CGIAR

RESEARCH PROGRAM ON
Dryland Systems

International Center for Agricultural Research in the Dry Areas (ICARDA)

2015 Annual Report

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Food security and better livelihoods for rural dryland communities

The CGIAR Research Program on Dryland Systems aims to improve the lives of 1.6 billion people and mitigate land and resource degradation in 3 billion hectares covering the world's dry areas. Dryland Systems engages in integrated agricultural systems research to address key socioeconomic and biophysical constraints that affect food security, equitable and sustainable land and natural resource management, and the livelihoods of poor and marginalized dryland communities. The program unifies eight CGIAR Centres and uses unique partnership platforms to bind together scientific research results with the skills and capacities of national agricultural research systems (NARS), advanced research institutes (ARIs), non-governmental and civil society organizations, the private sector, and other actors to test and develop practical innovative solutions for rural dryland communities.

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

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This document was prepared by Douglas Merrey (Team Leader), Judit Szonyi (member) and Ross McLeod (member) of the CRP-Commissioned External Evaluation team for the CGIAR Research Program on Dryland System. The views expressed in this document do not necessarily reflect the views of the Dryland Systems program.

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List of Acronyms

ECBA	Extended Cost Benefit Analysis
FBNYV	Faba Bean Necrotic Yellows Virus
IFAD	International Fund for Agricultural Development
IP	Impact Pathway
IRR	Internal Rate of Return
MRB	Mechanised Raised Bed
NARS	National Agriculture Research System
NAWA	North Africa and West Asia
NPV	Net Present Value
SI	Supplemental Irrigation
SLA	Sustainable Livelihoods Approach
WP	Water Productivity

SECTION I – Key MESSAGES

a. Synthesis of Progress and Challenges (1 ½ page)

The significant cuts to CRP DS budget for 2015 had serious implications on the implementation and the continuation of a range of activities across the three countries hosting CRP DS (Egypt, Morocco, and Tunisia). In this respect, the planned total area under conservation farming in Meknes and Sidi Bouzid Sites was reduced and the activity on the agro-pastoral system bio-modeling, a key component in assessing systems, was curtailed. The repeated cuts in the budget destabilised relationship with NARS and created an atmosphere of mistrust and a lack of confidence in the CRP and the CGIAR as a whole. This had significant implications for staff being able to make regular visits to the action sites as per the agreed upon work plan 2015. Whilst the challenges associated with budget cuts are by no means a reflection of the management of DS and the partner Centres, it does reflect a systemic flaw in the funding approach to the CGIAR. It is of note that that even with these budgetary issues the NARS provided significant support to selected activities that they considered important to their overall strategy. It is clear that these challenges have affected system research across the action sites. It is hoped that the budgetary challenges facing the CRPs will be addressed in Phase 2 and that great stability in funding will emerge.

Even with the challenges significant outputs emerged over the reporting period some of which are highlighted below:

1. Within the NAWA region CRP DS is studying the effectiveness of 44 introduced technologies. These are categorized into mechanical/physical, biological, chemical technologies, along with the introduction and management of crops and livestock. Between 25 to 100 % of these technologies and approaches have an explicit target of reaching women farmers. Most of these technologies are being evaluate in the field and 30 % of the technologies is targeted at decreasing inequality between men and women. Approximately 25% of the technologies that have emerged through the Program are being out-scaled through public and private sector partners. They include zero-till seeders, small scale olive harvesters, improved rams, soil and water conservation technologies, small ruminant feeding systems, small ruminant health control, community-based seed production, conservation agriculture practices, supplemental and deficit irrigation, and cactus production and transformation.
2. The CRP DS team in NAWA introduced novel and improved technologies that have enabled farmers to increase their productivity of their system while saving water. These include but not limited to no-till cropping, supplemental irrigation, and raised-bed technologies. Numerous on-farm trials have been conducted in the target CRP DS sites targeting dissemination of these technologies and the development of technical manuals and protocols to enhance crop production with minimum inputs (i.e. water). For example at the Mekness site supplemental irrigation (SI) proved efficient in improving crop yields while saving water when compared to farmer's practice. Supplemental irrigation combined with early planting increased wheat and potato yields by 43%. The introduction of the mechanized raised-bed technology (MRB) in the Nile Delta increased wheat and faba bean yields by 25% when compared to farmer's practice. This latter based approached focuses on more efficient distribution of water along furrows thereby saving water application at the field scale. There are clearly significant advantages in moving towards MRB approaches in surface irrigation systems with respect to energy savings. In Sidi Bouzid area (agro-pastoral system), barley

cropping between the rows of cactus (cactus-barley alley cropping) under conservation farming improved barley yields (grain and straw/stubbles). These combined technologies hold promise to enhance barley production while saving water and avoiding the deleterious impacts of increased soil loss through both water and wind erosion.

While the above technologies target crops, CRP DS started working on water productivity (WP) for livestock production under the rain-fed (Mekness-Morocco) and the agro-pastoral (Sidi Bouzid-Tunisia) systems. WP for milk production form cattle was investigated on 4 farms at the Mekness action site whilst WP for sheep and goat meat production was assessed in Sidi Bouzid. Research on the aforementioned is on-going and will provide practical recommendations for better use of water for meat and milk production under the prevailing conditions in the context of different production systems.

3. Policy studies continued over the reporting period with a focus on the impact of water harvesting technologies, assessment of cereal farm aggregation, viability of solar energy options, the seed and wheat sector, ground water tariff policy, and land policy. It is anticipated that the outcomes of these initiatives over 2016 will influence decision makers in implementing the required reforms need to ensure an enabling environment is created.
4. Around 1000 farmers are actively involved in the testing and assessment of the various technologies/tools in the NAWA region that is estimated to have an impact on approximately 22,000 ha.
5. The scientific outputs from the NAWA region over the reporting period includes the publishing of 11 research papers in ISI journals, 9 papers in non ISI peer-reviewed journals, and 9 papers in peer-reviewed proceedings. It is anticipated that these figures will rise in the final year of the Program. Further, other communication tools (blogs, leaflets/factsheets, manuals, technical reports, and media coverage) were produced to support the dissemination of the research findings.
6. The development of open access data bases is at an early stage, with databases covering various fields, including agro-biodiversity, household baseline surveys, animal nutrition deficiencies, gender inclusiveness, and climate change maps. There is a need to invest in this activity and bring it to a higher level, a process that is on-going through the development of a platform that will be used in monitoring and evaluation.

7. CRP-DS NAWA team invested in partnership building to strengthen collaboration with NARS, NGOs, development agencies, the private sector and decision makers in each of the target countries. It is worth noting that the program is effectively dependent on the efforts of bilateral projects in the region in the generation of research outputs. In this respect GIZ has funded three new projects in Tunisia one on the use of solar energy for milk cooling at the farm level; the provision of proven feed resource technologies to improve the red meat value chain in Tunisia; and an initiative that is entitled “Randomized complete trials on the impact of agro-technical interventions on the income of female and male youth in Sidi Bouzid/Tunisia”.

b. Significant Research Achievements (1 page)

n/a

c. Financial Summary (1/2 page)

This section will be updated once your center closes the accounting books in 2016.

SECTION II– IMPACT PATHWAY AND INTERMEDIATE DEVELOPMENT OUTCOMES (IDOS)

a. Progress Along the Impact Pathway (1/2 page)

Developing systems research has been a challenge for scientists from ICARDA and the. Since the start of CRP DS efforts have been made to tackle this impasse. The new system expert, Dr Quang Bao Le who joined CRP DS-PMU in early 2015, assisted the CRP DS teams (ICARDA and NARS) in better understanding and conceptualizing system research and provided assistance for the action site coordinators in the development of impact pathways for the CRP DS work in the three NAWA action sites. The format of the impact pathway was revised as per that for the action site Beni Kedache-Sidi Bouzid (agro-pastoral system). Through an integrated system analysis, a set of integrative interventions has been made based on the potentials of the action site in order to address the identified constraints. As developed below these interventions include a range of promising technologies that include conservation farming, integrated and cost-effective agronomic packages (e.g. supplemental irrigation combined with early planting of crops, mechanized raised-bed technology combined with improved varieties, fertilization and IPM, etc.). These technologies among others introduced in the CRP DS sites are in line with the main challenges (e.g. water scarcity, climate change, natural resources degradation, etc.) that are hindering the development of agriculture and the empowerment of the livelihoods of the rural populations. The quantitative assessment of these interventions revealed that most of the technologies studied by CRP DS are welcomed by farmers and that they hold promise in improving system productivity and sustainability. The next step will be the integrative implementation of promising technologies at, thus efforts should be made to attract and convince potential partners (donors, development organizations, NGOs, etc.) to invest in upscaling and out-scaling of CRP DS achievements. We consider that at the current stage of CRP DS it is early to talk about the impact assessment of introduced technologies as the life cycle of CRP DS is short.

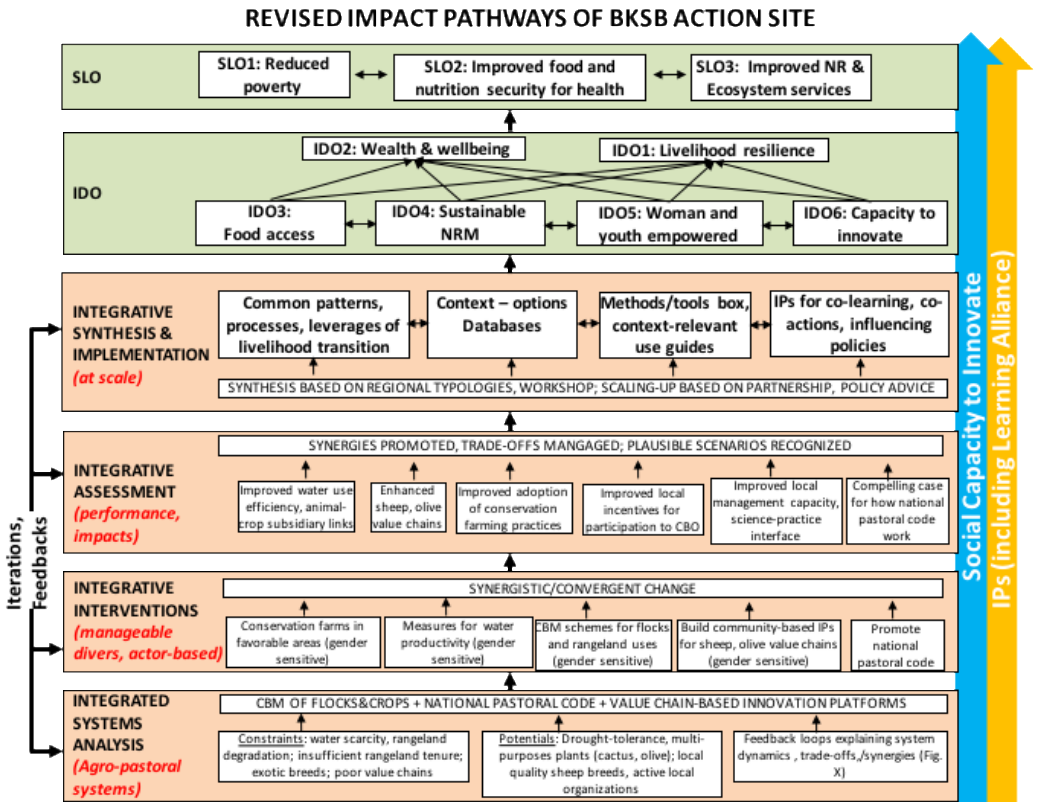

Figure 1. Impact pathway for Beni Kedache-Sidi Bouzid Site (Agro-pastoral system)

The IPs for the two other action sites are being revised and are presented in Figures 2 and 3 below.

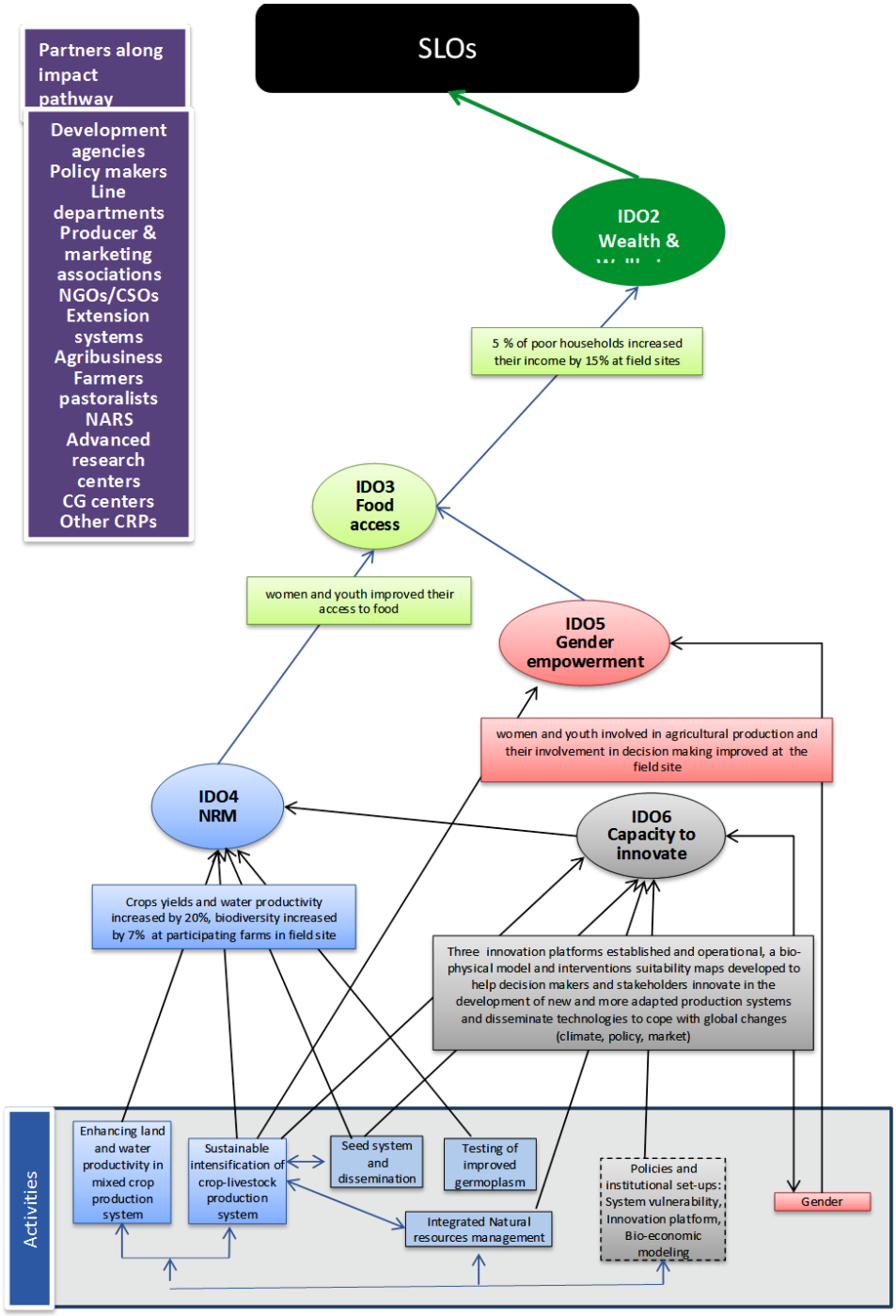

Figure 2. Impact pathway for Mekness site (Rain-fed based system) and associated contribution to IDOs.

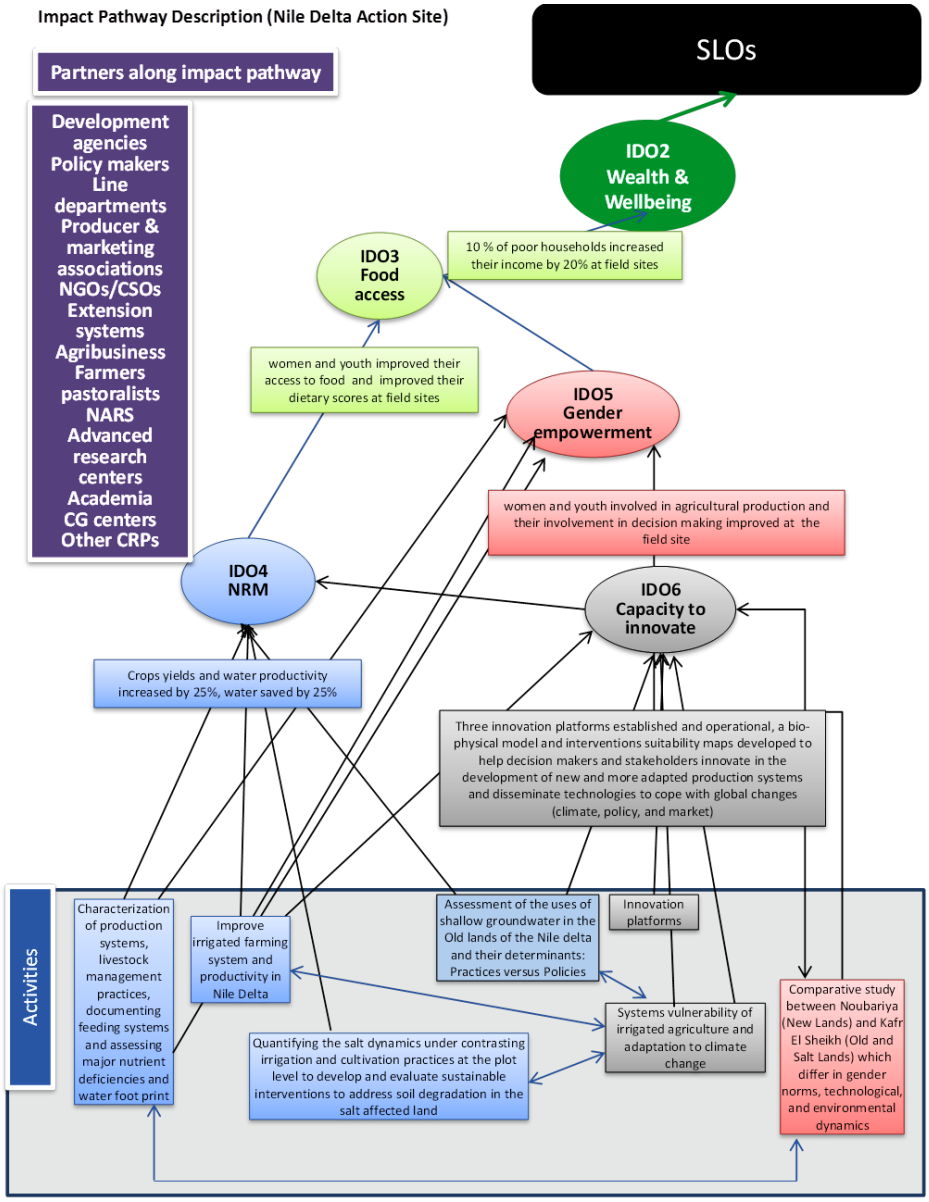

Figure 3. Impact pathway for Nile Delta site (Irrigated crop-fed based system) and associated contribution to IDOs.

b. Progress in NAWA/AgroPastoral

I. Progress towards outputs (2 pages)

The following examples are presented as evidence of progress that has been made in the NAWA action site over the reporting period.

Innovation platforms and women/youth associations

The research and development activities were undertaken by IRA (NARS) in collaboration with IFAD and local NGO's in Beni-Khedache under the aegis of the innovation platform. These initiatives were identified based upon a mutually agreed and identified entry points in the innovation platforms would support the development a learning alliance. In 2015, IRA strengthened market linkages through producer organizations, envisioned under the innovation platform initiative, driven by its institutional mandate for applied research for development; and with limited engagement on a common DS framework for scientific methodology given the inability for DS to effectively support the same.

Post-Harvest and Market Access

Scientific ISI journal article on "Poverty and olive oil in Tunisia: examining options for inclusive development" will be submitted to the Development Policy Review (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1467-7679). An ISI journal article on "Value chain analysis of sheep in Sidi Bouzid, Central Tunisia: Main stakeholders and marketing channels analysis" will be submitted to Small Ruminant Research (http://www.journals.elsevier.com/small-ruminant-research/). Further the creation of value chain "Dar El Oula" in Zammour community was achieved and approximately 15 rural women from Zammour are involved in the "Dar El Mouna" project

Impacts of soil and water conservation works

A study on the benefit/costs analysis of soil and water conservation investments in Oum Zessar watershed in South Tunisia applying an integrated impact assessment framework was completed. The framework combines extended cost benefit analysis (ECBA) with the sustainable livelihoods approach (SLA). Results show that coupling the two methods is useful to upscale impact assessment from field level to regional level and to cover the impacts on different rural household capitals (human, financial, physical, natural and social) influencing well-being of the local population. The analysis for 30 years period found that, despite environmental externalities in the form of increased flood damage, investments in water harvesting techniques are beneficial at private and social levels for the local population. The financial analysis indicated that these investments are highly beneficial with 30 years IRR of 24% and a positive NPV of 3615 TD/ha at 10% discount rate. The economic analysis using market prices and accounting for subsidies, the investment becomes even more interesting with a NPV of 4283 TD/ha (discount rate of 10%) and an IRR of 27%, which is a clear improvement compared to the financial analysis. These results are robustly positive at a high discount rate of 12% (NPV of 2073 DT/ha) and reduced benefits when considering some negative environmental effects such as higher flood damage due to failure of Jessours (NPV of 1333 DT/ha and IRR of 20%). Besides the financial and economic benefits, the positive impacts of the soil and water conservation techniques on livelihoods of the local population were evident.

Pastoral Code and related policies

Pastoral codes and related policies are important in Tunisia as the current rules and regulations are promoting open access pastoralism and illegal and legal privatization, which has resulted in degradation. Laws that govern and manage communal tenure with greater involvement of all government actors are needed. The project has successfully raised awareness of the pastoral code approach to sustainably managing this resource. A bibliography on the governance of sustainable rangeland management that would facilitate dialogues was developed. In addition, two successful face-to-face workshops were held. The first workshop was to initiate the discussion with various stakeholders (Government ministries, extension workers, development agencies, FAO, and the real estate court) and the second workshop was to formulate various institutional options for the pastoral code. An action plan was developed as an outcome of the second meeting that is currently under development with the Ministry of Agriculture. This is important as it builds ownership and ideally insures sustainability of any new proposed polices. Further work would help to follow up with this action, build further awareness, and conduct a cross comparison study. The project has successfully initiated dialogues at the national level and involved multiple government ministries, development agencies, the United Nations, as well as the real estate court.

Management of water scarcity

The output planned under this activity is to search and analyse previous research conducted in Tunisia on the impact of soil and water (SWC) measures and water harvesting (WH) structures. Preliminary results on SWC's adoption by farmers and impacts in the study sites available was completed in June 2015 and published in ResearchGate. The paper has been well received based on the number of downloads that has occurred. The research on the impacts of SWC techniques at the watershed level are ongoing at two sites located in the Béni Khedache-Sidi Bouzid transect (Kaf-Hamam – Zoghmar

watershed, central Tunisia; Koutine watershed, Southern Tunisia), and in one additional site located in semi-arid northern Tunisia (Sbaihia – Rmel watershed). This research is based on hydrologic process modelling under varying land use and SWC scenarios. Research aimed at the analysis of factors affecting the adoption of SWC in Sidi Bouzid site has been completed employing a binary logistic regression model with data obtained through a survey of 250 farmers. Preliminary results are available.

Management of communal rangelands and biodiversity conservation

An assessment of the biodiversity of forage plants was performed using multiple transects in different locations as well as a survey of pastoralists knowledge of these plants. Trials to improve seed productivity and to understand the adoption of some species were conducted. A forage nursery was established. These activities help understanding the status of agro-biodiversity within the action site in Tunisia.

Multiple conference proceeding papers were written on non-destructive techniques for estimating rangeland vegetation cover and biomass. New techniques that were developed are described in these papers along with their applications. A peer reviewed paper on "A reliable and non-destructive method for estimating forage shrub cover and biomass in arid environments using digital vegetation charting technique," was submitted to the journal of Agroforestry. A workshop training of trainers was conducted in Amman, Jordan that focused on sustainable land management techniques (SLM) that are globally supported by FAO and IUCN. One ISI journal article was published on improving seed establishment of *Artemisia herba-alba*. Two articles are in press regarding mapping land degradation in the region and another on the future priorities for grasslands in the Mediterranean. The impact of climate change on rangeland plant communities has been undertaken using an ecological modelling approach.

Community-based flock and crop management

Cost-effective and environment friendly options were targeted to improve the efficiency and sustainability of livestock-based system along the transect Sidi Bouzid-Beni Khedache. The options presented below were selected to provide practical solutions for cropping and livestock constraints that prevail in this action site.

Introduction of conservation farming – Water scarcity coupled with the high cost of fuel and the high labor demand of conventional farming (tillage-based) have been the main drivers for the increased awareness and readiness of farmers to test conservation farming. For the 2014-2015 cropping season, around 30 ha under CA system were implemented in the Zoghmar community to show to farmers the benefits from CA as compared to Conventional farming in terms of crop productivity and water use efficiency. Barley production based systems were implemented in open fields or cactus rows (alley-cropping technique). This season was exceptionally dry (rainfall 186 mm vs average annual rainfall 350 mm). Results have indicated that grain yield (0.7 vs 0.57 T/ha) and above ground biomass (1.88 vs 1.62 Ton/ha) of barley were higher with CA than conventional farming. Water use efficiency (WUE) of grains was increased by 21% and 8% under CA and conventional farming; respectively reflecting the importance of alley-cropping and CA as an option to adapt to drought/CC. Mapped projects to CRP DS in Tunisia support these findings and contributed significantly to the up-scaling of CA. It is clear that the CRP DS through a system approach had contributed significantly to the wide dissemination of CA by farmers living in the action site but also in other semiarid areas of Tunisia.

Establishment of a flock management programs – sheep production is still the most important activity of farmers in central and southern Tunisia. However, numerous factors affect the productivity of these animals and there are emerging challenges. These include mainly feed and water scarcity and changing quality (nutrient deficit and water salinity), heat stress, and low market access. Therefore, we considered important to assess changes, if any, in sheep husbandry practices and flocks' structure, to evaluate the degree of crossing between Barbarine native breed and thin tail breeds and to monitor

the effect of actual market demands on existing sheep breeds. 120 Surveys were conducted in two major small ruminant production locations in Sidi Bouzid Governorate targeting flocks, butchers and meat consumers. The characterization of the production systems focused on the current breeding practices in small ruminant flocks, on marketing channels and opportunities for animals and their products, marketing animals and on institutional settings that affect animal management. Three major sheep practices were identified: the first group was the lamb producers (LP) only and they represent 21%, the second cluster was the lamb producers-fatteners (LPF) which represent 55%; and the third one was the fatteners only (F) representing 24% of the total sheep practices in Zoghmar community. Compared to 2004, livestock owners, who had been mainly breeders, represented 47% while 33% were breeder-fatteners and 20% were fatteners. Livestock practices have changed from breeders to breeder-fatteners and to only fatteners with less dependency on rangeland grazing and more use of purchased feeds. For each group, there is a dominant genotype: the (LP) raised mainly the Barbarine breed (native fat-tail breed) under low input production system (rangelands are considered the main feed source for these animals with small amounts of concentrate feed supplements occasionally provided. The (LPF) group has 50% Barbarine and 50% Ouled jlel (Algerian thin tail) breeds. For the (F) group, they fatten mainly Algerian thin tail lambs. This breed is a trans-boundary breed between Tunisia and Algeria, and this group is mainly intensive and relies on purchased feed and concentrates. For the two last groups that practice fattening, three fattening periods are followed in Zoghmar community: a short fattening period where fatteners sell their lambs at less than three months after weaning. A second cluster of fatteners that have an average of 3-6 months of fattening after weaning and a third cluster of long fattening period with more than six months after weaning and those animals were mainly for religious holiday (Aid el Edha).

Feeding management – In the region of Sidi Bouzid, sheep feeding costs are estimated to range between 362 and 265 Tunisian dinars/head/year for the Algerian thin tail breed and the Barbarine breed respectively. The strategy followed by CRP-DS is to reduce the cost of production by reducing the concentrates used in the animal feed, and by relying more on on-farm feed production and other alternative feed sources that are inexpensive and locally available. The assessment of flock management in Zoghmar community showed that feeding calendar is composed of four types of diets and diets contain 30 to 70 % of concentrate feeds (barley, wheat bran and commercial concentrate). In the summer and autumn season, farmers rely on cactus to replace part of concentrate feeds and gross feedstuffs (stubbles, hay and straw).

Mutation of livestock-based systems – Understanding farmers' objectives and practices is crucial to develop appropriate strategies for the improvement of livestock production. Through the CRP DS work, it is clear that farmers are shifting their practices from a totally rangeland-based system to a mixed system based on 56% rangeland (traditional system) and 44% indoor (semi-intensive or intensive) with feeding concentrates for fattening lambs. Over the past two decades, the fat-tailed breed commonly named Barbarine sheep used to be the unique breed reared in the region of Sidi Bouzid. Currently, lambs are now produced from three genotypes: the Barbarine, the Algerian thin tail and their crosses. In addition, sheep farmers in Sidi Bouzid have shifted (more than 50%) from the Barbarine fat tail to the Algerian thin tail breed to satisfy mainly butchers. The practices of indiscriminate crossbreeding of the local Barbarine breed with introduced breeds (mainly with the thin tail breed) has led to many populations and genetic erosion of the adapted indigenous populations. This represents a threat to the integrity of the local breed. For market trend, we noticed at the same age and lamb weight, the prices payed by butchers for Algerian thin tail breed are 40 TND higher compared to fat tail lambs, the price being dictated by butchers. However, consumers still prefer the fat-tail Barbarine breed; the Barbarine lambs tend to be superior in flavor and acceptability to consumers; and meat of lambs from Sidi-Bouzid tend to have higher acceptance for its distinct flavor and quality than that of lambs reared in urban areas. The establishment of the local community

based organization (CBO) has facilitated the empowering of small farmers in Zoghmar through improved production of lambs and increased selling price.

Water productivity and management for livestock – Livestock production in semiarid and arid areas in Tunisia is constrained by water scarcity. Producing more meat with less inputs including water consumption is a perquisite in farmer decision making. Surveys were performed to asses water use for livestock production systems and to generate data required for the determination of water productivity (WP) for sheep and goats. Results indicate that both physical and economic water productivity for goat meat (2.57 $/m^3 and 0.238 kg/m^3) are higher than for sheep meat (1.70 $/m^3 and 0.158 kg/m^3). In terms of economic water productivity, production of goat meat is more efficient that producing sheep meat. Restricted access to drinking water is common in southern Tunisia. Grazing sheep/goats and dromedaries have discontinuous access to watering points. Consequently in order to assess goat response to water restrictions, a control group (permanent access to water) was compared to a group subjected to recurrent 4 day-cycles of water deprivation (period 1: hydration; period 2: water privation and period 3: rehydration). The water deprivation during 4 days resulted in a daily weight reduction (5%) in the local goat. Water restriction group exhibited significant decreases in feed intake and breathing rate. Water deprivation results in increased levels of liver enzymes ALT, AST and urea during the period of deprivation. Goats mobilize their reserves as a mechanism to cope with water deprivation.

Monitoring of the nutritional status of grazing sheep, goat and dromedaries - This research aims a seasonal evaluation of the nutritional status of grazing sheep, goats and dromedaries in Beni Kedache-Sidi Bouzid transect. A questionnaire survey was conducted to analyze the feeding practices of farmers. Data generated through this questionnaire was instrumental in the collection and analysis of blood profiles and the determination of nutrients in feed (range vegetation, gross forages and feed supplements) to determine nutrient balance in the feed. These analyses are in progress. The deficit of some trace minerals including copper and selenium was identified in the Zoghmar community flocks. Experiments have been designed to evaluate sheep response to the observed deficiencies.

Health control - Serological and molecular prevalence of Toxoplasma gondii in meat sheep in the governorate of Sidi Bouzid – Livestock health is a major factor affecting their productivity and could have serious implications on human health. Sheep is the main intermediary *T. gondii* host. The primo-infection in pregnant ewes causes abortion thereby inducing high economic losses. During early pregnancy, infection can cause fetal death and resorption. *T. gondii* is zoonotic; humans get infections after ingesting raw or undercooked meat or oocysts via vegetables; or congenitally by transplacental transmission of tachyzoites. Previous studies in Tunisia reported a high seroprevalence (70%) in girls in marrying age from rural Northern areas. The role of sheep meat consumption in the cycle has not been established in Tunisia. It is important to understand the infection pathway and mode with respect to human infection in order to develop interventions to reduce contaminations. A study was undertaken in the governorate of Sidi Bouzid to estimate the prevalence of *Toxoplasma gondii* DNA in female sheep meat. Preliminary results show that the overall prevalence of *T. gondii* infection in meat was 31.03%. There were no differences in prevalence according to age group, breed or locality ($p > 0.05$). In 2013, this prevalence was estimated to 25.5% in the same region in heart apexes of 106 sheep. Moreover, few Toxoplasma genotypic studies associated with human toxoplasmosis in Africa have been carried out. The predominance of genotype II was reported. Sequencing and SNPs analysis enabled typing of meat isolates in sheep and revealed the presence of mixed strains in Tunis City. Genetic studies will determine the occurrence of different genotypes in Sidi Bouzid Region.

