



RESEARCH
PROGRAM ON
Dryland Systems

CGIAR Research Program on Dryland Systems North Africa and West Asia Flagship 2014 Performance Monitoring 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.

For more information please visit:

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I. CRP PERFORMANCE MONITORING REPORT FOR CALENDAR YEAR 2014

1.1. PREAMBLE

The CRP-DS in the North Africa and West Asia region (NA&WA) is implemented in three Agricultural Livelihood Systems (ALSs), namely the agro-pastoral system (Jordan and Tunisia sites), intensive rainfed system (Morocco site), and irrigated crop system (Nile Delta, Egypt). The program is implemented over an area of about 145,500 km² with a total population of 50.6 million and a rural population of about 29 million.

The Arid agro-pastoral system is represented by the Béni Khedache-Sidi Bouzid transect in Tunisia and the Tafila-Salamyah transect in Jordan-Syria. These arid agro-pastoral systems are facing serious threats of natural resource degradation and water scarcity. This agricultural livelihood system is based on small ruminants, barley and olive crops, and scattered small-scale irrigated areas where horticultural crops (e.g. vegetables, fruit trees, cereals and forage) are dominant. The remnant pastoral system is rapidly evolving to agro-pastoral with significantly less nomadism.

Degradation of rangelands due to uprooting of vegetation for domestic use, overgrazing and encroachment on rangelands with barley and olive crops is common. Sheep and goat production is the dominant husbandry activity. The area suffers from low investments and limited diversification, as well as difficult access to markets and credit. Opportunities are presented by diversification into fruit trees (e.g. olive, figs, almonds), aromatic and medicinal plants (with great market potential), enhancing biodiversity, which can be integrated with well-preserved local know-how (water harvesting, etc.), and the help of very active local organizations: NGOs, etc.

In the intensive rainfed production system the wheat-based cropping system is prevalent. Here, land fragmentation poses a serious threat to the livelihood system and the options and potential of re-aggregation through directed social and economic organization of farming communities is a major research topic being pioneered at the Meknes-Sais site (Morocco). A further focus of the program is a sustainable intensification of the main production systems (wheat-based system) by diversifying into fruit tree-based systems and vegetable-based systems, thus improving the profitability from decreasing farming units. A major challenge for research is the design and testing of agricultural livelihood systems that can cope with drought, water scarcity, and global change (food and climate). It is imperative to design these systems in a resilient and sustainable fashion since they require sizeable investments and serve demanding markets.

A key challenge for rainfed cropping areas is to increase their incomes and improve their livelihoods in a region characterized by historically low state investment in agriculture, increasing drought and water scarcity, and limited access to markets. Morocco provides a unique environment for experimenting and testing system innovations within the NAWA region to address this challenge, given the state initiative to modernize the agricultural sector, in concert with a program for poverty reduction.

The irrigated production system in NAWA is represented by the Nile Delta site that covers an area of about 39,300 km². The climate is arid, especially in the southern part. However, the Nile provides good opportunities for sustainable intensification of the agricultural livelihood systems as the entire area is irrigated. The total annual withdrawal of water is estimated to be 81.2 BCM, around 82.5% of which is used for agriculture. The poverty amongst the rural population is 17%. Malnutrition among young children is a serious problem that should be taken into account. The unemployment rate ranges from six to 20%, and is

highest among females. The average farm holding size is less than one hectare where rice, cotton and wheat-based rotations are common.

The main animal species raised within the irrigated agricultural livelihood system are buffalo, cattle, sheep, goat, and camels. Among the problems faced by the irrigated system is the lack of market access for small holders and land fragmentation (80% of the landholdings are smaller than five feddans). Policies related mainly to pricing, subsidies for inputs and production, and access to land and water resources are also hampering the advances in agriculture in the Nile Delta action site. The CRP DS addresses most of the above problems and the challenge now is to achieve sustainable water and land use management, to integrate crop and livestock, to promote the role of women, to increase income, and in general, to secure farmers' livelihoods. The approach for this system is the integration of market-oriented vegetables and fruit tree cropping, together with intensive and high yielding wheat and forage. Cattle for dairy production is also pursued. As in other regions of the irrigated production systems in the dry areas, the Nile Delta is threatened by salinization and research is on-going to save affected areas through alternative production systems.

1.2. TEMPLATE FOR REPORTING

A. Key Messages (1 ½ page)

1. Twenty three products have been produced by the CRP-DS of the NAWA region, addressing, but not limited to, natural resource management in rangelands, drought and climate change, salinity, land and water policies, and system vulnerability. Twenty three percent of these products have been explicitly targeted to women farmers.
2. Large numbers of communication tools (24 blogs, 15 leaflets/factsheets, 10 manuals, 27 technical reports, eight examples of media coverage) have been produced to support the dissemination of the research findings; around 20 % of these tools have explicitly targeted women farmers.
3. The development of open access data bases is at an early stage, with ten 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.
4. The scientific production has been quite prolific with 35 papers in ISI journals, 20 papers in non ISI peer-reviewed journals, and 23 papers in peer-reviewed proceedings.
5. Eleven value chains are being investigated, focusing on irrigation water management, olive production, sheep and figs in agro-pastoral ALS, tomatoes and potatoes in intensive rainfed ALS, and buffalo milk and citrus in irrigated crop ALS.
6. Significant time has been invested in human capacity building:
 - Short-term training of trainers: 384, 19 % women
 - Short term training of farmers: 5447, 16 % women
 - MSc degree training: 34, 41 % women
 - PhD degree training: 43, 51 % women
 - In addition, two regional training workshops have been conducted: (i) a training workshop on system analysis and modeling, and (ii) a training workshop on grazing lands.
7. Eight multi-stakeholder R4D innovation platforms (IPs) have been established: three in the intensive rainfed system, four in the agro-pastoral system, and one in irrigated crop systems. These

IPs are gathering all partners, from farmers to decision makers, and are built around targeted commodities (see value chain section). They are key in identifying system constraints and research priorities.

8. The CRP-DS in the NAWA region has 44 technologies currently under study: eight mechanical/physical technologies, seven biological, two chemical, 12 management and cultural, and 15 livestock management. Approximately 25 to 100 % of these technologies have an explicit target of reaching women farmers. Most of these technologies are being field-tested and 30 % of the technologies are targeted at decreasing inequality between men and women. Eleven technologies are released by public and private sector partners (outscaling phase III). They are: a milk fat separator, zero till seeders, small scale olive harvesters, improved rams, soil and water conservation technologies, small ruminant feeding practices, small ruminant health control, community-based seed production, conservation agriculture practices, supplemental and deficit irrigation, and cactus production and transformation.
9. Germination and emergence of crops is one of the main constraints of crop production in the NAWA region due to the low-quality seeds used by farmers. In the action site of Meknes, Morocco, the 59 farmers involved in CRP DS produced a total of 38 MT of quality seed from the 4.4 MT of seed distributed to them at the beginning of the cropping season. The seed quantity produced is enough for about 450 ha of land in the 2014/15 cropping season. Moreover, the experience gained by the farmers from the formal and on-the-job training and technical backstopping on quality seed production, post-harvest seed operations, and seed enterprise management, provided them with the necessary skills and confidence to manage the business during the 2014/15 cropping season.
10. Ten policy studies are under way (exploration phase I) related to the impact of water harvesting technologies, an assessment of cereal farm aggregation, the viability of solar energy options, the seed and wheat sector, ground water tariffing policy, and land policy.
11. Around 1000 farmers are involved in testing the various technologies/tools in the NAWA region over an area of about 22,000 ha.
12. Convinced by the importance of partnership building, the CRP-DS NAWA team lobbied to strengthen collaboration with NARS, NGOs, development agencies, the private sector and decision makers in target countries. It is worth mentioning that the program is relying on 12 bilateral projects in the region, including three funded by IFAD: one in Jordan (<http://drylandsystems.cgiar.org/content/scaling-dryland-systems%E2%80%99innovations>), the second in Tunisia (<http://operations.ifad.org/web/ifad/operations/country/project/tags/tunisia/1704/>), and the third in Morocco. The new *IFAD-funded Agro-pastoral and Associated Value Chain Development Project in the Governorate of Medenine* is located within the CRP-DS site of Beni Khedache-Sidi Bouzid. (http://operations.ifad.org/web/ifad/operations/country/project/tags/tunisia/1704/project_overview).
13. Building partnerships with ARIs is important to help the program achieve its goals. The most salient features in building our partnerships with advanced institutions are:
 - The joint training workshop on systems analysis and modeling with SupAgro, IAM Montpellier, University of Wageningen, and the University of Madrid
 - The joint training workshop on grazing lands with CIHEAM/IAM Zaragoza
 - The development of a research initiative on system analysis and modeling in the Moroccan and Tunisian sites to be funded by Agropolis, Montpellier (the SIAMG Project).

Finally, here some key messages from the report of the “Review Panel of the Centre Commissioned External Review (CCER) on Livestock Systems Research at ICARDA,” which took place between the 3rd and 30th of November, 2014. Some of the messages are general to the livestock activity within ICARDA; others are more specific to the work under CRP DS in Tunisia.

