**	**Objectives:** Identify research entry points. **Locations:** Chinyanja Triangle and Zimbabwe. **Methods:** interviews, literature review. **Gender: -. Links to other CRPs:** Water, Land and Ecosystems.	**Outputs:** Report outlining at least 3 entry point recommendations and one entry points and research strategy. Scoping study report based on survey of 200 households and 10 key informants in Chinyanja Triangle. 2 reports for Zimbabwe on effect of integrated crop-livestock interventions on soil, crop, livestock productivity and household income and livelihoods from 480 households in Zimbabwe (Mashonaland and Matabeleland). **Research Outcomes: N/A 2014.** Entry points used for interventions by NARES and development partners to better target improved intensification options for 1000 households.	*56*
(E&SA) 3.7 **Youth and gender**	**Objectives: U**nderstand how to mainstream youth and gender. **Locations:** Kenya, Ethiopia, Chinyanja Triangle. **Methods:** surveys,	**Outputs:** In Malawi (Chinyanja triangle) a gender report is produced based on surveys of 50	*64*

	interviews. **Gender:** Yes. **Links CRPs:.**	households, and used by NARES to target interventions for 500 households. **Outcomes: N/A2014** Tools, methods and processes enhance capacity of NARES to create and customize improved intensification options.	
(E&SA) 3.8 Technology transfer	**Objectives:** Understand opportunities/ constraints to adoption. **Geographical Location (s) including the Action Sites:** Kenya, Ethiopia, Chinyanja Triangle. **Methods:** Surveys, FGDs, etc. **Gender : -. Links to other CRPs: -.**	**Outputs:** Two reports - Chinyanja triangle and Ethiopian site – will highlight constraints and opportunities affecting technology adoption. **Outcomes: N/A 2014.** Tools, methods and processes enhance capacity of NARES to create and customize improved intensification options.	*65*
(E&SA) 3.9 Research- extension links	**Objectives:** Identify and strengthen research-extension-farmer links along value chains. **Locations:** Zimbabwe, Chinyanja Triangle. **Methods:** value chain studies; establish innovation platforms. **Gender: -. Links to other CRPs: -.**	**Outputs:** Value chain approach to introduce interventions in the Chinyanja Triangle through capacity building; Four target districts of Zimbabwe, five innovation platforms for maize, sorghum, groundnut, and livestock fully operational; Technical and institutional interventions to improve farmer access to value chains identified. **Outcomes:** Value chain members understand priority interventions and share them in the Innovation Platforms in Zimbabwe. Chinyanja triangle stakeholders understand value chain approach and use it to improve linkages.	*1,025*
(E&SA) 3.10 Test best bets	**Objectives:** Begin field tests of best-bet interventions. **Locations:** Chinyanja Triangle; Zimbabwe, Ethiopia. **Methods:** action research, on farm trials. **Gender:** 75% of farmers targeted are women in Chinyanja triangle. **Links to other CRPs - .**	**Outputs:** Best-bet cereal-legume and fertilizer/ manure management demonstrated on 50 farms in Chinyanja triangle (75% women); Yield gap analysis paper published; Zimbabwe - 480 core project farmers influence 4000 farmers to address marketing issues in mixed crop-livestock systems. **Outcomes:** Adoption of crop-livestock options in Zimbabwe (480 farmers) and Chinyanja triangle (50 farmers).	*558*
(E&SA) 3.11	**Objectives:** Disseminate information about technologies and seeds.	**Outputs:** Germplasm availability improved;	*346*

Information dissemination	**Locations:** Chinyanja Triangle. **Methods used:** communications. **Gender: -. Links to other CRPs - .**	Information on technologies disseminated; One paper for Chinyanja triangle published on soil and landscape health; field manuals developed. **Outcomes:** 80 farmers manage their plots using an integrated soil and agronomic health approach.	
(E&SA) 3.12 Interventions for successful adoption	**Objectives:** Implement interventions to overcome barriers to successful adoption. **Locations:** Kenya and Ethiopia, Chinyanja Triangle, Zimbabwe. **Type of methods used:** Training events, seed systems development. **Gender : -. Links to other CRPs - .**	**Outputs:** Seed systems for legumes, forages, cereals developed and improved: in Zimbabwe 3 communal and 12 individual forage seed multiplication plots established in 2 districts. NARES and farmers trained. In Kenya and Ethiopia, exchange visits held with 50 farmers on accessibility and benefits of program interventions. **Outcomes: N/A 2014.** Enhanced capacity of NARES to create and customize improved intensification options. E.g. in Kenya and Ethiopia - partners in DGIS project ensure program interventions are accessible and beneficial to different categories of farmers.	*337*
(E&SA) 3.13 Out-scaling	**Objectives:** Map domains for out-scaling. **Locations:** Ethiopia, Chinyanja Triangle. **Methods:** Geoinformatics. **Gender: -. Links to other CRPs: -.**	**Outputs:** Out scaling domains mapped. **Outcomes: N/A 2014.** Action researched focused on scaling domains rather than pilot sites.	*11*
(E&SA) 3.14 Food system characterization	**Objectives:** Characterize food systems, household diets. **Locations including the Action Sites:** Chinyanja Triangle. **Methods:** surveys **Gender:** data gender disaggregated. **Links to other CRPs: -.**	**Outputs:** Recommendations for improved food security and incomes from modeling exercises. Food systems characteried. **Outcomes:** N/A 2014. Partners use knowledge about diets and food sources in food systems to design interventions to improve year round access.	*114*
(E&SA) 3.15 Entry point identification	**Objectives:** Identify entry points and interventions. **Locations** Chinyanja Triangle. **Type of methods used:** surveys. **Gender:-. Links to other CRPs: -.**	**Outputs:** Survey completed. **Outcomes: NA/2014.** Partners use knowledge about diets and food sources in food systems to design interventions to improve year round access.	*139*
(E&SA) 3.16 Model ex-ante impacts	**Objectives:** Model ex-ante impact assessments of interventions. **Locations:** Ethiopia. **Methods:** models **Gender: -. Links to other CRPs: - .**	**Outputs:** Productive and profitable practices identified; Precision agricultural practices piloted. **Research Outcomes:** N/A 2014**.**	*107*