II. Progress towards the achievement of research outcomes and IDOs (2 pages)

Innovation platforms and women/youth associations
Due to limited funds and staff time allocation there was limited progress made on this platform.

Post-harvest and market access
Two stakeholder workshops were organized in Beni Khedache to promote the value chain “Dar El Mouna" in Zammour, Béni Khédache (Tunisia). An outcome from these meetings was the formation of a committee to monitor procedures for promoting this value chain.

Impacts of soil and water conservation works
The overall aim of this study is to inform stakeholders including researchers, farmer organizations, development organizations and policy makers on the financial, economic and social feasibility and returns to investments in soil and water conservation practices in the dry areas. Social changes at large scale occurs only after robust social debate. The study provides the needed empirical evidence as input into the public discourse among stakeholders and contributes to the efforts in sustaining soil and water conservation programs which are not only wise investment in terms of financial and economic returns but also have clear impacts on the livelihoods of local populations. This first step of the pathway towards the IDOs has been accomplished.

Pastoral Code and related policies
Rules and regulations for effective and sustainable use of rangelands are being developed to support the sustainable use of rangelands. The Ministry of Agriculture of Tunisia is developing an action plan to formulate pastoral laws that insure communal land management of pastoral areas. Further project support through backstopping is supporting the development of the action plan. The projects work is laying the foundation for the potential of more sustainably managed agro-ecosystems. As pastoral land in Tunisia is arid and susceptible to variable rainfall, individual property rights may not be well suited to these systems as it would effectively exclude significant number of pastoralists from access to large tracks of land, this representing the capture of resources by a small minority resulting in social exclusion and conflict. However, open access also creates the tragedy of the commons. While the team has worked with communities to promote the concepts of sustainable pasture management that sells grazing permits, Tunisia needs better pastoral laws to support communities who want to have greater standing forage and more sustainable managed agro-ecosystems.

Management of water scarcity
The outcome of this activity (Tools, methods, processes and capacity of stakeholders to create/customize resilience options improved) involves increasing the capacities of the NARS by means of joint research and scientific publication with ICARDA. This initiative targets the following IDOs: *Enhanced adaptive capacity to climate risks, Enhanced capacity to deal with climate extremes, Enhanced individual capacity in partner research organizations through training and exchange; Land, water and forest degradation (including deforestation) minimized and reversed.*
The outcome indicator for 2015 (number of reads of the published literature review) has been exceeded expectation. The outcome indicator for 2016 will be matched if three papers will be accepted by ISI journals. In 2015 three Tunisian PhD students participated in at least one training on advanced watershed modelling organized by ICARDA in Amman.

Management of communal rangelands and biodiversity conservation
While the project outcomes are not due until 2016 the activities performed this year are contributing to the awareness of rangeland biodiversity through multiple factsheets that have been developed on different species. In the biodiversity assessment that was conducted capacity of the national staff was

strengthened. The project funding made it possible to develop multiple tools, methods and processes to assess rangeland health. Such tools are essential to provide timely and cost reduced ways of assessing rangeland status in order for management strategies to be adapted before critical thresholds are reached.

Community-based flock and crops management

A high rate of adoption of conservation farming is one of the key outcomes of CRP DS. Some achievements of CRP DS reflect an increasing interest of farmers and stakeholders in conservation agriculture. The following s illustrate these:

- 1000 ha in semi-arid regions were implemented under CA system at Siliana governorate in collaboration with an IFAD-funded development project (PDRAI), IFAD-ICARDA CLCA project focusing on integrated crop-livestock under conservation agriculture and the program work of the National Institute of Field Crops (INGC-Tunisia)
- 250 ha in sub-humid region were implemented under CA system at Jendouba governorate in collaboration with the ACIAR-CANA project (Conservation Agriculture in North Africa) and INGC
- 200 farmers have adopted CA system
- 700 farmers and NGOs were trained in conservation agriculture (farm field school, field days and training)
- Local farmers association created and 3 innovation platforms that have been implemented
- 15,000 people (farmers, NGOs, students, researchers, extension service, policy makers, and private company) were informed and targeted directly and indirectly by Radio broadcasts, TV programs, leaflets, Factsheets, field days, training, web site.

III. Progress towards Impact (1/2 page)

It is too early to assess the impact in most research fields investigated under the framework of CRP DS. However, work undertaken to date on the value chains of olives and olive oil and Sidi Bouzid meat sheep production holds promise that will reinforce the importance of olive and sheep husbandry in the agro-pastoral production system of Tunisia.

IV. Unexpected Outputs, Outcomes and or Impact

In order to increase the profitability of products of origin, a request on the labelling of two local products, i.e. Olive oil (variety Zarrazy) and Barbarine breed sheep have been submitted to the registration authorities in Tunisia. Labelled products of origin will create improved markets and as consequence it will result in increased farmer incomes.

c. Progress NAWA/ Rainfed

I. Progress towards outputs (2 pages)

Dissemination of conservation agriculture

Efforts have been made to promote CA among farmers in Mekness (Morocco) action site. Compared to other areas in Morocco, farmers in Mekness are not familiar with conservation farming. Through CRP DS, 34 farmer managed demonstration fields with CA were established. A higher number of farmers and the area under CA were not achieved due to the limited funds made available. A field day was organized with stakeholders (40 farmers in two associations: Ennasir and Bismilah). Chickpea and wheat were seeded using no-till and conventional seeders. Farmers observed through these field demonstrations the higher wheat and chickpea grain and biological yields when seeded with no-till seeders. The soil suitability map for CA established indicates that

based on biophysical properties, more than 60% of soil are highly to moderately suitable to no-till for cereal-based system in Meknes-Saiss region. These achievements suggest that CA has signficant potential in this action site in terms of low cost crop production coupled with the environment protection (soil biological nitrogen fixation, water saving, etc.).

Fertilizer management in mixed cropping system

Fertilization is a key element in the agronomic package that is recommended to crop producers. Even though practical information on legumes fertilization are scanty. To generate such information for farmers in Mekness site and elsewhere we compared 3 Moroccan faba bean varieties (V) (*Vicia faba minor*) Alfia 5, Alfia 17 and Alfia 21 that were grown under four phosphorus (P) rates (0, 20, 80 and 160 kg P_2O_5/ha) in the INRA-experiment station of Douyet in Meknes action site. Statistical analysis indicates no significant effect of phosphorus rate, variety and their interaction on the nodulation parameters (nodules number and weight), biomass production at flowering and total dry matter and grain yields at harvest. However, although not significant, grain yield tended to be affected by P rate variation; with varieties responding differently. The optimum yield was attained at 80 kg P_2O_5 /ha by the varieties Alfia 17 and Alfia 15 and at only 20 kg P_2O_5 /ha by the variety Alfia 21. Alfia 17 was the most productive under all P fertilizer rates.

Cereal and legume systems IPM

Faba bean (food and feed types) production, combining two hoeings with a single herbicide application (Haloxyfop-R Methyl Ester) increased seed yield by more than 2 tons/ha when compared to non-weeded plots which yielded < 1 ton/ha. In the management of wheat diseases (mainly Septoria leaf bloch) and weed control, application of fungicide and herbicide application resulted in > 3.5 tons/ha seed yield at Ain Jamaa and more than 4 tons/ha in Sidi Slimane. In both locations, the check gave less than 1.5 tons/ha seed yield. A total of 45 farmers were trained in both communities and the results were promoted through radio and television. One field day was organized in Douyet Research station and over 40 farmers and researchers attended the event. The effort in identifying post emergence herbicide (30 days after crop emergence) to control dicot weeds indicated that the herbicide Bentazone provided adequate control of weeds and low phytotoxicity on chickpea, faba bean and field pea. However the herbicide was toxic on lentil.

Water and land productivity in rainfed systems

As completion of the agronomic packages that should be transferred to farmers in Mekness site, irrigation is an element that could improve crop production. However, in the context of water scarcity, supplemental irrigation (SI) holds promise in stabilizing and increasing crop yields while saving water. To increase awareness of this approach amongst farmers, a set of studies were conducted. Firstly, the study focused on the combined effect of planting date, SI and varieties of durum wheat. In addition, two on-farm demonstration trials on the response of wheat to the application of improved packages of full supplemental irrigation (FSIP) and deficit supplemental irrigation, DSIP (SI and DSI + improved agronomic practices) were undertaken at the Oulad Driss site in Tadla. CRP DS team conducted three trials on deficit irrigation of olive trees, potatoes and onion in Bitit site of Meknes region. Data on yield and water use were collected and an annual report summarizing the results produced. Two field days were conducted on wheat (30 farmers) and potatoes (25 farmers). For all crops, the application of deficit irrigation (75% of crop water requirement or ETc) allowed the optimum yield and the highest water level reduced water productivity. Under SI conditions, early planting increased yield by 43%, as compared to late planting. However, under rainfed situations, early planting increased yield by only 17.2%. Durum wheat Karim tended to out yield the other three varieties (Louiza, Massira and PM9). The lowest yields were obtained by PM9. For improved packages FSIP and DSIP increased yields by 18% and 9% (18% in the previous year), respectively and DSIP saved 895 m^3 of water. In trials conducted

in two orchards of olive trees, irrigation reduction of at 25% ETc did not negatively affect olive yield; but it improved olive oil content. However, there was a significant reduction in olive yield (23% for Menara and 20% for Arbequina cultivars on average) with a deficit irrigation of 50% ETc. In potatoes, the reduction of irrigation water by 1/3 and 2/3 as compared to the amount of water applied by the farmer increased by 15% and decreased by 10% tuber yields, respectively. In brief, farmers are now aware of a set of promising agronomic packages that are easy to apply and cost-effective for improved crop yields.

Water productivity of forage/cattle

Bearing in mind the problem of water scarcity that is being exacerbated by climate change prevailing in North Africa, the improvement of water use efficiency (WUE) at the farm level is among the research priorities in the CRP DS agenda. The current activity has characterized WUE in dual purpose cattle farming systems in Meknes site. The results indicated that many impediments determine the final performance of water productivity in cattle farming. An insufficient supply of feed combined with the frequent imbalances between energy and nitrogen is a widespread problem. This research indicated that milk production uses only 20.5% of the water it needs from irrigation, the remaining volumes coming from rainfall and virtual water. Therefore, in the context of dry years, as in this case, the livestock sector appears to be less dependent on groundwater than traditional cash crops of the region.

System vulnerability

A baseline study on the production and livelihood systems in the Menes-Saies site was completed. The analysis indicated relatively high levels of non-attendance of school amongst surveyed household heads leading to high illiteracy levels of 37-40%, which was higher among women members. Land fragmentation is a problem with one third of the surveyed households cultivating 2 hectares or less. Agriculture provides 33-60% of the household income, with 34% from rainfed crops; 33% from irrigated crops; and 18% from livestock. Contrasting this, off farm income contributes approximately 12% to household income; but this source is more important for the smallholder farmers who are receiving income levels below the poverty line of USD 1.2 per person per day, estimated at 27.4% of the households having income levels that fall below that poverty line. An exodus from agriculture was the most frequent strategy for smallholder farmers as a result of climate shocks i.e. drought. Low awareness of adaptation measures to climate shocks were registered among farmers. Although cereals (mainly wheat) and food legumes cover the largest areas, there is, resources permitting, increasing cultivation of high value crops such as onions, potatoes, fruit trees and vegetables. The sustainably of these intensified production systems both economic (market aspects) and resources and environmental constraints, should continue to be the focus of research and policy. The government of Morocco has an ambitious program of supporting this intensification process.

Innovation platforms (IP)

The outputs generated by the research conducted is that: 1) An innovation system emerged as a successful approach to disseminating information and connection a range of stakeholders at the Meknes site. The IP comprised of: (i) ICARDA and INRA, (ii) ONCA, (iii) water user associations and farmer cooperatives, (iv) Credit Agricole, (v) private input suppliers, (vi) private farmers, (vi) DRA Meknes, (vii) OCP foundation and there is evidence to suggest the a private potato processing factory will join the platform in 2016. The innovation system aims at improving market access to credit, output markets, productive inputs as well as technical knowledge and advice in reducing post-harvest loss,

A 5-day workshop on lessons learned from innovation driven research under DS in NAWA, conducted by Shinan Kassam in Cairo over the period of April 26 to April 30, and funded by the Arab Fund for Economic and Social Development (AFESD) was a key output.

Bio-Economic models

The Principal Component Analysis of the absolute percentage value of the loadings of the factors of production in Meknes site shows that the variables describing intensification levels (water, nitrate, labour, etc.) have the greatest loading with the first principal component (PC1). The second principal component (PC2) is associated with vegetables (onion, potatoes, etc.) and revenue from legumes (particularly faba-beans). In the final analysis, the two axes (PC1 and PC2) explained 56% of the variance. These PCs were therefore used as classification variables in the Hierarchical Cluster Analysis allowing the identification of 4 classes of farms namely:

- Households with small intensive vegetable farms: Class 1 contains the farms with the highest inputs use (e.g. average water cost: 8285 dh/ha), high soil fertility (76% of soils have high fertility), fairly low cereals production and a high vegetables consumption (potatoes and onions). This class is predominantly farms growing vegetables crops on hillsides (altitude of 673 m).
- Households with large cereal/legume farms: Class 2 mostly contains farms cultivating rainfed cereal and legumes in the plains of Sais. This class has fairly high labour use (228 dh/ha), low nitrate use for fertilization (7 dh/ha), and the highest level of cereals and legume for consumption. The fertility levels of soils in this class are medium to high.
- Households with small less intensive mixed farms: Class 3 contains farms located in the hills (with average altitude of 723 m.a.s.l.), with relatively high soil fertility, low nitrate fertilization but high water and labour use. They cultivate and consume cereals, legumes and vegetables;
- Households with small and low-input cereal farms: Class 4 contains farms located in the plain with the lowest water, nitrate and labour costs. The farms in this class cultivate mainly rainfed cereals in farms with medium to high soil fertility.

II. Progress towards the achievement of research outcomes and IDOs (2 pages)

Dissemination of conservation agriculture

Both CRP DS and the ACIAR-CANA (Conservation agriculture in North Africa) that is mapped to CRP DS contributed to dissemination of CA in Morocco. However, the termination of this project in June 2015 coupled with the severe cuts of CRP DS budget has constrained the up-scaling of CA.

Fertilizer management in the mixed cropping system

No outcomes were produced this year as the level of phosphorus content in the soil was high. However, the study demonstrated that the variety Alfia 17 of small faba bean is well adapted to a range of phosphorus conditions. Consequently, it has the potential to be out-scaled in Meknes region characterized by high calcareous soils where P availability is low and hence would increase and sustain faba bean productivity (Poverty related IDO 1.4).

Cereal and legumes systems IPM

The two IPM options developed and demonstrated for faba bean and wheat were used by 25 farmers and covered 32 ha in both communities. This is an ecouraging devlopemnt for futher scaling activties. The outcomes will increase productivity of the two crops, incomes (Poverty related IDOs 1.4 and 1.3, respectively) and improve wheat based cropping systems. Use of IPM options

reduce costs and enviromental hazard (Natural resource management –related IDO 3.3) and food safety (IDO 2.2) due to pestcide applications.

Water and land productivity in rainfed systems

One research outcome produced as planned is the increase of water productivity through deficit supplemental irrigation package for wheat that allowed a saving of 895 m^3 of irrigation water per ha (Natural resource management –related IDOs 3.1 and 3.3) without any negative effect on yield. Along with this farmer incomes were increased by 34% (as compared to the average of farmers (Poverty related IDOs 1.4 and 1.3, respectively). If the deficit supplemental irrigation package is applied in only 20% of the potential area (adoption rate is 21%) in Tadla irrigated command arear (10,444 ha), the amount of irrigation water that will be saved will be around 9,350,000 m^3 of irrigation water, with a doubling of water productivity. This holds significant potential in what are extremely water scare areas.

Water productivity of forage/cattle

The study demonstrates that many setbacks characterize water productivity in cattle farming. The amount of irrigation applied seems to be higher than crop requirements in some farms, meaning less efficient water productivity. The results show that milk production used only 20.5% of the total water it needed from irrigation, the remaining requirements coming from rainfall and virtual water. The pressure on irrigation water was even less for live weight gain. Therefore, even in a dry year, the livestock sector in the study area depends mainly on rainfall, whereas specialization in cash crops implies a growing pressure on groundwater. Consequently, perspectives for the resilience of livestock production are good, but they would require improving water productivity by adopting sound practices.

System vulnerability

The overall project aim is to inform stakeholders including researchers, farmer organizations, development organizations and policy makers about the state of the production and livelihood systems and to provide a diagnosis of the state of the farming systems, livelihoods, and emerging trends. This first step on a pathway towards the IDOs has been accomplished and the study has created information and data for a dialogue among stakeholders on the current and future directions and sustainability of the intensifying production systems in the dry areas. It will contribute to identifying what research and development policies are needed to ensure both sustainable improvement of rural livelihoods and sustainable agricultural production systems.

Innovation platforms (Shinan Kassam): One key outcome has been a clear understanding by research partners of the need for incorporating more pluralistic service provision (including access to finance) in the initial research design. This is pertinent in the proof of concept stage when assessing water saving technologies as well as in research aimed at uncovering institutional options for enhancing market access. This is evidenced by the willingness and buy-in to participate within the innovation platform initiative and with a realization by both public and private partners that, while the Green Morocco Plan is being implemented through state support and oversight, the role of the private sector and civil society is instrumental for out scaling of technologies and best practices. Outcomes and learning from this research is aimed at delivering on IDO C1 (Enabling environment improved) through a set of policy notes (in 2016) and IDO 1.2 (Enhanced smallholder market access) through the fostering of more effective and inclusive market linkages for productive inputs and services (initiated in 2015 and continued in 2016 with FAO funding).

Bio-Economic models

This activity will contribute to the ultimate achievement of the research outcomes and IDOs. However, at its current level, it will only inform researchers, policy makers and other development workers on the major types of farm households that exist in the Meknes area. This is now being

used in the development of the bio-economic model that is progressing well where we are trying to explicitly capture the different household typologies.

Agricultural Gender Wage Gaps (Dina Najjar): The **outcomes** produced are: 1) The knowledge generated on the wage gap and working conditions improve gender inclusiveness in decision-making process. Future interventions designed that are based on the findings of this research could resolve gender-specific problems and improve working conditions thereby contributing to the IDO of 'Gender inclusiveness in decision making processes improved'. 2) The recommendations produced for policy-makers and development practitioners from the current research strengthen the inclusiveness of gender issues in labour policies thereby contributing to the IDO of 'Gender inclusiveness in decision making processes improved'.

III. Progress towards Impact (1/2 page)

Dissemination of conservation agriculture
Most farmers are convinced by the benefits from conservation farming. However, the major constraint behind the low adoption rate is the unavailability of no-till seeders that are affordable. As per some countries such as Jordan and Syria the support inf the manufacture of these seeders in Morocco which are adapted to farmers' conditions and the creation of farmers' associations to provide services (renting no-till senders, technical support, etc.) would enhance the adoption of CA in the target action site and also at the national level.

Fertilizer management in the mixed cropping system
The study shows that the application of high amounts of P fertilizer can benefit successive crops in a rotation (different crops) and not only to one crop. The use of adapted varieties can increase P use efficiency and allow the reduction of the amounts to be applied, the negative environmental effects and operational costs.

Cereal and legume systems IPM
The outcomes can be scaled out and the validation of the new herbicide with low toxicity on food legumes will assist farmers in growing their crops early in the season that would facilaited signficant increases in yield. Knowldge and skills in IPM will help farmers to make decisions when to apply crop protection measures.

Water and land productivity in rainfed systems
The impact of the work on supplemental irrigation on wheat has been that engineers of ORMVAT (Regional department of irrigation management in Tadla) were involved in the on-farm demonstration trials and the allocation of water to the farmers takes into consideration the research results. During drought full supplemental irrigation is replaced by deficit supplemental irrigation for wheat.

Water productivity of forage/cattle
The promising results obtained in this study confirmed the need to expand this important research topic that is not yet well documented at the international level. The expected outcome of this activity is to develop a strategy targeting the improvement of livestock production with minimum water use.

System vulnerability
The establishment of the baseline data and analysis of key systems performance indicators (production, productivity, resource use, income levels and sources, poverty, cropping patterns, input use, crop budgets, farmer perceptions, emerging high value crops, etc.) are essential and

necessary first steps to initiate and monitor the impact of research and policy interventions in the systems. This first steps have been accomplished very effectively with this study.

Innovation platforms

The impact is that the current research is assisting FAO to better address gender disparities in rural areas through a project in 2016 aiming at using these research findings for i) sharpening a tool to assess decent work for women in rural areas and ii) for fostering evidence-based policy dialogue.

IV. Unexpected Outputs, Outcomes and or Impact

n/a

d. NAWA/ Irrigated

I. Progress towards outputs (2 pages)

Improve irrigated farming systems and productivity in the Nile Delta

This activity deals with the assessment of the mechanized raised bed technology (MRB) in the Nile Delta as a farming system. This technology includes better water management, increases farmer's income, improves soil conditions and drainage water quality (reused several times in Nile delta), cropping patterns (cereal-legume) and IPM options. The objectives of this activity are:

1- Saving applied water and improvement of water productivity.
2- Improve soil fertility.
3- Increase of crop yield and reduction of farming costs.
4- Development of new planting options for emerging biotic constraints for the food legume and cereal systems.
5- Simplification of the mechanized raised bed planting.
6- Improvement of stakeholders' capacity including farmers and extension officers.

Number of varieties and lines of two important food crops for in Nile Delta (wheat and faba bean) were tested under different soil conditions in Nile Delta covering two agro-systems in Nile Delta (old lands and salt-affected lands). The following outputs have been achieved:

- Introduction of the mechanized raised-bed technology (MRB). This new technology was presented to farmers growing wheat as a promising option to reduce powdery mildew, increase grain yield and to save irrigation water. MRB reduced mildew severity and consequently increased grain yield compared with the wheat traditional sowing method. To fill the gap of wheat and faba bean production in Nile Delta, several initiatives of demonstrating the raised bed planting method started in 2013. This CRP DS activity was linked to the ongoing activities in Sharkia and Dakahlia regions, whereas MRB was implemented in 220 single variety demonstrations distributed among 13 districts. The results showed the average grain yield in the project participant farmer demonstration fields was 9.17 tons/ha compared to 7.36 tons/ha in the neighboring project non-participant farmer fields. The increase in grain yield was 1.49 tons/ha equivalent to 24.5%. The project succeeded in increasing the amount of certified seed sold by the government and private companies by 10% compared to 2009/2010. Thanks to the dissemination activities of CRP-DS in Nile Delta in 2014 and 2015, the area grown on raisedbed reached 35 times the area which was grown in 2010 (29,167 ha in 2014 and 33,000 ha in 2015 vs. 950 ha in 2010).

Testing new lines of wheat – A field experiment was conducted in two locations in two governorates differing in their soil characteristics (Al-Sharkia and Al-Dakahlia) to evaluate grain yield of new wheat lines derived from both the Egypt national wheat program and ICARDA. The experiment included also four check varieties Gemmeiza 11, Shandweel 1, Giza 171 and Sids 13.

- The results of the experiment in the two locations Sahl El-Hussania at Al-Sharkia governorate (Saline soils EC 9 dS/m) and Dekernes at Al-Dakahlia governorate (non-saline soil EC 2.5 dS/m) showed significant differences among some genotypes; some new lines yielded more grain than the checks.
- In the saline location at Sahl El-Hussania and compared to check varieties the genotypes 14, 3 and 13 were highest in grain yield (5.53, 5.10 and 5.05 tons/ha, respectively).
- In the non-saline location at Dekernes genotypes numbers 7, 8 and 15 ranked the highest in grain yield with values of 8.22, 8.22 and 7.95 ton/ha, respectively.
- Three lines have high potential yield and exceeded the highest check (Gemmeiza 11) in grain yield by 16, 13 and 12.9% respectively and those varieties are recommended for dissemination among farmers.
- The three high grain yielding lines of wheat will be submitted to the national program for retesting (salinity and alkalinity tolerance) and confirmation of obtained results before release to farmers.

Introduction of faba bean varieties with high yield and resistant to pest, salinity and orobanche – Varieties fitting with these characteristics have been identified and tested in the field using an improved agronomic package. Orobanche tolerant cultivars Giza 843 and Misr 3 resistant varieties were compared to Orobanche susceptible Giza 3 through on-farm demonstration trials. The planting was under zero tillage system. The sowing date was delayed to mid-November, the seed rate was 80-90 kg/ha, and the crops were sprayed with Glyphosate at reduced rate 34 g/ha + NPK two times at flowering and 3 weeks after. We also adopted the mechanized raised bed planting system. The main results were:

- The Faba bean cultivar “Sakha-1” survived under high salinity level at 7,500 ppm in Sharkia.
- Faba bean seed yield in demonstration fields was higher than that in out-demonstration fields. The average seed yield of faba bean cultivars “Giza-843, Misr-3 and Giza-3” in the demonstration fields at Sharkia governorate were higher than the demonstration fields by 31, 12 and 7%, respectively. Giza 843 and Misr-3 had higher seed yield than that by Giza 3.

Water - Field trials on growing faba bean in raised beds was conducted. The experiments evaluated one, two, three and four rows of faba bean plants on beds of 65 (farmer practices), 100, and 130 cm beds widths respectively. The results showed that raised bed with width of 130 cm and three faba bean rows seems to be very promising approach of using raised bed for faba bean with a saving in applied water of 22% and an increase the yield of 18%. These findings need more verification in the coming growing season before scaling it out at farmer plots.

IPM - Concerning the back-up research on faba bean three experiments were conducted to measure the effect of the fungicide "Rizolex" in controlling FBNYV in five cultivars of faba bean (Misr3, Giza-843, Sakha-1, Giza-3 and Giza-716), irrigation water management at two locations and measuring the effect of two pesticides (Apron and Celest) in controlling Aphids on three faba bean cultivars. Preliminary results indicate that "Rizolex" treatment affected the number and weight of seeds per plant. The highest seed yield (ton/ha) was recorded in the cultivar Gemmeiza-8 followed by Misr-3

and Sakha-1 (3.22, 2.93 and 2.64 tons/ha, respectively). The highest seed yields were obiatend in Rizolex-treated plants.

Land Degradation and Salinity Management

Interventions to combat degradation associated with salt accumulation have been made during four cropping seasons (summer 2013, winter 2013/14, summer 2014 and winter 2014/15). Field trials were conducted with various treatments including application of gypsum, organic matter, bio-fertilizers, ammonia injection, and installation of mole drains. The required datasets (soil, water, and plant) were collected and analyses were completed. The overall conclusion of these studies is that application of soil amendments had a significant effect on crop yields and the physical properties of salt-affected soils. Combined interventions of soil amendments being implemented include conventional farmer practices: control, fertilized by urea (C+U) compared to gypsum + anhydrous ammonia (G+Ag); gypsum + bio-fertilizer + urea (G+B+U); gypsum + ammonium sulphate (G+As); gypsum + urea (G+U); gypsum + farm manure + anhydrous ammonia (G + F + Ag); gypsum + mole drain + anhydrous ammonia + farm manure + bio-fertilizer (G+M+Ag+F+B); gypsum + mole drain + anhydrous ammonia (G+M+Ag); gypsum + mole drain + urea (G+M+U); and mole drain + urea (M+U). During winter 2013/14 and 2014/15, field trials were undertaken to test the response of wheat and sugar beet to soil amendment treatments. The G+F+Ag treatments resulted in the highest yields of wheat grain (6.58 and 6.16 tons/ha) and straw (8.48 and 8.26 tons/ha) followed by G+M+Ag+F+B (with mole drain at 4-m spacing). The G+F+Ag treatment resulted in the greatest increase in uptake of macronutrients in wheat grain and straw followed by G+M+Ag+F+B (with mole drain at 4-m spacing) treatment in both years. The G+F+Ag treatment resulted in the highest NUE (34.6 kg grain/kg N). The highest water productivity of 1.34 and 1.32 kg /m^3 during 2013/14 and 2014/15 winter seasons was achieved with the application of gypsum combined with injection of ammonia gas and farm manure.

For sugar beet, G+M+Ag+F+B (with mole drain at 4-m spacing) treatment significantly affected sugar beet root yields (41.5 ton/ha in 2013/14 and 40 ton/ha in 2014/15), sugar percentage, and sugar yield during both years. Ammonia gas was more effective than urea and other N-sources in producing higher yield. Soil salinity values decreased after harvesting wheat and sugar beet compared with the values obtained after harvesting rice (summer 2013) in all treatments except the control treatment. The highest rate of salt leaching was achieved for the G+M+U treatment.

Innovation platform initiative

- In collaboration with CRP-WLE initiatives related to out-scaling of mechanized raised bed technological packages, a draft manuscript for peer review has been prepared and is expected to be submitted to *Applied Economic Perspectives and Policy* by December 2015.
- Successful acquisition of a FAO grant to ICARDA. Component 5 of this grant includes initiatives for leveraging and cross-leveraging the CRP-DS supported innovation platform in the Nile-Delta, aimed at enhancing inclusive access to machinery services and water saving technologies, on the basis of supporting research on the 'science of scaling'.
- A 5-day workshop on lessons learned from innovation driven research under DS in NAWA, was conducted in Cairo (April 26- 30, 2015 and funded by the Arab Fund for Economic and Social Development (AFESD)). Ten participants from across the region were nominated by regional NARS'. Despite a request for consideration of women participants, all nominated attendees by the national partners were male and signals a continued need for promoting gender equity in capacity development initiatives within national centres of research.

An innovation system comprised of ICARDA, Zagazig University, ARC Egypt, a private equipment manufacturer, private machinery service providers in Sharqia, an agricultural cooperative in Sharqia and private farmers has emerged. The innovation platform within which the innovation system will undertake its activity, aimed at enhancing broad uptake of mechanized raised bed technological packages and attendant research on the process of scaling, is placed in Sharqia under the Dryland Systems initiative (co-supported by FAO) and will also be established in 2016 within Asyut governorate (under FAO funding).

Characterization of livestock-based systems

- A series of six face to face women meetings were conducted to capture the local knowledge in dairy processing and to identify constraints faced.
- Simple technologies to enhance product quality were identified. These include pre-treatments of milk for processing, practices to enhance the quality, the use of suitable dairy culture and the use of dairy by-products to enhance the income.
- Options for diversification of dairy production are developed and planned for 2016.

System vulnerability

This activity aims to establish baseline information on the socioeconomic and biophysical aspect of the three delta sites in Egypt as part of livelihood characterization and provides reference for monitoring impact in the future. The study also looked at historical trends in climate using meteorological data from five climate stations in the Nile Delta.

For socio economic analysis, the three sites representing the main delta regions (old lands), salt affected lands and recently reclaimed desert lands (termed 'new' lands) wer selected. A baseline survey of 452 households was conducted in equal proportions in the three land types and covering 8 villages in Zagazig district (old lands), 5 villages in El-Hosinia district both of these in Sharkia governorate and 9 villages in Bustan district in Nobaria governorate (new lands). The study reveals quite high levels of illiteracy among household heads (18-33%). New lands with higher proportion of graduates settled by the governorate as employment option has the lowest illiteracy (18%). Illiteracy was highest among women farmers. This specific factor is critical for communicating with farmers using written material of new technologies and modern farm management. The farm holdings of the surveyed households are small, ranging from 1-2 feddans (less that a hectare) in the more resourceful old lands, 5 feddans (2.1 ha) in salt affected lands, and 2.5 to 10 feddans (1.0-4.2 ha) in the new lands.

The income of households farming the Old lands is more balanced and diversified as shown by the frequency of farmers reporting income from crops (91%) and livestock (86%), and from off farm work in agriculture (52%) and non-agricultural (32%) sectors. However these famers mainly rely on farm income, with crop and livestock providing 76% of the income, and that is equally divided by crops and livestock (38% each). Crop income is dominated by wheat (15%) and rice (17%) and off-farm work in the non-agricultural sectors (19%). Unexpectedly, agricultural farm labor on average, contributed very little and the reason could be the fact that the surveyed households were farming households with own lands who are less likely to work as farm labor compared to the landless households who will fill that role.

In the salt affected area, crops provided the main source of livelihoods contributing 70% of the income, with rice at dominant place 29%, followed by cotton and sugar beet each with 15% and wheat 9%. Livestock contributes to 24% of the income, and agricultural farm labor providing 5%. In the New lands a different income pattern emerges. Contribution of farm income (from crop, trees, and livestock) to total annual household income on average reaches 54%. The contribution from field crops represents about 18%, fruit trees 35% and from livestock production only 1% of the gross household income. A contribution off-farm activity in agricultural working was represented 30%, while contribution of off-

farm activities in non-agriculture sector was around 16% of the gross household income. Orange production (characterized as mainly local orange type) is relatively more important for the household income compared to field crops; average income from orange was the highest (67% of income from all crops and fruit trees combined) followed by wheat (10%).