- **Comment 1.** Overall, the panel was impressed with ICARDA’s accomplishments in livestock research, its impressive and productive partnerships with NARS, and ability to cope with the disruption and difficulties of the past few years.
- **Comment 2.** ICARDA should be congratulated on its strong production systems focus in dry areas and the effective participatory research partnerships it has developed with NARS.
- **Comment 3.** Field visits made by panel members to both Tunisia and Ethiopia observed well-integrated relevant research in close partnership with NARS, development agencies and community development groups of farmers. In CRP 1.1 Dryland Systems in Tunisia, visits to Zoghmar and Tataouine demonstrated well-integrated disciplinary approaches involving rangelands and feeds (e.g. cactus) at Zoghmar, and rangelands and purchased feeds at Tataouine.
- **Comment 4.** Where NARS are strong and committed, for example, in Tunisia, ICARDA is clearly working in vibrant productive partnerships with research institutes, development agencies, and farmers at action sites in CRP 1.1, for example in the lamb fattening value chain in Zoghmar.

B. Impact Pathway and Intermediate Development Outcomes (IDOs) (1/4 page)

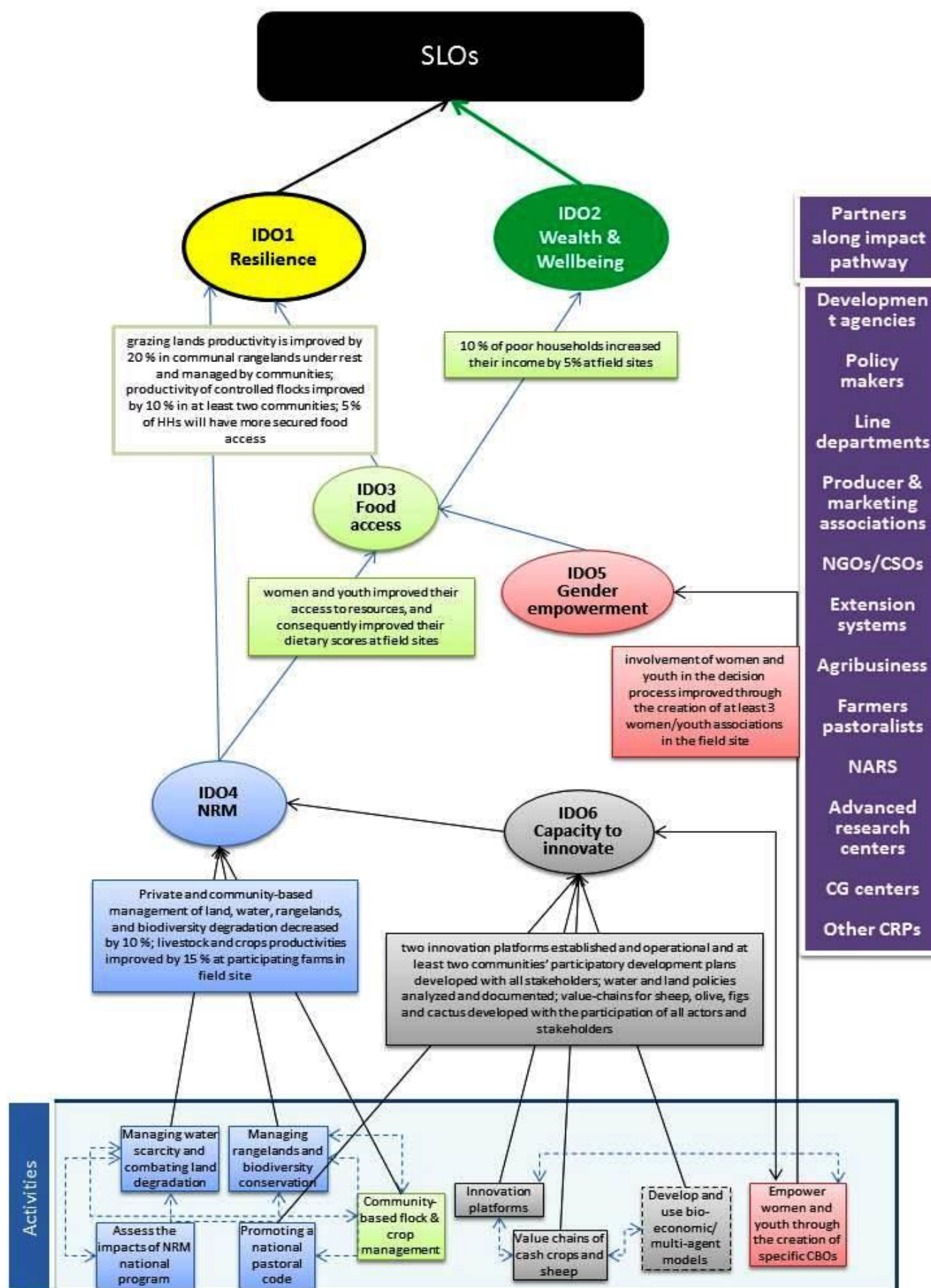


Figure1: Impact pathway CRP-DS Beni Khédache-Sidi Bouzid site, Tunisia (agro-pastoral)

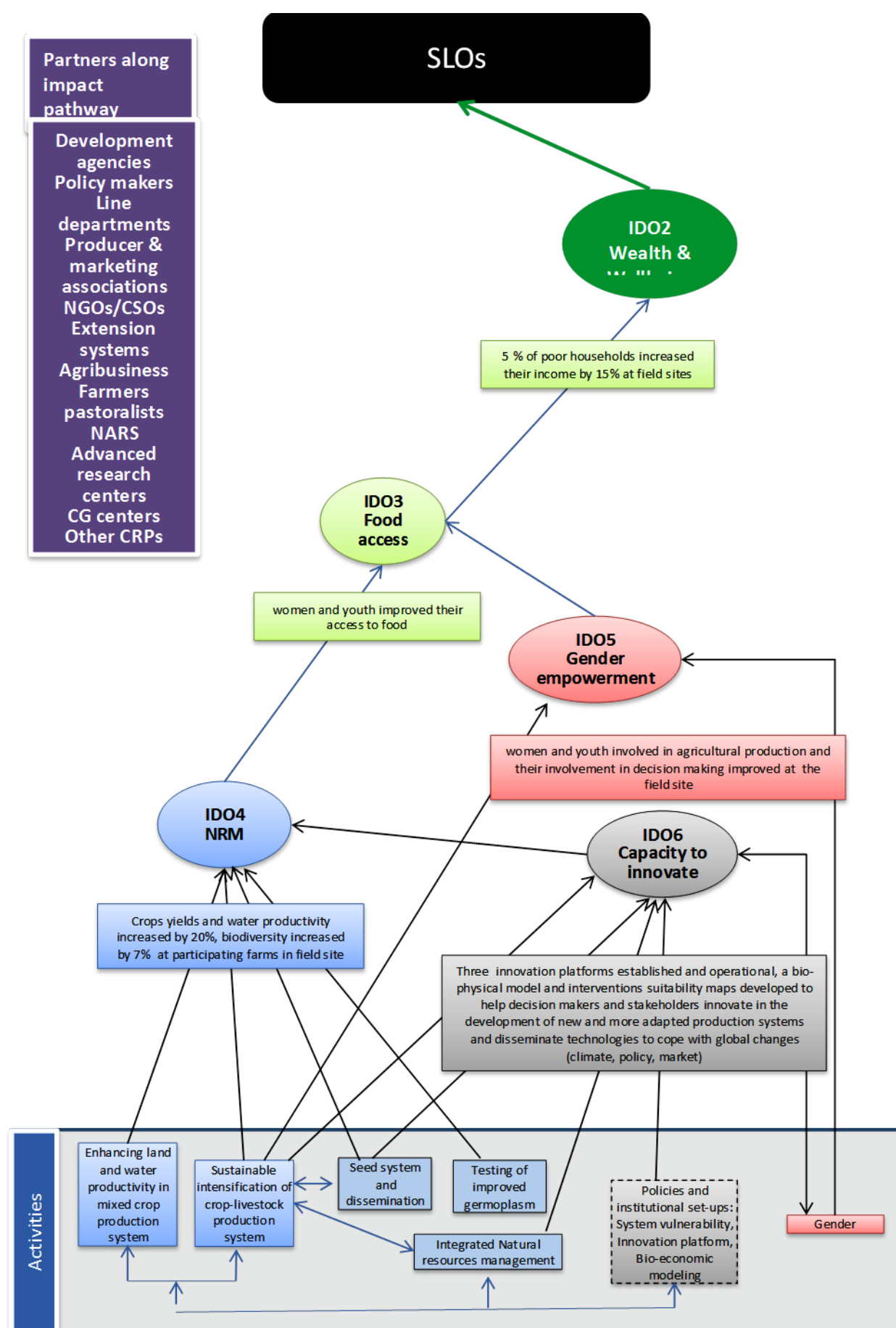


Figure2: Impact pathway CRP-DS Meknes-Sais site, Morocco (intensive rainfed)

Impact Pathway Description (Nile Delta Action Site)