(E&SA) 3.17 Pilot proof of concept	**Objectives:** Pilot precision agriculture practices. **Locations:** Ethiopia. **Methods:** on-farm trials. **Gender: -. Links to other CRPs: -.**	**Outputs:** Precision agricultural practices piloted **Outcomes:** N/A 2014.	*380*
(E&SA) 3.18 Participatory characterization	**Objectives:** Produce local NRM assessment with stakeholders. **Locations:** Kenya/ Ethiopia; Chinyanja Triangle. **Methods**: action research, focus groups, community mapping. **Gender: -. Links to other CRPs:** Water, Land and Ecosystems, rainfed work on Natural Resources Management and governance in pastoral systems.	**Outputs:** In two case studies (Kenya and Ethiopia), validate a participatory NRM model and a workshop with 50 stakeholders; Journal article on rangelands governance. Policy brief and journal article published on NRM governance in Marsabit, Kenya. Five agricultural land and soil management practices mapped and analyzed to develop technical packages for on-farm integrated soil and water management (Kenya and Ethiopia DGIS sites); Protocol developed to guide participatory resource and NRM assessments. (Chinyanja Triangle). **Outcomes:** Local stakeholders in Ethiopia and Kenya have evidence of community validation of participatory rangelands methods. DGIS implementing partners in Kenya and Ethiopia use packages to support uptake of integrated soil and water management; In Chinyanja triangle stakeholders use the participatory protocol for planning.	*331*
(E&SA) 3.19 NRM and land use plans	**Objectives:** Develop and pilot approach to map rangelands. **Locations:** Ethiopia, Kenya, Chinyanja Triangle**. Methods used:** mapping, tradeoff analysis. **Gender: -. Links to other CRPs: -.**	**Outputs:** For two counties in northern Kenya, rangeland management documented and mapped with participation of 60 stakeholders. Framework for evaluating sustainable rangeland management produced and shared at national level with Kenya ASAL stakeholder forum. **Outcomes:** Local stakeholders participate in mapping and planning governance of rangelands in two counties in Northern Kenya.	*205*
(E&SA) 3.20 Value chain characterization	**Objectives:** Characterize value chains and understand constraints to participation, particularly in pastoral areas. **Locations:** Kenya, Chinyanja Triangle, Ethiopia. **Methods:** value chain studies, trader surveys,	**Outputs:** One Drought Resilience Audit toolkit produced for assessing market interventions in pastoral areas of six counties of northern Kenya.	*180*

	interviews. **Gender: -. Links to other CRPs: -.**	In the Chinyanja triangle, existing major markets are identified to promote linkages between input and output markets. **Research Outcomes:** Stakeholders aware of how market interventions can enhance resilience in six counties in northern Kenya.	
(E&SA) 3.21 Interventions to promote participation	**Objectives:** Develop interventions to promote participation. **Locations:** Kenya. **Methods:** action research, market studies. **Gender):** Women's role in milk and other markets a focus. **Links to other CRPs:-.**	**Outputs:** Potential for market interventions to enhance resilience to drought reviewed for six counties in northern Kenya and shared with the county technical working groups and steering committees. **Outcomes:** Learning networks sharing experiences about market interventions.	*100*
(E&SA) 3.22 Test extension approaches	**Objectives:** Understand how risk management interventions can be supported by range of extension partners including private/ NGO: including Index based Livestock Insurance and Livestock Corridor management and maintenance. **Locations including the Action Sites:** northern Kenya. **Methods capacity** development, learning models. **Gender: - . Links to other CRPs:-.**	**Outputs:** For DGIS (ICRAF) project, 50 stakeholders, 10 extension services and 10 institutions mapped and analyzed, and their capacity development needs. One national level report on importance of maintaining livestock corridors in Tanzania produced and 30 government employees trained. Three county level livestock corridor maps produced with maintenance plans (Kenya). **Outcomes:** Two partners in northern Kenya offer service linked to Index-based Livestock Insurance. Thirty percent of target clients in six counties in northern Kenya understand role and value of index-based insurance through outreach activities. Sales of IBLI increase (target is 2000 pastoralists). DGIS partners develop innovation platform with farmer organizations, service providers and national initiatives to exchange information and develop capacity.	*849*
(E&SA) 3.23 Farmer associations and cooperatives	**Objectives: ….Locations:…. Methods:…. Gender:…..**	**Research Outputs: Research Outcomes:**	*185*
(E&SA) 3.24	**Objectives:** Improve capacity of local partners for risk management	**Outputs:** Capacity of local partners improved for	

Capacity Development	and M&E for resilience. **Location (s) including the Action Sites:** Kenya, Ethiopia. **Methods used: -.** Training. **Gender: -.**	risk management. Capacity of member states improved for M&E of resilience investments in Kenya and Ethiopia. Two capacity building and training plans and four workshops on exchange and learning (Ethiopia and Kenya DGIS project areas). **Outcomes:** Two IGAD member states (Kenya and Ethiopia) have M&E framework for resilience investments. In Kenya and Ethiopia, DGIS project partners strengthen competency of farmer organizations in service provision.	*100*

(CA) 4.1 Improve the productivity of marginal lands in irrigated farming and pastoral systems	**Objectives:** Improving agricultural production under saline conditions with minimal trade-offs within the Basin, applying a farming systems approach **Locations:** Aral Sea Region (Turkmenistan, Uzbekistan and Kazakhstan). **Methods: I**nventory of existing practices; Improved land preparation and cultivation methods (irrigation application, mixed farming systems for maximum production with available natural resources). **Gender:** Changes in farming system usually affect the labor load, or labor division within families. Each potential intervention or introduction will be linked to these labor loads and labor divisions. Farm-level decision making has a gender aspect. The decision making process for new introductions will be considered in the on-farm salinity management processes. **Links to other CRPs: WLE**	**Outputs: '**Ideas Books' for salinity management; Inventory and classification of agricultural production systems and marginal lands/management scenarios; Dataset for the Aral Sea Basin; Networking with national partners and policy makers on institutional support for long-term salinity management; Contact list of partners, policy makers; field-based management strategies with the CRP Water, Land and Ecosystems; A "research for development" vision for Aral Sea Basin; Processes for gender-aggregated labor and decision making for communities in salt-affected production systems. **Outcomes:** Improved knowledge source for extension services in the Aral Sea Basin; Increased knowledge and links between regional salinity management and field-based interventions in high producing and marginal lands; Improved interaction between CRP Dryland Systems research and policy makers in the region related to salinity management; Improved gender aggregated data for communities living in the Aral Sea Basin and expected impact of interventions on salinity management and marginal lands.	*266*