The data revealed that the major farm constraints is the lack of or week provision of services including credit (mostly relying on traders for financing their operations), availability of inputs, and market fluctuations as well as distances of markets. This suggests a need for strong review of agricultural finance and calls for the development of financing arrangements that are more suitable to smallholder farming needs (one third of who are illiterate as revealed in this survey).

The study reveals that farm income is stretched thinly to cover household needs and overall income is very close to the income poverty line (overall sample average around USD2 per day per capita). Crop area is dominated by the major cereals (rice and wheat) which are supported by government policy.

Climate change is considered as a global phenomenon, but investigations at the regional level are essential to understand the changes induced, and to suggest suitable adaptation strategies. Monthly climate data were collected from five locations in the Nile Delta and analysed. The trend in daily rainfall, maximum and minimum temperature, wind speed and solar radiation were analysed considering those as indicative of climate change phenomenon and influencing the irrigation hydrology. The trend analysis of maximum temperature during 1980-2014 for the Kafr El Sheik station gave increasing trends that indicate there is a positive linear relationship between annual averages of maximum temperature over time and that the rate of increase is 0.08°C/year. The results were confirmed using the Mann-Kendall test and t-test. The maximum temperatures were recorded in the month of August and average maximum temperature for the period was 30.52°C. The average minimum temperature was showing a declining trend and the rate of decrease is 0.005°C/year. The minimum temperature was recorded during the month of January and average minimum temperature was 11.14°C/year. The z-values obtained for maximum and mean temperature was 4.587 and 1.789 respectively which shows that the variation is statistically significant at 95% level of significance. The t-test also gave similar significant increasing trend in temperature. The trend in rainfall in the region was also analysed. The trend in average rainfall showed statistically significant increasing trend and the increase is at the rate of 4 mm/year during 1980-2014. Mann-Kendall test gave a statistical significance at a=0.1. In the t-test, statistical significance was at a=0.1. Wind speed showed a statistically significant decreasing trend and solar radiation data showed no significant trend. The trends in climate variables may lead to changes in agricultural water demand in the future. Appropriate adaptation measures need to be undertaken for controlling future scarcity of water considering the trends in climate variables. Through this activity ARC staff in Egypt has been trained in using 'TREND' analysis tool.

The study raised two fundamental questions for Egypt's agriculture. The first question is: What are the most efficient crops that can provide the highest value for the limited land and water resources in terms of farm income and rural employment, considering the different land types such as salinity, newly reclaimed desert lands, etc. This should consider the balance between cereals and fruits and vegetables and also consider the fluctuations of market prices. Related point to this question is: What are the trade-offs between supporting cereal production through policy and promoting high value products (livestock, fruits and vegetables) with high standard for trade. The other fundamental question is how climate change would affect Egypt's agriculture in the future and what adaptation measure can be taken now to avoid irreversible consequences. Climate change may also affect the crop mix in the future and that has to be analysed. The baseline data provided opportunity to address

this fundamental question through whole farm and sector modelling by region as specified by the land type.

Water productivity - A journal article was drafted (now under review) which estimate the impacts of the main primary production factors (e.g., seeds, nitrogen, phosphorus, irrigation water) on the total production of wheat, rice, cotton, maize and berseem crops with special emphasis on the examination of the potential substitution between water and other agricultural inputs (such as nitrogen). This analysis was conducted through an empirical analysis using a linear and Cobb Douglas production function (generated from survey data on 150 farms located in two villages in Sharkia governorate, Egypt) and taking into consideration farmers' objectives about crop yield, production and net profit in their own farms. Results show that irrigation water productivity in terms of marginal productivities of irrigation water in wheat, rice, cotton and maize crops are relatively low. The estimated values of marginal products for irrigation water for berseem, wheat, rice, cotton and maize production at 0.85 LE/M^3, 1.14 LE/M^3 0.45 LE/ M^3, 0.74 LE/M^3 and 0.56 LE/M^3, respectively. These values of marginal products of irrigation water in monetary terms are important in factors in farmer decision-making. In the situations where water cost is very low or much lower than value of marginal product of water, farmers would benefit in increasing irrigation water applications. This could explain farmers' water use behaviour and may lead to inefficient use of water.

II. Progress towards the achievement of research outcomes and IDOs (2 pages)

Improve irrigated farming system and productivity in Nile Delta

- The raised bed technology has been demonstrated in 2015 for several crops including wheat, sugarbeet and maize in farmer's fields. For wheat, maize and faba bean crops, water savings at the field level were up to 25%, 35% and 20% respectively. In addition, farmers increased their grain yield by 25%, 20% and 18% for wheat, maize and faba bean respectively. The associated farming cost under raised bed was reduced by 25%. The project succeeded in increasing the amount of certified seed sold by the government and private companies by 10% compared to 2009/2010. Thanks to the dissemination activities of CRP-DS in Nile Delta in 2015, the area grown on raised bed reached 33 times the area which was grown in 2010 (33,000 ha in 2014 vs. 950 ha in 2010).
- At least 9 tons of seeds of three faba bean cultivars (Giza 51, Giza 370 and Giza 9) were produced.
- Farmers saved 20-25% of irrigation water that would represent an increase in water use efficiencies at the field level and reduce social conflicts between upstream and downstream water users in the same canal.
- High yielding wheat varieties were adopted by 550 farmers and orobanche resistant faba bean varieties adopted by 50 farmers.

Land Degradation and Salinity Management

- Soil amendment techniques tested at the plot-level offer farmers a range of possible mitigation techniques to combat salinity.
- There is usually no single way to control salinity and sodicity, therefore several practices should be combined into a package that function satisfactorily. This package should be field tested under farmer conditions. The project will be able to make some recommendations on

a package combining physical, chemical and biological interventions, once the collated data are fully analyzed.

There has been a marked improvement in skills and knowledge among team members from ARC and NWRC, particularly among the younger team members who conducted the majority of the field work. Five MSc and PhD students (two at Kafr el Sheik University, two at Ain Shams University, and one at Cairo University) are doing their research under the umbrella of this project. The capacity of these young Egyptian scientists has benefitted through their interactions with scientists from ICARDA and IWMI. It is expected that these trained scientists will eventually transfer skills gained to other colleagues and students.

Innovation platform initiative

In forming an innovation system comprised of research, academic, public and parastatal institutions, together with private machinery service providers and farm households, significant progress has been made towards cross-cutting DS IDO's B.1 (Equity and Inclusion achieved) and D.1 (National partner and beneficiaries enabled). One key outcome has been a clear understanding by research partners of the need for incorporating more pluralistic machinery service provision in the initial research design and testing of proof of concept stage when assessing alternative paradigms of land use management practices. This is evidenced by the willingness and buy-in to participate in controlled trials wherein the impact of raised bed equipment service provided by private machinery service providers (on a business model), by the agricultural cooperative, by national research organizations and by agricultural universities is assessed on a number of indicators including: (i) inclusivity of female headed and marginalized households; (ii) efficacy in service provision in terms of productivity and timely service; and (iii) fee for service rates as well as evidence of accruing funds to support timely and needed maintenance of equipment for sustainable service. Outcomes and learning from this research, formulated in 2015 and undertaken in 2016, is aimed at delivering on IDO C.1 (Enabling environment improved) through a set of policy notes and IDO 1.2 (Enhanced smallholder market access) through the fostering of more effective and inclusive market linkages for productive inputs and services.

Characterization of livestock-based systems

This activity is related to IDOs 1.1, 1.4, 2.2 and B.1. It will continue in 2016 so that the full characterization of the livestock-based systems in the Nile Delta can be completed. Dairy production improvement through appropriate management of animals and feeding is being targeted. Opportunities for milk processing and enhanced product safety are among the main objectives the CRP DS team is working on.

System vulnerability

The overall aim is to inform policy makers and operators of the likely agriculture futures to cope with the impacts of climate change and their implications. The process involves a structured and systematic set of workshops and other consultative activities in the next stage of the project after analysing future climate scenarios. At the core of this activity is the stakeholder generation and objective evaluation of future scenarios for irrigated agriculture in Nile Delta. As such, the proposed approach and methodology guarantees a pathway for wide and meaningful contribution from stakeholders and adoption of project results by the NARS.

III. Progress towards Impact (1/2 page)

Improve irrigated farming system and productivity in Nile Delta

This integrated activity led to improving farmers' income, reducing costs of farming system, improved soil characteristics and fertility for sustainable agriculture functions, increasing farmers' knowledge through training courses and field visits. These achievements led to significant positive impacts on improving smallholder farmers' livelihoods and enhanced food security of farmer communities.

The success of disseminating the mechanized raised bed farming system in Nile Delta was one of the most successful achievements of CRP-DS in Nile Delta with high impact on farmers' income whereas the introduced raised bed machine developed by ICARDA played a very significant role to promote the adoption of RB farming system. The use of the raised bed machine, allowed farmers to save 50% on seeding rate, reduced 25% of farming cost, achieved 25% of water saving at the field level and increased the yield by 25%. The Government of Egypt is currently seeking to promote this technology country-wide to save water used in agriculture and to increase crop yields. Several initiatives already started to scale out the raised bed technology, one of these initiatives is wheat national program which adopted this technology and is promoting it in many areas in Egypt. The wheat cultivated area in Egypt is estimated to be 3 million acres. Appropriate policies for scaling-up this technology should be set-up to achieve significant economic, social and environmental impacts.

IV. Unexpected Outputs, Outcomes and or Impact

n/a

SECTION III – CROSS-CUTTING ISSUES

a. Gender Research Achievements (1 page)

The current gender research **is assisting FAO Rome** to better address gender disparities in rural areas through a project in 2016 aiming at using these research findings for i) sharpening a tool to assess decent work for women in rural areas and ii) for fostering evidence-based policy dialogue. In the Mekness site (rainfed production system) the research addressed the agricultural gender wage gaps. Related achievements in 2015 are summarised below:

- A survey administered to 400 laborers (200 women and 200 men) in Saiss, Morocco (districts of Betit, A'in Jom'a and Sidi Sliman), 16% of which are youth. This was complemented with unstructured interviews with participants in paid agricultural labour, labour lords, and farm owners as well as participant observation. Only 20% of the hired agricultural labourers are women in A'in Jom'am, women constitute 60% of the waged labour force in Betit and Sidi Sliman. New technologies such as drip irrigation, digging of wells, mechanization of tasks have led to both gains and losses in labour opportunities. The gender wage gap is 25%. Skill-intensive tasks which were specific to women often paid 25% less than skill-intensive tasks specific to men. In the informal sector, men are routinely paid more than women for the same work by 13%. Many of the youth employed in agricultural tasks have left schooling before completion of high schools. Sexual

harassment was also identified as a significant problem for women in the agricultural sector with 16% of young women and 9% of adult women ranking it as a top problem. Enforcing equal-pay legislation for women as well as training employers to respond adequately to, and to deal proactively with, sexual harassment is an essential first step towards enabling women to benefit equitably with men from their labour contributions to the agricultural sector;

- A draft paper on the gender wage gap and working conditions for the youth, men and women employed in the agricultural sector of Saiss Morocco has been prepared and accepted for consideration in the special issues of the Journal of Gender, Agriculture and Food Security on policies, institutions, and markets;
- A presentation on the gender wage gap and working conditions for the youth, men and women employed in the agricultural sector of Saiss Morocco was presented at the International Association for Feminist Economics on July 16-18, 2015 in Berlin http://www.iaffe.org/media/cms_page_media/290/IAFFE%20Annual%20Conference%20%20%20Program.Version%201.4_1.pdf.

Gender research in the Nile Delta focussed on women's contribution to climate change adaptation through agricultural innovations in Egypt. This was made visible in multiple forms for multiple audiences: i) A conference presentation in a panel discussion entitled 'A Political Ecology of Women, Water and Global Environmental Change' presented at the Association for American Geographers on Thursday April 23, 2015 in Chicago, Illinois; ii) a book chapter published in Buechler, S. and Hanson, AM. (Eds). A Political Ecology of Women, Water and Global Environmental Change. London and New York: Routledge; and iii) two related blogs presented on the ICARDA and CCAFS websites.

Environmental impacts differ along gender lines and therefore women must be involved in any efforts to remedy them. The Middle East remains one of the most water stressed and unequal gender regions in the world, most notably evident through increased violence against women during the Revolution. Due to the general lack of focus on gender inequalities and alternative methods to adaptation in current approaches, the study adopts a feminist political ecology approach by focusing on 1- practices (local innovations) and policies that enable women to adapt to climate change and 2- on integrating social and ecological aspects in adapting to climate change. This study draws on research conducted over a 14-month fieldwork period in two desert settlements (Intilaq and Sa'yda), which are part of the Massive Mubarak Resettlement Scheme. Findings reveal that in Intilaq women graduate settlers are planting cactus, which requires less water, fertilization, and labour, as a means to avoid eviction in hostile reclaimed desert lands (limited schooling, potable water). In Sa'yda, on the other hand, women heads of household settlers are more likely to cultivate barley (which is tolerant to salts) due to a lack of adequate labour and finances to fertilize and irrigate wheat. Yet, government policies did not encourage cactus or barley crops in its extension or marketing support. The issue is further complicated for women in local agriculture as participation on water user associations in both settlements was limited and more so in Sa'yda due to local norms and ineffective roles for water user associations more generally. More focus is needed on approaches that consider the local biophysical conditions and capitalize on women's innovations, whom are largely disadvantaged by local norms and government policies.

Empirical data was collected through a gender survey administered to 400 farmers (200 women and 200 men) in the New and Old Lands. The surveys were conducted in Noubariya and Kafr Sheikh, respectively, because they differ significantly in gender norms, levels of economic development and biophysical dynamics to cover as diverse experiences as possible with rural work. The survey data was complemented with unstructured interviews as well as participant observation. Based on subsequent findings related to gender-specific problems in agricultural production and needs in extension advice,

two workshops relaying these research findings to 30 extension agents and 2 policy makers in each of Noubariya and Kafr Sheikh were conducted. Findings reveal that women were more interested in information on pest management and were more likely to identify shortages in labour as a problem in local agricultural production. Extension agents commended the research as being first of its kind in presenting sex-disaggregated findings and recommended building libraries for their continuous education and the engagement of women in women-only groups through Farmer Field Schools due to strong gender segregation norms.

The current research on working conditions and the implications for different 'types' of women farmers in both commercial and subsistence production areas is assisting FAO Rome to better address gender disparities in working conditions in rural areas. This will be achieved through a 2016 project that will be implemented with the following aims: i) sharpening a policy tool (to assess decent work for women in rural areas) and ii) fostering evidence-based policy dialogue towards achieving decent work for rural women.

The CCAFS Blog on women's adaptation to climate change had 33 shares on various development agencies websites (such as ILRI and FAO). The chapter on women's adaptation to climate change in Egypt was assigned to the International Development Course at the Department of Geography at the University of Arizona for the Week of April 27.

The knowledge generated about the operational conditions for different 'types' of men and women in differing economic contexts in rural areas contribute to the IDO of Gender inclusiveness in decision making processes improved. Through the respective knowledge produced policy-makers and development practitioners alike are enabled to address the clear, identified gender-specific problems generated by this research.

b. Partnerships Building Achievements (1 page)

Dissemination of conservation agriculture
Hassan II Agronomy and Veterinary Medicine Institute in Morocco is the main national partner in charge of the implementation of this activity.

Fertilizer management in the mixed cropping system
The activity was conducted in collaboration with Regional Research Center of INRA and extension services in Meknes.

Cereal and legume systems IPM
The research activities were implemented in partnership with INRA, farmers and Office of Agriculture through innovation platform. Wheat and faba bean varieties used in the study were released by NARS.

Water and land productivity in rainfed systems
The activity was conducted in collaboration with Regional Research Centers of INRA of Meknes, Tadla and Settat and extension services.

Water productivity of forage/cattle
Collaboration was established with Hassan II Agronomy and Veterinary Medicine Institute in Morocco to undertake the activity.

System vulnerability
The baseline study is well aligned with the Green Morocco Plan (GMP) which is seeking to intensify production and increase the share of high value commodities to increase agricultural output and rural employment. It provides data on the state of current production patterns and development indicators which can be easily integrated into the GMP.

c. Capacity Building Achievements (1 page)

Dissemination of conservation agriculture
One field day on CA was organized with 40 farmers in two associations (Ennasir & Bismilah).

Cereal and legume systems IPM
Farmer Field School was formed and a total of 45 farmers were trained in integrated pest management practices in the two communities.

Water and land productivity in rainfed systems
One visit (on-the-job training) was organized to the on-farm trials for 35 farmers and extension engineers to train them on deficit/supplemental irrigation and crop management.

Water productivity of forage/cattle
One M.Sc. student was supervised under this activity (by Srairi, Karrou and Ates).

Agricultural Gender Wage Gaps
A training was completed for 20 government employees (a third of which are women) from different parts of the Arab world. In addition to Eritrea and Iran, basic gender analysis and applications as well as identifying relevance to the trainees' individual work over two training events: "Impact Assessment and Livelihood Analysis in Systems Research" on 22-26 November 2015 in Amman, Jordan and "Water Policies and Policy Analysis" on December 6-10, 2015 in Amman, Jordan were conducted.

Water and soil conservation

- A face to face Training Course on SWAT modelling and CC downscaling was organised in Amman on May 5th-7th. Four Tunisian NARS (3 PhD students and 1 researcher) participated.
- One individual training session on SWAT modelling calibration and implementation Held in Amman, November 23 to 30, 2015. One Tunisian NARS (1 PhD student) participated in this training.

d. Risk Management (less than 1/2 page)

The major risk was budget reduction to implement the planned activities. This resulted in the reduction of some activities at the field level and decreased commitment of NARS.

e. Lessons Learned (1 page)

Dissemination of conservation agriculture
The availability of appropriate no-till seeders is the key constraint for the adoption of CA farming across the three production systems in the NAWA region.

Cereal and legume systems IPM
Use of Innovation Platform (IP) and Farm Field School (FFS) approaches helped to bring stakeholders together to identify major production constraints; jointly plan activities and exchange experiences on their own plots. The feedbacks from IP and FFS will help to incorporate in the backup research.

Water & land productivity in rainfed systems

Working with communities in the field and effective involvement of farmers and extension services in the implementation of the activities enhances the confidence of technology users in science and speedup the dissemination process (farmer to farmer and extension to farmers).

f. CRP Financial Report

This section will be completed when your centre will close the accounting books in 2016.

SECTION IV - RESEARCH OUTCOME STORIES

Note: Please repeat the following template for each individual story submitted as part of your centre's 2015 annual report!

OUTCOME STORY 1

OUTCOME STORY 2

OUTCOME STORY 3

OUTCOME STORY 4

OUTCOME STORY 5

OUTCOME STORY Template

This template is intended for use of Dryland Systems scientists and partners to identify and highlight outcomes of their research activities funded by and/or mapped to the program. Each section in the template is followed by a self-check, which outlines criteria relevant to that section. The maximum number of word required to fill this template is 1450- 1500.

Name of research activity/project title:

Flagship:

Geographical region:

Name and email of Activity Lead:

Name and email of Outcome Story Lead:

Activity Lead Center:

Activity Partner Center(s):

Activity Partner CRPs:

1. Outcome Story Headline:

Guidance:

In no more than 15-20 words, please provide a descriptive headline that captures the main research outcome

SELF-CHECK – Have you:

- ☐ *Captured the overall message of the outcome story?*
- ☐ *Included an action verb?*
- ☐ *Captured the reader's attention?*

2. Outcome Story Abstract

Word limit: 200 words

SELF-CHECK – Have you:

- ☐ *Summarized the problem, program/activity, and outcomes?*
- ☐ *Provided a summary with specific measurable outcomes that avoids broad, sweeping statements such as "There was a noticeable increase in healthy eating habits"?*

3. Problem/Challenge Overview:

Some guidance:

Start with the issue, challenge, problem or opportunity that Dryland Systems has aimed to address. This should relate to one of the IDOs (resilience, wealth and wellbeing, food access, natural resources management, gender empowerment, capacity to innovate).

Clarify who this outcome story is about (e.g., farmer, scientist, community, research partner, policy maker, etc.) by adding a human interest angle. Who is/was experiencing this problem/challenge and how would they benefit if it was solved? What are the opportunities and what is at stake for a person, community or other group of people?

Word limit: 150 words

SELF-CHECK – Have you:

- ☐ *Described the issue(s), challenge(s), problem(s), opportunities being addressed and why are these important?*
- ☐ *Used data to frame the problem, including the social and economic costs?*
- ☐ *Specified the affected dryland population(s)?*
- ☐ *Specified the affected dryland area (in hectares)*

4. What are the main research activities:

Some guiding questions:

Please describe the main research question(s), activities, strategy and timeline.

What did you do to address the aforementioned challenge(s) and make the most of the opportunities available?

How were different research users engaged in or consulted in the research process?

How do you think this made your research better?

Word limit: 150 words

SELF-CHECK – Have you:

- ☐ *Described your approach of designing and implementing the research?*
- ☐ *Identified the various research users involved at different stages of the research process?*
- ☐ *Identified any major shifts or changes to the research activities and approach?*

5. What are the main Outcomes of your research?

An outcome is generally defined as the short-term and medium-term effect of an intervention's outputs, such as change in knowledge, attitudes, beliefs, behaviors.

Bearing this definiton in mind, please provide a short description of the actual changes that occurred as a result of your research activities and outputs. How are different users utilizing your research outputs? what has changes in their practice, policy and/or investment? How and why did they take up the research outputs? What are the key milestones in the timeline of change that occurred? What is the potential for scaling the outcome up and out?

Word limit: 200 words

SELF-CHECK – Have you:

- ☐ *Described actual changes that occurred as opposed to desired or anticipated changes in your initial research proposal?*
- ☐ *Identified any outcomes that you did not intend or anticipate? How are these justified and/or attributed to your activities?*
- ☐ *Demonstrated the scalability of the outcomes for greater reach and impact (in terms of both dryland communities and land area?*

6. What are the main research Outputs that resulted in the outcome(s)?

Outputs are generally defined as the tangible products or direct deliverables of your research activities, such as research papers, publications, policy recommendations, models, on-farm trials, methodologies, technologies, assessments, improved seeds, increased yields, hectares of degraded land restored, quantity of natural resources management, efficiency gains, new institutional arrangements made, participatory research actions, innovation platforms, trainings, etc.

Bearing this definition in mind, please list the main research outputs of your research that led to the outcomes reported above.

Word limit: 150 words

SELF-CHECK – Have you:

- ☐ *Identified all types of outputs delivered and observed?*
- ☐ *Included facts and figures to demonstrate the strength and outreach of your research outputs?*
- ☐ *Avoided vague output statements such as "farmers benefited from increased food security as a result of our assessments of crop varieties."*

7. Who were the intermediary and direct users of your research outputs and what role did they play in achieving the outcome:

Guidance:

Please list the main intermediary and direct users of your research and indicate the role they played in achieving the reported outcomes

For example:

X partners were the intermediary users of the research outputs for dissemination of the technology/tool/practice

Y partners were the intermediary/direct users of research outputs for formulation of policy or development project

X number of farmers in X area were are the direct users of the technology/tool/practice

Word limit: 100 words

SELF-CHECK – Have you:

- ☐ *Clearly identified all users and distinguished between intermediary and direct users of your research?*
- ☐ *Described their specific related role in terms of research, development, technology dissemination, policy formulation, adaptation, adoption, etc.?*
- ☐ *Used facts and figures to strengthen your statements?*

8. How were your research outputs used (will be used in the future):

Describe how your research output was used and what changes occurred? How did these changes set the stage for the achievements of the outcomes reported above? Where there any research activities and changes you did not anticipate, and if so, how did you adjust? What steps did each user take to adopt, scale out or scale up the results of your research outputs? What are the follow up actions to ensure sustainability?

Word limit: 150 words

SELF-CHECK – Have you:

- ☐ *Described actual changes that occurred during or immediate after the release of your research outputs?*
- ☐ *Identified how the use of research outputs set the stage for achieving the outcomes?*
- ☐ *Identified steps and actions for ensuring sustainability?*

9. What is the Evidence of Your Research Outcomes:

Provide solid evidence for this outcome (Document, news article, impact assessment, etc.) in terms of actions and changed behaviour of users and beneficiaries of your research. How can these changed actions and behaviours be sustained in the long run?

Word limit: 150 words

SELF-CHECK – Have you:

- ☐ *Identified how the actions and behaviours of key stakeholders have now changed?*
- ☐ *Identified how these changes will be sustained?*

10. Testimonials:

Testimonials are written or recorded statements that support program credibility and level of expertise. They also strengthen our reputation by expressing the trust that other people have in the program and its offerings. They are a wonderful way to help us to attract a deeper interest from existing and prospective stakeholders. Testimonials are the holy grail of marketing and advertising. Marketing Experiments demonstrate that testimonials can work wonders. For example, a written testimonial can increase customer conversion by 25%; video testimonials on the other hand, can increase the conversion rates increased by a whopping 201%!

- ☐ Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)
- ☐ Testimonials from Partners (quote, video, letter, interview, survey, etc.)

SELF-CHECK – Have you:

- ☐ *Included the name, position, organization and location of person giving the testimonial?*
- ☐ *Included a testimonial that clearly identifies a direct benefit to a person/community/organizations, as opposed to vague general praise for the program activity?*
- ☐ *Included a testimonial that captures the beneficiary's strong emotion stemming from the outcome of your activities in his/her life, community, organization, etc.?*
- ☐ *Ensured each quote is no more than 2-3 lines.*

11. Lessons Learned:

Lessons learned are usually defined as generalizations based on the evaluation of programs, interventions or policies that abstract from the specific circumstances to broader situations. Frequently, lessons highlight strengths or weaknesses in preparation, design, and implementation that affect performance, outcome, and impact.

Some guiding questions:

What did you learn in this process?

What was difficult or challenging?

How did you overcome the challenges faced?

How did you engaged or worked with partners successfully?

If you were to start over, what would you do differently?

Word limit: 200 words

SELF-CHECK – Have you:

- ☐ *Identified both challenges/weaknesses and successes/strengths?*
- ☐ *Identified what you might have done differently to ensure a better outcome or greater impact?*
- ☐ *Identified who/what other organization/canter/CRP can potentially benefit from these lessons?*

12. Full reference citations and URL link to published research work.

For all research publications and other types of research outputs (data, tools, guidelines etc.) associated with this outcome story, please include below:

13. Please check any of the following that are being submitted to complement your outcome story:

- ☐ Quality Photo(s) (of landscape, beneficiaries and activities) with appropriate captions and credit
- ☐ Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)
- ☐ Testimonials from Partners (quote, video, letter, interview, survey, etc.)
- ☐ Full reference citations and URL hyperlinks to published research work
- ☐ Blog and/or other website stories with URL links
- ☐ Newspaper Articles (print or electronic)
- ☐ Communication (non-scientific) Materials Produced (brochure, poster, press release, etc.)
- ☐ Supporting Materials (presentations, workshop reports, activity reports, donor reports)
- ☐ Video/Audio Clips
- ☐ Other (please explain: _____)

14. Final Checklist

Please use the following checklist to ensure your outcome story is ready for sharing.

No.	Question to consider	Yes	No
1	Does the story describe the outcomes the research produced and the people who are benefitting? What changes–in skills, knowledge, attitude, practice, or policy–has the research brought, and who is benefitting from these changes?		
2	Does the story capture outcomes from an interesting angle (possibly a human angle) that would captivate the attention of the target audience?		
3	Does the story explain what new insights the research brings? Does the story describe a key insight on what works and what doesn't and something that future research could build on.What are the main lesson learned?		
4	Does the story make a compelling point that people will remember? Does the story show how the research makes a difference to improving livelihoods and reducing poverty?		
5	Does the story provide interesting facts that people will remember?		
6	Does the story explain in clear and measurable ways the kind of impact - beyond the level of the reported outomces - could be achieved if the research outputs scaled out and up?		
7	Does the story show which partners contributed and how?		

8 Does the story include quotes from scientists, partners and/or beneficiaries?

9 Have I provided links to other media (journal articles, website news, newsletter, blogs, annual reports of other CGIAR centres, CRPs) that also feature this story?

10 Have I provided the contact details of people who can provide more information?

SECTION V – LIST OF 2015 PUBLICATIONS AND SCIENTIFIC OUTPUTS

In 2015, NAWA flagship produced under the framework of the CGIAR Research Program on Dryland Systems a total of X published articles (Y indexed by ISI), Z books, and several policy and technical briefs.

A clear move towards the examination of new systems approaches is emerging in this body of scientific knowledge, including two strategy papers. We expect the systems approach will generate greater public awareness of agricultural livelihood issues in dryland areas and reshape traditional thinking about key performance determinants of dryland agro-ecosystems and relevant responses to meet challenges faced by rural dryland communities.

The following represents a summary of all 2015 publications and research outputs produced by Centre under Dryland Systems by Region/ALS Flagship, including full and correct citation of all publications, weblink and categories of scientific output marked with the following codes to indicate:

- (S) = multidisciplinary/system research
- (M) = mono-disciplinary research

- [X.XX]= ISI Impact Factor[1]
- (O) = Open Access

*IMPORTANT NOTE": All listed publications must clearly acknowledge the research was conducted under the framework of CGIAR Research Program on Dry and Systems and include the appropriate acknowledgment statement as suggested in the Guidance on Dryland Systems Acknowledge and Disclaimer (see link).

Table 1. Summary of all ISI publications

Region/ALS	ISI Factor [range of ISI scores]	ISI Open (% of ISI articles)	ISI Monodisciplinary (% of ISI articles)	ISI Multidisciplinary (% of ISI articles)
WAS/ NAWA/ ESA/ CA/ SA/ TOTAL	0.312-3.089	27.3%	81.8%	18.2%

Table 2. Summary of Non-ISI Publications

Region/ALS	Non-ISI Articles	Book Chapters	Technical Reports & Working Papers	Proceedings	Datasets	Other
WAS/ NAWA/ ESA/ CA/ SA/ TOTAL	09	04	02	09	0	10

[1] *For ISI, the JCR Impact Factor List for 2013 has used (https://www.360researchpapers.com/resources/impact-factor, accessed 6 July 2015). For journals not listed, the website of that journal was checked and if it lists an* Region *ISI factor, this was recorded.*

Please list in alphabetical order, full citation, weblink and codes as applicable for all publications as shown in the examples below under each category of research output.

ISI Journal Articles (11)

1. **(M)** – **(O)** Akroush, S. & Dhehibi, B. 2015. Predicted Willingness of Farmers to Adopt Water Harvesting Technologies: A Case Study from the Jordanian Badia (Jordan). American-Eurasien Journal of Agricultural and Environmental Sciences, 15 (8): 1502-1513. **[n/a]**
2. **(M)** Ates, S., Keles, G., Inal, F., Gunes, A. & Dhehibi, B. 2015. Performance of indigenous and exotic × indigenous sheep breeds fed different diets in spring and the efficiency of feeding system in crop–livestock farming. Journal of Agricultural Science 153, 554-569. **[1.157]**.
3. **(M)** Dhehibi, B., Ibrahim, Ali, & Aw-Hassan, A. 2015. Impacts of Irrigation on Agricultural Productivity in Egypt. International Journal of Water Resources Development - Special Issue: Water in the Arab World (in press). **[1.094]**.
4. **(M)** – **(O)** Dhehibi, B., Telleria, R., Aw-Hassan, A., Saad, H.M., Ziadat, F. & Weicheng, W. 2015. Impacts of Soil Salinity on the Productivity of Al-Musayyeb Small Farms in Iraq: An Examination of Technical, Economic and Allocative Efficiency. Agricultural Economic Review (in press). **[n/a]**.
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RESEARCH PROGRAM ON Dryland Systems

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Annex 1: CRP indicators of progress, with glossary and targets

This table will be automatically generated by Dryland Systems' Monitoring, Evaluation and Learning (MEL) platform. However, it is recommended that you fill the tables to ensure accuracy of reporting and accountability.