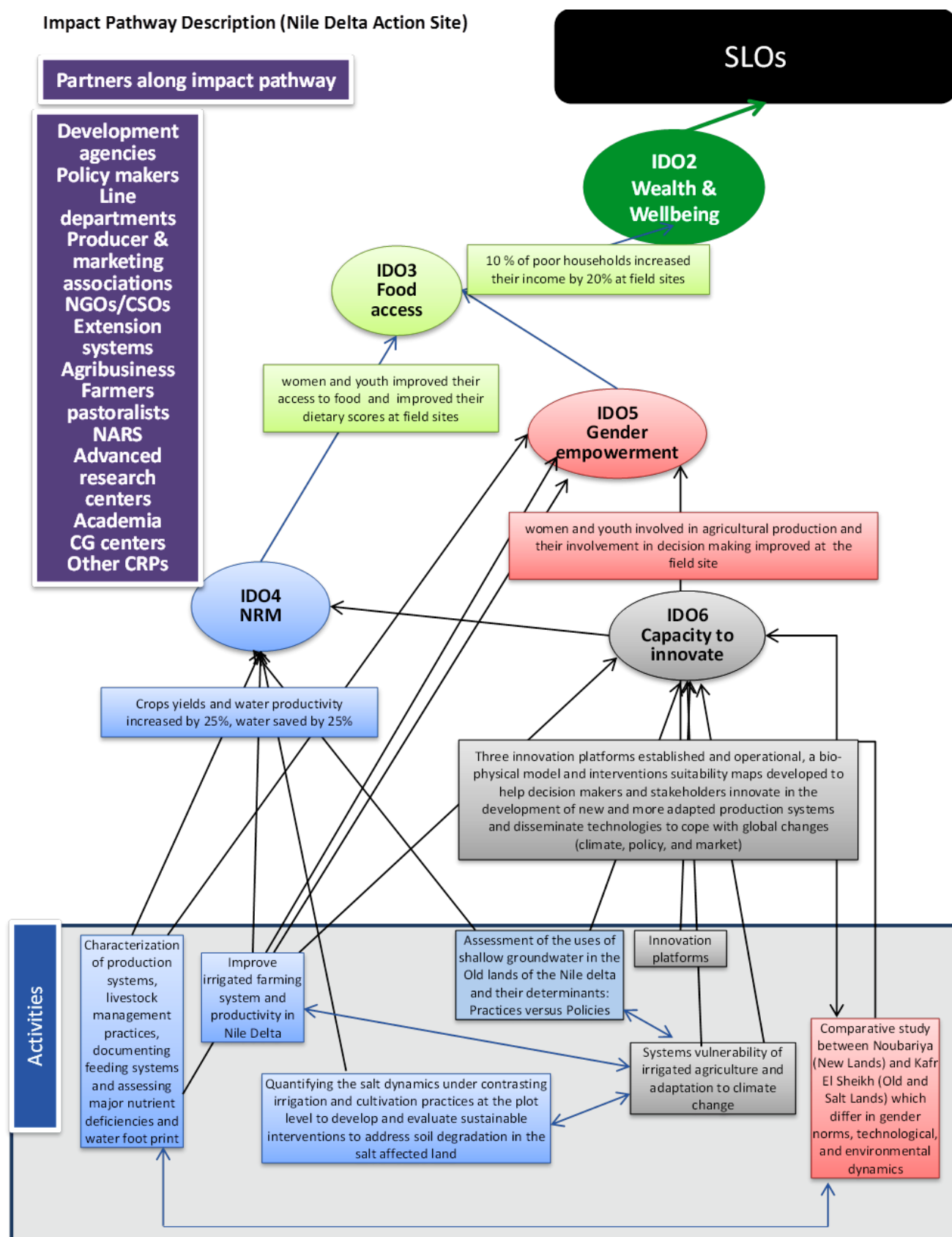


Figure 3: Impact pathway CRP-DS Nile Delta, Egypt (Irrigated)

C. Progress along the Impact Pathway

C.1 Narrative of major achievements, by Theme (1 ½ pages)

1. System analysis and modeling

- **Promoting regional integration and center partnership around system analysis and modeling.**
An international training course on integrated system assessment and modeling approaches to sustainable intensification and resilience of agricultural systems was organized by ICARDA CRP - Dryland Systems, in Hammamet (Tunisia), 24-28 November, 2014. The course benefited from insightful input lectures given by renowned scientists from Montpellier-SupAgro, CIHEAM-IAMM, Wageningen University, Technical University of Madrid, and ICARDA. Course participants included researchers from CRP-DS, its R&D partners, and other systems-focused CRPs such as Humid Tropics. More than half of the participants were young woman researchers. The course structure was orientated towards achieving intermediate development outcomes of the CRP such as resilient livelihoods in marginal areas, sustainably improved income, more social equity in access to foods, and the management of natural resources in dry areas. Participants appreciated and developed a basic understanding of how an integrated research framework and its components can contribute towards systems analysis, including identification of suitable approaches, the design and development of methods, and an assessment of innovations within the CRP-DS program. Certainly, developing an in-depth understanding of specific model components was beyond the scope of this course. Participants suggest to CRP-DS PMU to (i) consider this group as the embryo for a thematic research team on system analysis and modeling; this group may be reinforced by the appointment of additional scientists from CG centers involved and selected NARS, and (ii) plan for in-depth workshops by flagship that may be implemented by the same team of experts aiming to draft the skeleton of specific models.
- **Launching a system modeling approach** for developing a better understanding of semiarid production systems where mechanisms and processes behind natural resources, different economic enterprises, and the behavior of different agents and their interactions is well documented. This approach would allow the assessment of distinct change scenarios, including a shift in technologies such as from conventional tillage systems to conservation agriculture. The approach guarantees improved linkages between biophysical indicators and economic and climate variability, within the context of dry lands. Scenario simulations will be possible once all system components are mature.

2. Intensification and diversification for system productivity

- **Conservation agriculture (CA).** CRP-DS, together with mapped bilateral projects, such as the ACIAR-CANA Project, the IFAD-CLCA project and others, are very active in the NAWA region. In Morocco, Algeria, Tunisia and Jordan, more than 3000 ha under CA with different options (grain-legume rotation, alley cropping, different levels of residue uptake, weed control, etc.), are under trial, involving around 400 farmers. The major constraint to CA adoption is the zero-till seeder. ICARDA, in collaboration with its NARS partners, developed locally-manufactured, low-cost seeders (Iraq, Syria, Jordan, Tunisia, Morocco). These seeders are in process of being manufactured by local enterprises. The benefits of this technology have been demonstrated and disseminated. For example, grain-legume rotation systems introduced and widely adopted in different locations of West Asia (Iraq, Syria, Jordan) showed an increase in wheat yield by 31% with 22% less inputs, increasing resilience, boosting income by 25%, and lifting 57% of adopters out of poverty. In Tunisia, CA improves grain yields and above ground biomass of barley and wheat by 10%, compared to conventional systems (CV) under semiarid conditions. Also, WUE increased by 15% for both crops under CA. In Morocco, zero-tillage increased wheat yields by 25-40%, compared to the conventional tillage of farmers. Surface Soil Organic Matter was also enhanced, leading to better storage of water in the soil and improving soil resistance to water erosion (+ 20 %). Vetch was introduced as a forage crop to deal with drought. Yields of barley

improved by 25 % under alley cropping (cactus as alleys), compared to barley cultivated in open fields under CA system (CRP, WLI, CLCA reports).

- The success of disseminating the mechanized raised-bed farming (RB) system in Nile Delta was one of the most successful achievements of CRP-DS in this ALS, generating significant additional farmer income; the introduced raised-bed machine developed by ICARDA played a very significant role to promote the adoption of the RB farming system. Thanks to the raised-bed machine, farmers saved 50% on their seed rate, reduced 25% of their costs, achieved 25% water savings, and increased yields by 25%.

<http://ifad-un.blogspot.com/2013/03/old-meets-new.html>

<http://www.procasur.org/biblioteca/index.php/features/learning-routes/learning-routes-1/2013-1/sustainable-water-management-in-egypt/120-sharkia-systematisation-document-eng/file>

<http://www.icarda.org/new-technologies-food-security-arab-countries>

<http://www.scidev.net/global/biotechnology/news/egypt-wheat-experiment-produces-dramatic-yield-boost.html>

- **Seeds systems and dissemination in Morocco.** Primary and secondary data on seed demand and supply in Morocco covering the Meknes site have been collected, entered, and a draft report prepared. Further refinement, discussion and communication to policy makers are planned in 2015. Three communities have been supported to initiate village-based seed production and marketing. A total of 38MT of quality seed of faba bean, chickpea and lentil varieties have been produced and marketed for further seed multiplication and crop production. The 38 MT is enough to cover a total crop production area of 500 ha. It is very challenging to directly involve women without access to land or capital in seed businesses. Nevertheless, there is a plan to involve them in the necessary diversification processes of the VBSE operationalization through the production and marketing of value added products such as preparation and the commercialization of clean packs of grain for domestic uses.
- Salinity and orobanche-tolerant faba bean cultivars were identified and disseminated as part of improved agronomic packages in 2014. The improved production package included the following: Orobanche tolerant cultivars (Giza 843 and Misr 3) to replace the Orobanche susceptible Giza 3; Planting under zero tillage system; Delaying sowing date to mid-November; Applying a seed rate of 80-90 kg/ha; and Spraying with Glyphosate at a reduced rate of 34 g/ha + NPK - two times at flowering, and three weeks thereafter. The results showed that the Faba bean seed yield in demonstration fields was higher than that generated on farmer fields. Cultivars Giza-843, Misr-3 and Giza-3 achieved seed yields that were higher than farmer fields by 39, 59 and 67%, respectively.
- Livestock management initiatives included: Community-based selection of improved rams, the documentation of ethnopractices assessing natural vegetation resources and animal health status, identification of sheep flock management practices to meet lamb market demand, determination of nutrient deficiencies in small ruminant flocks, seasonal characterization of small ruminant feeding systems, and determination of water footprints and the water productivity of animal products in the action site.