(CA) 4.2 Increase livestock productivity to improve availability of animal proteins to the households and increased revenues and wellbeing of the pastoralists	**Objectives:** Increase livestock productivity to improve availability of animal proteins to the households and increased revenues and wellbeing of the pastoralists **Locations:** Aral Sea Region (Uzbekistan, Kazakhstan), Rasht Valley (Tajikistan). **Methods:** Sheep and goat production systems analysis; qualitative value chain analysis; on-farm trials – genetic improvement, animal diseases end-product quality. **Gender:** Increase livestock productivity will lead to increasing households incomes, improved resilience both male and female pastoralists. **Links to other CRPs:** Livestock and Fish.	**Outputs:** Analysis - sheep and goat production systems of 4-5 communities in two Action Sites: 400 small-ruminant keeping households (2200 people); Interventions identified and prioritized to increase productivity and enhance participation by the poor; action plan for each prioritized intervention; two interventions - increased on-farm productivity, improved market efficiency, with 150 households each; Collaboration agreement with World Bank project on Animal Health **Outcomes:** Increased capacity of national partners to implement value chain analysis; meat value chain channels fully understood and bottlenecks addressed; Livestock keepers testing improved practices to organize themselves for better access to markets and services.	*300*
(CA) 4.3 Improve water use efficiency	**Objectives:** Determine water and energy productivity of dryland production systems with high level of vulnerability and with greater potential for more productive, profitable and diversified dryland agriculture. **Locations:** Fergana Valley (Kyrgyzstan, Tajikistan and Uzbekistan) Aral Sea Region (Kazakhstan, Uzbekistan and Turkmenistan) **Methods:** on-farm analysis of water and energy productivity; assessment of water and energy requirements; agronomic analysis by of cooperatives or Water User Associations; on farm testing of technologies – socio economic, institutional. **Gender:** Work related to water use efficiency **Linkages to other CRPs**: Water, Land and Ecosystems.	**Outputs:** Two farmer field days; Presentation at International and national conference. Journal paper international conference paper; Two papers at national conferences. **Outcomes:** 300 farmers 4-5 communities in the Action Sites trained on improved water use efficiency. 100 women in 4-5 communities in the Action Sites benefit from improved knowledge on water use efficiency.	*426*
(CA) 4.4 Identify and introduce stress tolerant, high-yielding and improved quality varieties of cereals, potato, vegetable,	**Objectives:** Identifying multiple new varieties with better and reliable yields will reach more farmers who cultivate in the prevalent crop-livestock systems to improve the competitiveness of crops within farming systems by enabling labor-saving technologies to reduce weeding and harvesting costs. **Locations:** Aral Sea Region (Turkmenistan, Uzbekistan and Kazakhstan); Rasht Valley (Tajikistan and Kyrgyzstan) Fergana Valley (Kyrgyzstan, Tajikistan and Uzbekistan). **Methods:** Field trials of winter crops; Field trials of vegetables (vegetable soybean) and legumes (mungbean); Evaluation trials - field plot experimentation	**Outputs:** 200 advanced lines of wheat, barley, chickpea, mungbean, tomato and potato evaluated by farmers; One training course on planning, management and evaluation of field experiments; One training course on using statistical software in data analysis, results presentation and interpretation, reporting. Three farmer field days. **Outcomes:** At least 20 candidate varieties identified of wheat, barley, chickpea,	***466***

horticultural, fodder crops through on-farm adaptive trials	techniques; Field days for men and women farmers, researchers, extension workers, seed producers and policy makers; Training courses - design of on-farm and in-station field experiments. **Gender:** Men and women, primarily young researchers and farmers trained in conducting standard field experiments, crop management and evaluation. **Links to other CRPs:** CRP3.1, CRP3.2, CRP3.3, CRP3.4, CRP3.5, CRP3.6	mungbean, tomato and potato, superior to the locally grown varieties; 25 young researchers (15 men and 10 women) trained in scientific methods of field experimentation; 20 young researchers(10 men and 10 women) trained in application of statistical software; At least 200 men and women farmers, seed producers, researchers and policy learn about new, improved varieties of field crops, vegetables, and potato.	
(CA) 4.5 Creation of a seed systems platform to supply smallholders with high quality seed and planting materials for improved livelihoods, food security and income	**Objectives:** Introduce a new approach based on public/private partnerships to make the seed system sustainable, profitable and ensure timely availability of quality seed to enhance the benefits of smallholder farmers growing stress tolerant varieties of cereals, potato, vegetables, fruits, fodder and tree crops and the livelihood of rural populations living in the Action Sites. **Locations:** Aral Sea Region (Kazakhstan, Turkmenistan and Uzbekistan); Rasht Valley (Tajikistan and Kyrgyzstan); Fergana Valley (Kyrgyzstan, Tajikistan and Uzbekistan). **Methods:** Analysis of seed value chain and delivery system; Base-line survey; Ex-ante analysis of technologies; Establish public-private partnerships; Farmer Field Days; In-field capacity building for the implementation of Quality Declared Standards (QDS). **Gender:** Women farmers will be trained and encouraged to take lead in this activity. **Links to other CRPs:** CRP3.1, CRP3.2, CRP3.3, CRP3.4, CRP3.5, CRP3.6	Characterization report of the seed value chain and delivery system produced; 50 seed growers trained on seed storage (potato, cereals among them sorghum, pearl millet, alfalfa and fodder shrubs). Seed systems partners identified; a contact list of partners, policy makers, at least 30 personal contacts for at least 10 institutions; Stakeholder consultation; Five seed growers trained in land preparation, cultivation practices, seed multiplication techniques, storage; Seed multiplication of soybean and mungbean for the production of 1 and 35 tons of seed, respectively; Seed multiplication of sorghum pearl millet, alfalfa and perennial fodder shrub (*Kochia prostrata*); Three demonstration plots established on different crops (one in each Action Site). **Outcomes:** Increased local capacity in seed-related research; Demonstration seed plots established and seed growers trained, including in post-harvest practices; Criteria identified for the selection crop specific registered seed growers.	*202*
(CA) 4.6 Establishing a Strategic Innovation	**Objectives:** Facilitate creation of innovation platform in partnership with all relevant actors in the region (information support, demonstration of the practical applications, consulting and training); **Locations: A**ral Sea Region (Turkmenistan, Uzbekistan and Kazakhstan); Rasht Valley	**Research Outputs:** Baseline study (socio-economic, gender, youth, capacity building, extension) in at least one Action Site covering 100 households; Database. **Outcomes:** Agreement with	*234*

Platform for multi-stakeholder processes to reduce vulnerability of the agro-pastoral system and encourage sustainable intensification in Action Sites	(Tajikistan and Kyrgyzstan); Fergana Valley (Kyrgyzstan, Tajikistan and Uzbekistan). **Methods:** Baseline survey for project M&E indicator; on-line consultations on agricultural productivity, research, extension and human capacity in Action Sites and in Central Asia; database on innovations. **Gender:** M&E of mainstreaming gender in the DS CRP. **Links to other CRPs:** Policies, Institutions and Markets.	stakeholders on establishing strategic innovation platform (face-to-face consultations); SIP framework, model and architecture established by consensual decision. Capacity of stakeholders increased through training program; Recommendations to enhance extension system to science to farmers developed with CACAARI and GFRAS in the region.	
(CA) 4.7 Knowledge synthesis, generation, packaging and dissemination (knowledge platform) of sustainable land management practices in Central Asia. Knowledge Management CACILM	**Objectives:** Enhance the CACILM knowledge management component for facilitating widespread dissemination of SLM technologies and approaches; Improve agricultural systems for enhanced productivity and sustainability, and promote climate change adaptation approaches and technologies. **Locations:** Aral Sea Region (Turkmenistan, Uzbekistan and Kazakhstan); Rasht Valley (Tajikistan and Kyrgyzstan); Fergana Valley (Kyrgyzstan, Tajikistan and Uzbekistan). **Methods:** Knowledge gap analysis and synthesis; knowledge generation on Sustainable Land Management; Typology of stakeholders and knowledge dissemination pathways; Capacity building; Policy dialogue. **Gender:** Produce new and useful information for farmers male and female and decision makers to improve sustainable land management. **Links to other CRPs: -.**	**Research Outputs:** Synthesis and selection of 50 high potential SLM technologies and approaches and 4-8 are prioritized using criteria for selection to target 4 agro-ecosystems (rainfed, rangelands, irrigated, mountain); Shortlisted technologies presented in database (WOCAT template); Five similarity country maps for each intervention; Calibration of 1 downscaling model of Climate Change and 10 trained national staff; Development of a web-based SLM knowledge platform; Series of training events - 15 specialists in GIS, 10 national specialists in downscaling of the global climate change models to regional scale; Stakeholder workshop and SLM technology evaluation - Capacity building in access to and dissemination of knowledge. **Outcomes:** Knowledge about SLM in CA countries is synthesized, packaged and disseminated in forms that facilitate widespread uptake by decision makers in the region; knowledge platform to provide updated information about SLM accompanied by a strategy to ensure sustainability and link with worldwide resources; Established knowledge sharing process for coordination and policy dialogue for sustainable use and	*540*