Indicator	Description of Activities and Products measured by Indicator	Deviation narrative (+/- 10%)	2015 Actual	2016 Target
KNOWLEDGE, TOOLS, DATA				
1. Number of "products" produced by the Center	Deficit supplemental irrigation + Improved agronomic package on wheat Deficit irrigation on crops (potatoes, onion, Olive)		1 1	1 1
2. Number of products produced that have explicit target of women farmers/NRM managers	Glossary: The web pages, blog stories, press releases and policy briefs supporting indicator #1 must have an explicit focus on women farmers/NRM managers to be counted Provide concrete examples of what you include in this indicator			

3. Number of products produced that have been assessed for likely gender-disaggregated impact	Glossary; Reports/papers describing the products should include a focus on gender-disaggregated impacts if they are to be counted Provide concrete examples of what you include in this indicator 2 presentations and 1 draft paper 5 (1 conference presentation, two blogs, one book chapters, and one workshop report)		3 5	
4. Number of "tools" produced by the Center	Aquacrop model (activity. Water & land productivity in rainfed systems)			1
5. Number of tools that have an explicit target of women farmers	Glossary: The web pages, blog stories, press releases and policy briefs supporting indicator #4 must have an explicit focus on women farmers/NRM managers to be counted Policy tools on decent work for women Developing a tool for assessing working conditions for women in rural areas			1 1
Indicator	**Description of Activities and Products measured by Indicator**	**Deviation narrative (+/- 10%)**	**2015 Actual**	**2016 Target**

KNOWLEDGE, TOOLS, DATA				
6. Number of tools assessed for likely gender-disaggregated impact	Glossary: Reports/papers describing the products should include a focus on gender-disaggregated impacts if they are to be counted			
7. Number of open access databases maintained by Center	Yields and water use in field experiments (wheat, Potatoes, onion, Olive)		4	4
8. Total number of users of these open access databases		-		
9. Number of publications in ISI journals produced by Center	Please indicate total number and complete in detail Section V of the annual report Response of wheat and olive trees to different levels of deficit irrigation			3

10. Number of strategic value chains analyzed by Center	Clearly indicate the type of value chains you are reporting on in the next columns Olive VC – sheep meat VC -		3	3
11. Number of targeted agro-ecosystems analysed/ characterised by Center	Specify the type of system, using its main products as descriptors (e.g., mixed crop, livestock system; monoculture of XX; agroforestry with maize, beans, etc..; mixed cropping with upland rice, cassava, etc…)by geographical location and agroecological zones (FAO typology) Water productivity in forage based cattle production was characterized in Meknes site		1	
Indicator	**Description of Activities and Products measured by Indicator**	**Deviation narrative (+/- 10%)**	**2015 Actual**	**2016 Target**
KNOWLEDGE, TOOLS, DATA				

12. Estimated population of above-mentioned agro-ecosystems	Three communities in Meknes region, Morocco		Potential (41,479)	
CAPACITY ENHANCEMENT AND INNOVATION PLATFORMS				
13. Number of trainees in short-term programs facilitated by Centre (male)	IPM		45	

14. Number of trainees in short-term programs facilitated by Centre (female)	(see above, but for female) Training related to agricultural gender wage gaps: Trainees with one third are women		20	
15. Number of trainees in long-term programs facilitated by Center (male))	Glossary: The number of people who are currently enrolled in or graduated in the current fiscal year from a bachelor's, master's or Ph.D. program or are currently participating in or have completed in the current fiscal year a long term (degree-seeking) advanced training program such as a fellowship program or a post-doctoral studies program. A person completing one long term training program in the fiscal year and currently participating in another long term training program should be counted only once. Specify in this cell number of Master's and number of PhD's MS student		1	
16. Number of trainees in long-term programs facilitated by Center (female)	(see above, but for female)			

Indicator	Description of Activities and Products measured by Indicator	Deviation narrative (+/- 10%)	2015 Actual	2016 Target
CAPACITY ENHANCEMENT AND INNOVATION PLATFORMS				
17. Number of multi-stakeholder R4D innovation platforms established for the targeted agro-ecosystems by the Center	Glossary: To be counted, a multi-stakeholder platform has to have a clear purpose, generally to manage some type of tradeoff/conflict among the different interests of different stakeholders in the targeted agro-ecosystems, and inclusive and clear governance mechanisms, leading to decisions to manage the variety of perspectives of stakeholders in a manner satisfactory to the whole platform. Indicate the focus of each platform in this cell, including geographical focus Cereal & legumes systems IPM		1	
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT				

18. Number of technologies/NRM practices under research in the Center (Phase I)	IPM		3	
	Varieties of durum wheat; Deficit supplemental irrigation on potatoes, Onion and Olive		2	
	Water productivity in cattle farming was characterized and sustainable water management for improved management practices were identified.		2	

19. Number of technologies under research that have an explicit target of women farmers	The papers, web pages, blog stories, press releases and policy briefs supporting indicator #x must have an explicit focus on women farmers/NRM managers to be counted			
Indicator	**Description of Activities and Products measured by Indicator**	**Deviation narrative (+/- 10%)**	**2015 Actual**	**2016 Target**
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT				

20. Number of technologies under research that have been assessed for likely gender-disaggregated impact	Reports/papers describing the products should include a focus on gender-disaggregated impacts if they are to be counted			
21. Number of agro- ecosystems for which CRP has identified feasible approaches for improving ecosystem services and for establishing positive incentives for farmers to improve ecosystem functions as per the CRP's recommendations	Use the same classification of agro-ecosystem as for indicator 11 above, including geographical location and agro-ecological zone			

22. Number of people who will potentially benefit from plans, once finalised, for the scaling up of strategies	Indicate the potential number of both women and men Deficit supplemental irrigation on wheat		Potential(41,479)	41,479
Indicator	**Description of Activities and Products measured by Indicator**	**Deviation narrative (+/- 10%)**	**2015 Actual**	**2016 Target**
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT				
23. Number of technologies /NRM practices field tested (phase II)	Package (Deficit supplemental irrigation, Early planting, Fertilizers management, Weed control)		4	4

24. Number of agro-ecosystems for which innovations (technologies, policies, practices, integrative approaches) and options for improvement at system level have been developed and are being field tested (Phase II)	Clearly identify in this cell the type of technology and the geographical location of the field testing/pilot projects, and use the same classification of agroecosystem as for indicator 11, specifying the type of agroecosystems in which field testing is taking place Supplemental/deficit irrigation		1	

25. Number of above innovations/approaches/options that are targeted at decreasing inequality between men and women				
Indicator	Description of Activities and Products measured by Indicator	Deviation narrative (+/- 10%)	2015 Actual	2016 Target
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT				

26. Number of published research outputs from CRP utilised in targeted agro-ecosystems	Papers in ISI journals Papers in non-ISI journals Papers in proceedings		11 09 09	
27.Number of technologies/NRM practices released by public and private sector partners globally (phase III)	Glossary: In the case of crop research that developed a new variety, e.g., the variety must have passed through any required approval process, and seed of the new variety should be available for multiplication. The technology should have proven benefits and be as ready for use as it can be as it emerges from the research and testing process. Technologies made available for transfer should be only those made available in the current reporting year. Any technology made available in a previous year should not be included. Clearly identify in this cell the technologies/practices thus released (scale up phase), the geographical areas concerned			
POLICIES IN VARIOUS STAGES OF DEVELOPMENT				

28. Numbers of Policies/ Regulations/ Administrative Procedures Analyzed (Stage 1)	Number of agricultural enabling environment policies / regulations / administrative procedures in the areas of agricultural resource, food, market standards & regulation, public investment, natural resource or water management and climate change adaptation/mitigation as it relates to agriculture that underwent the first stage of the policy reform process i.e. analysis (review of existing policy / regulation / administrative procedure and/or proposal of new policy / regulations / administrative procedures).Please count the highest stage completed during the reporting year – don't double count for the same policy. Clearly identify in this cell the type of policy, regulations, etc. from the above list			
Indicator	**Description of Activities and Products measured by Indicator**	**Deviation narrative (+/- 10%)**	**2015 Actual**	**2016 Target**
POLICIES IN VARIOUS STAGES OF DEVELOPMENT				

29. Number of policies / regulations / administrative procedures drafted and presented for public/stakeholder consultation (Stage 2)	....that underwent the second stage of the policy reform process. The second stage includes public debate and/or consultation with stakeholders on the proposed new or revised policy / regulation / administrative procedure. Clearly identify in this cell the type of policy, regulations and so on, and the geographical location of the consultations			
30. Number of policies / regulations / administrative procedures presented for legislation(Stage 3)	: ... underwent the third stage of the policy reform process (policies were presented for legislation/decree to improve the policy environment for smallholder-based agriculture.) Clearly identify in this cell the type of policy and the country/region concerned			

31. Number of policies / regulations / administrative procedures prepared passed/approved (Stage 4)	: ...underwent the fourth stage of the policy reform process (official approval (legislation/decree) of new or revised policy / regulation / administrative procedure by relevant authority). Clearly identify in this cell the type of policy and the country/region concerned			
Indicator	**Description of Activities and Products measured by Indicator**	**Deviation narrative (+/- 10%)**	**2015 Actual**	**2016 Target**
POLICIES IN VARIOUS STAGES OF DEVELOPMENT				

32. Number of policies / regulations / administrative procedures passed for which implementation has begun (Stage 5)	: ...completed the policy reform process (implementation of new or revised policy / regulation / administrative procedure by relevant authority) Clearly identify in this cell the type of policy and the country/region concerned			
OUTCOMES ON THE GROUND				
33. Number of hectares under improved technologies or management practices as a result of CRP research	Cereal & legumes systems IPM		32	

34A. Number MALE of farmers and others who have applied new technologies or management practices as a result of CRP research	Supplemental irrigation on wheat Deficit supplemental irrigation on wheat		32 72% adoption rate 21% adoption	

34B. Number of FEMALE farmers and others who have applied new technologies or management practices as a result of CRP research	Clearly identify in this cell the geographic location of these farmers and whether the application of technologies is on a new or continuing area and indicate:			


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Annex 2: Performance indicators for gender mainstreaming with targets defined

Please delete the part not achieved by your centre and add details.

Performance Indicator	CRP performance approaches requirements	CRP performance meets requirements	CRP performance exceeds requirements
1. Gender equality targets defined	Sex-disaggregated social data is being collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations	Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations And The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs)	Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations And The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs) And CRP targets changes in levels of gender inequality to which the CRP is or plans to contribute, with related numbers of men and women beneficiaries in main target populations

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ANNEX 3: List of Centre Research Staff contributing to Dryland Systems

Please provide list and relevant information of all research staff in your centre involved in Dryland Systems research from all Windows

2. Institutional architecture for integration of gender is in place	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy -CRP M&E system has protocol for tracking progress on integration of gender in research	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS and funds allocated to support their interaction. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy -CRP M&E system has protocol for tracking progress on integration of gender in research And A CRP plan approved for capacity development in gender analysis	CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS and funds allocated to support their interaction. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy -CRP M&E system has protocol for tracking progress on integration of gender in research And A CRP plan approved for capacity development in gender analysis And The CRP uses feedback provided by its M&E system to improve its integration of gender into research

of funding by completing the attached excel document and submitting it separately as an attachment to the annual report.


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Central Asia Flagship 2015 Annual Report

December 2015

Food security and better livelihoods for rural dryland communities

The CGIAR Research Program on Dryland Systems aims to improve the lives of 1.6 billion people and mitigate land and resource degradation in 3 billion hectares covering the world's dry areas. Dryland Systems engages in integrated agricultural systems research to address key socioeconomic and biophysical constraints that affect food security, equitable and sustainable land and natural resource management, and the livelihoods of poor and marginalized dryland communities. The program unifies eight CGIAR Centres and uses unique partnership platforms to bind together scientific research results with the skills and capacities of national agricultural research systems (NARS), advanced research institutes (ARIs), non-governmental and civil society organizations, the private sector, and other actors to test and develop practical innovative solutions for rural dryland communities.

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

For more information please visit:

drylandsystems.cgiar.org

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DISCLAIMER

This document was prepared by Douglas Merrey (Team Leader), Judit Szonyi (member) and Ross McLeod (member) of the CRP-Commissioned External Evaluation team for the CGIAR Research Program on Dryland System. The views expressed in this document do not necessarily reflect the views of the Dryland Systems program.

Table of Contents

List of Acronyms

AIS	Agricultural Innovation System
BISA	Basin Irrigation System Authority
CA	Conservation Agriculture
CI	Crop Intensity
ET	Evapo-Transpiration
GEF	Global Environment Fund
HMZ	Hydro-Module Zone
K_c	Crop Coefficient
NARS	National Agricultural Research System
SGP	Small Grant Program
USD	United States Dollar
WCA	Water Consumer Association
WUA	Water User Association
WUE	Water Use Efficiency

SECTION I – Key MESSAGES

a. Synthesis of Progress and Challenges (1 ½ page)

System approach studies in irrigated agro-ecosystems that have targeted the Fergana Valley and Khorezm region have demonstrated that the introduction of raised bed and cutback furrow irrigation approaches to enhancing water productivity significantly improved water and energy productivity. In addition, diversification of production systems through the introduction of mungbean into wheat/cotton cropping system has resulted in increased farmer revenues and overall reductions in labor cost through the introduction no-till. This effectively resulted in a significant cost savings (twice less) than conventional tillage.

ET calculator in Russian version was developed as part of the weather station based irrigation advisory system. This application was developed for WUAs and farmers, in order to reduce excessive application of irrigation water to fields.

A field-tested toolkit for rapid small ruminants' value chain assessment was developed in Russian. One of the gaps is forage options for saline lands in Aral Sea Basin, was addressed through local initiatives that included women learning alliances. Solutions include the growing of winter feed for livestock keepers, using non-conventional crops. Further the use of ultrasound pregnancy diagnosis has been introduced to address poor lambing rates. This has been successful in assisting farmers to provide supplemental feeding regime and to identify those ewes that are barren and need to be culled from the flock.

A seed system was initiated to strengthen farmers' capacity to locally produce high quality (yellow rust resistant) wheat seed. Formal and informal meetings were organized with seed producing farmers and policy makers about establishing a mungbean seed system platform. By producing seed, the participant farmers' were able to increase their income through premium process being paid for quality seed.

A network of forage seed growers was established and options for double cropping (suitable crops and their seeds such as corn, sorghum, pearl millet, mungbean, sudangrass, forage pea, sunflower, soybean) was introduced. The seed Growers Network produced 2 tons of forage seed in 2015 clearly indicating that there is sustainability and demand for these diverse crops and their introduction into current production systems.

In the Tajikistan and Uzbekistan sites of Fergana Valley, informal and indigenous WUAs have emerged and are fully operational. These groups are collecting data and information that are being used in decision making. Such groups could play an important role in sustainable water management and the establishment of functional institutions that are required to address the current impasse on sustainable water use in the region.

Gender-disaggregated data sets have been generated for three locations in Central Asia. These data sets have captured the spatial variation in livelihoods and could be used to identify interventions that potentially could be introduced along with insights in institutional and policy reforms that are required to improve livelihoods.

b. Significant Research Achievements (1 page)

Several notable outcome stories originated from activities carried out in Fergana Valley and Aral Sea action sites. These are highlighted below in brief.

Increased awareness and application of conservation agriculture among producers. Promotion of conservation agriculture in the pilot area has received new impetus with steady increases in fuel and fertilizer prices and by providing opportunity to integrate food/feed legumes into cereal cropping system along with promising water saving benefits. These were the 'weakest links' for a farmer to address in order to diversify crops and cover input costs in an environment where irrigation water insecurity poses risks to invest and generate sufficient incomes. As a result area, within 2015 under CA reached 50 ha.

Farmer network of forage seed growers using no-till in Uzbekistan. Forage crop seeds and associated production of forage for livestock feed is persistently undersupplied, particularly during off-season when demand for feed is high. For major food security crop such as wheat, the governmental agencies play major role, however most other seeds including forage seeds are still imported from abroad. Farmers have been organized to build a seed grower network to produce forage crop seeds of six salt and drought resistant crops using no-till. The seed material produced is pooled for bulk-scale supply to forage farmers located in neighborhood. Through this activity the network of farmers have produced 2 tons of seed of improved varieties of forage crops and plan to distribute to small farmers for seed multiplication for out-scaling in 2016.

Rural women learning alliance. Living conditions for rural communities inhabiting the small villages around the Aral Sea area in Uzbekistan have been exacerbated by a combination of climate change and land degradation factors. Seminars covering different aspects of alternative forage crops for animal feeding in winter, as well as a popular master cooking class on preparation of food recipes from non-traditional nutritious crops were inspiring for about forty-five (45) women farmers who decided to create a *Rural Women Learning Alliance* in order to join forces with the scientists and with each other to identify and promote strategies for diversifying household incomes through cultivation of non-traditional crops. The cultivation of halophytes in combination with forage biomass or remains of traditional crops after harvesting represents a critical innovation in the cattle feeding system in this Aral Sea region.

Introducing mungbean into the crop rotation has increased the existing wheat-cotton based cropping intensity (CI) to 150%, in the Fergana Valley. Mungbean cultivation improves the soil health through nitrogen fixation, thus reducing the cost of fertilizer application for farmers allowing them to earn additional income of USD 683/ha from wheat seed production and USD 1900/ha from mungbean seed production. These results prompted project managers to conduct a capacity building activity for wheat and mungbean seed producers, on production of quality mungbean seed by providing them technical information and field demonstrations of the technology. Substantial additional income from wheat-mungbean rotations using short duration improved varieties of mungbean is changing the mind-set of the farmers to adopt this technology. Policy makers are considering allocating additional farmland under wheat-mungbean annual crop rotation, which will increase CI to 200%, and expand this technology to other parts of Uzbekistan.

c. Financial Summary (1/2 page)

This section will be updated once your center closes the accounting books in 2016.

SECTION II– IMPACT PATHWAY AND INTERMEDIATE DEVELOPMENT OUTCOMES (IDOS)

e. Progress along the Impact Pathway (1/2 page)

CGIAR centres and their partners implemented 24 activities in Fergana Valley and Aral Sea Action Sites in 2015, with significant contributions to IDOs. In both action sites, a number of activities aimed at sustainability enhancement of the productivity of current production systems, its internal and external interaction, and organizing platforms to foster multi-stakeholder process in addressing pressing issues. Major achievements are directed towards;

In the Aral Sea Basin; Maximizing WUE through weather based irrigation, improving water productivity through integrated land and water management, salinity management, integrating forage and legume crops through conservation agriculture, and seed platforms to improve availability of seeds and forage production from irrigated areas, combining value chain analysis with rangeland, forage and livestock research,

In the Fergana Valley; Training seed growers and enhancing their skills, implementing seed storage system, support to farmers in the production of quality seed, improved irrigation systems, forming innovation platforms, gender research on agricultural labour, water and energy productivity assessment, enhancing WUAs role in water management and the performance of irrigation scheduling.

f. Central Asia/ Agro-Pastoral

I. Progress towards outputs (2 pages)

Salinity management. Field trials with three different furrow irrigation configurations within raised beds that included conventional methods (every furrow irrigated), alternating skip furrow and permanently skip furrow irrigation along with two wheat varieties were implemented in Chimbay District, at experimental site of Karakalpakstan Crop Husbandry Research Institute. http://www.cac-program.org/crpds/reports

Performance of irrigation methods and irrigation scheduling and their profitability. A system research field trial with raised bed furrow irrigation, two crop rotation and three wheat varieties implemented in Urgench district, at experimental site of Khorezm branch of Uzbekistan Cotton Research Institute. Results show that, mungbean yield values improved by 17%, whereas water productivity enhanced by 20%. K_c values for mungbean determined as 0.60, 0.90 and 1.02. At the end of the trial, the farmers' revenue was increased by 16% through the introduction of mungbean. http://www.cac-program.org/crpds/reports

Innovation Platform. Baseline survey in Karauzyak district was undertaken covering 100 households from two villages "Karabuga" and "Algabas". Collected dataset on socio-economic, gender, youth, capacity building, extension, market and finance aspects will be available to Multidisciplinary Research Team and community of practice from January, 2016 at http://cac-program.org/download/file/220. The dataset will be periodically updated.

Weather station-based irrigation advisory system fine-tuned, tested and operationalized for most-predominant hydro-module zone (HMZ) of Khorezm region of Uzbekistan. Field monitoring for soil-water balance and crop growth was carried out to compare with the crop models developed for popular cultivars of winter wheat and cotton (open access database - https://dataverse.harvard.edu/dataverse/wue?q=&types=dataverses&sort=dateSort&order=desc&page=1). Results indicate that, farmers are applying excess volumes of irrigation. There is potential to reduce the amount of water applied at the field level by 30-35% irrigation water at the field level without adversely affecting yields. In order to facilitate uptake of this research by stakeholders, tools that include a Russian version of reference ET-calculator were developed, handbooks, with testimonies of local authorities, in local language were published, seminars, stakeholder consultation events and training courses were organized.

Forage options for saline lands in Karabuga village and neighboring villages. Cultivation of non-conventional, salt tolerant forage species for the winter feeding of Karakul sheep was evaluated (including 6 forage and vegetable legumes varieties, 3 varieties of sorghum, 3 atriplex varieties, 2 pearl millet varieties, 2 fodder beet varieties, 2 topinambur varieties, 2 kochia varieties, as well as salinity resistant varieties of alfalfa, *Amaranthus Indigofera*, perennial sorghum, sweet clover, sainfoin, sesame, sunflower, triticale). A total of 15 households participated in testing the forage varieties.

Small-ruminant value chain. Field-tested toolkit for rapid small ruminants' value chain assessment made available in Russian. Implementation of small ruminants' value chain rapid assessment in Karauzyak district, Karakalpakstan is on-going (report under review: Rudenko et al. 2015).

At least two improved livestock management practices tested and evaluated with livestock keepers at the action site. A nucleus flock for Karakul-Sur was established in order to give new impetus for genetic improvement of pelt production in the district of Karauzyak, Karakalpakstan. The flock composed of 317 ewes and 15 improved rams, 10 of which are pedigree Karakul-Sur purchased from the elite flock of the Uzbek Research Institute for Karakul Husbandry and Desert Ecology in Turtkul district. At least 125 controlled matings were facilitated between the 10 improved rams and the elite ewes expecting about 100 lambs of high quality pedigree Sur (report under review: Rekik et al. 2015). Introduced field solutions for ultrasound pregnancy diagnosis to reduce reproductive losses and increase lambing rates in at least 10 sheep flocks (http://drylandsystems.cgiar.org/news-opinions/ultrasound-diagnosis-low-tech-tool-sheep-and-goat-production-systems).

List of agencies involved in seed chain of crops prepared. Workshop (http://www.cac-program.org/files/120c74366bc03594d6bc886fb84f4b36.pdf) was organized (March 2015) to understand diverse agencies involved in seed chain of different crops (http://www.cac-program.org/files/4fcffae3b5577ea66526842ff77bbeb8.pdf). There were 49 participants (42 men and 7 women) including farmers, seed producers, extension specialists, and policy makers. For the dominant food security crop wheat, governmental agencies play a major role. For minor cereals, farmers themselves and the grain market are major providers of seed. For vegetables, potato and fruits, private seed suppliers play a key role. The infrastructures for wheat seed system are largely in place in Karaozak district, but some additional farm equipment and seed processing facilities are needed (http://www.cac-program.org/files/f56814786d233c2c8a9394c48e7fc8b0.pdf). For crops other than wheat modest infrastructures are needed for a functional seed systems to make available quality seed to the farmers.

Double cropping under no-till. Analysis of cropping system in Karakalpakstan have shown great potential for double cropping under no-till of alternative cereal crops, food and forage legumes that fit into current cropping patterns without compromising government policies. Combinations of laser leveling and bed planting (which are permanent beds) provided similar or higher crop yields compared to traditional practice. The maximum grain yield of sorghum 3.02 t/ha was recorded with furrow irrigation while conventional produced the lowest yield 0.97 t/ha. Water use efficiency under furrow irrigation increased by 21–30% combined with an approximate 17% savings in applied irrigation.

Seed production of agricultural crops. The research was able to address farmers' access to quality seed of new varieties through a *Seed Growers Network* which has already produced 2 tons of forage seed in 2015 to be distributed in 2016. This seed network will facilitate the development of new plant varieties and the delivery of high quality seed of those varieties to farmers to increase crop productivity, food security and economic development.

The assessment of the economic implications of introduced salt-tolerant and drought resistant crops under conservation agriculture. Under the prevailing conditions in Karakalpakstan conventional tillage was more costly compared to either reduced or no-till. Despite lower productivity under no-till, i.e. mungbean, overall labor cost under no-till was 50% less than in conventional tillage. Such savings in labor and time for field operations offer great benefits. For

example, the highest profit was with no-till mungbean (1,782 USD vs. 1,733 USD under conventional) while the negative net revenue was observed with forage pea under conventional tillage (-123 USD vs. 169 USD under no-till).

II. Progress towards the achievement of research outcomes and IDOs (2 pages)

IDO 1

Innovation Platform. Gender-disaggregated database of 100 household survey available that captures the spatial variation in livelihoods, and to define interventions at technical, institutional and policy levels to improve livelihoods. Multidisciplinary Research Team use an 'Innovation Platform' approach to engage with a range of stakeholders that have a focus on collective actions to identify and alleviate the constraints affecting productivity growth.
List of agencies involved in seed chain of crops prepared. Capacity of 49 (7 female) farmers and seed growers was strengthened through information provided on availability of crop varieties and seed production technologies of different crops that they can benefit from (http://www.cac-program.org/files/120c74366bc03594d6bc886fb84f4b36.pdf). Pool of trained staff and agencies involved in seed chain contributed to the establishment of a functional *Seed System Platform* in Karaozek district.
Forage options for saline lands in Karabuga village and neighboring villages. Livestock keepers engaged in winter feed production, in the genetic improvement of the Karakul sheep breed for high-quality Sur pelt production and in enhancing reproductive performance (improvement of lambing rates and reduction of reproductive losses). These technologies contribute towards IDO 1.1 “Increased resilience” and IDO 1.4 “Increased productivity”. The work on forage is gender-related, hence contributes to the cross-cutting IDO B1 “Equity and inclusion achieved”.
Double cropping under no-till. *Network of forage seed growers* established through enabling conditions created for farmers to use no-till (machinery) and options for double cropping (suitable crops and their seeds such as corn, sorghum, pearl millet, mungbean, sudangrass, forage pea, sunflower, soybean).

IDO 3

Building partnerships with local stakeholders on evaluating irrigation methods on salt dynamics of the soil and wheat agriculture. Design field trials. Engaged 40 stakeholders in field trials on raised bed furrow irrigation established in Karaozek district. The capacity of 45 farmers strengthened through information provided to them on irrigation methods and salinity management. (http://www.cac-program.org/crpds/reports)
Mung bean practices improved. Winter wheat planted. Capacity of 6 researchers (including 4 female) of local partner NGO KRASS enhanced on integrated land and water management, conservation agriculture, wheat varieties, irrigation scheduling, raised bed furrow irrigation applications and economic evaluation of water saving technologies.
Weather stations, Mung bean trials and irrigation managed by ET based scheduling. Established experimental fields on irrigation scheduling using weather stations in Urgench district. Trained 30 farmers (including 10 female) on mungbean irrigation using ET based scheduling.
Economics of mung bean cultivation. Local partner NGO KRASS adapted and implemented economic evaluation methods of field interventions.
Weather station based irrigation advisory system organized consultation event with 76 stakeholders (15 female) from local WUAs, NARS, national experts as well as scholars from academia to develop a robust and practical work plan (http://dx.doi.org/10.7910/DVN/O0U12V). As the activity progressed a series of 3 seminars and field visits were organized to educate total of 46 (10 female) WUA technical staff on the methodology – this included trainings on data collection protocols, management of irrigation

water as per weather station data analysis and comparison of results between control and treatment sites.

Impact of conservation agriculture on WUE. Capacity of 30 farmers strengthened on using alternate furrow irrigation and zero slope furrow irrigation.

III. Progress towards Impact (1/2 page)

Inspired by the research results on forage testing, about forty-five (45) women farmers created a *Rural Women Learning Alliance* in order to join forces with scientists and with each other to identify and promote strategies for diversifying household incomes through cultivation of non-traditional crops, in particular forage production for winter feeding of Karakul sheep. (http://drylandsystems.cgiar.org/news-opinions/rural-women-empowered-knowledge-improve-own-livelihoods).
Seed system platform is established and have move significantly towards being fully functional in the first year. In parallel to seed system for wheat (http://www.cac-program.org/files/120c74366bc03594d6bc886fb84f4b36.pdf) with infrastructures in place, the local network of forage seed producers has been formed (*link to be provided later, once outcome story is complete*). This impact can be viewed as self-organization of farmers and producers to take action based on research interventions from CRP DS funded activity that demonstrated seed production using conservation agriculture.

IV. Unexpected Outputs, Outcomes and or Impact

Innovation Platform activity facilitated online discussions on Agricultural Innovation Systems (AIS) for food security and nutrition (FSN). This online discussions on the role of AIS in Central Asia and Caucasus countries and China towards more sustainable food security and nutrition (http://www.fao.org/fsnforum/eca/en/AIS-CAC-China) was facilitated by CRP DS Innovation Platform coordinator and conducted from the 6th May until the 9th June 2015.The online discussions harvested 83 comprehensive contributions coming from 48 experts. The geographical scope of participants was wide, drawing from 18 countries of different regions as well as from developed and developing economies. People from 73 countries visited the discussion's webpage and over 10,000 people received information on the outcomes of consultation. Roughly 35% of the participants who have took part in the discussion were women and 10% young professionals.

One of the outputs of online consultation was a set of recommendations on enhancing innovation in agro-pastoral systems in Central Asia that has contributed to CRP DS community of practice http://mel.cgiar.org/uploads/reporting/Xu3SSIJfHFwSgi3vT5oktZ94jupWgy.docx.

The Rural Woman Learning Alliance is an example of a positive unexpected outcome which resulted from participatory approaches to research that are inclusive and considerate of local community needs. (http://drylandsystems.cgiar.org/news-opinions/rural-women-empowered-knowledge-improve-own-livelihoods)

A conceptual model of a no-till drill has been facilitated by the activity on conservation agriculture. Local authorities and factory producers enthused by the performance and potential for handling diverse crops requested to borrow the available no-till drill to produce a prototype. Facilities allowed fabrication in a factory workshops located in Amudarya district, Karakalpakstan. The GEF Small Grants Programme (SGP) in Uzbekistan expressed its interest to support a proposal from a local producer to manufacture no-till drills in demonstrated facilities.

g. Central Asia/ Irrigated

I. Progress towards outputs (2 pages)

Training of seed growers. A farmer's field day was organized in Fergana, Uzbekistan (June 2015) to demonstrate comparative performance of yellow rust resistant new wheat varieties to locally grown yellow rust susceptible varieties (http://www.cac-program.org/files/37803863fae252f532ac41129de29696.pdf). A set of 17 varieties were evaluated in the farmer's field demonstration plots. 38 (2 women) wheat farmers, seed producers, extension specialists and policy makers attended the event, and their knowledge on production of high quality wheat seed, and associated production practices was strengthened.

A seed system was initiated to strengthen farmers' capacity to locally produce high quality seed for commercial production. Four farmers in Kuva district produced elite grade seed of a recently released high yielding, high quality variety 'Yaksart' on 84 ha, and harvested 574 ton of seed (http://www.cac-program.org/files/ec9f7aca08a1460f0debbbab0399c61c.pdf). Similarly, 4 farmers multiplied seed of three improved varieties of mungbean on 8 ha and produced 12.5 ton seed (http://www.cac-program.org/files/ec9f7aca08a1460f0debbbab0399c61c.pdf).

Considering seed price is twice the price of grain, these seed producing farmers earned more from seed production than they would have done from grain production. On average the farmers made additional income of USD 683/ha by producing wheat seed compared to grain. Similarly, mungbean farmers earned an average net profit of USD 1900/ha

Support to farmers production of quality seeds. A training workshop on production of quality mungbean seed was organized on December 2015 in Kuva, Fergana, in which 31 farmers (9 women) participated. There were around 30% young farmers among the participants (http://www.cac-program.org/files/6f59f8d0abe1470efda99793a991c938.pdf). The participants received information on mungbean seed production technology and seed certification and a booklet on mungbean seed production (http://www.cac-program.org/files/0ed3d962dca9c6f70e49adbd54bd5d5f.pdf). Four wheat farmers in Kuva district produced 84 ton of wheat seed of a high yielding, high quality variety Yaksart. Similarly, five farmers produced 12.5 ton of mungbean seed. By producing seed, the participant farmers' were able to increase their income since the price of seed is more than twice that of grain for both wheat and mungbean (http://www.cac-program.org/files/ec9f7aca08a1460f0debbbab0399c61c.pdf). On average the farmers made additional income of USD 683/ha by producing wheat seed compared to grain. Similarly, mungbean farmers earned an average net profit of USD 1900/ha.

Improved irrigation system – A farmer field day was conducted to demonstrate winter wheat and mungbean cultivation and various irrigation technologies. (www.mel.cgiar.org) A field experiment was completed in 2015, conducted in the farmer's field at K. Umarov Water Consumer Association, Tashlak District of Fergana Province. Trials included; wheat mungbean rotation (AVRDC is project partner), 3 wheat varieties and 3 irrigation practices. Results show that cut back furrow irrigation has positive advantages in comparison to other irrigation technologies for both crops as there are water savings and improved performance of the crop.

Innovation platform. A baseline survey was conducted in 11 major dimensions in the selected B. Gafurov district and Dj. Rasulov district of Sugd province of Tajikistan, Fergana Valley. The survey covered randomly selected 100 households. Two sets of data have been elaborated and presented in the following links; http://cac-program.org/files/Kyrgyzstan_dataset.xlsx and. http://cac-program.org/files/Tajikistan_dataset.xlsx.