3. *Enhancing community and landscape resilience*

- **Impact of climate change on olive production in Medenine, Tunisia, may threaten the enormous investments that are made in this production system.** A model based on hydraulic balance and taking into account parameters such as slope, soil type, and climate conditions has been developed. It should help identify the most suitable areas in the landscape for olive production.
- Three CC scenarios have been investigated for the period 2020-2050. The extension 'ModelBuilder' of ARCGIS allowed an automatic combination of inputs. Maps demonstrating the vulnerability of olive to Climate Change were possible when the water balance software "BUDGET" is coupled to the system. Simulations show a clear decrease in areas suitable to olive tree cropping in the Medenine Governorate. (Ouassar M., A. Zerrim 2014. Analyse de la vulnérabilité de l'olivieraie au changement climatique (CC) dans le gouvernorat de Médenine moyennant un outil SIG. Revue des Régions Arides - Numéro Spécial, 33: 33-37).

- **The "Climate Change and Drought Atlas for Jordan,"** with its set of 339 maps, offers a comprehensive characterization of past and expected climatic change in Jordan. The Atlas will improve awareness of climate change for policy makers and communities, and of the promising agricultural technologies that are relevant for adapting to climate change and increasing resilience.
- **Participatory assessment of land and water policies in Beni Khedache, Tunisia.** Land privatization and agricultural subsidies have had negative effects such as land fragmentation and increasing pressure on water and land resources. Most of the traditional agrarian system has disappeared and been replaced by a system characterized by competition for natural resources, in particular land and water. Several policies have influenced NRM in Tunisia. While natural capital has decreased, social capital has increased more rapidly than human, physical and financial capital. Stakeholder expectations regarding future scenarios involving the full implementation of a water and soil conservation (WSC) strategy were extremely positive - with higher scores for overall indicators. WSC technologies, protected land, biodiversity, capacity to adapt, and knowledge and skill indicators received higher scores (Ouassar Mohamed, Bechir Riadh, Abdeladhim Mohamed Arbi, Telleria Roberto. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014).
- **Assessing the vulnerability of agro-pastoral systems in Tunisian arid zones (food security, coping strategies and adaptation to drought).** The farming system is family-based, oriented toward self-consumption and to feed livestock. Households save by setting aside a portion of their produce which they can use during dry years. In fact, the food strategy varies from one year to another, depending on the amount of rainfall. Olive oil production for private consumption and marketing is the first agricultural enterprise able to meet the food needs of households, with the second rank taken by cereal production. Livestock products are generally intended for sale and are regarded as the main activity of generating household incomes. Analysis shows the following: that the production of olive is sufficient to cover the need of the household (HH); in rainy years, the average production of cereal crops is sufficient, but insufficient during drought years; and in dry years rangelands do not cover animal needs and herders are forced to purchase feeds. Off-farm activities appear as an essential factor to compensate the decrease of agricultural income (Mondher Fetoui, Riadh Béchir, Mohamed Abdel Adhim & Mongi Sghaier, 2014). National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014).

4. Improving water management and equitable allocation

- **The prospects for Water and land productivities in the rainfed agro-systems in Morocco.** Intensification strategies tested include: Irrigation scheduling and fertilizer management with ten on-farm demonstration trials in Meknes site; Four trials on deficit supplemental irrigation applied to olive trees (2), potatoes (1) and Onion (1) implemented in Meknes site; Three on farm trials of 2 ha each implemented on fertilizer management of wheat/food legumes. In addition, supplemental irrigation packages were applied to wheat in the outscaling site of Tadla: seven farmers used the package of supplemental irrigation and two field days were organized for 50 farmers to enhance their awareness of the importance and use of deficit supplemental irrigation and improved crop management to increase wheat yield and save irrigation water. Data on climate, soil, water, and plant parameters have been collected from trials to calibrate/validate an Aquacrop model to be used in irrigation scheduling.
- Comprehensive Assessment of Marginal-quality waters in Agriculture (CAMWA) for improved water and land productivities was conducted to evaluate the benefits, costs, and impacts of the treated wastewater production and use. The results will enable better investment and management decisions in treated wastewater utilization in agriculture, or other water sectors in the near future. The assessment was conducted by a wide-reaching partnership of researchers and policy makers.
- In a sample of 120 farmers, the adoption rate of supplemental irrigation packages for wheat in Tadla was 72%, and that of deficit supplemental irrigation was 20%. This package offered an increase of wheat yields by 20% and a saving of 30% irrigation water, compared to the farmers'

technique. For all tested crops, deficit irrigation allowed a saving of an average of 25 to 30% irrigation water, without significant yields reductions.

- The adoption of raised-bed technology is increasing in the Sharkia Governorate (Egypt) with approx. 4000 acres currently using this technology. The Government of Egypt is currently seeking to promote this technology country-wide to save the amount of water used in agriculture, and increase crop yields. In this regard, several initiatives have already started to scale-out the raised-bed technology, one of these initiatives being a wheat national program which adopted this technology and promoted it in many areas throughout Egypt. The wheat cultivated area in Egypt is estimated at three million acres. If appropriate policies are in place to scale out this technology, the economic, social and environmental impacts are going to be huge.
http://www.icarda.org/AR_HTML_assets/PDFs/chapters/SS_INCREASING.pdf
http://www.karianet.org/files/0000/165/1%20Call%20for%20Applications_WM_Egypt.pdf
<http://www.icarda.cgiar.org/water-benchmarks-project>

5. *Reversing/preventing land degradation*

- **Modeling tool to evaluate and assess desertification risk in the pastoral and agro-pastoral regions of Tunisia.** A spatial and integrated approach/method is being developed in order to better assess and target actions against desertification risks in the Tunisian arid zones. This tool consists of overlaying two spatial information maps in ArcGIS. The first map results from the environmental modelling of the region with LEIS (Local Environment Information System). The second layer arises from mapping the interventions already implemented against desertification risks in the study area. The approach was applied with the cooperation of local actors and showed its simplicity and its acceptance. The tool aims to facilitate the introduction of measures that are likely to be effective and to better target interventions to combat desertification (M. Fétoui and al., 2014. *Revue des Régions Arides - Numéro Spécial- n° 33 (1/2014)*).
- **Impact analysis of water harvesting techniques (WHT) on rural livelihoods under different climatic and socio-economic scenarios, assessing the profitability of investing in WHT in Oum Zessar, Tunisia** (WLI Tunisia). An Integrated Impact assessment (IIA) framework, based on extended cost-benefit analysis (ECBA) and Sustainable Livelihoods Approach (SLA) shows that in Beni Khedech social capital is the most common asset followed by physical capital. Financial capital seems to not be available due to the low crop and livestock incomes. Projections indicate that the livelihood assets will be changing over the 2013-2030 period with a slow increase in physical, human and social capital. Natural capital will decrease due to agricultural intensification and poor land management. The ECBA shows that WHT is profitable with an IRR of 24 % and an NPV (at 12 % discount rate) of 1380 US \$. The inclusion in the analysis of the off-site benefits improves the economic profitability to 1680 US\$. The WHT is apparently beneficial at private and social levels for local populations within the watershed (Abdeladhim M., Sghaier M., Ouessar M. and Ben Zaid M. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014).
- Desertification monitoring is a challenging problem. An assessment and monitoring tool for rangeland health trends in NAWA region was developed using near earth remote sensing (VegMeasure) (<http://www.vegmeasure.org>)- a smart phone app for vegetation canopy cover estimation which could be used as a main input for an early warning system (discovery phase) <http://research.engr.oregonstate.edu/ecomonitoring/node/1/>
- With soil and water conservation high on the DS agenda, work continued on the introduction and adoption of an innovative technique of soil and water conservation (Valerani). An Intermittent single-furrow plowing implement (adopted by national development institutions) is being tested in Jordan; Hill Lakes are being developed in Tunisia and Jordan; In addition to semi-circular bunds (Jordan and Tunisia); check dams for aquifer recharge and plantations (Jordan, Tunisia), and terracing (Jordan, Tunisia).

6. Gender and youth

- The creation of a local beneficiary women's committee (LBWC) for grey water use has the following mandates: To start local women networking; To train other women (women-to-women learning approach); To help the project achieve the on-site training of the households in best practices for grey water use; To work as a component of the project team under project coordination; To introduce grey-water concepts within and outside the community. In terms of achievements, the LBWC has undertaken 28 training sessions with the wives of beneficiary households.
- A publication on the role of women in adapting to climate change in the new lands of Egypt identifies recommendations towards achieving IDO 1 and 5. (Najjar, D. (forthcoming). Women's Contributions to Climate Change Adaptation in Egypt's Mubarak Resettlement Scheme through Cactus Cultivation and Adjusted Irrigation. In BUECHLER, S. and HANSON, AM. (Eds). A POLITICAL ECOLOGY OF WOMEN, WATER AND GLOBAL ENVIRONMENTAL CHANGE. Routledge.
<http://www.amazon.com/Political-Ecology-Environmental-Routledge-International/dp/0415749352>)
- In Morocco, a survey of 200 women labourers conducted in villages is oriented to understand the available work opportunities for women and men, and the role of women in decision making in agriculture.