		development of shared knowledge platform.	
(CA) 4.8 Strengthen capacity for use of Geographic Information Systems/Remote Sensing for assessment and sustainable management of soil, water, agro-biodiversity	**Objectives:** Leveraging the geo-informatics technology and application in an integrated agro-systems research and sustainable management of soil, water, agro-biodiversity resources through mapping, monitoring and impact assessment, establishing partnership, and geo-informatics capacity development. **Locations:** Aral Sea Region (Turkmenistan; Uzbekistan and Kazakhstan) Rasht Valley (Tajikistan and Kyrgyzstan) Fergana Valley (Kyrgyzstan, Tajikistan and Uzbekistan). **Methods:** Leveraging the application of geo-informatics techniques in agro-ecosystem research and resources mapping and management; Sampling protocols for land cover monitoring & assessment; Assessment of contribution of rangelands to livestock feeding; Mapping spatial and temporal rangeland condition. **Gender:** Enhancement of RS/GIS techniques and maps for gender related activities and rural advisory services. Male and female practitioners and rural advisory services agents will be trained in application of GIS techniques **Links to other CRPs:** CRP3.1, CRP3.2, CRP3.3, CRP3.4, CRP3.5, CRP3.6	**Outputs:** One micro-meteorology station established for the Central Asia region; Processing and Synthesis of the flux database for year 2014; Maps and geodatabase of LULC, croplands, pest and disease risk and climate vulnerability; Maps and geo-database of Rangelands/Grasslands and its decadal vegetation dynamics; At least 10 partners/staff trained on geoinformatics Applications; At least 1 refereed paper on vegetation dynamics in Central Asia. **Outcomes:** Assessment of vulnerability of the dryland crops for pests and diseases; Assessment of spatio-temporal rangeland/grasslands condition under changing climate; Geo-informatics capacity development. Dissemination of geospatial data and products.	*176*
(SA) 5.1 Identification and demonstration of promising technologies in rain fed and irrigated areas	**Objectives:** Identify technologies (e.g. varieties of chick pea, barley, millet, soil health related etc.) for matrix of intensification and resilience building. **Locations:** Jaisalmer, Barmer, Jodhpur **Methods:** Participatory on farm research**. Gender:** Women farmers are explicitly in most activities. **Links to other CRPs:** Water Land and Ecosystems, CCAFS, Biodiversity.	**Outputs:** Improved technologies and processes to enhance productivity by 20 % and improved incomes by 25% (for target farm enterprises), demonstrated on 500 farmers' fields in 8 action site villages in West Rajasthan. **Outcomes:** Farmers and NARES use the improved methods, technologies and tools to improve productivity and sustainability.	*3,794*
(SA) 5.2 Post/Pre project impact analysis	**Objectives:** Generate evidence of the impacts of selected interventions on livelihoods of farmers **Locations:** Jaisalmer, Barmer, Jodhpur in Rajasthan, Karnataka and Andhra Pradesh. **Methods used:** Build on-farm typologies, based on cost-benefit analysis from baseline and experimental data, assumptions **Gender: - Linkages to other CRPs (if relevant):** CRP-WLE, CCAFS.	**Outputs:** Information and knowledge on potential benefits /limitations of priority technologies generated. **Outcomes:** NARES and farmers use knowledge-based decision for technologies adoption and identification of their niches.	*65*
(SA) 5.3 Capacity building of stakeholders for	**Objectives:** Improve capacity and perception of stakeholders on technology up-scaling. **Locations:** Jaisalmer, Barmer, Jodhpur, Anantapur, Kurnool and Bijapur, and sites in Karnataka and Andhra	**Outputs:** Training of smallholder farmers and stakeholders to create awareness and skills for up-scaling of promising technologies. **Outcomes:**	*283*

up scaling promising technologies	Pradesh. **Methods:** On-farm and off-farm on innovation platforms **Gender:** Training women farmers to create awareness and skills on management of promising options. **Links to other CRPs:** Water Land and Ecosystems, CCAFS.	NARES and farmers improve capacity of and knowledge to upscale and monitor the performances of new technologies.	
(SA) 5.4 Evaluating conservation agriculture for rapid adoption by smallholder farmers	**Objectives:** Generate knowledge and database on impacts of Conservation Agriculture on farmers' livelihoods, ecosystems and trade-offs. **Locations:** ICRISAT sites. **Methods:** On-station experiments on CA under different land uses and management conditions, laboratory analysis on nutrient flows, trade-off analysis. **Gender: - . Links to other CRPs:** Water, Land and Ecosystems, CCAFS	**Outputs:** Datasets on CA benefits and trade-offs analyzed through on-station research. **Outcomes:** Enhanced understanding of CA and customizing future application.	*236*
(SA) 5.5 Enhanced use of cactus to promote better livelihoods in arid areas of India	**Objectives:** Assess adaptability and potential of Opuntia ficus-indica **Locations:** Rajasthan and Chakwal. **Methods:** On-station and on-farm screening of spineless cactus and workshop and training courses. **Gender:** Cactus as a multi-purpose species, serves all gender groups **Links to other CRPs:** CCAFS.	**Outputs:** Understand role and niches of cactus in production system and introduce and evaluate cactus accessions. **Outcomes:** Increased awareness of cactus as multi-purpose species Skills of NARS partners increased	*85*
(SA) 5.6 Establish reference situation / baselines for the action sites to support systems approaches	**Objectives:** Improved systems understanding and resilience options (components, interactions and their management; explicit consideration of buffer functions, managing trade-offs between production and risk; nested scale risk mitigation, including incentives to adopt them). **Locations:** Anantapur, Kurnool, Bijapur and Chakwal **Methods:** Focus group discussions, field investigation and household survey and increasing capacity of local partners **Gender:** Includes womens' access to resources and decision making **Link to other CRPs:** Water, Land and Ecosystems, CCAFS.	**Outputs:** Baseline survey and agricultural assessment biodiversity. **Outcomes:** NARES use tools, methods and processes to generate and customize improved resilience options for targeted groups of vulnerable households.	*167*
(SA) 5.7 Analyzed, validate the household vulnerability model result of 2013	**Objectives:** Ground truthing using indicators, statistics tools and targeting of technologies. **Locations:** Anantapur, Kurnool Bijapur and Chakwal. **Methods:** sites visits, stakeholder and community consultation, FGD, statistical analysis using descriptive statistics and econometrics for the Chakwal sites. **Gender: -. Links to other CRPs:** Water, Land and Ecosystems, CCAFS.	**Outputs:** Vulnerability indicators developed and system characterized and vulnerability of 700 farmers' households validated. **Outcomes**: Greater awareness by stakeholder on causes of systems vulnerability and local coping mechanisms.	*196*
(SA) 5.8 Identification, validation, and out scaling of	**Objectives:** Identify technologies that will contribute to matrix of intensification and resilience building, and build farmer capacity **Geographical Location (s) including the Action Sites:** Anantapur, Kurnool and Bijapur. **Methods:** On-farm participatory demonstration/ evaluation	**Outputs:** Technologies, methods and processes to enhance productivity and improve resilience identified and documented. **Outcomes:** One million farmers in India adopt improved	*300*