Strategic gender research CRP DS review on agricultural labour and gender. 80 farmers (50 Male, 30 Female) have applied improving WUE technologies that are; furrow irrigation technology, using alternate dry furrow irrigation technology, short furrow irrigation technology, and water accounting in small holder farms in Fergana Valley.

Water and energy productivity assessment. Studies in 2015 prove the concept that irrigation methods and irrigation application rates need to be selected based on water and energy productivity of the cropping system, and not a single crop. Three factors were considered jointly: new high yielding varieties of crop, crop rotation- winter wheat – mungbean, and irrigation methods – conventional furrow, alternate furrow and cutback furrow. Based on the water and energy productivity concept cutback irrigation method was found to be the most appropriate method to apply for winter wheat/mung-bean system. Highest yield was recorded for Elomon variety (6.3 t/ha). Introducing a new variety of winter wheat and cutback furrow irrigation increased irrigation water productivity from 1.25 kg/m^3 to 2.38 kg/m^3. Energy productivity is increased from 0.26 to 0.33 kg/MJ. Mungbean sown after harvesting of winter wheat and received a pre-sowing irrigation and one more irrigation during cropping season produced additional 1.6 t/ha of grain. Total water productivity is increased from 2.38 to 3.5 kg/m^3 and energy productivity from 0.33 to 0.5 kg/MJ.

Enhancing WUA role in water allocation and management via institutional interventions. Research on the water governance situations at WUAs was conducted in Tajikistan and Uzbekistan sites of Fergana Valley. Results showed that there are informal and indigenous institutions in Fergana Valley that are operational, have data and information, and could play an important role in sustainable water management. Publications (URL links as below) were produced from this research; a key-note presentation as well as extended abstract of the paper has been published in the International Forum titled: "Agriculture and climate change in transition economies. June 2015 at Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle, Germany. (http://projects.iamo.de/fileadmin/veranstaltungen/iamo_forum/2015/IAMO_Forum_2015_Detailed_program_11_06_2015.pdf) and abstracts with presentations at http://projects.iamo.de/forum/2015/abstracts-and-presentations.html

http://projects.iamo.de/fileadmin/veranstaltungen/iamo_forum/2015/Presentations/IAMO_Forum_2015_B1_3_Mukhamedova.pdf

Research findings have also contributed to the discussion of the Policy workshop of the InDeCa2 project of the Volkswagen Foundation program: "Between Europe and the Orient - A Focus on Research and Higher Education in/on Central Asia and the Caucasus". In May 2015, InDeCA research, project staff provided a presentation on the importance of institutional innovation in agricultural extension for the improvement of water productivity at plot level. http://www.indeca-project.de/index.php?page=news_events. Final Research report was finalized in December, 2015 and uploaded to http://mel.cgiar.org/.

Performance of irrigation scheduling. A database has been built around field monitoring for soil-water balance and crop growth of wheat and cotton and results are compared to the crop models. https://dataverse.harvard.edu/dataverse/wue?q=&types=dataverses&sort=dateSort&order=desc&page=1). Results from the research over two years conclude that, farmers are applying excess volumes of irrigation and there is the potential to save approx. 30-35% irrigation water at the field level without adversely affecting yields. An ET calculator tool in Russian was developed, handbooks, with testimonies of local authorities, in local language was published. Seminars, stakeholder consultation events and training courses were organized.

[2] Promotion of Institutional Development for Common Pool Resources Management in Central Asia (InDeCa) project

II. Progress towards the achievement of research outcomes and IDOs (2 pages)

IDO1, IDO2 and IDO3

Capacity of 38 (36 male and two female) farmers, researchers, extension workers and policy makers was strengthened on new superior winter varieties available for cultivation in Fergana Valley of Uzbekistan, and production of high quality seed. The participant farmers showed interest in growing Yaksart', 'Buniyodkor' and 'Hazrati Bashir varieties in 2015-2016 crop year, and inquired about availability of seed (http://www.cac-program.org/files/37803863fae252f532ac41129de29696.pdf)

Capacity of 31 farmers (9 women) were strengthened in mungbean seed production through a training workshop organized on 11th December 2015 (http://www.cac-program.org/files/6f59f8d0abe1470efda99793a991c938.pdf).

Mungbean seed system improvement was initiated in Fergana Valley. This was evidenced through a meeting of five mungbean seed producers (3 men and 2 women) who showed commitment towards continuing seed production activities in future (http://www.cac-program.org/files/7041de21f623ffc606acc937b9a01adc.pdf)

In Kuva, farmers through producing seeds, have increased their income, since the seed price is more than twice that grain for both wheat and mungbean (http://www.cac-program.org/files/ec9f7aca08a1460f0debbbab0399c61c.pdf)..

Formal and informal meetings were organized with the seed producing farmers and policy makers about establishing a mungbean seed system platform in Kuva district of Uzbekistan. (http://www.cac-program.org/files/7041de21f623ffc606acc937b9a01adc.pdf).

IDO 2; IDO 4

A farmer field day, with the participation of 60 farmers, WUAs personnel, representatives of district and province water departments, local governance officials and other interested stakeholders, inspired 15 farmers to cultivate mung-bean, as a second harvest crop in 2016. http://www.cac-program.org/crpds/reports

Following the institutional analysis of WUAs, capacity building activities were conducted in Kuva in Uzbekistan, Babajan Gafurov and J.Rasulov Districts in Tajikistan of Fergana Valley. 3 WUAs have benefited from the trainings, which serve over 200 farmers where 20% are women.

3 WUAs governance bodies, also recognized the necessity of involving farmers in decision making processes while managing water resources.

Increased WUE on 350 ha of irrigated land was demonstrated for 100 farmers in Kuva district of Fergana Valley, Uzbekistan.

Two field workshops were held in the Fergana Valley for farmers and WUA staff during July (Andijan Province) and November (targeting Fergana Province) to demonstrate the weather station-based irrigation advisory system. At the July workshop, 30 farmers, WUA staff and regional administration staff were trained in the use of a project-developed handbook, exposed to field demonstration, posters and presentations. At the November workshop, 110 people participated including 60 farmers and WUA staff from non-participating neighbouring WUAs that included Tashkent, Syrdarya, Djizak, and Samarkand Provinces.

III. Progress towards Impact (1/2 page)

Three new wheat varieties, Buniyodkor, Shams, and Yaksart showed 23 to 36% higher yield than the widely grown commercial variety Krasnodar-99 in Fergana Valley of Uzbekistan

(http://www.cac-program.org/files/46a8decb92cf4631c17c71e3623c2e7d.pdf), their cultivation will increase farm productivity by >20% and contribute to food security.
Farmers' income was substantially increased from seed production of wheat and mungbean. This will have impact as more farmers are interested in seed production, thus quality seed would reach more rural farmers.

IV. Unexpected Outputs, Outcomes and or Impact

Online discussions on Agricultural Innovation Systems (AIS) in Central Asia and Caucasus countries and China towards more sustainable Food Security and Nutrition (FSN) (http://www.fao.org/fsnforum/eca/en/AIS-CAC-China) was facilitated by CRP DS Innovation Platform, and conducted from the 6th May until the 9th June 2015, with the participation of 48 experts, from 18 countries from different regions as well as from developed and developing economies. Above 10,000 People from 73 countries visited the discussion's webpage and above 10,000 people received information on the consultation. Roughly 35% of the participants who have taken part in the discussion were women and 10% young professionals.
A set of recommendations on enhancing innovation in irrigated systems in Central Asia based on the outputs and outcomes of the online-Discussion on the "The role of Agricultural Innovation Systems in Central Asia and Caucasus countries and China towards more sustainable food security and nutrition" provided to CRP DS community of practice in Central Asia http://mel.cgiar.org/uploads/reporting/gKzsBY271OSLXkhcn8ZMMkcm7uEgRJ.docx

SECTION III – CROSS-CUTTING ISSUES

a. Gender Research Achievements (1 page)

Over the reporting period gender-disaggregated social multi-dimensional datasets, including social/gender aspects collected in Karaozek district of Karakalpakstan, Aral Sea Action site http://cac-program.org/download/file/220. This data will be used to diagnose important gender-related constraints and interventions.

The work on forage production for winter feeding is gender-related as the target audience is predominantly women farmers. Further, gender sensitive training on reproduction and reproduction-related diseases of livestock are envisaged in 2016.

In all activities and events organized within the Aral Sea action site gender considerations were given due attention, where both men and women participated. Overall female participation in events ranged from 20 to 100% in select field demonstrations and seminars.

Two sex-disaggregated social multidimensional datasets, including social/gender aspects are being collected in Sugd province Tajikistan (Irrigated systems) http://cac-program.org/files/Kyrgyzstan_dataset.xlsx and Batken province, Kyrgyzstan (Irrigated systems) and http://cac-program.org/files/Tajikistan_dataset.xlsx.

b. Partnerships Building Achievements (1 page)

Karakalpakstan Crop Husbandry Research Institute; Uzbek State Soil Scientific Research Institute; Khorezm Rural Advisory Support Service (KRASS), in Uzbekistan, have collaborated in implementing field trials on irrigation management and scheduling.

International Centre of Bio saline Agriculture to implement the component on winter forage production in the district of Karaozek.

Uzbek Research Institute for Karakul Husbandry and Desert Ecology covered piloting genetic improvement of Sur pelt production and assessment of rangeland status and genetic diversity.

Establishing the nucleus flock for Karakul-Sur production led to the development of strong partnership with the **governor office of the district of Karaozek.**

Institute of Plant Science of Republic Uzbekistan, in obtaining the new varieties of winter wheat.

AVRDC, a joint action was built to conduct experiments with new varieties of mung-bean under different irrigation technologies in Uzbekistan.

Water Consumer Association (WCA) K. Umarov in Tashlak district, Uzbekistan has been chosen for field experiments and for a case-study on WUA for assessing the water governance on-farm level.

Water Consumer Association Tomchi-Kuli in Markhamat District, Andijan Province, Uzbekistan as well as **Water Consumer Association Qodirjon-A'zamjon** in Kuva district, Fergana Province, Uzbekistan have been chosen for assessing the water governance on-farm level;

Partnerships were built with the **Basin Irrigation System Authorities** (BISA) in Uzbekistan and Tajikistan for capacity building and technology transfer activities of WUAs. The BISAs are; **Syrdarya-Sokh Basin Irrigation System Authority** in Uzbekistan; **Sughd Basin Water Management Organization, Jabbor Rasulov District Water Management Authority, Water User Association (WUA) Obi Ravoni Ovchi-Qalacha in B. Ghafurov District and X. Olimov in J. Rasulov District** in Tajikistan.

University of Bern, Switzerland, in capacity development, 1 PhD student.

Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle, Germany, to pursue research on improvement of common pool resource management.

Executive Secretariat of the International Fund for Saving Aral Sea (EC-IFAS) in particular, linking CRP DS research activities with the priorities of PBAM-3 program of IFAS.

Close linkages is established with **CRP 5, Water Land and Ecosystems**.

IWMI and ICARDA joint action was conducted. ICARDA worked on better irrigation scheduling to farmers' fields whereas IWMI focused on crop diversification, institutional arrangements of water management and gender issues, in Fergana Valley.

Training, Advisory and Innovation Center (TAIC) in Kyrgyzstan and **Zilola NGO** in Tajikistan, in collaboration for the Innovation Platform activities.

Khorezm Rural Advisory Support Service in Uzbekistan.

c. Capacity Building Achievements (1 page)

121 (30% female) farmers and representatives of involved stakeholders in both Karaozek and Urgench districts were trained on irrigation management activities. This has also led to NARS partners adoption and implementation of delivered material, such as by NGO KRASS economic evaluation methods of field interventions.

Activity on weather station based irrigation advisory system organized consultation event with stakeholders from local WUAs, NARS, national experts as well as scholars from academia to develop a robust and practical work plan (https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/8AXNBA).

A major training (ToT) on ultrasound-based technology for pregnancy diagnosis was organized for 2 veterinarians and 2 livestock specialists in November 2015 (all male). The training aimed (1) basic pregnancy scanning where pregnant and non-pregnant females are identified after completion of the mating season and (2) more advanced use of commercial, field-applicable ultrasound scanners in order to determine the number of fetuses (litter size) and their age;

Field training seminar on "Alternative forage crops for animal feeding in winter on household farms" for 27 participants including 15 women in Almash Abdambetova household farm, Shirkat Koybak in July 2015. The trainers focused on the crop characteristics, their nutritional value and different uses for forage, food, oil production. Special emphasis was placed on cultivation techniques, especially the root zone salinity management, irrigation regime and pest control (brief report was uploaded for six month reporting);

Seed system activity strengthened capacity of 49 farmers (42 men and 7 women) on availability of improved varieties of different crops and their seed multiplication practices for Karaozek district in Uzbekistan (http://www.cac-program.org/files/120c74366bc03594d6bc886fb84f4b36.pdf);

Activity on Conservation agriculture conducted a series of events, including training course for 32 participants on planting spring crops under no-till technology (June 2015, Karaozek). The training course focused on issues and concepts of practices of crop rotation under no-till practices and the technical aspects of double cropping as well as participatory research and extension methodology.

Karaozek district scale field day was conducted on the demonstration site which attracted 48 participants including farmers, district authorities, researchers, local and national TV. The participants had an opportunity to see how to install and calibrate no-till drills and engage in lively discussions on various economic and environmental aspects of conservation agriculture in Karakalpakstan.

1 PhD Student, in coordination with University of Bern, on Water Governance in Fergana Valley.

Capacity of 38 farmers (36 men and 2 women) was strengthened by providing them information on availability of improved varieties of wheat during farmers' field day (http://www.cac-program.org/files/37803863fae252f532ac41129de29696.pdf).

Capacity of 31 farmers (22 men and 9 women) was strengthened in mungbean seed production (http://www.cac-program.org/files/6f59f8d0abe1470efda99793a991c938.pdf).

More than 60 farmers were exposed to different irrigation technologies for the cultivation of different varieties of winter wheat and mung-bean;

More than 20 scientists from Andijan and Samarkand Agricultural Institutes as well as 60 farmers of Andijan and Samarkand Provinces exchanged views, experience and knowledge on application of different irrigation techniques to cultivate potato varieties;

In total seven WUAs have increased their capacity in water governance.

A consultation event was organized at the start of the year (Jan 26, 2015) in which stakeholders from local water user associations, NARES partners, national experts on the topic as well as scholars from academia were invited to develop a robust and practical work plan (https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/8AXNBA). As the activity progressed a series of seminars and field visits were organized to educate the WUA technical staff on the methodology – this included trainings data collection protocols, management of irrigation water as per weather station data analysis and comparison of results between control and treatment sites.

d. Risk Management (less than 1/2 page)

In Karakalpakstan, farmers are reluctant to adopt no-till practices, since they believe that it will cause yield declines in their field.

Decision makers may not buy-in the intervention due to political reasons. Mitigation measures include joint development of interventions that fit into the existing system or propose gradual change in the system.

Quality of the data from the NARS partners. To enhance quality of such data activities regularly conduct trainings and closely work together to ensure that at least data collected from joint experiments are of the required quality.

Budget cut towards the end of the year affected collection and completion of data collection for the "Strategic gender research CRP DS review on agricultural labour and gender" activity. Moreover, the late announcement, affected activity leaders and their agreements with NARES partners, since most activities depend on the vegetation season.

e. Lessons Learned (1 page)

A significant challenge for farmers in lower reaches of Amudarya (Khorezm and Karakalpakstan) is the reliability of accessible water for irrigation and its high salinity. Raised bed furrow irrigation applications would improve water productivity, reduce the salinity effect and improve the land productivity. Scientifically supported, guidance is needed for both decision makers and farmers.

The activity undertaken on seed production is of a developmental nature and needs considerable investments from a donor agency. Hence, establishing seed system platform should be further developed jointly with a donor agency to realize the full impact which might take more than five years to achieve.

It has been a difficult task to obtain authentic data on ground situation on seed systems due to certain tax related matters that could arise for the respondent. Farmers often hesitated to tell the truth as this could get them into trouble from the local authorities.

In some cases, despite the effort to involve more women participants in the activities, there has been much lower participation than expected. This is partly because of social norms.

Conservation agriculture is very important for making crop production profitable which has become more challenging due to the recent increases in fuel and fertilizer prices. Understanding the whole CA system, including social and economic aspects, is fundamental to any consideration of the possibilities for sustainable agricultural development in the region.

Mind set – overcoming the culture of the plough remains one of the major challenges. However, at a producer level no-till was welcomed, and this could be used in order to guide component research into topics and techniques which will be applicable by producers.

f. CRP Financial Report

This section will be completed when your centre will close the accounting books in 2016.

SECTION IV - RESEARCH OUTCOME STORIES

OUTCOME STORY 1

Name of research activity/project title:	Improve land use efficiency through crop rotation under Conservation Agriculture in salt and drought affected areas of Karakalpakstan
Flagship:	Central Asia
Geographical region:	Aral Sea Action site
Name and email of Activity Lead:	Aziz Nurbekov, a.nurbekov@cgiar.org
Name and email of Outcome Story Lead:	Aziz Nurbekov, a.nurbekov@cgiar.org
Activity Lead Center:	ICARDA
Activity Partner Center(s):	Karakalpak Research Institute of Farming
Activity Partner CRPs:	DS

1. Outcome Story Headline:

Farmers' awareness on conservation agriculture increased.

SELF-CHECK – Have you:

√ *Captured the overall message of the outcome story?*

☐ *Included an action verb?*

☐ *Captured the reader's attention?*

2. Outcome Story Abstract

The results of this activity provided convincing evidence to neighbouring farmers to adopt conservation agriculture in Karakalpakstan. As of 2015, the area under conservation agriculture is currently 50 ha. Four different crops have been planted in autumn using no-till drill, including winter wheat, barley, oats and forage pea. Scientists and farmers learned how to adjust and use the new equipment.

SELF-CHECK – Have you:

√ *Summarized the problem, program/activity, and outcomes?*

☐ *Provided a summary with specific measurable outcomes that avoids broad, sweeping statements such as "There was a noticeable increase in healthy eating habits"?*

3. Problem/Challenge Overview:

No-till practices are very important for making crop production profitable which has become more challenging due to the recent increases in fuel and fertilizer prices. There is no doubt that studying the whole of the CA system is fundamental to any consideration of the possibilities for sustainable agricultural development in the region.

Mind set – overcoming the culture of the plough. A complete understanding is required on the socio-economic aspects of the CA farming system, to guide research no-till technology

SELF-CHECK – Have you:

√ *Described the issue(s), challenge(s), problem(s), opportunities being addressed and why are these important?*

☐ *Used data to frame the problem, including the social and economic costs?*

☐ *Specified the affected dryland population(s)?*

☐ *Specified the affected dryland area (in hectares)*

4. What are the main research activities:

Integration of food/feed legumes into cereal cropping systems;

Organization of seed production of cereals and leguminous crops and forages in Karakalpakstan

Effect of different irrigation methods on productivity of sorghum in irrigated conditions of Karakalpakstan

Cost benefit analysis of different agricultural crops under two tillage systems

SELF-CHECK – Have you:

√ *Described your approach of designing and implementing the research?*

☐ *Identified the various research users involved at different stages of the research process?*

☐ *Identified any major shifts or changes to the research activities and approach?*

5. What are the main Outcomes of your research?

As the result of the activity farmers in the region are now becoming increasingly aware of conservation agriculture as a new, promising technology.

A new seed grower network named (SGN) as “Qorako’l” was established to increase seed production. The project implementing team believed that the newly created SGN is the basis for increasing agricultural production and effectively managing seed distribution of forage crops on irrigated lands

SELF-CHECK – Have you:

☐ *Described actual changes that occurred as opposed to desired or anticipated changes in your initial research proposal?*

√ *Identified any outcomes that you did not intend or anticipate? How are these justified and/or attributed to your activities?*

☐ *Demonstrated the scalability of the outcomes for greater reach and impact (in terms of both dryland communities and land area?*

6. What are the main research Outputs that resulted in the outcome(s)?

There is an economic benefit to farmers. Generally, an immediate cost reduction due to decreased farming and machinery operations can be achieved directly after the introduction of the technology. This is important for poor farmers in times of steeply rising costs of fossil energy sources. Saving fuel also helps improving the carbon balance of land use.

SELF-CHECK – Have you:

√ *Identified all types of outputs delivered and observed?*

☐ *Included facts and figures to demonstrate the strength and outreach of your research outputs?*

☐ *Avoided vague output statements such as "farmers benefited from increased food security as a result of our assessments of crop varieties."*

7. Who were the intermediary and direct users of your research outputs and what role did they play in achieving the outcome:

Researchers from Karakalpak Research Institute of Farming were the intermediary users of the research outputs for dissemination of the no-till technology in the district

District level authorities were the intermediary/direct users of research outputs for formulation of policy support for no-till technology

4 farmers on 50 ha have already started using no-till technology on their farms

SELF-CHECK – Have you:

☐ *Clearly identified all users and distinguished between intermediary and direct users of your research?*

☐ *Described their specific related role in terms of research, development, technology dissemination, policy formulation, adaptation, adoption, etc.?*

√ *Used facts and figures to strengthen your statements?*

8. How were your research outputs used (will be used in the future):

This situation highlighted the need to organize different training courses on conservation agriculture and to support state programs in order to become more active in conducting research and extension on CA. The focus should be on establishing multi-stakeholder partnerships to disseminate CA technologies aimed at improving fodder production from arable land under rain-fed and irrigated conditions in small-scale crop-livestock systems. Emphasis should also be given to fodder conservation for winter feeding to fill feeding gaps during harsh winter conditions when livestock are sheltered for long periods.

SELF-CHECK – Have you:

☐ *Described actual changes that occurred during or immediate after the release of your research outputs?*

√ *Identified how the use of research outputs set the stage for achieving the outcomes?*

☐ *Identified steps and actions for ensuring sustainability?*

9. What is the Evidence of Your Research Outcomes:

We worked in the research and demonstration site with highly motivated and enthusiastic partners that were committed to making the project a success and also to reach success on conservation agriculture in the region. All work on testing new technologies has been undertaken using farmer participatory methods during field days which further helped to disseminate technologies on wider area. During the field visits and field works on project sites all work was undertaken jointly with selected farmers.

SELF-CHECK – Have you:

√ *Identified how the actions and behaviours of key stakeholders have now changed?*

☐ *Identified how these changes will be sustained?*

10. Testimonials:

Mr. Davletbay Utemuratov, Governor Qorao'zak district, Autonomous Republic of Karakalpakstan, made a statement during the training conducted. He expressed his hope that the training workshop would cover all challenges on sustainable agriculture development. He informed the meeting that in the contemporary world there is a pressing issue of population growth, food security and source scarcity. He also highlighted that the synergy of able scientists and farmers along with the experiences of ICARDA will lead towards the achievement of common goals of sustainable agricultural development to improve livelihoods in Qorao'zak district.

√Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)

☐ Testimonials from Partners (quote, video, letter, interview, survey, etc.)

SELF-CHECK – Have you:

√ *Included the name, position, organization and location of person giving the testimonial?*

☐ *Included a testimonial that clearly identifies a direct benefit to a person/community/organizations, as opposed to vague general praise for the program activity?*

☐ *Included a testimonial that captures the beneficiary's strong emotion stemming from the outcome of your activities in his/her life, community, organization, etc.?*

☐ *Ensured each quote is no more than 2-3 lines.*

11. Lessons Learned:

Quality of staff for data collection and entry with some partners - constant follow-up needed to show that we were seriously interested in real data.

Time demanding nature of repeated supervision and reduced monitoring visits but active continuous telephonic follow-up.

Better understanding of partner capacities, more effective communication

SELF-CHECK – Have you:

☐ *Identified both challenges/weaknesses and successes/strengths?*

☐ *Identified what you might have done differently to ensure a better outcome or greater impact?*

√ *Identified who/what other organization/center/CRP can potentially benefit from these lessons?*

12. Full reference citations and URL link to published research work.

Nurbekov Aziz, Asad Musaev, Dossymbek Sydyk, Zokhidjon Ziyadullaev and Jozef Turok. Conservation Agriculture in Irrigated Areas of Azerbaijan, Kazakhstan and Uzbekistan. 2015. ISBN: 92-9127-476-3. Tashkent, Uzbekistan. Pp46.

https://cloud.mail.ru/public/EsAA/JRdA5LuGN

Nurbekov A., A.Kassam, A.Musaev, D.Sydyk, Z.Ziyadullaev, D.Feindel, H.Muminjanov and J.Turok. Effect of tillage methods on productivity of winter wheat in the irrigated conditions Central Asia and the Caucasus. 18th International Soil Conservation Organization Conference May 31 – June 5, 2015 El Paso, Texas, USA.

http://iscoabstract.weebly.com

Nurbekov A., A. Kassam, A.Mirzabaev, J. Turok, D. Sydyk and Z. Ziyadullaev. Possible role for Conservation Agriculture in climate change adaptation and mitigation in Central Asia: A preliminary review. "Agriculture and climate change in transition economies". 17-19 June 2015. Halle (Saale), Germany

http://projects.iamo.de/forum/2015/abstracts-and-presentations.html

13. Please check any of the following that are being submitted to complement your outcome story:

√Quality Photo(s) (of landscape, beneficiaries and activities) with appropriate captions and credit

√Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)

√Testimonials from Partners (quote, video, letter, interview, survey, etc.)

√Full reference citations and URL hyperlinks to published research work

☐ Blog and/or other website stories with URL links

√Newspaper Articles (print or electronic)

√Communication (non-scientific) Materials Produced (brochure, poster, press release, etc.)

☐ Supporting Materials (presentations, workshop reports, activity reports, donor reports)

√Video/Audio Clips

☐ Other (please explain: _____)

14. Final Checklist

Please use the following checklist to ensure your outcome story is ready for sharing.

No.	Question to consider	Yes	No
1	Does the story describe the outcomes the research produced and the people who are benefitting? What changes–in skills, knowledge, attitude, practice, or policy–has the research brought, and who is benefitting from these changes?	X	
2	Does the story capture outcomes from an interesting angle (possibly a human angle) that would captivate the attention of the target audience?	X	
3	Does the story explain what new insights the research brings? Does the story describe a key insight on what works and what doesn't and something that future research could build on. What are the main lesson learned?	X	
4	Does the story make a compelling point that people will remember? Does the story show how the research makes a difference to improving livelihoods and reducing poverty?	X	
5	Does the story provide interesting facts that people will remember?	X	
6	Does the story explain in clear and measurable ways the kind of impact - beyond the level of the reported outomces - could be achieved if the research outputs scaled out and up?	X	
7	Does the story show which partners contributed and how?		√
8	Does the story include quotes from scientists, partners and/or beneficiaries?	X	
9	Have I provided links to other media (journal articles, website news, newsletter, blogs, annual reports of other CGIAR centres, CRPs) that also feature this story?	X	
10	Have I provided the contact details of people who can provide more information?	X	

OUTCOME STORY 2

Name of research activity/project title:	Seed production of the salt tolerant and drought resistant promising agricultural crops using site-similarly mapping
Flagship:	Central Asia
Geographical region:	Aral Sea Action site
Name and email of Activity Lead:	Aziz Nurbekov, a.nurbekov@cgiar.org
Name and email of Outcome Story Lead:	Aziz Nurbekov, a.nurbekov@cgiar.org
Activity Lead Center:	ICARDA
Activity Partner Center(s):	Karakalpak Research Institute of Farming
Activity Partner CRPs:	DS

1. Outcome Story Headline:

Network forage seed grower farmers established.

SELF-CHECK – Have you:

√ *Captured the overall message of the outcome story?*

☐ *Included an action verb?*

☐ *Captured the reader's attention?*

2. Outcome Story Abstract

A Breeding program of agricultural crops directly connected with the organization of seed production. The objective of this study is to organize seed production of salt and drought resistant crops in Karakalpakstan. Six different forage crop seed production was organized under no-till technology. Crops included the following: Sorghum, Corn, Sunflower, Pearl millet, Millet, Sesame and Field pea.

SELF-CHECK – Have you:

√ *Summarized the problem, program/activity, and outcomes?*

☐ *Provided a summary with specific measurable outcomes that avoids broad, sweeping statements such as "There was a noticeable increase in healthy eating habits"?*

3. Problem/Challenge Overview:

Most cereal, legume, oilseed and forage crops varieties are still imported from abroad which means there is no local seed production systems in Karakalpakstan and over the entire Republic of Uzbekistan. The national seed system for forage crops is not well organized. The private seed sector is dealing with seed production of the aforementioned crops however good quality seed is not available to farmers

SELF-CHECK – Have you:

√ *Described the issue(s), challenge(s), problem(s), opportunities being addressed and why are these important?*

☐ *Used data to frame the problem, including the social and economic costs?*

☐ *Specified the affected dryland population(s)?*

☐ *Specified the affected dryland area (in hectares)*

4. What are the main research activities:

Organize seed production of salt and drought resistant crops in Karakalpakstan. Seed is the most important input for accelerating agricultural growth. Therefore, seed production of high-yielding varieties is important to make available quality seed for increasing agricultural production. During seed multiplication the varietal purity gradually deteriorate as a result of mechanical contamination, cross-pollination, segregation, mutation, etc. It is necessary to periodically renew from breeder seed, which is the basis for certified seed production.

SELF-CHECK – Have you:

√ *Described your approach of designing and implementing the research?*

☐ *Identified the various research users involved at different stages of the research process?*

☐ *Identified any major shifts or changes to the research activities and approach?*

5. What are the main Outcomes of your research?

Seed growers network to produce forage crop seed which will then be pooled for bulk-scale supply to forage farmers who are located in the neighbourhood. The activity has already produced two tons of seed of improved varieties of forage crops and will be distributed to small farmers for seed multiplication for out-scaling in 2016.

SELF-CHECK – Have you:

☐ *Described actual changes that occurred as opposed to desired or anticipated changes in your initial research proposal?*

√ *Identified any outcomes that you did not intend or anticipate? How are these justified and/or attributed to your activities?*

☐ *Demonstrated the scalability of the outcomes for greater reach and impact (in terms of both dryland communities and land area?*

6. What are the main research Outputs that resulted in the outcome(s)?

The research was able to address farmers' access to quality seed of new varieties through seed network partnership. This seed network will facilitate the development of new plant varieties and the delivery of high quality seed of those varieties to farmers to increase crop productivity, food security and economic development.

SELF-CHECK – Have you:

√ *Identified all types of outputs delivered and observed?*

☐ *Included facts and figures to demonstrate the strength and outreach of your research outputs?*

☐ *Avoided vague output statements such as "farmers benefited from increased food security as a result of our assessments of crop varieties."*

7. Who were the intermediary and direct users of your research outputs and what role did they play in achieving the outcome:

Researchers from Karakalpak Research Institute of Farming were the intermediary users of the research outputs for dissemination of the no-till technology in the district

District level authorities were the intermediary/direct users of research outputs for formulation of policy support for no-till technology

3 farmers on 5 ha have already started to produce good quality seed using no-till technology

SELF-CHECK – Have you:

☐ *Clearly identified all users and distinguished between intermediary and direct users of your research?*

☐ *Described their specific related role in terms of research, development, technology dissemination, policy formulation, adaptation, adoption, etc.?*

√ *Used facts and figures to strengthen your statements?*

8. How were your research outputs used (will be used in the future):

Seed production and processing operations of forage crops are constrained by lack of infrastructure where private seed producers are not able to clean, process and market seed directly to the farmers, as stipulated in the existing national seed laws. Therefore, provisions should be made for the time being to assist the farmers to install the seed cleaning units at affordable credit rates.

SELF-CHECK – Have you:

☐ *Described actual changes that occurred during or immediate after the release of your research outputs?*

√ *Identified how the use of research outputs set the stage for achieving the outcomes?*

☐ *Identified steps and actions for ensuring sustainability?*

9. What is the Evidence of Your Research Outcomes:

We worked in the research and demonstration site with highly motivated and enthusiastic partners that were committed to ensuring the success of the project along with the adoption of conservation agriculture in the region. All work on testing new technologies was undertaken using farmer participatory methods during field days which further help to disseminate technologies on wider area. During the field visits and field works on project sites all works were done together with selected farmers.

SELF-CHECK – Have you:

√ *Identified how the actions and behaviours of key stakeholders have now changed?*

☐ *Identified how these changes will be sustained?*

10. Testimonials:

An interview of NARS partner on seed production of forage crops under the no-till technology was broadcasted through national TV.

☐ Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)

√Testimonials from Partners (quote, video, letter, interview, survey, etc.)

SELF-CHECK – Have you:

√ *Included the name, position, organization and location of person giving the testimonial?*

☐ *Included a testimonial that clearly identifies a direct benefit to a person/community/organizations, as opposed to vague general praise for the program activity?*

☐ *Included a testimonial that captures the beneficiary's strong emotion stemming from the outcome of your activities in his/her life, community, organization, etc.?*

☐ *Ensured each quote is no more than 2-3 lines.*

11. Lessons Learned:

Quality of staff for data collection and entry with some partners - constant follow-up needed to show that we were seriously interested in real data.

Time demanding nature of repeated supervision and reduced monitoring visits but active continuous telephonic follow-up.