7. Knowledge synthesis and communication

- Huge efforts have been invested in knowledge synthesis and communication with the production of: 34 papers in ISI journals, 20 papers in non ISI peer review journals, and 24 papers in peer review proceedings. In addition, there have been 24 blogs, 15 leaflets, six manuals, 25 technical reports, and eight media covering all thematic areas of CRP-DS. Around 30-40% of these tools target women farmers.

8. Institutions, policy and governance

- Five innovation platforms have now been set up across NAWA, with clear entry points for action, roles and responsibilities of actors agreed upon, and with national facilitators identified under an initially agreed upon governance system that requires formal ratification by all members of the platform. <http://drylandsystems.cgiar.org/events/innovation-platforms-dryland-systems-development-strategic-framework>
<http://drylandsystems.cgiar.org/content/opening-session-initiating-development-innovation-platform-framework>
<http://drylandsystems.cgiar.org/content/innovation-platforms-what-innovation>
- **Learning Alliances (LA):** Learning alliances provide legitimacy for the innovation platform and initiate identification of entry points and opportunities for engagement. In close collaboration with post-harvest and market access activity, they also validate evidence and priorities for the defined entry points. Learning alliances initiated include: Morocco (Meknes) – three field sites; Tunisia (Sidi Bouzid – Zoghmar); Tunisia (Medenine – Beni Khedech); Egypt (Nile Delta and adjoining region). Two learning alliances were also initiated in Jordan (Al Kresha and Al Erak), under a CIDA-funded grant. <http://drylandsystems.cgiar.org/content/learning-alliances-sustaining-adoption-new-innovations>, <http://drylandsystems.cgiar.org/content/learning-alliances-case-studies-egypt-morocco-tunisia-and-jordan>
- **“Assessment of cereal producers in Meknès-Tafilalet region” (Morocco).** This research focuses on the problem of cereal aggregation nationwide, vis-à-vis finding alternative ways to address this issue. The report contains elements that describe the regulatory framework in Morocco for promoting the aggregation of cereal producers; experiences with cereal aggregation; and proposals for organizing local farmers from the Meknes-Tafilalet region to aggregate themselves around a government-supported aggregation project.
- **“Barley subsidies in Jordan: The effects on small ruminant production, food security and development of the livestock sector.”** This research presents an analysis of agricultural policies in Jordan in support of the small ruminant sector (sheep and goat). This analysis includes a discussion

of the different types of support provided by the government and their impact on livestock herds, cereal production and productivity, cereal imports, and household incomes. The report is being prepared to be published in an international peer-review journal.

- ***“Groundwater tariffing policy (Jordan): effects on household livelihoods and groundwater consumption in Jordan.”*** This research is almost finalized and will be presented to the Ministry of Water and Irrigation of Jordan for discussion.
- ***“Farmers’ perceptions of water policies and development projects: A case study from Jordan”.*** This research focuses on farmers’ perceptions of policies and regulations to improve wellbeing and water security in Jordan. The research found that in Jordan the government has been able to make farmers aware of water policies, regulations and laws, but their implementation lacks farmer participation and ownership. We argue that in the short term the government will have to substantially involve local communities in the formulation and implementation of projects if more efficient, equitable, and rational use of water and other natural resources is to be achieved.
- ***“Land policies, production systems and livelihoods in South-East Tunisia.”*** This research analyzes, from an historical viewpoint, the profound changes, linked to different government systems that result in land tenure schemes affecting the social and economic dynamics of local populations. The document provides policy makers with an overview of different dynamics overtime, linking the following: contrasting behaviors of sedentarization, privatization and fragmentation of land, decline of pastoral activities and rangelands, agricultural development, extension of irrigated perimeters, and changes in the use of natural resources.
- ***Land and water policies in the Meknes region of Morocco:*** An overall evaluation of water and land policies, and institutional set-ups on food security, agricultural production and the use of natural resources in Morocco, with a particular focus on Bittit and Sidi Slimene sites. The collected information was analyzed and a report is in the process of preparation.

9. Capacity development

- The capacity development of farmers and young NARS scientists has been considered a priority: A total of 3000 farmers have benefited from short-term and/or on-the-job training in various fields, among them 420 women farmers. Also, 170 NARS scientists have benefited from short-term and/or on-the-job training in various fields, including 28 female scientists, and training for graduates has included 25 PhD and 18 MSc students, including 12 female PhDs and 6 female MSc students.

C.2 Progress towards outputs (1 ½ page)

Agro-pastoral Livelihood Systems

Arid agro-pastoral systems are represented by the Béni Khedache-Sidi Bouzid transect in Tunisia and the Tafila-Salamyah trasect in Jordan-Syria. These arid agro-pastoral systems are facing the serious threats of natural resource degradation and water scarcity. The agricultural livelihood system is based on small ruminant, barley and olive crops, and small-scale irrigation.

According to the IPCC 4th Assessment Report on Climate Change, the area in and around the site is expected to become a hotspot of climate change, with an expected decline of 20-40% in annual precipitation by the end of the 21st century. The Agricultural Livelihoods Systems is mainly agro-pastoral, with scattered irrigated areas where horticultural crops (e.g. vegetables, fruit trees, cereals and forage) are dominant. The existing pastoral system is evolving to agro-pastoral, with significantly less nomadism. The major constraints in both sites refer to land degradation, water scarcity, salinity and the overuse of ground water. Degradation of rangelands due to the uprooting of vegetation for domestic use, overgrazing, and encroachment by barley and olive crops is common. Sheep and goat production is the dominant agricultural activity. The area suffers from low investments and diversification, as well as difficult access to credits. Among the opportunities there are important aromatic and medicinal plants and fruit trees biodiversity (e.g. olive, figs, almonds), well preserved local know-how (agro-pastoralism, water harvesting, etc.), and very active local organizations such as NGOs.

1. Enhancing the system resilience

- **The "Climate Change and Drought Atlas for Jordan," (IDO 1)** with its set of 339 maps, offers a comprehensive characterization of past and expected climatic change in Jordan. The atlas will improve awareness of climate change for policy makers and communities, and of the promising agricultural technologies that are relevant for adapting to climate change (IDO1).
- **Impact of climate change on olive production in Medenine, Tunisia (IDO 1).** A model based on hydraulic balance, and taking into account parameters such as slope, soil type, and climate conditions has been developed. Three CC scenarios have been investigated for the period 2020-2050. The extension 'ModelBuilder' of ARCGIS allows an automatic combination of inputs. Maps of vulnerability of olive to CC was possible when the water balance software "BUDGET" is coupled to the system. Simulations show a clear decrease of areas suitable for olive tree cropping in the Medenine Governorate. (Ouassar M., A. Zerrim 2014. Analyse de la vulnérabilité de l'olivieraie au changement climatique (CC) dans le gouvernorat de Médenine moyennant un outil SIG. Revue des Régions Arides - Numéro Spécial, 33: 33-37) (IDO1 & 4).
- **Participatory assessment of land and water policies in Beni Khedache, Tunisia (IDO1 & 6).** Land privatization and agricultural subsidies have had negative effects such as land fragmentation and increasing pressure on water and land resources. As natural capital decreases, social capital increases and more so than human, physical and financial capital. The following indicators received higher scores: WSC technologies, Land protection, Biodiversity, capacity to adapt, and Knowledge and skills. Stakeholder expectations of full implementation of a Water and Soil Conservation (WSC) strategy was very positive, with higher scores for overall indicators. (Ouassar Mohamed, Bechir Riadh, Abdeladhim Mohamed Arbi, Telleria Roberto. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014).
- **Assessing the vulnerability of agro-pastoral systems in Tunisian arid zones (food security, coping strategies and adaptation to drought) (IDO1 & 6).** The farming system is family-based, oriented toward self-consumption and to feed livestock with the latter intended for sale and to generate household incomes. The analysis shows the following: that the production of olives is sufficient to cover the needs of the HH; in rainy years the average production of cereal crops is sufficient and insufficient during drought years; and in dry years rangelands do not cover animal needs and herders are forced to purchase feeds. Off-farm activities appear as an essential factor to compensate for the decrease in agricultural income (Mondher Fetoui, Riadh Béchir, Mohamed AbdelAdhim & Mongi Sghaier, 2014. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014).
- **Monitoring and improving rangeland productivity (IDO 1 & 4).** The aim is to ensure that new species play an integral role in national rehabilitation strategies, and ultimately help to reverse the devastating levels of degradation that inflict many rangeland areas. The work focuses on the testing and validation of productivity monitoring tools and testing potential fodder plants. At least five promising fodder species have been identified and characterized.
- <http://www.icarda.org/reversing-degradation-rangelands-promoting-sustainable-grass>
<http://www.icarda.org/sites/default/files/Retama-Shrub-Fact-Sheet.pdf>;
<http://www.icarda.org/sites/default/files/Mediterranean-saltbush-Factsheet.pdf>;
<http://www.icarda.org/sites/default/files/Bufel-grass-Factsheet.pdf>;
<http://www.icarda.org/sites/default/files/Stipa-lagascae-Factsheet.pdf>

Data compiled from different sources to form The PREDICTS database: a global database of how local terrestrial biodiversity responds to human impacts (open access dataset)

<http://onlinelibrary.wiley.com/doi/10.1002/ece3.1303/abstract>

Communication and training materials were prepared on promoting sustainable rangeland species, assessing and monitoring rangeland vegetation, and cultural practices (soil preparation) for rehabilitation of degraded rangelands.