technology (all agro-ecosystem based)	trials. **Gender: - . Links to other CRPs:** Water, Land and Ecosystems , CCAFS	productivity enhancement options thru out-scaling model of knowledge. Farmers, NARES use improved options, technologies and tools to contribute to resilience-building, enhanced productivity.	
(SA) 5.9 Document options for system diversification, enhance farmers coping mechanism and achieving food security.	**Objectives:** Develop farm typology-wise matrix of technology options and also assessment of technologies. **Locations:** Jaisalmer, Barmer, Jodhpur, Anantapur, Kurnool and Bijapur, Chakwal. **Methods:** Participatory Appraisal, site visit, literature review, on farm demonstrations. **Gender: - . Links to other CRPs:** Water, Land and Ecosystems CCAFS.	**Outputs:** Data/information, improved technologies/options for system diversification and integration for three agro-ecoregions with<500 mm annual rainfall documented. **Outcomes:** NARES use the information to maximize benefits, minimize risk, enhance resources use efficiencies- and reduce vulnerability through integration and diversification.	*195*
(SA) 5.10 Ex-post/ante impact analysis	**Objectives:** Generate evidence of impacts of selected interventions on livelihoods of farmers Locations**:** Anantapur, Kurnool and Bijapur and Bhoochetana-Karnataka project sites. **Methods:** Built on-farm typologies, based on cost-benefit analysis from baseline and experimental data, assumptions. **Gender: - . Links to other CRPs**: Water, Land and Ecosystems , CCAFS	**Outputs:** knowledge on potential benefits of technologies identified. Typology-specific interventions for 1500 farm households identified, options for diversification with high value crops assessed and linked to gender; Document potential benefits /limitations of improved technologies to improve productivity and social impacts. **Outcomes:** NARES and farmers use knowledge-based decisions for technologies adoption and identification of their niches.	*232*
(SA) 5.11 Capacity building of stakeholders for up scaling promising technologies	**Objectives:** Improve capacity, perception of stakeholders and farmers on technology up-scaling. **Locations:** Anantapur, Kurnool, Bijapur, Andhra Pradesh and Karnataka**. Methods:** On farm and off farm innovation platform training**. Gender:** Gender focused agricultural and livestock value chain study will generate strategies to empower women. **Links to other CRPs:** Water, Land and Ecosystems, CCAFS**.**	**Outputs:** Training to improve awareness and skills of smallholders and stakeholders on technologies and their up-scaling; Training of 1500 stakeholders; One million farmers trained to adopt improved practices to build resilience. **Outcomes:** NARES and farmers use skills and knowledge to implement and monitor the performance of new technologies and impact on their livelihoods	*91*
(SA) 5.12 Development of sustainability indicators	**Objectives:** Assess degree of sustainability of production systems at farm typology and system level and draw lessons to decide which to upscale. **Locations:** Anantapur and Kurnool**. Methods:** Use of existing farm typologies, adoption of framework, identification of indicators, building	**Outputs:** Sustainability indicators and index, developed. **Outcomes:** Information and lessons used by NARES and stakeholders to enhance sustainability at system scale.	*264*

	composite index and comparing environmental, social and economic indicators across typologies**. Gender: - . Links to other CRPs:** Water, Land and Ecosystems, CCAFS.		
(SA) 5.13 Identify, test and pilot options and strategies (including improved agricultural water management)	**Objectives:** Improve productivity of cereal-based systems through rainwater conservation, harvesting and more efficient use. **Locations:** Chakwal, Pakistan and in India**. Methods:** Field trials for assessment, fine-tuning and demonstration of packages to improve agricultural water management in different production systems. **Gender**: Identify gender mainstreaming activities in food production, value addition and capacity building; Raise awareness of nutritional water productivity among women**. Links to other CRPs:** CCAFS	**Outputs:** Best irrigation packages identified and off-season vegetables and high-value crops evaluated and demonstrated. **Outcomes:** These will come after 2014.	*74*
(SA) 5.14 Establish reference situation / baselines for the action sites to support systems approaches	**Objectives:** Assess food crops available to households and current dietary diversity of women and children and their relationship with agricultural biodiversity in the production system and markets. **Locations:** West Rajasthan , Anantapur Kurnool, Bijapur and Chakwal **Methods:** Household survey, community consultation. **Gender:** Target women and children access to improved food options **Links to other CRPs:** Water, Land and Ecosystems , CCAFS	**Outputs:** Improved resilience options components, interactions and their management; explicit consideration of buffer functions, managing trade-offs**. Outcomes:** NARES use tools, methods and processes to generate and customize improved resilience options for targeted vulnerable groups.	*134*
(SA) 5.15 Identify land and water management options in pastoral and agro-pastoral areas; understand biophysical bottlenecks for sustainable use	**Objectives:** Identify improved practices and institutionalize collective action. **Locations:** West Rajasthan districts (Barmer, Jaisalmer and Jodhpur), Kurnool, Anantapur and Chakwal. **Methods:** demonstration, experimentation, community consultation, farmers' days. **Gender:** Establish role of women in collective action to enhance ecosystem services and their equitable access **Links to other CRPs:** Water, Land and Ecosystems, **CCAFS**.	**Outputs:** Technologies, methods and process to enhance productivity and ecosystem services. Suitable improved collective institutional arrangements for management. **Outcomes:** NARES and farmers use the consolidated land and water management options to enhance productivity and eco-system services. Community acceptance of new technologies to sustain natural resource base.	*515*
(SA) 5.16 Demonstrate selected NRM options for their benefit to enhance production and	**Objectives:** Create opportunities for hands-on practices on NRM **Locations:** West Rajasthan districts (Barmer, Jaisalmer and Jodhpur), Andhra Pradesh (Kurnool, Anantapur). **Methods:** community consultation, sites demarcation, interventions, community training, evaluation. **Gender: -. Linkages to other CRPs: - .**	**Outputs:** Participatory demonstration of options for sustainable use of NRM. **Outcomes:** NARES and community will have hands-on practice and change their perception of NRM to improve productivity & eco system services.	*630*