Better understanding of partner capacities, more effective communication

SELF-CHECK – Have you:

☐ *Identified both challenges/weaknesses and successes/strengths?*

☐ *Identified what you might have done differently to ensure a better outcome or greater impact?*

√ *Identified who/what other organization/canter/CRP can potentially benefit from these lessons?*

12. Full reference citations and URL link to published research work.

Nurbekov Aziz, Asad Musaev, Dossymbek Sydyk, Zokhidjon Ziyadullaev and Jozef Turok. Conservation Agriculture in Irrigated Areas of Azerbaijan, Kazakhstan and Uzbekistan. 2015. ISBN: 92-9127-476-3. Tashkent, Uzbekistan. Pp46.

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Nurbekov A., A.Kassam, A.Musaev, D.Sydyk, Z.Ziyadullaev, D.Feindel, H.Muminjanov and J.Turok. Effect of tillage methods on productivity of winter wheat in the irrigated conditions Central Asia and the Caucasus. 18th International Soil Conservation Organization Conference May 31 – June 5, 2015 El Paso, Texas, USA.

http://iscoabstract.weebly.com

Nurbekov A., A. Kassam, A.Mirzabaev, J. Turok, D. Sydyk and Z. Ziyadullaev. Possible role for Conservation Agriculture in climate change adaptation and mitigation in Central Asia: A preliminary review. "Agriculture and climate change in transition economies". 17-19 June 2015. Halle (Saale), Germany

http://projects.iamo.de/forum/2015/abstracts-and-presentations.html

13. Please check any of the following that are being submitted to complement your outcome story:

√Quality Photo(s) (of landscape, beneficiaries and activities) with appropriate captions and credit

√Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)

√Testimonials from Partners (quote, video, letter, interview, survey, etc.)

√Full reference citations and URL hyperlinks to published research work

☐ Blog and/or other website stories with URL links

√Newspaper Articles (print or electronic)

√Communication (non-scientific) Materials Produced (brochure, poster, press release, etc.)

☐ Supporting Materials (presentations, workshop reports, activity reports, donor reports)

√Video/Audio Clips

☐ Other (please explain: _____)

14. Final Checklist

Please use the following checklist to ensure your outcome story is ready for sharing.

No.	Question to consider	Yes	No
1	Does the story describe the outcomes the research produced and the people who are benefitting? What changes–in skills, knowledge, attitude, practice, or policy–has the research brought, and who is benefitting from these changes?	X	
2	Does the story capture outcomes from an interesting angle (possibly a human angle) that would captivate the attention of the target audience?	X	
3	Does the story explain what new insights the research brings? Does the story describe a key insight on what works and what doesn't and something that future research could build on. What are the main lesson learned?	X	
4	Does the story make a compelling point that people will remember? Does the story show how the research makes a difference to improving livelihoods and reducing poverty?	X	
5	Does the story provide interesting facts that people will remember?	X	

6	Does the story explain in clear and measurable ways the kind of impact - beyond the level of the reported outcomes - could be achieved if the research outputs scaled out and up?	X	
7	Does the story show which partners contributed and how?		√
8	Does the story include quotes from scientists, partners and/or beneficiaries?	X	
9	Have I provided links to other media (journal articles, website news, newsletter, blogs, annual reports of other CGIAR centres, CRPs) that also feature this story?	X	
10	Have I provided the contact details of people who can provide more information?	X	

OUTCOME STORY 3

Name of research activity/project title:	Increase livestock productivity while sustaining natural resource base: Increased winter feed production from arable land and hayfields
Flagship:	Central Asia
Geographical region:	Aral Sea Region, Karauzyak district, Karakalpakstan
Name and email of Activity Lead:	Dr. Barbara Rischkowsky, ICARDA, b.rischkowsky@cgiar.org
Name and email of Outcome Story Lead:	Dr. Kristina Toderich, ICBA-CAC, k.toderich@cgiar.org
Activity Lead Center:	International Centre for Agriculture Research in the Dry Areas (ICARDA)
Activity Partner Center(s):	International Center for Biosaline Agriculture (ICBA)
Activity Partner CRPs:	
Suggested tags	Gender, crop improvement, integrated system approach, Uzbekistan, Aral Sea, sustainable land management, climate change, land degradation

1. Outcome Story Headline:

A Rural Women Learning Alliance in Uzbekistan is leading local community efforts to cope with the negative effects of climate change and land degradation

SELF-CHECK – Have you:

- ☐ *Captured the overall message of the outcome story?*
- ☐ *Included an action verb?*
- ☐ *Captured the reader's attention?*

2. Outcome Story Abstract

The area around the Aral Sea with a population of at least 1.6 million people, mostly living in remote rural areas, is a predominantly agro-pastoral agricultural system that is currently affected by extreme land degradation due to intensive irrigated agriculture and overgrazed pastures. Lack of good quality forage for winter, low grazing capacity of desert pastures and remote trade markets contribute further to the combined detrimental effect of these issues on the incomes and livelihood of local dryland communities. Scientist from the International Centre for Agriculture Research in the Dry Areas (ICARDA) and the International Center for Bio saline Agriculture (ICBA) are conducting research under the framework of CGIAR Research Program on Dryland Systems, have been researching and testing ways to increase livestock productivity by increasing winter feed production from desert pastures, hayfields and arable land. Several demonstration trials have taken place in shirkat (cooperative farm) “Koybak”, dekhkan (rural smallholders including householders) farms in Karabuga, - both located in Karauzyak region, Karakalpakstan. More than 45 women farmers decided to create a "Rural Women Learning Alliance" in order to join forces with scientists and with each other in order to identify and promote strategies for diversifying their household incomes.

SELF-CHECK – Have you:

- ☐ *Summarized the problem, program/activity, and outcomes?*
- ☐ *Provided a summary with specific measurable outcomes that avoids broad, sweeping statements such as “There was a noticeable increase in healthy eating habits”?*

3. Problem/Challenge Overview:

Karauzyak district in Karakalpakstan is the most representative of the agro-pastoral systems of the much larger Amu Darya River basin in the transition zone between irrigated agriculture and the Kyzylkum sandy desert. Desert rangeland productivity has been declining and biodiversity is being lost at an alarming rate due to intensive soil salinity, rising water table and increasing mineralization. In borderline of these territories the situation is made even worse because of intensive irrigated agriculture and overgrazed pastures, lack of good quality forage for winter and remote markets. As living conditions deteriorate under land degradation and climate change factors, people are also forced to migrate elsewhere in search of a better future, leading to loss of local traditional knowledge and experience of sustainable land and water use management.

SELF-CHECK – Have you:

- ☐ *Described the issue(s), challenge(s), problem(s), and opportunities being addressed and why are these important?*
- ☐ *Used data to frame the problem, including the social and economic costs?*
- ☐ *Specified the affected dryland population(s)?*
- ☐ *Specified the affected dryland area (in hectares)*

4. What are the main research activities?

The main goal of this research activity has been to study the effective management of marginal (low quality) land and water, production of non-conventional crops (NCC) as forage for livestock and other alternative uses. The key insight stemming from this study is that even in extreme conditions of high soil salinity and waterlogging, there are many salt loving species (halophytes) and salt tolerant non-traditional crops suitable for producing

good quality forage and grain. The utilization of halophytes in combination with forage biomass or remains of traditional crops after harvesting represents a critical innovation in the cattle feeding system. Two best-bet bio saline practices were evaluated: agro-forestry with planting trees and mixed farming livestock system. Fifteen (15) householders from neighbouring villages participated in the evaluation of these practices. In collaboration with local farmers, scientists tested several varieties of the most valuable salt-drought and heat tolerant non-traditional crops, including: forage and vegetable legumes varieties, sorghum (including perennial variety), pearl millet, alfalfa, topinambur, Amaranthus indigofera, sweet clover, sainfoin, sesame, sunflower, triticale, atriplex and kochia- as high potential sources for forage production. The area allocated to new forage crops was small (0.05-0.09ha), but enough to showcase the opportunities for growing poplar, apple, apricot, mulberry, Russian olive and different kinds of berry shrubs intercropped with salt-tolerant, non-traditional forage crops on saline lands for multi-purpose use including forage for winter.

SELF-CHECK – Have you:

- ☐ *Described your approach of designing and implementing the research?*
- ☐ *Identified the various research users involved at different stages of the research process?*
- ☐ *Identified any major shifts or changes to the research activities and approach?*

5. What are the main Outcomes of your research?

Identified farmers (at least 10), agro pastoralists (at least 10) and women –groups (2) of interest fully committed to adopt mixed farming and agro pastoral production systems; Trained in postharvest practices on seed quality and storage

10% increase in crops yield production and livestock performance ensured by farmers participatory planning

Seed producers farmers income increased by at least 20% through quality seed production compared to grain production

Improved interaction between CRP Dryland Systems research and policy makers in the region related to salinity management and rehabilitation of saline and marginal environments

SELF-CHECK – Have you:

- ☐ *Described actual changes that occurred as opposed to desired or anticipated changes in your initial research proposal?*
- ☐ *Identified any outcomes that you did not intend or anticipate? How are these justified and/or attributed to your activities?*
- ☐ *Demonstrated the scalability of the outcomes for greater reach and impact (in terms of both dryland communities and land area?*

6. What are the main research Outputs that resulted in the outcome(s)?

Cultivation of non-conventional, salt tolerant forage species for the winter feeding of Karakul sheep. Tested varieties include 6 forage and vegetable legumes varieties, 3 varieties of sorghum, 3 atriplex varieties, 2 pearl millet varieties, 2 fodder beet varieties, 2 topinambur varieties, 2 kochia varieties, as well as salinity resistant varieties of alfalfa, amaranthus, indigofera, perennial sorghum, sweet clover, sainfoin, sesame, sunflower, triticale. Technical recommendation for seed multiplication of non-conventional

crops and handbook on forage potential and nutritional characteristics of non-conventional forage crops for winter livestock feeding are developed.

SELF-CHECK – Have you:

- ☐ *Identified all types ofoutputs delivered and observed?*
- ☐ *Included facts and figures to demonstrate the strength and outreach of your research outputs?*
- ☐ *Avoided vague output statements such as "farmers benefited from increased food security as a result of our assessments of crop varieties."*

7. Who were the intermediary and direct users of your research outputs and what role did they play in achieving the outcome:

Dr Zulfiya Sultanova, Nukus Branch of Tashkent State Agrarian University and other researchers identified women farmers of interest in the spring of 2015 from three different areas in Koybak, Karabuga and Karauzyak (inhabitants from 9 neighbouring) villages. The researchers worked closely with the women farmers and agro-pastoralists throughout the year and organized a series of field training seminars from June to November. These seminars covered different aspects of alternative forage crops for animal feeding in winter, as well a master cooking class on the preparation of food recipes from non-traditional crops (such as topinambur, proso, millet, quinoa, pearl millet, sorghum and fodder legumes). Special emphasis was placed on crop characteristics, their nutritional value and different uses for forage, food, oil production; as well as cultivation techniques - especially root zone salinity management, irrigation regime and pest control. A total of 15 households participated in testing the forage varieties and cultivation practices on saline and marginal lands.

Inspired by the research results presented during these training seminars, about 45 women farmers decided to create a "Rural Women Learning Alliance" in order to join forces with scientists and with each other in order to identify and promote strategies for diversifying their household incomes, disseminate and exchange vital knowledge and information on innovative fodder production and livestock feeding systems to other farmers in the district and outside in Karakalpakstan, Khorezm region (in Uzbekistan), Dashauz province (northern Turkmenistan) and Kyzylorda region (in Kazakhstan).

SELF-CHECK – Have you:

- ☐ *Clearly identified all users and distinguished between intermediary and direct users of your research?*
- ☐ *Described their specific related role in terms of research, development, technology dissemination, policy formulation, adaptation, adoption, etc.?*
- ☐ *Used facts and figures to strengthen your statements?*

8. How were your research outputs used (will be used in the future):

There is a real potential to utilize non-conventional water and crops because the majority of these crops enables a desalinization effect by accumulating salts in their aboveground biomass and allowing less salt-tolerant crops to grow. Interestingly enough, these plants produce huge amounts of forage biomass rich in nutrients (protein, fiber, cellulose, and various micro- and macro- elements) for livestock feeding.

All these dual-purpose fodder crops can be planted on abandoned field margins of the traditional crop fields that are normally used for cultivation of cotton, rice or winter wheat. Since flooding irrigation is used for growing rice, there is no need for extra water to use for cultivation of forage crops in the field margins, fed by drainage water after irrigation of rice

and/or cotton-wheat. Scientists call this phenomenon as 'one drop of water per two crops'. Thus, non-conventional crops are planted using marginal water (drainage mineralized and artesian), resulting in effective utilization of low-quality water without wasting it, while simultaneously conserving water quality, supporting ecosystem function and protecting economic benefits of the households.

Improved interaction between CRP Dryland Systems research and policy makers in the region related to salinity management ensures sustainability for achieving outcomes of our collaborative research.

SELF-CHECK – Have you:

- ☐ *Described actual changes that occurred during or immediate after the release of your research outputs?*
- ☐ *Identified how the use of research outputs set the stage for achieving the outcomes?*
- ☐ *Identified steps and actions for ensuring sustainability?*

9. What is the Evidence of Your Research Outcomes:

The Rural Woman Learning Alliance is the perfect example of the positive and sometime unexpected outcomes that can come through participatory approaches to research that are inclusive and considerate of local community needs.

At least 10% increase in crops yield production from marginal lands and livestock performance ensured by farmers and agro-pastoralists participatory planning and sustainable management of marginal environments (water, soils and crops) in Aral Sea areas.

SELF-CHECK – Have you:

- ☐ *Identified how the actions and behaviours of key stakeholders have now changed?*
- ☐ *Identified how these changes will be sustained?*

10. Testimonials:

Farmer-participatory research on village/kishlak level is crucial in transferring the technology of cultivation of drought-salt and heat tolerant crops for rapid adoption. in addition institutional framing conditions are important to study and consider since a change in land use policies of marginal land may be necessary to implement some options. Institutional settings should become key components in providing direct economic benefits to rural farmers, income for the government via taxes, and lead to an overall improvement in ecological conditions in the region.

Close collaboration with the communities ensuring also the inclusion of traditional knowledge, collection and practice. Khokim of Karauzyak district should be considered as a link in dissemination of best practices and project results. The research and development approach will also employ a value chain approach and study the processing of crops and livestock products by using local traditional knowledge and experience

SELF-CHECK – Have you:

- ☐ *Included the name, position, organization and location of person giving the testimonial?*
- ☐ *Included a testimonial that clearly identifies a direct benefit to a person/community/organizations, as opposed to vague general praise for the program activity?*
- ☐ *Included a testimonial that captures the beneficiary's strong emotion stemming from the outcome of your activities in his/her life, community, organization, etc.?*
- ☐ *Ensured each quote is no more than 2-3 lines.*

11. Lessons Learned:

The gender mixed groups (smallholders and rich pastoralists among them) gave highest priority to improvement of productivity of saline and marginal lands and quality of livestock production in the downstream areas of Aral Sea Basin. This new Rural Women Learning Alliance of local communities initiative under supervision of international and regional research teams could become a strong unit in crop diversification and seed production programs to enhance the productivity of salt affected lands, improve livestock feeding system and increase the income of rural poor in both irrigated agricultural and desert pastures production systems. The researchers should support local communities learning efforts by providing brochures, leaflets, brief reports and other information. Ms. Almash Adambetova- a household leader from Koybak farm, strongly believe that the created women-led earning alliance it will play a good role in farming community partnerships and development.

SELF-CHECK – Have you:

- ☐ *Identified both challenges/weaknesses and successes/strengths?*
- ☐ *Identified what you might have done differently to ensure a better outcome or greater impact?*
- ☐ *Identified who/what other organization/canter/CRP can potentially benefit from these lessons?*

12. Full reference citations and URL link to published research work.

https://www.youtube.com/watch?v=z1mKi1X5zGw

http://www.cac-program.org/video/play/8

http://www.cac-program.org/video/play/9

http://www.cac-program.org/video/play/10

13. Please check any of the following that are being submitted to complement your outcome story:

- ☐ Quality Photo(s) (of landscape, beneficiaries and activities) with appropriate captions and credit
- ☐ Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)

X Testimonials from Partners (quote, video, letter, interview, survey, etc.)

- ☐ Full reference citations and URL hyperlinks to published research work

X Blog and/or other website stories with URL links
http://drylandsystems.cgiar.org/news-opinions/rural-women-empowered-knowledge-improve-own-livelihoods

X Newspaper Articles (print or electronic)

- ☐ Communication (non-scientific) Materials Produced (brochure, poster, press release, etc.)

X Supporting Materials (presentations, workshop reports, activity reports, donor reports)
X Video/Audio Clips

- ☐ Other (please explain: _____)

14. Final Checklist

Please use the following checklist to ensure your outcome story is ready for sharing.

No.	Question to consider	Yes	No
1	Does the story describe the outcomes the research produced and the people who are benefitting? What changes–in skills, knowledge, attitude, practice, or policy–has the research brought, and who is benefitting from these changes?	x	
2	Does the story capture outcomes from an interesting angle (possibly a human angle) that would captivate the attention of the target audience?	x	
3	Does the story explain what new insights the research brings? Does the story describe a key insight on what works and what doesn't and something that future research could build on.What are the main lesson learned?	x	
4	Does the story make a compelling point that people will remember? Does the story show how the research makes a difference to improving livelihoods and reducing poverty?	x	
5	Does the story provide interesting facts that people will remember?	x	
6	Does the story explain in clear and measurable ways the kind of impact - beyond the level of the reported outcomes - could be achieved if the research outputs scaled out and up?	x	
7	Does the story show which partners contributed and how?	x	
8	Does the story include quotes from scientists, partners and/or beneficiaries?	x	
9	Have I provided links to other media (journal articles, website news, newsletter, blogs, annual reports of other CGIAR centres, CRPs) that also feature this story?	x	
10	Have I provided the contact details of people who can provide more information?		x

OUTCOME STORY 4

Name of research activity/project title:	Establish a seed systems platform compatible with existing agro-ecological environments to supply farmers with high quality seed and planting materials so as to improve livelihoods, food security and incomes of smallholders
Flagship:	Central Asia
Geographical region:	Fergana Valley
Name and email of Activity Lead:	Dr. Ram Sharma, r.c.sharma@cgiar.org
Name and email of Outcome Story Lead:	Dr. Ravza Mavlyanova, r.mavlyanova@cgiar.org
Activity Lead Center:	ICARDA
Activity Partner Center(s):	AVRDC-The World Vegetable Center
Activity Partner CRPs:	

15. Outcome Story Headline:

Improvement of farmers income in Central Asia, by cultivating Wheat-Mungbean Rotation and Seed Multiplication Using Improved Varieties

SELF-CHECK – Have you:

- ☐ *Captured the overall message of the outcome story?*
- ☐ *Included an action verb?*
- ☐ *Captured the reader's attention?*

16. Outcome Story Abstract

The two-year duration winter wheat-fallow-cotton rotation, which is widely used in Central Asia, results in 100% cropping intensity (CI). By introducing mungbean during the fallow summer months in the rotation, CI is raised to 150%. Inclusion of mungbean in the crop rotation is expected to improve soil health through nitrogen fixation, thus reducing the cost of fertilizer application. Through the cultivation of mungbean as an additional crop farmers were able to earn at least USD 1000/ha as net profit in 2014. Integrating seed multiplication of winter wheat and mungbean in the crop rotation allowed the farmers to earn additional income of USD 683/ha from wheat seed production and USD 1900/ha from mungbean seed production. In order to have wider impact of these outcomes, capacity of 35 wheat seed producers (33 men and 2 women) and 31 mungbean farmers (22 men and 9 women) was strengthened in production of quality seed by providing them technical information and field demonstrations of the technology. Because of the lower seed rate (16 kg/ha) used to plant mungbean, farmers are able to produce and store seed without additional facilities. This demonstrate sustainability of the farmers' based seed multiplication of mungbean. Substantial additional income from wheat-mungbean rotation using short duration improved varieties of mungbean is changing the mind-set of the farmers to adopt this technology. The policy makers are considering allocation of additional farmland under wheat-mungbean annual crop rotation, which will increase CI to 200%, and expand this technology in other parts of Uzbekistan.

SELF-CHECK – Have you:

- ☐ *Summarized the problem, program/activity, and outcomes?*
- ☐ *Provided a summary with specific measurable outcomes that avoids broad, sweeping statements such as "There was a noticeable increase in healthy eating habits"?*

17. Problem/Challenge Overview:

Farmers in the Fergana Valley of Central Asia have traditionally grown cotton- winter wheat, 2-yr crop rotation. Both these crops have high demand for irrigation water and soil nutrients to attain high yields, thus rendering soil impoverished. This two-year long rotation allows one

fallow summer followed by winter. While the fallow land during winter can't be utilized due to low temperatures (up to -15C) and snow falls, it is possible to grow a crop during fallow summer period. However, such a crop must tolerate temperatures that can reach between 40 to 50 C. In addition, crops grown during summer must be cultivated with limited irrigation water supply because there is no rainfall from June until September. There could be limited options to integrate a heat and drought tolerant catch crop during summer months. Besides, planting of such a crop will depend on maturity of wheat crop, the traditional winter wheat matures between the middle of June to middle of July. The old, traditional varieties of mungbean take more than 100 days to mature and have low yield potential. Therefore, the challenge was to find high yielding early maturing varieties of winter wheat and mungbean which could fit well in the wheat-fallow-cotton rotation. Moreover, seed availability of such wheat and mungbean varieties would be a must to adopt such a rotation. In order to make seed available locally some level of capacity development in wheat and more so in mungbean is urgently needed.

SELF-CHECK – Have you:

- ☐ *Described the issue(s), challenge(s), problem(s), and opportunities being addressed and why are these important?*
- ☐ *Used data to frame the problem, including the social and economic costs?*
- ☐ *Specified the affected dryland population(s)?*
- ☐ *Specified the affected dryland area (in hectares)*

18. What are the main research activities:

A winter wheat-mungbean crop rotation and seed production activity started soon after wheat harvest in June 2014 in the Fergana Valley of Uzbekistan as a pilot project under CRP Dryland System (CRP-DS). The research objective included increasing system intensification for improving land and water productivity, strengthening farmers' capacity in seed production of wheat and mungbean, and creating opportunity for higher farm income through additional crop in the system and seed production. Four new varieties (Durdona, Zilola, Marjon and Turon) of mungbean and a recently released high yielding, high quality and yellow rust (the most important disease of wheat in Central Asia) resistant winter wheat 'Yaksart' were used in the study. After successfully growing and producing mungbean varieties and accomplishing seed multiplication on 1.1 ha during summer 2014, seed production of wheat was accomplished between October 2014 and June 2015 on 84 ha. This was followed by another year of mungbean seed multiplication on 8 ha using two early maturing mungbean varieties in the summer of 2015. In order to develop farmers' capacity in seed production one training on wheat seed production and one training on mungbean seed production, storage and certification was organized. Additional income from seed compared to grain production was estimated.

SELF-CHECK – Have you:

- ☐ *Described your approach of designing and implementing the research?*
- ☐ *Identified the various research users involved at different stages of the research process?*
- ☐ *Identified any major shifts or changes to the research activities and approach?*

19. What are the main Outcomes of your research?

i. New technology evaluated and adopted:

Out of four new mungbean varieties evaluated by the farmers, short duration variety 'Durdona' with 70 days maturity period, was successfully introduced into crop rotation during short summer fallow season. Another three varieties (Marjon and Zilola) with 90-95 days duration as well as Turon variety with 100 days duration but higher yield than early maturing

varieties could be suitable in rotation with early maturing wheat varieties or where the crop following mungbean could be planted in November.

ii. Income increased

Farmers who cultivated mungbean were able to earn substantial income from this short duration (3 month) crop. At an average grain yield of 1.5 t/ha and grain market price of around USD 1.6/kg, farmers received total earning of USD 2400/ha. Considering an average production cost of USD 400/ha, there was a net earnings of around USD 2000/ha. The income was much higher considering the price of the quality seed that farmers sold was USD 3/kg, twice the cost of mungbean grain.

Similarly, the wheat farmers sold the seed at the price of 1.65 times higher than that of grain. Thus, considering 6.83 t/ha yield and USD 0.1/kg higher price of seed compared to grain, the wheat seed producers made a net additional earning of USD 683/ha.

iii. Capacity strengthened

The capacity of 35 wheat farmers (33 men and 2 women) and 31 mungbean farmers (22 men and 9 women) was strengthened through seed production training, information sharing and farmers' field day.

iV. Policy influenced

Through observations of research activities and interactions at various occasions, policy makers have taken up seed multiplication to increase the area under production of wheat variety Yaksart. Similarly, they are planning to bring out guidelines of mungbean seed production and expanding the area under cultivation within and beyond the Action Site.

v. Multiple stakeholders benefited

For scientists - new data on mungbean production and soil chemical and microbiological composition;

For farmers – an opportunity to grow appropriate new mungbean varieties after wheat harvest for diversification, effective land use, reduced expenses for field management and harvest, knowledge on soil fertility improvement and cultivation technology, water saving, income increasing and export potential;

For household – knowledge increasing on mungbean crop value for nutrition, growing of new mungbean varieties in home garden to increase soil fertility, supply a family with food, use green mass as a feed for a livestock, decreases expenses for the purchase of grain on a market;

For women – knowledge increasing on mungbean crop value for nutrition at the household level, involved in mungbean production and additional income for a family.

For policy makers: There is a potential for scaling up the outcomes as the Fergana region government will report to the Ministry of Agriculture and Water Management on achievements and will prepare a perspective plan on mungbean seed production farms and wheat-mungbean rotation in the republic.

SELF-CHECK – Have you:

- ☐ *Described actual changes that occurred as opposed to desired or anticipated changes in your initial research proposal?*

☐ *Identified any outcomes that you did not intend or anticipate? How are these justified and/or attributed to your activities?*

☐ *Demonstrated the scalability of the outcomes for greater reach and impact (in terms of both dryland communities and land area?*

20. What are the main research Outputs that resulted in the outcome(s)?

i. New technology :

Out of four new mungbean varieties evaluated by farmers, short duration variety 'Durdona' with70 days and 'Majon' variety with 90 days, respectively were successfully introduced into crop rotation during the short summer fallow season. A further two varieties with 95-100 days duration but higher yield than early maturing varieties were found suitable in rotation with early maturing wheat varieties.

The first year of successful mungbean cultivation by two farmers on 1.1 ha with 1.8 t seed production in 2014 increased to four farmers on 8.0 ha with 12.5 ton seed in 2015. The plan for 2016 is to increase seed production on 25 ha with a target of 60 ton seed and commercial cultivation on more than 400 ha by more than 200 farmers. The plan for 2017 is to expand commercial cultivation on 4200 ha involving more than 1000 farmers.

Wheat seed production of the new variety Yaksart on 84 ha yielded on average 6.83t/ha with a production 574 ton seed in 2015. This seed was sold to the Government managed seed processing plant which is expected to be planted on more than 2000 ha in 2016.

ii. Enhanced capacity

Capacity of 35 wheat farmers (33 men and 2 women) and 31 mungbean farmers was strengthened through seed production training and information sharing.

iii. Publications

- Research reports on conducted mungbean trials;
- Posters, articles, booklets and leaflets on new mungbean varieties and cultivation technology; presentation of information and display varieties on the Republic Exhibitions;
- Meetings with policy makers, farmers and householders;
- Data from on-farm data
- Seed of improved new mungbean varieties seeds with the farmers.

SELF-CHECK – Have you:

☐ *Identified all types of outputs delivered and observed?*

☐ *Included facts and figures to demonstrate the strength and outreach of your research outputs?*

☐ *Avoided vague output statements such as "farmers benefited from increased food security as a result of our assessments of crop varieties."*

21. Who were the intermediary and direct users of your research outputs and what role did they play in achieving the outcome:

Two research institutions (wheat research and vegetable research) were the intermediary users of the outputs who will use the experimental data in developing the varieties of mungbean and wheat and their production practices that could fit into the existing farming systems to maximize productivity and profitability. These institutions provided seed of the wheat and mungbean varieties and contributed to capacity development efforts.

District, regional and national level policy makers were the intermediary users of the outputs to formulate policy on seed production and adoption of wheat-mungbean crop rotation. They help identify the participant farmers for conducting the activity and capacity development efforts. They also contributed by bringing the needs of farmers and support needed. They provided local administrative support to successfully complete the activities.

Seven farmers directly benefited by producing wheat seed on 84 ha and mungbean seed on 8 ha. The area under mungbean is planned to be expanded on more than 400 ha involving more than 200 farmers in 2016. The participant farmers substantially increased their income from adopting wheat-mungbean rotation and seed production. Seed production of new variety has already been taken up by the district and regional administration. These farmers evaluated the technology in their fields.

SELF-CHECK – Have you:

- ☐ *Clearly identified all users and distinguished between intermediary and direct users of your research?*
- ☐ *Described their specific related role in terms of research, development, technology dissemination, policy formulation, adaptation, adoption, etc.?*
- ☐ *Used facts and figures to strengthen your statements?*

22. How were your research outputs used (will be used in the future):

The new, improved mungbean varieties and its introduction in production system changed approaches to crop rotation in Fergana valley. For the first time a new model of "Winter wheat – mungbean" crop rotation on a state level was organized. This model was welcomed by the farmers from other regions of the republic as well those whose seed would be distributed for planting mungbean after wheat harvest in the summer of 2016. The mind-set of a large number of farmers within and outside the CRP-DS Action Site is changing about wheat-mungbean crop rotation using new varieties of mungbean. The motivation comes primarily from substantial additional income from mungbean cultivation, besides its positive impact on soil health and family nutrition. We have experienced the interest of additional farmers in the region to grow new varieties which is also reflected through the numerous requests coming for mungbean seeds not only from the Fergana valley but from other provinces. The Government is planning to spread new mungbean varieties as a catch crop after wheat to other regions to ensure technology expansion for maximizing benefit to the farmers and improving food and nutritional security.

SELF-CHECK – Have you:

- ☐ *Described actual changes that occurred during or immediate after the release of your research outputs?*
- ☐ *Identified how the use of research outputs set the stage for achieving the outcomes?*
- ☐ *Identified steps and actions for ensuring sustainability?*

23. What is the Evidence of Your Research Outcomes:

- CRP-DS Activity Report 2015 (http://www.cac-program.org/files/ec9f7aca08a1460f0debbbab0399c61c.pdf; http://www.cac-program.org/files/6f59f8d0abe1470efda99793a991c938.pdf)
- Learning to grow more with less in Central Asia. CAC News. June 10, 2014. http://www.cac-program.org/news/detail/414
- Scientists urge more attention to vegetable seed systems in Central Asia, Caucasus. CAC News. October 21, 2014. http://www.cac-program.org/news/detail/432
- Improving seed systems in Uzbekistan. Fresh News from AVRDC – The World Vegetable Center, May 8, 2015, p. 20.www.avrdc.org
- Seeds of hope: improving agricultural seed production in Uzbekistan. CAC News. 31.03.2015. http://www.cac-program.org/news/detail/446
- Kuzieva D. 2015.Mungbean rejuvenates a soil and consumer requested product. Journal "Farmer", №1, January, 2015. p. 43-45. (on Uzbek).
- Booklet. Mungbean new varieties cultivation technology in Fergana valley. ICARDA/AVRDC, 2015 (in Uzbek). (http://www.cac-program.org/files/0ed3d962dca9c6f70e49adbd54bd5d5f.pdf)
- Booklet. Mungbean variety Durdona.
- Booklet. Mungbean variety Zilola.
- Booklet. Mungbean variety Marjon.
- Booklet. Mungbean variety Turon.

New mungbean varieties were presented on the Republic Exhibition in ExpoCenteron 23-25 April 2014 and 19-21 May 2015.
In December 2015, the Fergana region Khokimiyat (Administrative Office) issued the internal order on mungbean seed production on 400 ha in 2016 in Fergana Province. This seed production model will be presented to the government to issue a State Order in 2016 and seed multiplication and distribution in large quality (around 800 tons) in other regions of the republic in 2017.