http://www.icarda.org/wli/news_Field-day-on-Grazing-Management.html

<http://research.engr.oregonstate.edu/ecomonitoring/node/1/>

<http://www.vegmeasure.org/>

- **Alley cropping (IDO 4 & 1)** was introduced to farmers in agro-pastoral ecosystems to reduce pressure on rangelands, fill gaps in feed resources, reduce soil erosion, enhance infiltration, and boost carbon sequestration. Multi-purposes cactus pear (*Opuntia ficus-indica*) accessions were disseminated to over 75 households in karak (Jordan). Special emphasis was placed on the targeting of woman farmers to enhance their income by selling high quality cactus pear fruit.
<http://drylandsystems.cgiar.org/content/promoting-sustainable-solutions-overcome-feed-shortages>. <http://icarda.org/drylandstinking/Cactus-sustainable-and-versatile-plant-dry-areas>.
<http://dialogues.cgiar.org/blog/how-much-cactus-is-in-your-lipstick/>.
<http://www.icarda.cgiar.org/sites/default/files/Cactus-for-Livestock-Fact-WEB.pdf>.
- **Biodiversity conservation (IDO 4)**. Baseline data (diversity, status and threats) were collected for dryland agrobiodiversity in the action sites (Karak-Jordan; Zoghmar and Benikhedach-Tunisia). Data entered into databases were analyzed to guide management plans, in coordination with rangeland and water harvesting teams. The Cultivation of local and exotic medicinal and aromatic/herbal plants (MAPs) were promoted in Erak as a source of income to support the *in situ* conservation and sustainable use of Dryland Agro-biodiversity., in collaboration with AARINENA, Jordan.
- **System vulnerability analysis (IDO 1)**. General methodology development, data collection, field work, and workplan. Local knowledge of pastoral and agro-pastoral communities for managing uncertainties in Southeastern Tunisia- the case of Béni Khédache:
http://drylandsystems.cgiar.org/sites/default/files/Progress%20Report_System%20Vulnerability_IRA%20BKSsite%20TUN.pdf
http://drylandsystems.cgiar.org/sites/default/files/Progress%20Report_Local%20Knowledge_IRA%202014.pdf

2. Preventing land degradation

- **Modeling tool to evaluate and assess desertification risk (IDO 1)**. A spatial and integrated approach/method in order to better assess and target actions against desertification risks in the Tunisian arid zones was developed, consisting of two overlying spatial information maps by ArcGIS. The first map derives from environmental modelling LEIS (Local Environment Information System), and the second from field mapping of the locations with actions already implemented against desertification risks in the study area. This simple approach helps identify measures able to combat desertification (M. Fétoui and al., 2014. *Revue des Régions Arides - Numéro Spécial- n° 33 (1/2014)*)
- **Innovative techniques of soil and water conservation (IDO 1 & 4)**: Single-furrow Plowing Implemented and adopted by national development institutions in Jordan; Hill lakes in Tunisia and Jordan; Semi-Circular Bunds (Jordan, Tunisia); Check dams for aquifer recharge and plantation (Jordan, Tunisia); and Terraces (Jordan, Tunisia).

3. Improving the livelihoods of the rural poor

- **Sustainable improvement of livestock productivity (IDO 1, 2 & 4)**. The activity on livestock productivity builds on ICARDA's expertise from a number of past R4D projects and aims to ensure impact through livestock related (best-bet) interventions on small ruminants in agro-pastoral livelihood systems in different locations. The livestock activity is designed in close integration with the rangeland activity and the post-harvest and market access in particular with regards of marketing.

Zoghmar/ Sidi Bouzid (Tunisia) site: The work in 2014 in the Sidi-Bouzid region focused on assessing the needs for **interventions in animal husbandry. 1)** Sheep farmers have shifted (more than 50%) from the Barbarine fat tail to the Algerian thin tail breed to satisfy butchers. The Barbarine breed is under a random crossbreeding with the thin tail breed, which represents a threat to the breed's integrity. Only 20% of sheep owners remain breeders, 40% were at the same

time breeders and fatteners, and a percentage of 40% were only fatteners. **2)** Sheep production was found to depend for 35% to 58% on concentrate feeds (barley, commercial concentrate and wheat bran), with a high feeding cost. In summer farmers rely on cactus (18 %) and stubble (10%) to replace part of concentrate. The nutritional status of sheep flocks, based on the determination of blood metabolites were approximately 42.1 g/l \pm 18.3 for the total protein, 2.26 mmol/l \pm 1.36 for glucose, and 5.06 mmol/l \pm 2.95 for urea. Those values reflect the poor nutrition status of sheep due to the unbalanced diet. **3)** Preventive animal health measures are mostly provided by the State Veterinary Service, which provides vaccination to 84% of Zoghmar herds against foot and mouth disease, Pox sheep, brucellosis, and blue tongue diseases. The community shepherds largely rely on herbal medicinal and aromatic plants (HMAP) for treating animals. **4)** The water footprint of small ruminant products ranged from 4521 liters/Kg of carcass and 6222 liters/kg for goat and sheep, respectively. For sheep and goat meat production, a total of 94% of the water used is green water, 5% is blue water, and 1% is grey water.

Jordan site: 1) The modified Jameed milk processing method is an output of OFID and IFAD-funded projects taken up within CRP DS. Characterization of dairy processing and socioeconomic and marketing conditions in four target villages were completed. The improved processing package developed by ICARDA (based on proper pasteurization, introduction of fat separators and more efficient butter churners) is now being outscaled to 15 villages in the El-Karak action site. Each of these villages is typically composed of 10,000 inhabitants and the sheep population for each village can go up to 20,000 milking ewes. The targeted milk processing units are women-led and employ women. Therefore, more than 90 women are directly impacted by this work. The new processing package, while preserving the authenticity of the indigenous end products, save on energy, water, increase income by 8%, and allow a higher diversification of the processed products. **2)** The sero-prevalence and risk factors of abortive diseases was assessed by a random sampling of 20 sheep flocks, representing a total population of nearly 40,000 ewes spread over an area of 53 km². It revealed an overall sero-prevalence of 5% and 39% for *chlamydomphila abortus* and Q-Fever (IDO 4).

- **Conservation agriculture in agro-pastoral systems**

In Zoghmar/Sidi Bouzid, Tunisia: During the 2013-2014 cropping season work continued in on the evaluation of CA under farmers' field conditions (IDOs 2 & 4). Conservation agriculture (CA) improved grain yields and above ground biomass of barley and wheat by 10% compared to conventional systems (CV) under semiarid condition. Also, WUE increased by 15% for both crops under CA. Surface Soil Organic Matter was also enhanced, leading to more storage of water in the soil and improving soil resistance to water erosion (+ 20%) under CA compared to CV. Vetch was introduced as a forage crop to deal with drought. Yields of barley improved by 25% under alley cropping (cactus as alleys), compared to barley cultivated in open fields under the CA system (CRP, WLI, CLCA reports). Under more sub-humid conditions a mixture of vetch/triticale was introduced in the CA crop rotation as a forage option. Compared to mono-crops of wheat, WUE of wheat was improved by 15 % and 10% when it was cultivated after vetch-triticale mixture and after faba bean, respectively. A low-cost new zero-till prototype seeder adapted to local conditions was also developed. Low-cost ZT tine seeder technologies were identified on the international market and two models were acquired (from Australia and Spain) to provide a baseline for low-cost tine seeder performance and technology. Local production will reduce the cost by 50% and prototypes were available in 2014, and are being tested in three countries in the region. Finally, a weed management guide for conservation agriculture (Arabic version) is now being prepared (ACIAR-CANA reports).

Efforts were also undertaken to identify constraints to the adoption of CA by smallholder farmers and ways of enhancing adoption, most importantly identifying and testing socioeconomic options. A baseline characterization of the region has been performed, and the general characteristics of farms and farmers were described. Information about, and attitudes towards, the new CA technology were assessed. Adoption constraints included: the limited farm size, the lack of financial means to cover the expenses of activities, the limited information available on CA, and the cost of investing in the required machinery.

In Jordan: Prototypes of low cost ZT seeders (US\$5-10 K) originating from Iran, Iraq and Jordan were completed and 16 new seeders are planned for delivery in 2014/15. Kits to convert 40 farmer seeders to ZT were also provided. Four Iranian ZT seeders were also evaluated, and a second prototype of a small Rama seeder was produced and tested at Mushagher and Palestine. The area of ZT adoption increased to 15,000 ha (mainly Ninevah).

- **Water scarcity (IDO 4 & 6).**

Experience and progress in implementing, monitoring and modeling soil and water conservation interventions bring together different partners and projects from research and development in a multi-criteria participatory approach. Linking partners from different sites in CRP-DS (Tunisia and Jordan) was initiated to facilitate knowledge and experience exchange.