provide ecosystem services.			
(SA) 5.17 Analyze and monitor trade-offs, for different options, to develop decision tools for improved land and water management and collective action	**Objectives:** Generate evidence of impacts of selected interventions on livelihoods and ecosystem. **Locations:** West Rajasthan districts (Barmer, Jaisalmer and Jodhpur) , Kurnool and Anantapur **Methods:** Cost-benefit analysis from experimental data, baseline data sets **Gender: - . Links to other:** WLE and CCAFS.	**Outputs:** Information and knowledge on potential benefits and trade-offs of different technologies generated **Outcomes:** NARES and farmers use knowledge-based decisions for technologies adoption and identification of their niches	*148*
(SA) 5.18 Build capacity on collective action and conflict resolutions for smallholders	**Objectives:** Identify areas of conflict and also collective actions on CPR and enhance the capacity of stakeholders in this respect **Locations:** West Rajasthan districts (Barmer, Jaisalmer and Jodhpur), Kurnool, Anantapur. **Methods:** Consultation, dialogues, literature review, training, establishing proof of concept. **Gender: - . Links to other CRPs:** Water, Land and Ecosystems, CCAFS**.**	**Outputs:** Organize training, visits on collective action and conflict resolution mechanisms. Develop innovative collective action model for governance. **Outcomes:** NARES and farmers use knowledge-based decisions for technologies adoption and identification of their niches	*50*
(SA) 5.19 Develop and assess mechanisms to improve farmers access to market	**Objectives:** Understand farmers existing marketing options, networks, bottlenecks and suggest improved options **Locations:** West Rajasthan districts (Barmer, Jaisalmer and Jodhpur), Kurnool and Anantapur. **Methods:** Survey, community consultations and literature review; participatory action research; institutional innovations analysis; pricing analysis, marketing information system; learning alliance. **Gender:** Training of women on marketing options to improve their skills to negotiate and target market opportunities**. Links to other CRPs:** Water, Land and Ecosystems, CCAFS	**Outputs**: Report on existing farmers' market options, networks and bottlenecks and suggested improved mechanisms. **Outcomes**: A better, more comprehensive, and generally accepted understanding of the mechanisms and strategies to improve farmers' access to market.	*128*
(SA) 5.20 Developing strategies for convergence and piloting	**Objectives:** Internalize need for convergences and pilot interventions through convergences. **Locations:** West Rajasthan districts (Barmer, Jaisalmer and Jodhpur), Kurnool and Anantapur. **Methods:** Innovation platform and consultation of NGOS, government line departments and past experiences. **Gender: -. Links to other CRPs:** Water, Land and Ecosystems, CCAFS**.**	**Outputs:** Consecutive meetings to strengthen innovation platforms; Synthesis report on areas of convergence and enabling policy. Innovation platform for PR4D at three sites strengthened; 300 staff members from 20 consortium partners sensitized on convergence and integration. **Outcomes:** Stakeholders sensitized and informed to initiate convergence.	*385*

(SA) 5.21 Identify policy gaps and options to enhance adoption, resilience and intensification of agricultural systems	**Objectives:** Identify policy gaps in implementation of systems related development. **Locations:** West Rajasthan districts (Barmer, Jaisalmer and Jodhpur) Kurnool, Anantapur and Chakwal. **Methods:** Literature review, community consultation, FGD; review previous studies and secondary data; sector level approach. **Gender: Linkages to other CRPs:** Water, Land and Ecosystems, CCAFS.	**Outputs:** Major agriculture system related policy gaps identified and policy brief developed Determinants for non-adoption of traditional water harvesting techniques reviewed and analyzed and dialogue with different stakeholders initiated. **Outcomes:** Policy makers sensitized on policy gaps and options.	*92*

Table 2 – Planned CRP gender research budget: expected gender research results and associated budget

Level of organization within the CRP	Expected Gender research results as described in Table 1	Planned gender research budget ($ 000s)
Level n-1: Contributions to Gender		
(Further Flagships)		*(Further funds planned)*
1. North Africa & West Asia (NA&WA)		*969*
2. West African Sahel & Dry Savannas (WAS&DS)		*172*
3. East and Southern Africa (E&SA)		*293*
4. Central Asia (CA)		*226*
5. South Asia (SA)		*479*
(NA&WA) 1.1 Conservation agriculture	**Gender research outcome:** Increased awareness among national development partners about role of gender in conservation agriculture and 2 national development partners initiated actions to address gender gaps in CA information. **Gender research output:** Analysis of gender gaps in access of knowledge/information on good practices in CA.	*96*
(NA&WA) 1.2 Small ruminants productivity	**Outcome:** One national partner adopts steps to increase women's access to small ruminant knowledge and information. **Output:** Analysis of gender empowerment for small ruminant production and marketing; Analysis of gender access to knowledge/information on small ruminants and recommendations to increase women's access.	*61*
(NA&WA) 1.3 Water & land productivity in irrigated systems	**Outcome:** One national partner initiates steps to address gender-based practices that disadvantage women in accessing good practices in water management. **Output:** Analysis of gender roles in water management in agriculture and implications for water resources management.	*94*
(NA&WA) 1.4 Policies on natural resources	**Outcome:** Increased engagement by two national partners on gender implications of water policies and needed actions to address biases.	*59*