SELF-CHECK – Have you:

☐ *Identified how the actions and behaviours of key stakeholders have now changed?*

☐ *Identified how these changes will be sustained?*

24. Testimonials:

- Testimonials are written or recorded statements that support program credibility and level of expertise. They also strengthen our reputation by expressing the trust that other people have in the program and its offerings. They are a wonderful way to help us to attract a deeper interest from existing and prospective stakeholders. Testimonials are the holy grail of marketing and advertising. Marketing Experiments demonstrate that testimonials can work wonders. For example, a written testimonial can increase customer conversion by 25%; video testimonials on the other hand, can increase the conversion rates increased by a whopping 201%!
- Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)
- Testimonials from Partners (quote, video, letter, interview, survey, etc.)
- During visits of farmers' fields all farmers unanimously voiced the importance of mungbean cultivation in their farms that fetched substantial profit.
- Also positive impressions from mungbean cultivation were presented by the participants during workshops and trainings that motivated the participants. Below are a few people who spoke highly of the wheat-mungbean rotation:
- Representative of the Cabinet of Ministers of Uzbekistan Mr. Amir Amanov; Head of the Agroprom of Fergana region Mr.Kholmirza Pulatov, Deputy Khokim of Kuva district Mr.Abduvali Isakhonov, Water Users Association Director Mr.Jamol Akhmedov, and WUA agronomist Mr.Kurbonali Sharipov, Heads of farmers farms

Mrs.Izoz Matmusaeva and Muborakhon Tukhtasinova, Mrs.Mamaraim Mirzaliev and Akbar Khojimatov, and others (photos are attached),

- For additional information about this success stories, the following person can be contacted who contributed through suggestion in all steps of the activity.
- Dr.Amir Amanov, Director, Uzbek Research Institute of Plant Husbandry, Kibray, Uzbekistan, email: a.amanov54@yandex.ru
- Mr. Maraimjon Mirzaliev Tolmozor Village, Water Users' Association, Kuva District, Fergana region, Uzbekistan; Phone: 998 90 632 6313
- **Note:** Details of testimonials are provided as a separate file.

SELF-CHECK – Have you:

- ☐ *Included the name, position, organization and location of person giving the testimonial?*
- ☐ *Included a testimonial that clearly identifies a direct benefit to a person/community/organizations, as opposed to vague general praise for the program activity?*
- ☐ *Included a testimonial that captures the beneficiary's strong emotion stemming from the outcome of your activities in his/her life, community, organization, etc.?*
- ☐ *Ensured each quote is no more than 2-3 lines.*

25. Lessons Learned:

What did you learn in this process?

The Project aims to solving the challenge of developing a new direction for sustainable agriculture, a food security and wellbeing of a population living in vulnerable conditions. For successful implementation of the project required a well-written business plan, supported by the necessary funding. Also, choosing of the right partners to do the work and timely reporting is important. Cooperation with local authorities is essential to the successful dissemination of knowledge and development.

What was difficult or challenging?

To cope with the changing (decreasing) funding scenario. Also, other activities in the Action Site were moved from Fergana to Khorezm, which created doubt in the farmers' mind about successful completion of the activity.

How did you overcome the challenges faced?

Through transparent discussion with the farmers about the decreasing funding scenario in CRP, using some funds from other restricted projects working in the Action Site, and negotiating with partners for reduction in expenses wherever possible.

How did you engaged or worked with partners successfully?

We allowed the farmers to take responsibility and ownership of the activity and did everything in a transparent and shared manner. We always made plans involving local policy makers and farmers.

If you were to start over, what would you do differently?

Try to involve development partners who can help in out scaling of the technology to all potential beneficiaries in shorter time than this project will do.

SELF-CHECK – Have you:

- ☐ *Identified both challenges/weaknesses and successes/strengths?*
- ☐ *Identified what you might have done differently to ensure a better outcome or greater impact?*
- ☐ *Identified who/what other organization/canter/CRP can potentially benefit from these lessons?*

26. Full reference citations and URL link to published research work.

1. Learning to grow more with less in Central Asia. 2014. Newsletter. CAC-News. Tashkent, Uzbekistan.
2. Mavlaynova, Ravza. 2014, Scientists urge more attention to vegetable seed system in Central Asia. Newsletter. CAC-News. AVRDC, ICARDA. Tashkent, Uzbekistan.
3. Mavlyanova, R and R.C. Sharma. 2015, improving seed system in Uzbekistan. Newsletter. Fresh news from AVRDS - The World Vegetable Center. AVRDC, ICARDA. Tashkent, Uzbekistan p.20.

4. Kuzieva, Dilfuza. 2015, Mungbean rejuvenates the soil and it has good nutrition productivity. Article. “Farmer” Journal. Tashkent, Uzbekistan. p.43-45. (In Uzbek)
5. Mavlaynova, R and R.C. Sharma. 2015. Seed of hope: Improving agricultural seed production in Uzbekistan. Newsletter. CAC-News. AVRDC, ICARDA, Tashkent, Uzbekistan.
6. Mavlaynova Ravza. 2015, Technology of growing the new Mungbean varieties in Fergana region. Booklet. AVRDC, UzRIPI, Tashkent, Uzbekistan. (In Uzbek)
7. Mavlaynova Ravza. 2015, Mungbean variety “Durdona”. Booklet. AVRDC, UzRIPI, Tashkent, Uzbekistan. (In Uzbek and Russian)
8. Mavlaynova Ravza. 2015, Mungbean variety “Turon”. Booklet. AVRDC, UzRIPI, Tashkent, Uzbekistan. (In Uzbek and Russian)
9. Mavlaynova Ravza. 2015, Mungbean variety “Marjon”. Booklet. AVRDC, UzRIPI, Tashkent, Uzbekistan. (In Uzbek and Russian)
10. Mavlaynova Ravza. 2015, Mungbean variety “Zilola”. Booklet. AVRDC, UzRIPI, Tashkent, Uzbekistan. (In Uzbek and Russian)

27. Please check any of the following that are being submitted to complement your outcome story:

- ☐ Quality Photo(s) (of landscape, beneficiaries and activities) with appropriate captions and credit
- ☐ Testimonials from Beneficiaries (quote, video, letter, interview, survey, etc.)
- ☐ Testimonials from Partners (quote, video, letter, interview, survey, etc.)
- ☐ Full reference citations and URL hyperlinks to published research work
- ☐ Blog and/or other website stories with URL links
- ☐ Newspaper Articles (print or electronic)
- ☐ Communication (non-scientific) Materials Produced (brochure, poster, press release, etc.)
- ☐ Supporting Materials (presentations, workshop reports, activity reports, donor reports)
- ☐ Video/Audio Clips
- ☐ Other (please explain: _____)

28. Final Checklist

Please use the following checklist to ensure your outcome story is ready for sharing.

No.	Question to consider	Yes	No
1	Does the story describe the outcomes the research produced and the people who are benefitting? What changes–in skills, knowledge, attitude, practice, or policy–has the research brought, and who is benefitting from these changes?	X	
2	Does the story capture outcomes from an interesting angle (possibly a human angle) that would captivate the attention of the target audience?	X	
3	Does the story explain what new insights the research brings? Does the story describe a key insight on what works and what doesn't and something that future research could build on. What are the main lesson learned?	X	
4	Does the story make a compelling point that people will remember? Does the story show how the research makes a difference to improving livelihoods and reducing poverty?	X	
5	Does the story provide interesting facts that people will remember?	X	
6	Does the story explain in clear and measurable ways the kind of impact-beyond the level of the reported outcomes - could be achieved if the research outputs scaled out and up?	X	
7	Does the story show which partners contributed and how?	X	
8	Does the story include quotes from scientists, partners and/or beneficiaries?	X	
9	Have I provided links to other media (journal articles, website news, newsletter, blogs, annual reports of other CGIAR centres, CRPs) that also feature this story?	X	
10	Have I provided the contact details of people who can provide more information?	X	

SECTION V – LIST OF 2015 PUBLICATIONS AND SCIENTIFIC OUTPUTS

In 2015, Name of CENTER produced under the framework of the CGIAR Research Program on Dryland Systems a total of X published articles (Y indexed by ISI), Z books, and several policy and technical briefs.

A clear move towards the examination of new systems approaches is emerging in this body of scientific knowledge, including two strategy papers. We expect the systems approach will generate greater public awareness of agricultural livelihood issues in dryland areas and reshape traditional thinking about key performance determinants of dryland agro-ecosystems and relevant responses to meet challenges faced by rural dryland communities.

See example, and please provide a short narrative of what this body of scientific knowledge represents. What's new and innovative about it?

The following represents a summary of all 2015 publications and research outputs produced by Centre under Dryland Systems by Region/ALS Flagship, including full and correct citation of all publications, weblink and categories of scientific output marked with the following codes to indicate:

- (S) = multidisciplinary/system research
- (M) = mono-disciplinary research
- [X.XX]= ISI Impact Factor[3]
- (O) = Open Access

***IMPORTANT NOTE":** All listed publications must clearly acknowledge the research was conducted under the framework of CGIAR Research Program on Dry and Systems and include the appropriate acknowledgment statement as suggested in the Guidance on Dryland Systems Acknowledge and Disclaimer (see link).

Table 1. Summary of all ISI publications

Region/ALS	ISI Factor [range of ISI scores]	ISI Open (% of ISI articles)	ISI Monodisciplinary (% of ISI articles)	ISI Multidisciplinary (% of ISI articles)
WAS/				
NAWA/				
ESA/				
CA/	0.41			100
SA/				

[3] *For ISI, the JCR Impact Factor List for 2013 has used (https://www.360researchpapers.com/resources/impact-factor, accessed 6 July 2015). For journals not listed, the website of that journal was checked and if it lists an* Region *ISI factor, this was recorded.*

TOTAL

Table 2. Summary of Non-ISI Publications

Region/ALS	Non-ISI Articles	Book Chapters	Technical Reports & Working Papers	Proceedings	Datasets	Other
WAS/						
NAWA/						
ESA/						
CA/	1	2	12	3	7	5
SA/						
TOTAL						

Please list in alphabetical order, full citation, weblink and codes as applicable for all publications as shown in the examples below under each category of research output.

ISI Journal Articles (1)

- Gowda, P.H., T.A. Howell, R.L. Baumhardt, D.O. Porter, T.H. Marek, and V. Nangia. 2015. A user-friendly interactive tool for estimating reference ET using ASCE-EWRI standardized Penman-Monteith equation. Appl Eng Agric. Manuscript #NRES-11673-2015. Accepted, in press.

Non-ISI Journal Articles and Theses (1)

- Jumaboev, K., Anarbekov, O., Mohan Reddy, J., Mukhammedjanov, Sh., Eshmuratov, D. 2015. Irrigation Extension Development for improving water productivity in Fergana Valley of Central Asia. Designing Social Institutions in Transition, Promotion of Institutional Development for Common Pool Resources Management in Central Asia (InDeCA Series). Improving the Efficiency of Common Pool Resources Management in Transition: Case Study of Irrigation Water and Pasture. Humboldt University in Berlin Press. ISSN 2363-6653 (Printausgabe).

Books (1)

- ICARDA (2014). Manual on Climate Change. Downloading prognostic meteorological information from Earth System Grid Federation (ESGF). http://www.cacilm.org/en/manual-climate-change [in English]. http://www.cacilm.org/ru/руководство-по-изменению-климата [in Russian]

Book Chapters (1)

- Savadogo P. 2014. Sahelian bocage: an integrated conservation agriculture with tree approach in Burkina Faso In Trees and resilience: An assessment of the resilience provided

by trees in the drylands of Eastern Africa Edited by Jan de Leeuw, Mary Njenga, Bob Wagner and Miyuki Iiyama. ISBN: 978-92-9059-352. Nairobi, Kenya. ICRAF 166 pp.

Technical Reports and Working Papers (12)

- Anarbekov, Oyture. 2015. CRP DS: Technical Report: Survey data collected for at least from three Case-study pilot WUAs of Fergana Valley. Tashkent, Uzbekistan. URL: mel.cgiar.org
- Anarbekov. 2015. Comparative assessment of WUAs Governance role on efficient use of water resources in Fergana Valley. URL: mel.cgiar.org
- Benli, B., Yuldashev, T., Sharma, R., 2015. Integrated Land and Water Productivity Improvement in Aral Sea Basin within CGIAR Research Program on Dryland System (CRP DS). ICARDA Project Report. Tashkent, Uzbekistan: ICARDA. http://www.cac-program.org/crpds/reports
- Benli, B., Yuldashev, T., Sharma, R., 2015. Soil salinity management on raised bed with different furrow irrigation methods in salt-affected lands in Aral Sea Basin. ICARDA Project Report. Tashkent, Uzbekistan: ICARDA. http://www.cac-program.org/crpds/reports
- Djumaniyazova, Y., Nangia, V., Egamberdiev, O., Gowda, P., Sultanov, M., Sin, L., Akramkhanov, A., and Suleiman, A. 2015. Crop modeling of field trial data to estimate crop coefficient (K_c) for weather station network-based irrigation scheduling system in Aral Sea Basin Site. ICARDA Project Report. Tashkent, Uzbekistan: ICARDA. https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/EQUB0B
- Duchovny, V. A., S. Mukhamedjanov, A. Mukhamedjanov, and Nangia, V. 2015. Improving water use efficiency through innovative technologies in irrigation and agriculture in the Fergana Valley. ICARDA Project Report. Tashkent, Uzbekistan: ICARDA. https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/EBZFJZ
- Mukhamedova, Nozilakhon 2015 (IWMI). What makes gender empowerment in agriculture: Paid labour conditions and opportunities in Uzbekistan? Strategic Gender Research CRP DS Review on Agricultural Labour and Gender. IWMI, project report. (*A link will be provided once the report is finalized and uploaded*
- Nurbekov, A., Musaev, A., Sydyk, D., Ziyadullaev, Z. and Turok, J. 2015. Conservation agriculture in irrigated areas of Azerbaijan, Kazakhstan and Uzbekistan. ICARDA Working Paper 26. 46 pp. ICARDA, Beirut, Lebanon. ISBN: 92-9127-476-3.
- Rekik, M., Rischkowsky, B. and Shaumarov, M. 2015. Establishment of a Karakul-Sur nucleus flock in Karauzyak district, Republic of Karakalpakstan. ICARDA project report. Tashkent, Uzbekistan: ICARDA. *(A link will be provided once the report is finalized and uploaded)*
- Rudenko, I., Shaumarov, M. and Rischkowsky, B. 2015. Small ruminant value chain rapid assessment in the district of Karauzyak, Republic of Karakalpakstan. ICARDA project report. Tashkent, Uzbekistan: ICARDA. (*A link will be provided once the report is finalized and uploaded)*

- Toderich, K. 2015. Description of marginal categories of lands and their potential to be used for winter forage production. ICBA-ICARDA project report. Tashkent, Uzbekistan: ICARDA. (*A link will be provided once the report is finalized and uploaded*)
- Toderich, K. 2015. Halophytes and salt tolerant forages as animal feeds at farm level. ICBA-ICARDA project report. Tashkent, Uzbekistan: ICARDA. (*A link will be provided once the report is finalized and uploaded*).

Proceedings (5)

- Anarbekov, Oyture [IWMI], 2015. IWMI's experience and activities in institutional aspects of water management in Uzbekistan. Presentation has been done in the Policy workshop of the InDeCa project of the Volkswagen Foundation program: "Between Europe and the Orient - A Focus on Research and Higher Education in/on Central Asia and the Caucasus", May 19, Tashkent, Uzbekistan.
- Anarbekov, Oyture [IWMI], Kakhramon Jumaboev, 2015. Irrigation Extension development for improving water productivity in Fergana Valley of Central Asia. Presentation has been presented on May 20, 2015 at Tashkent Institute of Irrigation and Melioration (TIIM) by the request of TIIM and InDeCA research project, Tashkent, Uzbekistan.
- Anarbekov, Oyture [IWMI]; Mukhamedova, Nozila [IWMI-IAMO] 2015. "Water Users' Associations in Central Asia: Opportunities and challenges for development". [Submitted only Abstract]. IAMO (Leibniz Institute of Agricultural Development in Transition Economies) 2015 Annual Forum: Agriculture and climate change in transition economies. Dates: 17. – 19. June 2015 | Halle (Saale), Germany. http://projects.iamo.de/fileadmin/veranstaltungen/iamo_forum/2015/Presentations/IAMO_Forum_2015_B1_3_Mukhamedova.pdf.
- Nurbekov, A., Kassam, A., Mirzabaev, A., Turok, J., Sydyk, D. and Ziyadullaev, Z. 2015. Possible Role for Conservation Agriculture in Climate Change Adaptation and Mitigation in Central Asia: A Preliminary Review. Presented at the Conference "Agriculture and Climate Change in Transition Economies". Halle (Saale), Germany, 17-19 June 2015
- Nurbekov, A., Kassam, A., Musaev, A., Sydyk, D., Ziyadullaev, Z., Feindel, D., Muminjanov, H. and Turok, H. 2015. Effect of Tillage Methods on Productivity of Winter Wheat in the Irrigated Conditions of Central Asia and the Caucasus. 18th International Soil Conservation Organization Conference. El Paso, Texas, USA, 31 May – 5 June, 2015.

Factsheets (2)

- Contribution to the This monthly electronic newsletter provides a snapshot of some of the current work of the Regional Program for Sustainable Agricultural Development in Central Asia and the Caucasus, supported by the Consultative Group for International Agricultural Research (CGIAR).

- Provided News article on Teleconference on Improved irrigation methods for potato crop cultivation by Oyture Anarbekov and Kamola Mirzanazarova.

Data sets (7)

- Benli and Yuldashev. Dataset for integrated land and water productivity improvement in Khorezm http://www.cac-program.org/crpds/reports
- Benli and Yuldashev. Dataset for soil salinity management on raised bed with different furrow irrigation in salt affected lands in Aral Sea Basin http://www.cac-program.org/crpds/reports .
- Dosov et al. 2015, Aral sea action site, agro-pastoral systems, research site in Karauzyak rural community http://cac-program.org/download/file/220
- Fergana Valley Action site, Irrigated system, In Batken region, Kyrgyzstan http://cac-program.org/files/Kyrgyzstan_dataset.xlsx\,
- Fergana Valley Action site, Irrigated system, In Sugd region, Tajikistan http://cac-program.org/files/Tajikistan_dataset.xlsx
- Nangia et al. 2015, improving WUE in Aral Sea Basin region https://dataverse.harvard.edu/dataverse/asr
- Nangia et al. 2015, Improving WUE in Fergana Valley region https://dataverse.harvard.edu/dataverse/fv

Other publications (5)

- CGIAR-PFU. 2015. New wheat varieties help farmers save and earn more in Fergana Valley Action Site. CAC Newsletter. 9 June 2015. http://cac-program.org/news/detail/466
- CGIAR-PFU. 2015. Seeds of hope. CAC Newsletter. 31 March 2015. http://cac-program.org/news/detail/446
- CGIAR-PFU. 2015. *Promoting salt- and frost-tolerant wheat varieties in Central Asia*. CAC Newsletter. 7 June 2015. http://cac-program.org/news/detail/464
- Rekik, M., Rischkowsky, B., Haile, A. and Hilali, M. 2015. *Ultrasound diagnosis as low-tech tool for sheep and goat production systems.* http://drylandsystems.cgiar.org/news-opinions/ultrasound-diagnosis-low-tech-tool-sheep-and-goat-production-systems
- Toderich, K. and Pritchard, T. 2015. *Rural women empowered with knowledge to improve own livelihoods*. http://drylandsystems.cgiar.org/news-opinions/rural-women-empowered-knowledge-improve-own-livelihoods

Annex 1: CRP indicators of progress, with glossary and targets

This table will be automatically generated by Dryland Systems' Monitoring, Evaluation and Learning (MEL) platform. However, it is recommended that you fill the tables to ensure accuracy of reporting and accountability.

Indicator	Description of Activities and Products measured by Indicator	Deviation narrative (+/- 10%)	2015 Actual	2016 Target
KNOWLEDGE, TOOLS, DATA				
1. Number of "products" produced by the Center	• Innovation in family farming in Europe and Central Asia http://cacaari.org/en.php?/news/read/2263 • Recommendations on enhancing innovation in agro-pastoral systems in CA • Booklet. New wheat varieties help farmers save and earn more in Fergana Valley Action Site. CAC Newsletter. 9 June 2015. http://cac-program.org/news/detail/466 • Booklet. Seeds of hope. CAC Newsletter. 31 March 2015. http://cac-program.org/news/detail/446		4	
2. Number of products produced that have explicit target of women farmers/NRM managers				
3. Number of products produced that have been assessed for likely gender-disaggregated impact	• Anarbekov, Oyture. 2015 (IWMI-CDE). Comparative assessment of WUAs Governance role on efficient use of water resources in Fergana Valley. CRP Dryland Systems Central Asia Flagship, Fergana Valley Action Site; • Mukhamedova, Nozilakhon 2015 (IWMI). What makes gender empowerment in agriculture: Paid labour conditions and opportunities in Uzbekistan? Strategic Gender Research CRP DS Review on Agricultural Labour and Gender		2	
4. Number of "tools" produced by the Center	• Guidelines for farmers on using furrow irrigation, drip irrigation, discrete and impulse irrigation technology, irrigation scheduling and water accounting, in Fergana Valley • Winter feed production of traditional and non-traditional crops • Ultrasound-based tool for sheep and goats pregnancy diagnosis • Field-tested toolkit for rapid small ruminants value chain assessment made available in Russian • A weather station network-based decision-support tool to match the crop water requirement with the irrigation scheduling. Russian version of reference ET calculator developed to help perform calculations. (Blog: http://cac-program.org/files/b99ffb2d611550c1373cbf96f3c661c6.pdf; tool:		5	

5. Number of tools that have an explicit target of women farmers	• Rural Women Empowered with Knowledge to Improve Own Livelihoods http://drylandsystems.cgiar.org/news-opinions/rural-women-empowered-knowledge-improve-own-livelihoods • Interacting with women for the potential role in land and water management in Karakalpakstan. http://www.cac-program.org/crpds/reports • Interacting with women for the potential role in land and water management in Khorezm. http://www.cac-program.org/crpds/reports • Toderich, K. and Pritchard, T. 2015. Rural Women Empowered with Knowledge to Improve Own Livelihoods. http://drylandsystems.cgiar.org/news-opinions/rural-women-empowered-knowledge-improve-own-livelihoods		4	
Indicator	**Description of Activities and Products measured by Indicator**	**Deviation narrative (+/- 10%)**	**2015 Actual**	**2016 Target**
KNOWLEDGE, TOOLS, DATA				
6. Number of tools assessed for likely gender-disaggregated impact	• The work on forage production for winter feeding is gender-related as the target population is mainly represented by women farmers • Toderich, K. 2015. Description of marginal categories of lands and their potential to be used for winter forage production. ICBA-ICARDA project report (*A link will be provided once the report is finalized and uploaded*) • Toderich, K. 2015. Halophytes and salt tolerant forages as animal feeds at farm level (*A link will be provided once the report is finalized and uploaded*). • Field-tested toolkit for rapid small ruminants value chain assessment made available in Russian		4	
7. Number of open access databases maintained by Center	• Integrated lannd and water productivity improvement in Khorezmhttp://www.cac-program.org/crpds/reports • Salinity management in Karakalpakstan. Soil analysis. http://www.cac-program.org/crpds/reports • Baseline survey of households, Aral Sea Action site, Agro-pastoral ALS, Karaozek rural community http://cac-program.org/download/file/220 • Weather stations data, Nangia et al. 2015, Improving WUE in Aral Sea Basin region https://dataverse.harvard.edu/dataverse/asr • Data on soil, climate, yield, cropping system, seed production prepared and uploaded to MEL system • Open access online database for Aral Sea and Fergana Valley action sites (https://dataverse.harvard.edu/dataverse/asr;jsessionid=99c2a56939599dbb72648db30392)		7	
8. Total number of users of these open access databases		-		
9. Number of publications in ISI journals produced by Center	Gowda, P.H., Howell, T.A., Baumhardt, R.L., Porter, D.O., Marek, T.H., and Nangia, V. In press. 2015. A user-friendly interactive tool for estimating reference ET using ASCE-EWRI standardized Penman-Monteith equation. Appl Eng Agric. Manuscript #NRES-11673-2015		1	
10. Number of strategic value chains analyzed by Center	Implementation of small ruminants value chain rapid assessment in the district of Karaozek, Republic of Karakalpakstan		1	

Indicator	• Description of Activities and Products measured by Indicator	Deviation narrative (+/-10%)	2015 Actual	2016 Target
KNOWLEDGE, TOOLS, DATA				
11. Number of targeted agro-ecosystems analysed/ characterised by Center	• Mixed cropping system within Irrigated ALS • Mixed cropping system within Agro-pastoral ALS/ Livestock, cotton/wheat cropping, agroforestry within Agro-pastoral ALS		2	
12. Estimated population of above-mentioned agro-ecosystems	• In agro-pastoral ALS - 897,000 people corresponding to the rural population in the republic of Karakalpakstan • In irrigated ALS - 1,100,000 people corresponding to the rural population in Khorezm region			
CAPACITY ENHANCEMENT AND INNOVATION PLATFORMS				
13. Number of trainees in short-term programs facilitated by Centre (male)	• Water management capacity building events 91 • Capacity building on Irrigation techniques; 40 • Weather station based irrigation advisory system consultation event total 61. • Series of 3 seminars and field visits for total of 36 WUA technical staff; • Integrated livestock component training (ToT) for 2 veterinarians and 2 livestock specialists. • Field training seminar for 12 participants; • Seed system activity strengthened capacity of 42 farmers • Improved wheat varieties trinaing.36 • Mungbean seed production. 22 • Conservation agriculture and WUE events 94 participants • One training participants 30 and field day 41		499	
14. Number of trainees in short-term programs facilitated by Centre (female)	• Water management capacity building events 30 female • Capacity building on Irrigation techniques; 20 • Weather station based irrigation advisory system consultation event 15 female. • Series of 3 seminars and field visits for total of 10 female WUA technical staff; • Field training seminar for 15 women; • Seed system activity strengthened capacity of 7 women; • Improved wheat varieties trinaing.2 • Mungbean seed production. 9 • Conservation agriculture and WUE events 16 female	-4%	124	
15. Number of trainees in long-term programs facilitated by Center (male)	• PhD of Makhmud Shaumarov "Institutions for the Sustainable Management of Dryland Pastoral Systems in Uzbekistan: What are the Options?" University of Hohenheim, Institute 490c, Wollgrasweg 43, 70599 Stuttgart, Germany • Phd Student, in coordination with University of Bern, on Water Governance in Fergana Valley. • PhD Student Botir Abdurakhmanov, at TIIM, Uzbekistan		3	

16. Number of trainees in long-term programs facilitated by Center (female)	• PhD Student Nozilakhon Mukhamedova, at IAMO, Germany.		1	
Indicator	**Description of Activities and Products measured by Indicator**	**Deviation narrative (+/- 10%)**	**2015 Actual**	**2016 Target**
CAPACITY ENHANCEMENT AND INNOVATION PLATFORMS				
17. Number of multi-stakeholder R4D innovation platforms established for the targeted agro-ecosystems by the Center				
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT				
18. Number of technologies/NRM practices under research in the Center (Phase I)	• Sustainable water management; practices • Sustainable land management practices; • Natural resource management practices • Raised bed furrow system • Irrigation applications methods (Every Furrow, Alternate Furrow and Permanent Skip Furrow) • Wheat varieties • Integrated land and water management practice • Mungbean varieties • No-till and traditional tillage systems • Permanent bed planting • Genetic improvement of the Karakul sheep for pelt production • Improved management of fertility in sheep flocks		14	
19. Number of technologies under research that have an explicit target of women farmers	Salt tolerant species for winter feed production http://drylandsystems.cgiar.org/news-opinions/rural-women-empowered-knowledge-improve-own-livelihoods		1	

Indicator	Description of Activities and Products measured by Indicator	Deviation narrative (+/- 10%)	2015 Actual	2016 Target
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT				
20. Number of technologies under research that have been assessed for likely gender-disaggregated impact	Salt tolerant species for winter feed production http://drylandsystems.cgiar.org/news-opinions/rural-women-empowered-knowledge-improve-own-livelihoods		1	
21. Number of agro- ecosystems for which CRP has identified feasible approaches for improving ecosystem services and for establishing positive incentives for farmers to improve ecosystem functions as per the CRP's recommendations	• Mixed cropping system within Irrigated ALS • Mixed cropping system within Agro-pastoral ALS/ Livestock, cotton/wheat cropping, agroforestry within Agro-pastoral ALS		2	1
22. Number of people who will potentially benefit from plans, once finalised, for the scaling up of strategies	• In agro-pastoral ALS - 897,000 people corresponding to the rural population in the republic of Karakalpakstan (50% female) • In irrigated ALS - 1,100,000 people corresponding to the rural population in Khorezm region (50% female)			
23. Number of technologies /NRM practices field tested (phase II)	• SMS technology for irrigation scheduling • Raised bed furrow system • Irrigation applications methods (Every Furrow, Alternate Furrow and Permanent Skip Furrow) • Wheat varieties • Seed production • Integrated land and water management practice • Mungbean varieties • No-till and traditional tillage systems • Permanent bed planting • Genetic improvement of the Karakul sheep for pelt production • Improved management of fertility in sheep flocks • Salt tolerant species for winter feed production • Russian version of reference ET calculator developed		13	

Indicator	Description of Activities and Products measured by Indicator	Deviation narrative (+/- 10%)	2015 Actual	2016 Target
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT				
24. Number of agro-ecosystems for which innovations (technologies, policies, practices, integrative approaches) and options for improvement at system level have been developed and are being field tested (Phase II)	Irrigated ALS Agro-pastoral ALS		2	
25. Number of above innovations/approaches/options that are targeted at decreasing inequality between men and women				
26. Number of published research outputs from CRP utilised in targeted agro-ecosystems	• Booklet on mungbean seed production Seeds of hope. CAC Newsletter. 31 March 2015. http://cac-program.org/news/detail/446 • Rangelands of Central Asia that reflected on challenges and opportunities of rangeland management and on how to improve the range condition and biomass		2	
27.Number of technologies/NRM practices released by public and private sector partners globally (phase III)				

Indicator	Description of Activities and Products measured by Indicator	Deviation narrative (+/- 10%)	2015 Actual	2016 Target
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT				
POLICIES IN VARIOUS STAGES OF DEVELOPMENT				
28. Numbers of Policies/ Regulations/ Administrative Procedures Analyzed (Stage 1)	Institutional analysis at WUAs contributed with IWRM principles and approaches in the new Irrigation Reform Strategy of Tajikistan.		1	
29. Number of policies / regulations / administrative procedures drafted and presented for public/stakeholder consultation (Stage 2)	Sughd Province, Tajikistan, second stage debate on irrigation pricing at WUA level		1	
30. Number of policies / regulations / administrative procedures presented for legislation(Stage 3)			1	
31. Number of policies / regulations / administrative procedures prepared passed/approved (Stage 4)				

Indicator	Description of Activities and Products measured by Indicator	Deviation narrative (+/- 10%)	2015 Actual	2016 Target
POLICIES IN VARIOUS STAGES OF DEVELOPMENT				
32. Number of policies / regulations / administrative procedures passed for which implementation has begun (Stage 5)				
OUTCOMES ON THE GROUND				
33. Number of hectares under improved technologies or management practices as a result of CRP research	• Wheat and mungbean seed production. 92 ha, 574 ton seed wheat, 12.5 ton seed mungbean • No-till 50 ha • Umarov, Tashlaq District, Fergana Province, Uzbekistan; as well as in B. Gafurov and J. Rasulov districts of Sughd Province, Tajikistan.. Applied technologies on use of SMS technology for irrigation scheduling, using furrow irrigation technology, using alternate dry furrow irrigation technology, using discrete and impulse irrigation technology, using short furrow irrigation technology. 350 ha.		492	
34A. Number MALE of farmers and others who have applied new technologies or management practices as a result of CRP research	Wheat and mungbean seed production (4)		1	
34B. Number of FEMALE farmers and others who have applied new technologies or management practices as a result of CRP research	Wheat and mungbean seed production (4)		1	

Annex 2: Performance indicators for gender mainstreaming with targets defined

Please delete the part not achieved by your centre and add details.

Performance Indicator	CRP performance approaches requirements	CRP performance meets requirements	CRP performance exceeds requirements
1. Gender equality targets defined	2 Sex-disaggregated multidimensional datasets, including social/gender aspects collected in the Irrigated systems relevant research sites and it will used to diagnose important gender-related constraints in at least one of the CRP's main target populations). Data are available only by December 2015.	2 Sex-disaggregated multidimensional data, including social/gender aspects collected (and will be used to diagnose important gender-related constraints in at least one of the CRP's main target populations. The data are available only by December 2015.	
2. Institutional architecture for integration of gender is in place			

ANNEX 3: List of Centre Research Staff contributing to Dryland Systems

Please provide list and relevant information of all research staff in your centre involved in Dryland Systems research from all Windows of funding by completing the attached excel document and submitting it separately as an attachment to the annual report.

RESEARCH PROGRAM ON
Dryland Systems

CGIAR

South Asia Chakwal Site, Pakistan
2015 Annual Report

January – December
2015

Food security and better livelihoods for rural dryland communities

The CGIAR Research Program on Dryland Systems aims to improve the lives of 1.6 billion people and mitigate land and resource degradation in 3 billion hectares covering the world's dry areas. Dryland Systems engages in integrated agricultural systems research to address key socioeconomic and biophysical constraints that affect food security, equitable and sustainable land and natural resource management, and the livelihoods of poor and marginalized dryland communities. The program unifies eight CGIAR Centres and uses unique partnership platforms to bind together scientific research results with the skills and capacities of national agricultural research systems (NARS), advanced research institutes (ARIs), non-governmental and civil society organizations, the private sector, and other actors to test and develop practical innovative solutions for rural dryland communities.