In Oum Zessar, Tunisia (WLI Tunisia): An Integrated Impact assessment (IIA) mainly in Beni Khedech, based on Extended Cost-benefit Analysis (ECBA) and a Sustainable Livelihoods Approach (SLA), shows that for the adoption of water harvesting techniques (WHT) social capital is the most important factor, followed by physical capital. Financial capital seems to not play much of a role due to the low crop and livestock incomes. Projections indicate that livelihood assets will change during the 2013-2030 period, with a slow increment of physical, human and social capital. Natural capital will decrease due to agricultural intensification and poor land management. The ECBA shows that WHT works are profitable with an IRR of 24% and an NPV (at a 12% discount rate) of 1380 US \$. The inclusion in the analysis of the off-site benefits improves the economic profitability to 1680 US\$. The WHT works are apparently beneficial at private and social levels for local populations within the watershed (Abdeladhim M., Sghaier M., Ouessar M. and Ben Zaid M. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014)

In Jordan: Twenty seven (27) Grey Water Treatment Units (GWT) were constructed. A comprehensive program for networking, awareness, and dissemination has been implemented since the installation of the grey water treatment units. The results of the water sample analyses showed that using media-size volcanic tuff as a filtration media is more effective than using media-size gravel. Moreover, grey water quality after treatment was within the permissible limits of Jordanian standards for the use of grey water for irrigation. The treated grey water is mostly used to irrigate olive gardens and meets up to 60% of home garden demand for irrigation requirement and has reduced their water related expenditures by 35% (IDO 4).

- **Policies (IDO 4 & 1)**

Jordan: This research presents an analysis of agricultural policies in Jordan in support of the small ruminant sector (sheep and goats). The analysis includes a discussion of the different types of support provided by the government and their impact on livestock herds, cereal production and productivity, cereal imports, and household incomes. A report is being prepared to be published in an international peer-reviewed journal.

A report has almost been finalized on groundwater tariffing policy and its effects on household livelihoods and groundwater consumption in Jordan. The report will be presented to the Ministry of Water and Irrigation of Jordan for discussion. A further study, conducted collaborately with NCARE,

focuses on farmers' perceptions of policies and regulations to improve wellbeing and water security in Jordan. The study is based on focus-group discussions covering topics of agricultural policies, groundwater, and irrigation management in two small Jordanian villages. These revealed that in Jordan the government has been able to make farmers aware of water policies, regulations and laws, but their implementation lacks farmer participation and ownership. We argue that in the short term the government will have to substantially involve local communities in the formulation and implementation of projects if more efficient, equitable and rational use of water and other natural resources is to be achieved.

Tunisia: Research was carried out to analyze from a historical viewpoint the profound changes linked to different government systems and resulting land tenure schemes that have affected the social and economic dynamics of local populations in South-East Tunisia. The document provides policy makers with an overview of different dynamics over time, linking contrasting behaviors of sedentarization, privatization and fragmentation of land, decline of pastoral activities and rangelands, agricultural development, extension of irrigated perimeters, and changes in the use of natural resources.

http://drylandsystems.cgiar.org/sites/default/files/Policy%20report%20IRA%20BK%20site%20Tunisia_Final.pdf

- **Value chain and post-harvest in Jordan and Tunisia (IDO 3 & 2)**

Value chain analyses have been conducted on Sheep (Zoghmar, Tunisia), olive (Beni Khedache, Tunisia and El Erak, Jordan), and water (Al Kresha (Jordan)).

Tunisia: Analysis of the Sheep value chain in Zoghmar community, Governorate of Sidi Bouzid by Dhraief MZ, Oueslati M, Daly H, Abassi S, Baazaoui I, Bedhief S.; Boubaker Dhehibi; Shinan Kassam and Aden Aw-Hassan. Also : The olive oil value chain in Beni Khedache site, Médenine, South East of Tunisia: Potential, constraints and main operators by Abdeladhim MA., Riadh B., Fetoui M., Sghaier M.; Boubaker Dhehibi; Shinan Kassam and Aden Aw-Hassan.

http://drylandsystems.cgiar.org/sites/default/files/Report%20IRA%202014_Value%20chain%20olive%20oil%20BKTunisia_CRP-DS_F.pdf

Jordan (Al Kresha): Regulatory permission to access and manage irrigation water, as well as access to improved quality and range of public services. Also, in Al Erak: Improving production potential and profitability for olives (fresh and oil).

- **System analysis and modeling (IDO 4 & 6).**

Morocco: Bio-economic modelling activity in Meknes has started only recently. Compilation of available secondary data and development of basic understanding of the production system is well underway. Currently, the PhD student working on bio-physical modelling has made considerable progress in collecting historical experimental data and calibrating the Century model for bio-physical simulations. The other PhD student deployed for the farm household bio-economic modelling activity has also developed the first prototype of a Dynamic Agricultural Household Bio-economic Simulation Model (DAHBSIM), which is currently being discussed for validity and effectiveness. If successfully implemented, this innovation will push the frontier in modelling production systems as it will be a stochastic multi-period model, which will allow for modelling systems evolution over time with adequate treatment of risk.

WLI aims for **regional** impact and works on three planning tools for Site Specific Decision Making: modeling, the economics of natural resource management, and socio-economics. Regarding monitoring and modeling, equipment and sites were identified and the purchasing process was initiated. Knowledge transfer and sharing is used to benefit all sites. The modeling in Jordan has

progressed since it is a continuation of previous research efforts. In Tunisia, SWAT is now functional and will be adapted in the context of arid areas.

Tunisia: A rapid rural appraisal was conducted to identify constraints in the production systems of Zoghmar. This produced a long catalogue of problems which will be used to set research priorities in the future. The results will also be used as a basis for the construction of appropriate bio-economic models that might help in identifying the prime bottlenecks in the system.

Intensive rainfed livelihood system

In intensive rain-fed livelihood systems, where the wheat-based cropping system is prevalent, land fragmentation is occurring, making it ever more difficult for HH to earn a living. Whether and how re-aggregation is possible is a prime research topic. A shift from commodities to horticulture (potato, tomato, fruit trees) is an alternative to improve livelihoods through intensification and market-orientation. This system is represented in the NAWA region by the Meknes-Sais site (Morocco), site of an ambitious state-led program for modernization of the agricultural sector, together with a parallel program for poverty reduction through the directed social and economic organization of farming communities.

Through the Morocco Green Plan, significant incentives are being provided by the state towards the formation of agricultural production and marketing cooperatives. In conjunction with an ongoing reform of farm advisory services, this bodes well for testing more contemporary (inclusive) approaches for agricultural innovation. However, administrative complications, coupled with farmer mistrust of previous state-led cooperatives and claims of mismanagement, have thus far led to mixed results in the functioning of newly formed cooperatives. Initial work in the participatory definition of entry points for an innovation platform have signaled significant interest from public agencies, local governments, national research institutes, civil society, private traders, and most importantly, farmers (men and women), in the testing of more contemporary forms of social and economic organization that may lead to the more effective development of, and access to, agricultural research outputs. Yet, historical cooperatives continue to function, particularly in the area of irrigation water management. The inclusion of these cooperatives into an innovation platform is critical, given power dynamics at the level of community, but this has proven to be problematic in terms of reaching agreement on a clearly defined entry point for an innovation platform to be struck, and given perceived threats to the functioning of existing cooperatives.

The focus of the program is a sustainable intensification of the main production systems (wheat-based systems, fruit trees-based systems, and vegetable-based systems).

- Intensification and diversification for system productivity

Morocco: Conservation agriculture is being spread country-wide. A meeting was organized with 30 farmers, policy makers, extension technical staff, and scientists to increase awareness of the importance of conservation agriculture. On-farm trials (four on wheat and two on chickpea) were conducted on **conservation agriculture** in six sites (in two communities - Ain Jmaa and Betit) where soil and plant data were collected. Two field days were organized with stakeholders (50 farmers in two associations: Ennasir & Bismilah). The area under CA is 700 ha in the Meknes site and 8200 ha at the country level.

Primary and secondary data on **seed demand and supply** in Morocco covering the Meknes site have been collected, entered, and a draft report is being prepared. Further refinement, discussion and communication to policy makers are planned in 2015. Three communities have been supported to initiate village-based seed production and marketing. A total of 38MT of quality seed of faba bean, chickpea and lentil varieties have been produced and marketed for further seed

multiplication and crop production, enough to cover a total of 500 ha of crop production areas. It is very challenging to directly involve female players without access to land or capital in seed businesses. Nevertheless, there is a plan to involve them in the necessary diversification process of the VBSE operationalization through production and marketing of value added products such as the preparation and commercialization of clean packs of grain for domestic uses.

On-farm trials were conducted to select high-yielding and **more adapted lines of cereals and food legumes** provided by sister CRPS to the conditions prevailing in the Meknes-sais action site. More than 40 farmers and researchers, including six women participated in the evaluation of more than 70 advanced elite lines of cereals and food legumes proposed by ICARDA's breeders in two farmer fields. In the case of bread wheat, most of the lines tested presented good yield performance, compared to the check variety Achtar. One line (BT 10 : QIMMA-12/PASTOR-6//QIMMA-12) exceeded the check, while six lines presented a yield equivalent to that of Achtar. This line and three others (SHUHA-7/SHUHA-14/3/ALTAR 84/AEGILOPS SQUARROSA (TAUS)//OPATA; HUBARA-3*2/SHUHA-4; QIMMA-12/PASTOR-6//QIMMA-12) were also selected by farmers. For durum wheat, four lines (Ivigni3/Ainzen-1//Maamouri-3; Icakassem2; Icamor, Icamoram7, & Lahnmiki and Icajihan2013) out-yielded the highest yielding check variety Tomouh. For Barley, the highest yielding lines Lanaceur, G1 and Firdous, were also the top lines identified by farmers. The lines of food legumes selected by farmers are Super Aguadulce and Khalil for faba vean, FLIP 07-33C for checkpea, and 2009S96111-1 for lentil.