	Output: Evaluate of agricultural policies affecting households, by sex.	
(NA&WA) 1.5 System vulnerability	**Outcome:** Greater awareness by stakeholders of gender gaps in access to inputs and services in two action sites. **Output:** Gender analysis of smallholder farmers' access to inputs and services.	*28*
(NA&WA) 1.6 Bio-economic farm models	**Outcome:** Greater awareness by partners of two action sites of gender production, consumption and marketing decision scenarios based on preferences of men and women. **Output:** Simulation of gender-focused farm management choices and labor use under different interventions and climate change scenarios	*41*
(NA&WA) 1.7 Innovation platforms & scenarios	**Outcome:** Participants of innovation platform in 2 action sites (Morocco and Egypt) adopted gender-balanced practices and modalities for undertaking and addressing gender-gaps in agricultural knowledge and information generation and dissemination processes. **Output:** Participatory analysis among stakeholders of the innovation platform on gender-gaps in agricultural knowledge and information generation and dissemination processes and their implications for empowerment of women and youth, and how gender-biased practices impede adoption of technologies.	*79*
(NA&WA) 1.8 High-value chain clusters	***Outcome:*** Increased awareness and information sharing by stakeholders and partners in two action sites (Morocco and Egypt) in learning alliances of gendered roles in agricultural production and marketing; Civil society and national organizations two action sites (Morocco and Egypt) are more engaged in dialogue on gender-gaps in value chain development; ***Output:*** Analysis of state directed cooperative production and marketing and fragility in women's empowerment in Morocco in an article.	*90*
(NA&WA) 1.9 In-situ biodiversity	**Outcome:** Increased dialogue and awareness of gender differences on indigenous knowledge of natural plant diversity in one action site. **Output:** Analysis of gender-focused indigenous knowledge and its value, use and contribution to value of biodiversity and conservation	*42*
(NA&WA) 1.10 Water harvesting & soil conservation	**Outcome:** Increased awareness among national partners about role of gender is water harvesting and soil conservation and two national partners initiated actions to implement recommendations form gender analysis. **Output:** Analyze gender gaps in access to knowledge on good practices in water harvesting and soil conservation.	*91*
(NA&WA) 1.11 Water & land productivity in rainfed systems	**Outcome:** Increased awareness and engagement among partners (in innovation platforms) on gendered roles in water and land productivity; Two national partners address gender gaps in knowledge. **Output:** Analyze gender in water management in agriculture, implications for water and crop management.	*61*
(NA&WA) 1.12 Managing Salinity	**Outcome:** One national partner addresses practices that disadvantage women in	*34*

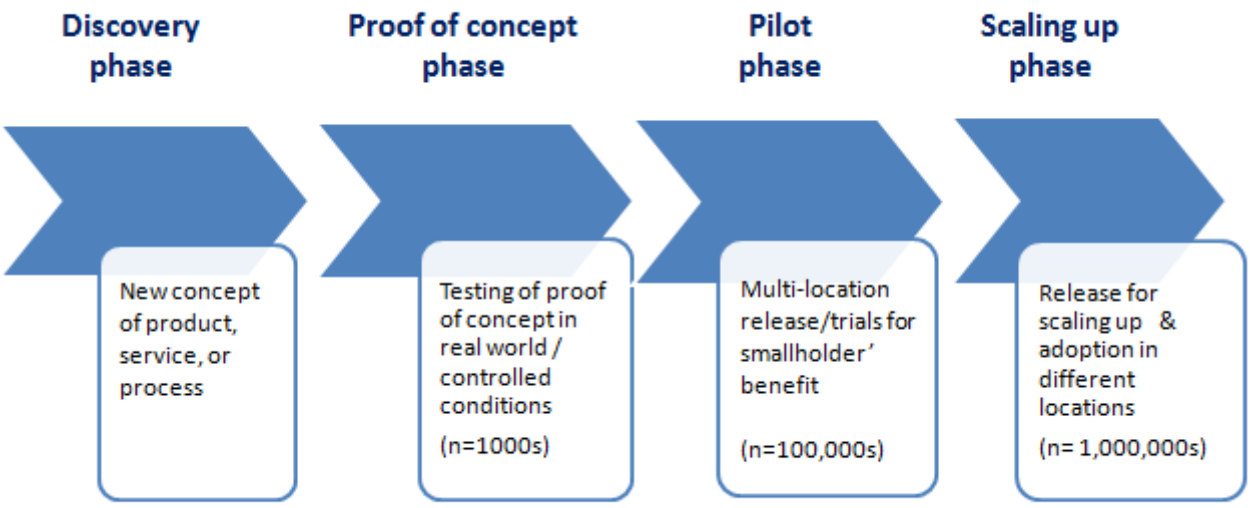
	accessing salinity management knowledge. **Output:** Analyze gender roles and access to knowledge.	
(NA&WA) 1.13 Seed system & dissemination	**Outcome:** Increase awareness among seed systems institutions of role of gender in seed systems; implement recommendations from gender analysis. **Output:** Analyze gender gaps for access to quality seeds and related information.	*22*
(NA&WA) 1.14 Cereal & legume species adaptation	**Outcome:** Increased awareness of national partners on gender gaps in access to information and technologies; two development partners address the constraint. **Output:** Analyze and document gender roles in value chain of cereal and food legumes; information and technology implications for women's empowerment.	*29*
(NA&WA) 1.15 Cereral & legume system IPM	**Outcome:** Increased awareness for extension services and NGOs on gender gaps in IPM technology, information and increased engagement and dialogue on issues and how these will be addressed. **Output:** Analyze gender-gaps in access to knowledge/ information on cereal/legume IPM technologies and policy factors explaining these gaps.	*25*
(NA&WA) 1.16 Managing agropastoral rangelands	**Outcome:** Increased engagement in dialogues of national partners on gender gaps in access to information; two national development partners address the constraint. **Output:** Analyze gender-focused knowledge of use of rangeland plant species and implications for long-term management of agro-pastoral rangelands.	*75*
(NA&WA) 1.17 Post- harvest & market access	**Outcome:** Increased dialogue among value chain stakeholders on improving value chain governance and performance, increasing womens' empowerment. **Output:** Analyze and document gender roles along value chain; social, environmental and policy related constraints to women participation.	*42*
(WAS&DS) 2.1 Review past work on dryland systems in the region; lessons on successes, failures and knowledge gaps for sustainable intensification and vulnerability reduction; evaluate vulnerability and risk management strategies in the action sites	**Outcome:** Engendered research and extension contributing to sustainable intensification and vulnerability reduction at local level Review of female and male farmer led innovations and adoption**. Output:** Review of female and male farmer led innovations and adoption	*18*
(WAS&DS) 2.3 Develop and test value adding strategies for post-harvest management, processing and use of agricultural produce and by-products including forest product	**Outcome:** Engage and empower women, youth and disadvantaged people in post-harvest handling. **Output:** Enhance inclusiveness and promotion of gender- sensitive activities like diversification of vegetables and planting of crop trees.	*30*
(WAS&DS) 2.4 Promote local and regional knowledge generation and exchange for scaling up promising intensification options and	**Outcome** Gender oriented action research at benchmark sites. **Output** Women are involved in the field and engaged in dialogue for co-learning	*23*