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

For more information please visit:

drylandsystems.cgiar.org

SUGGESTED CITATION
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DISCLAIMER

This document was prepared by Douglas Merrey (Team Leader), JuditSzonyi (member) and Ross McLeod (member) of the CRP-Commissioned External Evaluation team for the CGIAR Research Program on Dryland System. The views expressed in this document do not necessarily reflect the views of the Dryland Systems program.

Table of Contents

List of Acronyms

BARI	Barani Agriculture Research Institute
CRP-DS	Consortium Research Program Dryland System
DAS	Days After Sowing
DSSAT	Decision Support System for Agrotechnology Transfer
IRT	Interdisciplinary Research Team
FFD	Farmer Field Day
mm	millimetre
	Intermediate Development Outcomes
NARC	National Agriculture Research Centre
NARES	National Agriculture Research and Extension Scientist
NGOs	Non-Governmental Organizations
NRSP	National Rural Support Program
SA	South Asia
SAWCRI	Soil and Water Conservation Research Institute
SWAT	Soil Water Assessment Tool
USDA	United State Department of Agriculture

SECTION I – Key MESSAGES

a. Synthesis of Progress and Challenges (1 ½ page)

The soil and water management-related activities took a two-pronged approach – the crop modeling activity assessed avenues for sustainably increasing field-scale crop water productivity and building resilience whereas the SWAT modeling activity assessed avenues for managing natural resources at the watershed scale. The results indicate that for the Chakwal District, the second half of November and first week of December are the most optimal planting periods for wheat and barley, respectively. During drier than normal years, the application of 30 mm of supplemental irrigation between time of planting to 30 DAS provides similar yields to those of normal years. This provides a window of opportunity to make key strategic decisions on whether to apply a supplemental irrigation to ensure a crop at the end of the season in a year that may not conform to the norm. The ability to access long term forecasts for a season is critical in the decision making process and a relatively low application of water makes a significant difference with respect to harvesting a corp. Results of soil water assessment tool (SWAT) scenario simulations predict that 40-90% of the sediment losses in Attock (6396 km^2) and Chakwal (6863 km^2) Districts can be managed using erosion control structures that have been evaluated in the study watershed. This would have significant implications in the entire process of watershed development. Reducing sediment discharge would ensure the longevity of water storage structures that are often strategically placed within a watershed to control stream flow and act as groundwater recharge structures.

The socio-economic component for Chakwal Site under CRP DS supported the interdisciplinary research team (IRT) assisted the technical teams from different research institutes to effectively engage in the selection of sites, its characterization and priority setting for planning participatory research activities at the selected locations. Communities and other stakeholders including local NGOs and extension department were engaged in initial project activities including site selection and dialogue with communities over participation and collaboration in CRP DS activities. A training program on participatory technology validation was organized by the Social Sciences Research Institute that has assisted the IRT in focusing on the adoption and impact pathway associated with specific interventions that are being assessed. This was a new approach that was introduced and one that deviated from normal practices.

The process and activities were documented through developing different checklists and questionnaires in consultation with the IRT. Assessment of technologies, evaluation and validation along with dissemination and capacity buildings were undertaken in a participatory manner and the feedback from the target communities and participants documented and shared with the technical teams. The overall objective was to improve the process and field activities by incorporating community and target stakeholders insight and concerns in the adoption of new approaches as a means of increasing acceptability of. The highlights of the project activities and achievements were documented and projected through a comparative analysis of yield differences with the farmer practices along with analyzing ex-ante impact assessment of selected technology.

The active engagement as well as the projection of potential viable technologies assisted in the selection and promotion of viable technologies that could be adopted by communities. The process appears to have been successful in that communities have committed to and initiated the establishment of a village based seed enterprise that focuses on the production of oats as a fodder sources and large scale demonstration of cactus as a feed source for livestock on marginal lands. In the latter case there has been significant demand for planting material for cactus varieties that have been introduced into the region.

Greater involvement of rural women in value addition activities for improving food security and livelihood was one of the significant achievement. Significant improvement in knowledge and skills were improved and the activity was taken up by the local NGOs and women community organization. Training of trainers with a strong focus on women was undertaken within these organization in order to promote knowledge and skills along with technical backstopping by the IRT. Young social sciences staff participated in the field activities and assessment activities in data collection, project review meetings and interaction with multidisciplinary teams of the CRP project that further assisted in developing their capacity and skills in the assessment of multidisciplinary on-farm trials.

b. Significant Research Achievements (1 page)

Several research achievements were achieved over the reporting period. This included but not limited to:

The use of the auto-irrigate and auto-fertilize option in DSSAT crop simulation model resulted in the estimation of the potential yields for wheat and barley that were comparable with farmers' yields.
Probability analysis of simulation runs using 30 years of weather data assisted in recommendation on the most appropriate planting periods for wheat and barley under prevailing conditions as well as best depth and timing of supplemental irrigation application during dry years.
SWAT modelling using long-term monitoring data assisted in assessing the effectiveness of outscaling soil conservation structures over the entire Attock and Chakwal Districts of Pakistan that resulted in quantification of the value of these structures in reducing sediment loads. This will assist in strategically prioritizing investment in watershed development aspects associated with conservation structures.
The socioeconomic program was developed to provide backup for planning, conducting and highlighting impact of the CRP activities at Chakwal site. Following reports were prepared and submitted:

- Site selection criteria
- Characterization of project locations for Chakwal site (Pakistan) under CRP Dry Land systems"
- Gender mainstreaming in CRP dry land system; an assessment from socioeconomic perspective for training of women on value addition of fruits and vegetables at Chakwal site, Pakistan organized on September 25-26, 2014 at BARI, Chakwal
- Gender mainstreaming in CRP dry land system; an assessment from socioeconomic perspective for training of women on value addition of fruits and vegetables at Chakwal site, Pakistan organized on November 25-26, 2014 at BARI, Chakwal
- Capacity building of integrated research team: assessment of training on participatory technology validation at farmers' fields under CRP (1.1) – dry land systems Chakwal site, Pakistan (27-29 November, 2014)
- Assessment of on-farm technology demonstration and validation socioeconomic feedback on technologies validation trials at farmers' fields
- Ex-ante impact analysis: a case of introduction of spineless cactus at Chakwal site, Pakistan under CRP dryland systems (1.1)
- Participatory varietal selection: farmers' elicitation and assessment of field day on PVS; integrating the stakeholders in on-farm participatory varietal selection process at Chakwal site, under CRP dryland systems (1.1)
- Assessment of Cactus FFD at Chakwal site
- Technical report on participatory evaluation of training of master trainers on value addition training conducted under CRP-DS in Chakwal 2015

- Developed, shared and documented recommendation for improvement in the technology validation and capacity development activities for above activities.

c. Financial Summary (1/2 page)

SECTION II– IMPACT PATHWAY AND INTERMEDIATE DEVELOPMENT OUTCOMES (IDOS)

h. Progress Along the Impact Pathway (1/2 page)

Planting during suggested windows and the application of supplemental irrigation helps stabilize yields between normal and extreme rainfall years which leads to resilient livelihoods that can deal with climatic variabilities (IDO 1: Increased resilience of the poor to climate change and other shocks).

Placement of soil conservation structures helps reduce soil erosion which is a major problem in the Pothwar region of Pakistan. The research has identified structures which are most effective in doing so at different slope gradients. This contributes to IDO 4 (Increased productivity), more sustainable and equitable management of land, water resources, energy and biodiversity.

A shift from pasture (degraded grazing land) to silvopasture and the introduction of cactus have contributed to the creation resilient livelihoods that enhance the capacity of communities to manage the negative impacts of drought in marginal production areas (IDO 1: Increased resilience of the poor to climate change and other shocks). The use of cactus contributes to alleviating pressure on already degraded rangelands, allowing them to regenerate. This contributes to IDO 4 (Increased productivity) through increased productivity, sustainable and equitable management of natural resources.

Fodder and feeding interventions in targeted areas of Chakwal site, improves the farming community skills, increases knowledge, create awareness (IDO 4: Increased productivity), stimulates business growth and strengthens the role of female community, improved green fodder yield and its availability for animals managed by women (IDO 2: Enhanced smallholder market access) in which consequently provides and sustains their livelihoods (IDO 1: Increased resilience of the poor to climate change and other shocks) http://mel.cgiar.org/reporting/report/id/1104

The training imparted to women of farming communities from 44 villages (10% of 440 villages in Chakwal area) on value addition to locally-produced fruits and vegetables for balanced diets as well as serve as secondary source of household income contributed to gender empowerment (IDO 5: Improved diets for poor and vulnerable people) as well as capacity to innovate (IDO 6: Improved food security). The women in the program as well as the NGOs engaged are now serving as master trainers using the training material developed and disseminated using various different mediums to spread the message to other villages.

Demonstration of cactus as well as dissemination through FFD generated awareness and developed willingness to adopt the technology. The spill over effect of this approach was that five farmers not receiving training at the FFD have planted cactus on their own accord. Capacity development on value addition activities was streamlined for dissemination at large scale by engaging community activities from different NGOs and community organization and trained as master trainers. This will achieve the desired impact of improving household food security (IDO 6) by promotion of value addition at household level as well as a business activity for rural women (IDO 2: Enhanced smallholder market access). The improved fodder trials along with seed

production introduced the previous year will promote improved fodder production and hence improve year round quality feed for livestock in the target area.

i. South Asia/ AgroPastoral

I. Progress towards outputs (2 pages)

Chakwal is representative of large areas rainfed based production systems of Pothwar region of Pakistan. The following activities were conducted to facilitate sustainable livelihood alternatives for rural populations in the target area:

DSSAT crop simulation model was successfully calibrated and validated for popular wheat and barley cultivars using long-term historical trial data (http://mel.cgiar.org/uploads/reporting/b6jzmzlf0CMfm5ta8lg5xc6Bj1tOEE.zip). The model simulated responses to different depths and timing of supplemental irrigation and planting dates. Results indicate that during normal rainfall years (500-600mm), best planting date to achieve yields close to potential is within a 10 day window of opportunity between the 20-30 November for wheat and 5 December for barley; during dry years (200-500mm rainfall), the application of 30 mm of supplemental irrigation between time of planting and 30 DAS for wheat and as well as barley resulted in adequate yields that were equivalent to those achieved in normal rainfall years (http://mel.cgiar.org/uploads/reporting/yRdZ1iUxUFSEiaXlMxv4sYlMVcPXhs.docx).

The SWAT model was successfully applied to micro-watershed data. This model was subsequently applied to a larger area (district-level) to optimize watershed management in order to reduce soil erosion to what could be termed manageable levels (http://mel.cgiar.org/uploads/reporting/iZDrxQek8n.doc). Results indicate that 40-90% of the soil erosion in Attock and Chakwal Districts can be managed by strategically placing control structures in the watershed that effectively retard or capture surface runoff. Different control structures have been recommended for their effectiveness in managing erosion based on slope gradient. A Master's degree student from Center of Excellence in Water Resources Engineering of University of Engineering and Technology, Lahore conducted degree research in the study area and published his thesis (http://mel.cgiar.org/reporting/report/id/197). Two SWAT modelling training courses were organized during 2014 to build capacity of the NARES participating in implementation of the activity. Several manuscripts are under development.

A field day on cactus targeting 30 farmers (5 women) and 2 local agricultural extension staff was conducted undertaken. The field day focused on the introduction of cactus as a multi-purpose crop under intensive production system; one blog on the introduction of cactus pear to Pakistan published on CRP DS website; (http://mel.cgiar.org/reporting/download/hash/9WOPU3WW). Further communications activities include the posting of a blog on the introduction of cactus pear to Pakistan published on CRP DS website. A factsheet on the use of cactus as forage for livestock was developed in the local language and a further factsheet on silvipasture practices was developed. Evaluation (preliminary results) of the impact of grazing on rangeland productivity including options for women to feed their animals (reported). A field day on cactus feeding was organized for 25 farmers, however 76 farmers attended of which 10 were women. (http://mel.cgiar.org/reporting/download/hash/9U0PVBQQ)

During 2015 effort focused on engaging farmers in the process of varietal selection for wheat, chickpea and lentil. A total of 102 male and 48 female farmers participated in this training and a further 4 male farmers were trained in seed production of wheat and lentil. These capacity building programs improved awareness of the rural communities in the role of selection in improving of wheat and lentil production (http://mel.cgiar.org/xmlui/handle/20.500.11766/3543). With respect to the seed production training, the training focused that not only on the transfer of

knowledge on the development of businesses to potential seed entrepreneurs but also emphasized the importance of producing quality seed from introduced promising cultivar of wheat, chickpea and lentil. The focus of this approach is based on farmers selecting the most promising genetic material that is well adapted to the prevailing ecologies (http://mel.cgiar.org/xmlui/handle/20.500.11766/4441).

Several field based studies were undertaken on addressing livestock feed shortages using a range of proven fodder crops. The focus of this initiative was to disseminate proven approaches to improved fodder feeding systems through a range of demonstration trials within farmer based production systems. Further the development of informal seed delivery systems were demonstrated and piloted. Progress to date can be summarized as through data compilation of green fodder and dry matter yield from six validation plots (Farmer vs improved variety) with oats (http://mel.cgiar.org/reporting/report/id/212); the training of farmers in informal seed production and processing of oats (http://mel.cgiar.org/reporting/report/id/213); the aforementioned resulted in the production of 2 tons of improved variety of oat produced that was distributed to farmers over an estimated area of and distributed in 20 ha (http://mel.cgiar.org/reporting/report/id/213); improved varieties of maize, guar and millet were evaluated in four farmers' fields (http://mel.cgiar.org/reporting/report/id/2727); maize silage production was evaluated as a means of feeding livestock (http://mel.cgiar.org/reporting/report/id/2728); and data collection on fodder yields was completed and compiled (dataset http://mel.cgiar.org/reporting/report/id/2727);

Recipes for making squash, pickles, jams, ketchup and purees (http://mel.cgiar.org/uploads/reporting/7Tp6pyAyyX.pdf) were developed by Barani Agriculture Research Institute (BARI). These were for fruits and vegetables grown locally in Chakwal study area. Partnership with a NGO was established and 20 master trainers from the NGO were provided training (http://mel.cgiar.org/uploads/reporting/5DIIcM8vW0wEDKCm80ZnMdKUqmtFoU.pdf), training material (http://mel.cgiar.org/uploads/reporting/1K88EqWmjhOTXWu45taJDuAe54Xpq0.pdf; https://www.youtube.com/watch?v=E9SRmQOiq9o&feature=youtu.be) and technical backstopping to assist them to further conduct trainings for women of rural communities in Chakwal was undertaken. Hundreds of women from a total of 41 villages (out of 410) were targeted in these training events.

A number of initiatives were undertaken to assess the effectiveness of technology adoption and suitability along with the effectiveness of implemented training. These took the form of questionnaire surveys and participatory informal interviews. For example, post assessment of training and skill development on value addition of fruits and vegetables was undertaken. Evidence of outputs generated through this activity are: a questionnaire/checklist for feedback on participatory varietal selection trails for three introduced technologies (wheat, lentil and chick pea) was prepared and validated (http://mel.cgiar.org/reporting/report/id/224); A questionnaire/checklist for feedback on Farmer Field Day on Cactus was developed (http://mel.cgiar.org/reporting/report/id/224) and two questionnaires on participatory evaluation (one pre-training and one for post training) developed (http://mel.cgiar.org/reporting/report/id/224); A checklist for recording observations as participant in the training prepared; data collected for three activities (1-Cactis Farmer Field Day on Cactus, 2nd on Participatory varietal section of wheat and chickpea and 3rd on Consumer preferences for wheat flour and bread quality for varieties tested under participatory section trail) (http://mel.cgiar.org/reporting/report/id/224); two data sets prepared; Pre-assessment on value addition of fruits and vegetables from 30 participants/respondents (http://mel.cgiar.org/reporting/report/id/224).

II. Progress towards the achievement of research outcomes and IDOs (2 pages)

A policy brief (http://mel.cgiar.org/reporting/download/hash/zb7mhC2a) based on crop modelling using 30 years of weather and long-term field trial data was developed. A manuscript is under development to be publish the results in a scientific journal of repute.

GIS maps of suitable areas for out-scaling of the modelling results to the entire Attock and Chakwal Districts were developed. A Masters thesis was awarded for the research in this activity. A series of scientific articles based on the research results are under preparation or review.

In Pakistan livestock are under-fed throughout the year because of a lack of quality feed and is exacerbated by years with suboptimal rainfall and during certain periods of the year (December-February and May-June). About 40 percent of feed requirements for horses, donkeys and camels, and 60 percent of the goats and sheep are met from rangelands. Agro-forestry and alternative forages have the potential to alleviate the lack of feed in Pakistan through changes in management of these resources. To increase adoption of silvopasture and cactus for forage production the project has introduced cactus as a multi-purpose crop. A field day was held where planting cactus was demonstrated and 5 farmers planted it on their land and a field day where 70 participants attended. The project also developed two factsheets on alternative species in English and a factsheet on cactus in Urdu. The species presented in these factsheets can increase the productivity of rangelands and changed perceptions from cactus being an undesirable plant species to being in demand by farmers. All of these efforts have helped to increase the adaptation of silvopasture and cactus for forage production.

Evaluation, demonstration and dissemination of fodder and feed intervention assists farming communities in accessing quality winter and summer fodder that also covers lean period. These activities increased fodder yield per unit area and also improve livestock productivity (by introduction of improved fodder varieties). Male and female farmer skills were improved in quality seed production and both are able to produced quality fodder during both seasons to feed their animals. Farming communities learn to replace their local varieties with improved varieties by purchasing quality seed from village base seed enterprises. Capacity development of farming community in maize silage technology interventions was also covered in training as a means of address feed insufficiencies during lean periods and feeding trails had a positive effect on milk production of cattle vs. normal feeding. All these intervention in targeted the areas provides and sustains farming community livelihoods (http://mel.cgiar.org/reporting/report/id/1104).

The methodology that has been used to upgrade skills in the processing of primary food commodities that are nutritious and predominantly produced by women in the home was documented and disseminated as handbooks (http://mel.cgiar.org/reporting/download/hash/OB1QZ144), brochure (http://mel.cgiar.org/reporting/download/hash/0WMXEHYY) as well as YouTube videos (http://mel.cgiar.org/reporting/download/hash/KK1DGPTT). A national level NGO was engaged to provide master trainers who later visited 44 villages in Chakwal area to train women of local farming communities on the methods of value addition to locally-produced fruits and vegetables.

The socioeconomic team supported the technical partners in implementation of the planned activities at farmer's field in a more participatory way. Supported in conducting group activities during farmers field days on technology demonstration and participatory varietal section activities. Feedback from the participants and community was shared with the technical teams during the field activities. Assessment reports were shared. The reports contains detailed assessments as well as recommendations for improvement in technology validation and capacity building activities. Based on the socioeconomic team feedback, the technical teams has been able to develop a follow

up support plan to facilitate upscaling of the project activities as well as develop linkages with the target communities and project participants to provide technical backup required for ensuring sustainability. http://mel.cgiar.org/reporting/report/id/224

III. Progress towards Impact (1/2 page)

A policy brief has been developed and further fine tuning of the crop modelling is being carried out to have greater confidence in the research findings. Extension agents need to be engaged to spread the message across the Pothwar region of Pakistan.

Soil conservation structures have been used as demonstration sites in the micro watershed which was used for model calibration. Farmers have been trained on the effectives, placement as well as designing of these structures. There is a need to consider the lag time that is required for uptake of this technology as there are cost implication for the farmer.

While attitudes and perceptions have changed and demand is higher than current supply there is a requirement for time to ensure the availability of improved cactus planting material for distribution to recipients. Cladodes have been planted for reproduction, however it will take time for a larger crop to be available for distribution to farmers. Further, time is also needed to identify the best varieties that are well adapted to prevailing conditions in Pakistan. This demand is reflected in the blog written for the project (http://mel.cgiar.org/reporting/download/hash/XC5ZPDXX)

Fodder and feeding interventions in targeted areas of the Chakwal site, improves farming community skills, increases knowledge, creates awareness, stimulates business growth and strengthens the role of females within these communities. Improved green fodder yield and its availability for animals managed by women has a positive impact on their livelihoods http://mel.cgiar.org/reporting/report/id/2728 http://mel.cgiar.org/reporting/report/id/1104.

The value addition activity that has focused on household processing of products by women has been successful and local NGO has been provided with all the material and technical backstopping to spread the message across the Pothwar region. Time is required for the recipes to be taken up by larger numbers of women from these farming communities.

As a result of the project interventions and deliverables agroforestry practices were adopted and increased. A total of 70 farmers have had their skills improved in a training on agroforestry with emphasis on cactus. Demonstration of cactus as well as dissemination through FFD assisted in generating awareness and developed willingness to adopt the technology. It is noted that farmers were beginning to planted cactus on their own volition at a small scale. The improved fodder trails along with seed production started last year will help to promote improved fodder cultivars to improve feed in the target area. The capacity building on value addition activities was streamlined for dissemination at large scale by engaging community activities from different NGOs and community organization and trained as master trainers. This will help to achieve the desired impact for improving household food security by promotion of value addition at household level as well as a business activity for rural women. http://mel.cgiar.org/reporting/report/id/224

IV. Unexpected Outputs, Outcomes and or Impact

Lentils are not managed effectively within the crop modelling platform that was chosen for the study. Consequently it was replaced by barley, another important and widely grown cereal crop in the area that contributed to the assessment. There is a need to re-evaluate crop models for their ability to effectively model lentils and this is an area that needs to be followed up. The use of APSIM will be explored.

Cactus (*Opuntia ficus-indica*) was viewed as a noxious weed species. It was not anticipated that perceptions could be changed as rapidly within these communities. Once farmers observed the potential of the crop to alleviate feed gaps within the feeding regimes of livestock, demand for the plant has outstripped supply.
Agriculture service providers (ASPs) have shown interest in the adaptation of silage making technologies as a business opportunity in targeted areas where maize silage making technologies have been demonstrated during field day. This will have significant benefits in meeting feed shortages during the lean period.
Local extension staff and seed dealers were engaged in participatory varietal selection of wheat and lentil trials. This assisted in the establishment of linkages with the CRP team as well as communities from the project site and would contribute to the promotion of improved varieties in the target sites. Local NGOs and community organizations are linked with women activities with the project partners in the Chakwal site. This will develop community ownership as well as increase community contribution in implementation of the project activities.

SECTION III – CROSS-CUTTING ISSUES

a. Gender Research Achievements (1 page)

A field day on demonstration of promising technologies targeted 25 farmers had 76 participants of which 10 were women. It demonstrated of feeding cactus *(Opuntia ficus-indica)* to livestock. This should be seen as a positive initial step in promoting the role of women in agriculture and decision making in a society where males dominate the decision making process.

Two male and two female farmers were trained in oat seed production at Sagar and Latifal Village. (http://mel.cgiar.org/reporting/report/id/213)

Twenty women master trainers from a local NGO were provided training on value addition to locally available fruits and vegetables. The training material provided included brochures and recipes in Urdu language, tutorial videos and other lecture notes. These master trainers then trained hundreds of women in 41 villages in Chakwal area (http://mel.cgiar.org/uploads/reporting/5DIlcM8vW0wEDKCm80ZnMdKUqmtFoU.pdf= there are a total of 410 villages in the area and this activity targeted 10% of the total)

Feedback from 30 participating women and youth in the value addition training assisted in sensitizing partners to encourage higher women participation in project activities through providing backup support and developing linkages. http://mel.cgiar.org/reporting/report/id/224

b. Partnerships Building Achievements (1 page)

Partnerships were established with the Center of Excellence in Water Resources Engineering of University of Engineering and Technology, Lahore. The Center provided training on Soil Water Assessment Tool to NARES, assisted in applying the model to the study area, and provided a Master student to conduct degree research on the research topic.

A trip to the USDA capacity building team was made in Washington DC to make them aware of the rangeland work being undertaken in Pakistan. They currently work with the water group at ICARDA in Pakistan. Assistance received from FAO-ICARDA Cactus network was tremendous to assure provision of cactus pads from various countries.

Partnership was established with the Livestock Research Station, National Agricultural Research Centre, Islamabad. The centres silage making experts provided a technical services on maize

silage machine evaluating, silage making and its demonstration to the farming communities during a farmer's field day at Mial village.

Partnership was established with National Rural Support Program (NRSP) – a national NGO to provide training on value addition to 20 master trainers. These trainers then visited 41 villages and trained hundreds of women from farming communities of Chakwal.

c. Capacity Building Achievements (1 page)

A field day was held were 76 farmers attended a training on how to cultivate cactus. This was a significantly large number of farmers than initially anticipated. Two factsheets on alternative forages (http://mel.cgiar.org/reporting/download/hash/D0EV1NN) were developed and a factsheet in Urdu (http://mel.cgiar.org/reporting/download/hash/9U0PVBQQ) on cactus was created (http://mel.cgiar.org/reporting/download/hash/9XJ8GERR). There is willingness by farmers to plant cactus.

Fodder and feed intervention assited in capacity building of more than 48 farmers. Six were engaged in improved oat (Oat-NARC) vs. local oat variety validation plots; 12 were engaged in maize, millet and guar variety evaluation plots and two were engaged in maize silage feeding trials. Four were in oat seed production training and twenty eight livestock owners and service providers participated in maize silage demonstration at Mail village. (http://mel.cgiar.org/reporting/report/id/2728).

A two day training, for rural women on value addition of fruits and vegetables was undertaken at Chakwal, Pakistan (http://mel.cgiar.org/reporting/download/hash/LON5DWWW). Young staff of social sciences participated in the field activities and assessment activities for data collection, project review meeting and increased interaction with multidisciplinary teams of CRP project that further helped in capacity building on the assessment of multidisciplinary on-farm trails. http://mel.cgiar.org/reporting/report/id/224

d. Risk Management (less than 1/2 page)

Please list at least three major risks that hindered the expected delivery of results by the CRP and describe the mitigation actions taken to manage these risks.

The predominant risk as has been highlighted in the uncertainty in funding that the CRP has faced over the reporting period. This is by no means the fault of the Management of the CRP but rather that of the CO and associated governance bodies of the CGIAR. One cannot plan nor commit to long-term engagements with partners. It results in short term piecemeal approaches to research with little coherence. This holds significant reputational risk for the Centre and a credibility dilemma. This needs to be addressed.

e. Lessons Learned (1 page)

Farmer's perception could change through good practice demonstrated at the farm level. There is scope to improve rangelands not through rehabilitation measures but by alleviating the pressure on these fragile and degraded ecosystems. In this respect the introduction of alternative feeding systems (i.e. cactus) has the potential to alleviate pressure on the resource base. However, it should be note that there could be a perverse outcome of such interventions that could result in increased livestock due to a perception that there is more feed available.

Farmers' perception could change through technology demonstrations, evaluation and feeding trails at farmer fields. These intervention also significantly effect on the fodder yield and milk production of targeted areas animals. So, by promoting these interventions we can change livelihoods of dryland farming community on larger scare.

f. CRP Financial Report

SECTION IV - RESEARCH OUTCOME STORIES

SECTION V – LIST OF 2015 PUBLICATIONS AND SCIENTIFIC OUTPUTS

Table 1. Summary of all ISI publications

Table 1. Summary of all ISI publications

Region/ALS	ISI Factor [range of ISI scores]	ISI Open (% of ISI articles)	ISI Monodisciplinary (% of ISI articles)	ISI Multidisciplinary (% of ISI articles)
WAS/				
NAWA/				
ESA/				
CA/				
SA/				
TOTAL				

Table 2. Summary of Non-ISI Publications

Region/ALS	Non-ISI Articles	Book Chapters	Technical Reports & Working Papers	Proceedings	Datasets	Other
WAS/						
NAWA/						
ESA/						
CA/						
SA/	2	1	5		5	12

TOTAL

ISI Journal Articles (total count 0)

Nil

Non-ISI Journal Articles and Theses (total count 2)

5. Hussain, F., G. Nabi, M.W. Boota. 2015. Rainfall trend analysis by using the Mann-Kendall test and Sen's slope estimates: A case study of District Chakwal rain gauge, Barani area, Northern Punjab Province, Pakistan. Sci. Int.: 27(4), 3159-3165, ISSN 1013-5316.
6. Hussain, F. 2015. Impact of rainfall and landuse pattern on water and sediment yield of Soan basin, M.S. thesis, Center of Excellence in Water Resources Engineering, University of Engineering & Technology, Lahore, Pakistan.

Books (total count)

Nil

Book Chapters (total count 01)

7. Kathryn Clifton and Mounir Louhaichi. 2015. Land Tenure, climate change and livestock mobility in Central and Southern Asian Grasslands In. Book chapter. IGC India: 347-362

Technical Reports and Working Papers (total count 05)

1. Capacity building of women of farming community for value-addition to locally-produced fruits and vegetables. Final technical report http://mel.cgiar.org/uploads/reporting/5DIlcM8vW0wEDKCm80ZnMdKUqmtFoU.pdf
2. Decision making and planning in agriculture by calibrating, validating and scenario simulating the crop model (DSSAT). http://mel.cgiar.org/uploads/reporting/yRdZ1iUxUFSEiaXlMxv4sYlMVcPXhs.docx
3. Technical report on "**An Assessment of Farmer Field Day on Cactus Promotion at Chakwal Site of CRP-DS in Pakistan**", 11pp. Reference: CRP-DS- South Asia (Chakwal-Pakistan).http://mel.cgiar.org/uploads/reporting/aWFCYfV5vR.doc

4. Technical report on "**Assessment of Participatory Varietal Selection of Wheat Activity under CRP1.1 Dryland System**", 15pp. Reference: CRP-DS- South Asia (Chakwal-Pakistan).http://mel.cgiar.org/uploads/reporting/4hqWT3FvD3.docx

5. Technical report on "**Socio economic assessment and feedback on Training of Rural Master Trainers on Value Addition of Fruits and Vegetables – Gender Mainstreaming in CRP-DS Chakwal-Pakistan", 21pp.**Reference: CRP-DS- South Asia (Chakwal-Pakistan). http://mel.cgiar.org/uploads/reporting/3En1eZ73qF7YuEXvLpKS6V4MOE2rMz.docx

Proceedings(total count 0)

Nil

Factsheets (total count 04)

1. Qamar, I. A., Islam, M., Clifton K., and Louhaichi, M. 2015. Managing rangelands: promoting sustainable tree species "*Leucaena leucocephala*: A versatile tree producing nutritious fodder for ruminants". ICARDA's publication http://www.icarda.org/sites/default/files/LeucaenaFactSheet.pdf

2. Qamar, I. A., Islam, M., Clifton K., and Louhaichi, M. 2015. Managing rangelands: promoting sustainable tree species "*Acacia modesta*: A frost resistant and drought-tolerant tree ideal for alleviating feed shortages and feeding costs". ICARDA's publication. http://www.icarda.org/sites/default/files/Acacia_modesta_FactSheet.pdf

3. Qamar, I. A., Islam, M. Razzaq, Abdul and Louhaichi, M. 2015. Cactus pear (*Opuntia ficus-indica*) utilisation and management. Brochure. Local Language (Urdu).

4. Zahid, S. M., Zulfiqar, A and Majid, A. 2015. Maize (*Zea mays*) silage technology. Brochure. Local Language (Urdu). http://mel.cgiar.org/uploads/reporting/LTZXYcBWDxp0BS0SdGtKkVqIg4WUS5.jpg

Data sets (total count 05)

1. Dataset on sediment erosion used for SWAT modelling of micro watershed in Chakwal area. http://mel.cgiar.org/uploads/reporting/iZDrxQek8n.doc
2. Dataset on calibrated DSSAT models for wheat and barley for Chakwal site (Pakistan). http://mel.cgiar.org/uploads/reporting/stj0YReumqQ06eko9TqYYuICyDOElo.zip
3. Dataset on "Pre-training value addition assessment". http://mel.cgiar.org/uploads/reporting/Wy0HVRXzAbgG9nSEiMgzieo1O4K67a.xlsx
4. Dataset on " Post training value addition assessment". http://mel.cgiar.org/uploads/reporting/Wh4I6PDdXOPDey638Vr4pfkMfmHMoD.xlsx
5. Dataset of improved maize, millet and guar variety vs. local varieties for green fodder and dry matter yield (t ha^{-1}) of both farmers fields at Latifal village at Chakwal site. http://mel.cgiar.org/uploads/reporting/sMXj4BV8BZRCZxs8JmXvM036BCYKaK.docx

Other publications (total count 03)

11. Clifton, K., Louhaichi, M. and Islam, M. 2015. A Prickly cactus journey: From hellish plant to farmers' darling (blog).http://drylandsystems.cgiar.org/news-opinions/prickly-cactus-journey-hellish-plant-farmer's-darling

12. Manual on value addition to locally available fruits and vegetables for master trainers. http://mel.cgiar.org/uploads/reporting/7Tp6pyAyyX.pdf
13. Video on value addition tutorial. https://www.youtube.com/watch?v=E9SRmQOiq9o&feature=youtu.be

CGIAR

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Dryland Systems

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

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