strategies		
(WAS&DS) 2.5 Induce intensification and improve resource use efficiency through on-farm testing and evaluation of technologies	**Outcome:** Information on gender aspects of best practices influences further R4D efforts; **I**dentify best entry point for gender groups; Gender-relevant effects of cultural practices, including quality seed evaluated and reported; **Output:** Evaluate and test gender-smart best fit options for improved livelihood, and water management.	*19*
(WAS&DS) 2.6 Establish reference situation / baselines for the action sites to support systems approaches	**Outcome:** Engage and empower women, youth and disadvantaged in wheat value chain. Gender R4D efforts applied according to constraints and opportunities. Gender groups have perception of useful plant and animal diversity for food, medicine and income generation. **Output:** Enhance gender-focused capacity building, and women-led innovations, adopt and promote wheat commercialization in value chain. Determine gender farmer perceptions on sweet-potato; determine constraints and opportunities in farming and food systems. Report on assessment of vulnerability and risk including effect of gender on vulnerability to climate, market and other shocks. Gender-sensitive options for improved resilience for vulnerable households.	*19*
(WAS&DS) 2.7 Quantify resource use and associated tradeoffs to optimize community-level decision making to promote SI and vulnerability reduction	**Outcome:** Engage and empower women, youth and disadvantaged to promote conservation and sustainable use of biodiversity **Output:** Enhance inclusive and gender sensitive approach and capacity building to promote in-situ conservation and sustainable use of biodiversity.	*19*
(WAS&DS) 2.8 Facilitate effective linkages and knowledge exchange among different actors for improved system productivity and better market access	**Outcome:** Gender-targeted evaluation informs new R4D efforts to serve markets, enhance household nutritional status. Engage and empower women, youth and disadvantaged in process of dialogue and knowledge dissemination. **Output:** Analyze gender-specific market and household potential for orange-fleshed sweet potato.	*34*
(WAS&DS) 2.10 Review, analyze, develop and test community-based strategies for resource management including land tenure, seed systems, conflict management, access to market and financial services	Capacity building in seed multiplication and plant domestication for women farmers. Evaluation of gender role in conservation of plant genetic diversity in local communities	*10*
(E&SA) 3.1 Vulnerability frameworks	**Output:** Gender dimensions of vulnerability.	*74*
(E&SA) 3.2 Resilience - enhancing options	**Output:** Gender dimensions of resilience identified.	*13*
(E&SA) 3.4 Baseline surveys	**Output:** Gender-disaggregated data.	*64*
(E&SA) 3.7 Youth and gender	**Output:** Study - mainstreaming youth and gender in sustainable intensification activities.	*64*
(E&SA) 3.14 Food system characterization	**Output:** Assess gender differences in diet, food production and preparation.	*64*

(E&SA) 3.20 Value chain characterization	**Output:** Role of women in key value chains assessed (output)	*14*
(CA) 4.1 Marginal lands	**Outcome:** Gender issues mainstreamed in diagnostic tools and methods in salinity management. **Output:** Analyze gender roles and access to knowledge in salinity management in agriculture.	*19*
(CA) 4.3 Water use efficiency	**Outcome:** One national partner initiates improving womens' access to good practices in water use efficiency. **Output:** Analyze of gender roles and implications for water management in agriculture.	*81*
(CA) 4.4 On-farm adaptive trials	**Outcome:** Improved crop varieties cultivated that bring more food to households and higher farm income; Enhanced capacity of men and women farmers, researchers, seed producers and other stakeholders. **Output:** Young researchers and farmers trained in standard field experiments, crop management and evaluation.	*43*
(CA) 4.5 Seed systems	**Outcome:** Increase awareness for national partners of gender roles in promoting farmer-to-farmer seed exchange. Increase awareness in seed systems institutions on the role of gender in seed systems; actions to implement recommendations from gender analysis. **Output:** Analyze gender gaps in knowledge on availability of quality seed for smallholders growing stress-tolerant varieties of cereals, potato, vegetables, fruits, fodder and tree crops and rural population livelihoods.	*26*
(CA) 4.6 Innovation Platform	**Outcome:** Enhance capacity of women and youth to plan, implement , monitor and evaluate research and extension; **Output:** Increased participation of women and youth in socio-economic changes for more sustainable natural resource management; and interaction between types of households and degree to which women and youth members have engaged in this process analyzed.	*16*
(CA) 4.7 Knowledge Management CACILM	**Outcome:** National partners increase engagement in dialogue on gender gaps in access to information; one national development partner addresses the constraint. **Output:** Analyze gender differentiated knowledge of utilization of Sustainable Land Management.	*30*
(CA) 4.8 Geoinformatics capacities	**Outcome:** Improve capacity of female and male researchers, extension agents, service providers and lead farmers to apply Geographic Information Systems and Remote Sensing (GIS/RS) for sustainable management of soil, water, agro-biodiversity resources. **Output:** Analyze gender gaps in access to knowledge on applying GIS/RS.	*11*
(SA) 5.3 Capacity building of stakeholders for up scaling promising technologies	**Outcome:** Women farmers improve capacity and knowledge to use and assess new technologies and impacts on their livelihood. **Outputs:** 300 women farmers trained to create awareness and develop skills on management and performance monitoring.	*115*

(SA) 5.11 Capacity building of stakeholders for up scaling promising technologies	**Outcomes:** NARES apply strategies and entry points identified to empower women farmers. **Outputs:** A document on strategies to empower women in the agricultural and livestock value chain in west Rajasthan.	*115*
(SA) 5.18 Build capacity on collective actions and conflict resolutions for smallholders	**Outcomes:** Actors use information to engage women in collective actions and CPR management**. Outputs**: Information produced on role/equity of women in CPR collective actions to enhance ecosystem services and their equitable access (50 ha in West Rajasthan, Anantapur and Kurnool).	*134*
(SA) 5.19 Develop and assess mechanisms to improve farmers access to market	**Outcomes:** Skills and knowledge used by women farmers to better negotiate and target marketing options. **Outputs:** Women farmers in (west Rajasthan, Anantapur and Kurnool) trained on marketing options.	*115*
	TOTAL GENDER BUDGET FOR THE CRP (SUM OF ALL CELLS ABOVE) 2,839 (consists of 700 Strategic Gender and 2,139 from Gender Budget of Flagship Projects Presented in Table 2 above)	

Annex 1 – Different phases in Flagship Projects



The CGIAR Research Program on Dryland Systems brings together a wide range of partners, icluding countries, research and development organizations to bring rural communities living in the world's dry areas practical solutions for improved livelihoods and food security. The goal of Dryland Systems is to identify and develop resilient, diversified and more productive combinations of crop, livestock, rangeland, aquatic and agroforestry systems that increase productivity, reduce hunger and malnutrition, and improve quality of life among the rural poor. To develop solutions, research teams - in partnership with rural communities and countries - will validate the effectiveness of interventions in representative agro-ecosystems, and promote their scaling-out in the dry areas of five target regions: West Africa Sahel and the Dry Savannas; East and Southern Africa; North Africa and West Asia; Central Asia and the Caucasus.

The program involves a wide range of partners including nine CGIAR Centers (Bioversity International, CIAT, CIP, ICARDA, ICRAF, ICRISAT, ILRI, IWMI, World Fish), the Challenge Program for Sub-Saharan Africa, more than 60 national agricultural research systems, advanced research institutions, development agencies, civil societies and the private sector. It also involves research associations including GFAR, AARINENA, APAARI, CACAARI, FARA, ASARECA and CORAF.

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