Different combinations of methods of **pest management** were tested in farmers' fields and compared to farmers' practices. 1) One IPM option was developed to manage diseases and weeds in bread wheat farms with minimum fungicides and herbicides that gave a yield advantage of 9.3 and 7.2 q / ha for Amal and Arrihane varieties, respectively. 2) Two hoeings combined with grass killing herbicide at four leaf stages of faba bean at Ain Jemaa gave 3.2t/ha grain yield. At Sidi Slimane, a grain yield of 3t/ha was obtained for faba bean with two hoeings and herbicide applications, compared with 1.1 t/ha of farmers' weed management practices. 3) Out of 20 bread wheat lines tested, two elite lines (E33P39 and E33P45) showed high levels of resistance to yellow rust disease at Douyet -Meknès (SAÏS). The selected lines will be further evaluated for yield potential in the Action site.

- **Improving water management and equitable allocation**

Morocco: Irrigation scheduling and fertilizer management in the Meknes site involved on-farm experiments on deficit supplemental irrigation of olive trees (two), potatoes (one) and onion (one). A **supplemental irrigation** package on wheat was introduced at an outscaling site of Tadla: seven pioneer farmers used the package. Field days were organized for 50 farmers to enhance their awareness on the importance and use of deficit supplemental irrigation. In a subsequent sampling of 120 farmers, the adoption rate of supplemental irrigation packages for wheat in Tadla was 72%, and that of deficit supplemental irrigation was 20%. On average, 25 to 30% of irrigation water was saved due to the application of deficit supplemental irrigation in on-farm trials.

Two studies were implemented, one on dairy processing, and the other on the water productivity of cattle production. A survey with 100 potential users assessed dairy processing methods and identified constraints faced by producers. The safety and traditional products were characterized and analysed (250 analyses were done on Rayeb and Lban). A typology of the existing animal production systems was established. Six dairy and beef cattle farms which would accept the implementation of an on-farm research protocol were identified and periodic visits were conducted to assess the management of animals (feeding) and forage crops, including irrigation. Their production system and the current use of water resources were characterized and documented and beef-water productivity was estimated. The study showed that the average economic **water productivity per cubic meter used in livestock** is 0.05 US \$. This value is very low when compared to previous studies in irrigated areas of Morocco (0.18 to 0.25 US \$). This difference can be explained

by higher costs generated by cattle production in the current study (feed concentrates' prices have jumped sharply, whereas farm gate milk price has remained quite steady), and to the traditional management of forage crops and feeding of cattle.

- **Value chain and post-harvest:**

This activity targets the improvement of the value-chain of onion and potato in the El Hajeb region, Morocco. The major achievements are 1) developing a business plan to increase the market value of onion (60 onion producers); 2) the elaboration of a feasibility study for a potato transformation project (60 potato producers), and 3) the economic valuation of energy consumption for producing onion and potato in the El Hajeb region (60 onion and potato producers). Efforts were made to increase the awareness of the importance of grouping producers into cooperatives. For this purpose, workshops (four) and focus group meetings with designated producer leaders (three), and participation in a regional onion festival in El Hajeb (one) were undertaken. As a result, two aggregation projects for developed and evaluated and two producer cooperatives created. Three others producer cooperatives are in the creation phase. Best practices for improving energy efficiency identified, and ready for diffusion.

The number of technologies/tools that are field tested (Phase II) are: one modern storage technology of onion, one processing technology of onion powder, and one cold storage building for potatoes. It is estimated that 180 onion and potato producers will benefit from these activities.

- **Policies on natural resources and vulnerability:**

Morocco: An overall evaluation was undertaken of *water and land policies*, and institutional set-ups on food security, agricultural production, and the use of natural resources, with a particular focus on the agro-systems prevalent in the Bittit and Sidi Slimene sites. The evaluation focuses on aspects related to household livelihoods, property rights, land fragmentation, environment, and the use of land and water resources. A database containing secondary information on water availability and socio-economic and poverty indicators related to water resources was developed. This information will be published in a local journal. Also, two water and land policies, and institutional set-ups were analyzed.

A comprehensive description of production systems and livelihoods, with major indicators of socio-economic and biophysical aspects was conducted in six sites. Household and production baseline data sets of baseline surveys and secondary data were produced for selected sites. Six systems diagnosis briefs for different sites were published. During this year, one questionnaire for baseline studies was developed and implemented in three communities. The number of surveyed farms is 500 and the collected data is in the process of being analysed. This representative sample has allowed the characterization of existing production systems of 38,660 households (the three communities), their vulnerability, and local coping mechanisms. The major output of this activity is the preparation of a report on the problem of cereal farm aggregation nationwide, vis-à-vis finding alternative ways to address the issue. The report also focuses on field implementation of an aggregation project of cereal producers in the Meknes-Tafilalet region. It contains elements describing the regulatory framework in Morocco for promoting aggregation of cereal producer experiences with cereal aggregation; and proposals for organizing local farmers from the Meknes-Tafilalet region to aggregate themselves around the government-supported aggregation project. The report also contains a discussion of the problematic elements inherent to the grain sector, and a debate among the various stakeholders in relation to the most convenient way to aggregate their production. A database containing secondary information on the socio-economics of cereal

aggregation approach was developed. This information will be published in a local journal. Also, two policies for cereal aggregation and government incentives to aggregate grain producers were analyzed.

Irrigated crop livelihood System

This system is represented in the Nile Delta site, covering an area of about 39,300 km². The climate is arid, especially in the southern part. However, the Nile provides good opportunities for sustainable intensification of the agricultural livelihood systems as the entire area is irrigated. The total annual withdrawal water is estimated to be 81.2 BCM/year, around 82.5% of which is used for agriculture. Around two million hectares in the action site are irrigated to grow different winter (wheat, berseem, vegetables and fruits) and summer (rice, maize, cotton, vegetable and fruits) crops. It is worthwhile to note that saline lands cover 37,000 ha, representing 1.85% of the treated area. The Nile Delta is home to 36.5 million people, of whom 23 million are rural (60%). The poverty amongst the rural population is 17%. Malnutrition among young children is a serious problem that should be taken into account. The unemployment rate ranges from six to 20%, and is highest among females. The average farm holding size is less than one hectare where rice, cotton and wheat based rotation is adopted. These crops are irrigated with surface water and shallow groundwater.

Livestock represents 67% of total income for Bedouin systems, and their feeding systems are based on berseem, concentrate, stubble grazing, maize and crop residues. The main animal species raised under the irrigated system are buffalo, cattle, sheep, goat and camel. Among the problems faced by the irrigated system in this action site is the lack of market access for small holders, land fragmentation (80% of the landholdings are smaller than 5 feddans), a drastic decline in the contribution of rangelands to livestock feeding, declining soil fertility, decreased livestock productivity related mainly to diseases and feed scarcity, and unsatisfactory institutional support (extension and health services, etc.). Policies related mainly to pricing, subsidies for inputs and production, and access to land and water resources are also among the problems, hampering the promotion of agriculture in the Nile Delta action site. The CRP DS addresses most of the above problems and the challenges to achieve sustainable water and land use management, to integrate crop and livestock, to promote the role of gender, to increase income, and in general, to empower farmers' livelihoods.

The target for this system is market-oriented vegetable and fruit tree cropping, together with intensive and high yielding wheat and forages. Cattle production for dairy production is also prevalent, but this system is facing serious problems of salinity.

Intensification and diversification for system productivity (IDO 2 & 4)

A number of varieties and lines of two important food crops in the Nile Delta (wheat and fababean) were tested under different soil conditions, covering different agro-systems (new lands, old lands and salt-affected lands). Three **lines are of high potential yield** and they exceeded the highest check (Gemmeiza 10) in grain yield by 16, 13 and 12.9%, respectively, and those varieties are recommended to be disseminated to farmers. Three additional lines need more research and retesting for salinity and alkalinity before releasing them to farmers for adoption. **Salinity- and orobanche-tolerant fababean cultivars** (Giza 843 and Misr 3) were identified and disseminated as part of improved agronomic packages, initiated in 2014. The improved production package included zero tillage systems, delayed sowing to mid-November, seed rates (80-90 kg/ha) and Glyphosate at a reduced rate of 34 g/ha + NPK, two times at flowering and three weeks afterwards. This yielded grain increases of demonstration fields in orobanche-infested soil of 39% for Giza-843, 59 % for Misr-3, and 67 % for Giza-3.

Fungicide (Rizolex) helped to control FBNYV with five cultivars of Faba bean and irrigation water management at two locations. The effect of two pesticides (Apron and Celest) in controlling Aphids on the Faba bean cultivars was also measured. There was significant interaction between the two factors included in the experiment (cultivars X fungicide) for all characters except disease infection percentages. The highest seed yield was obtained for the "Rizolex" treatment (http://www.seedquest.com/news.php?type=news&id_article=27654).

A decision support model was tested for fertilization management to be used as a useful tool by agronomists and extension services for more efficient on-farm management and agriculture production. Field trials on soil fertility in new land were conducted in 2014 and the obtained results showed that fertilizer recommendations based on the model software need a lot of effort to be accurate and reliable. The trials also gave some promising results of combining fertilizer use with biofertilizers, and the economics of this alternative look promising.

System vulnerability and baseline survey

The objective of this activity is to establish baseline data on socio-economic and biophysical indicators at the household level, as well as the target areas as a whole, determine the causes of system vulnerability and local coping mechanisms, evaluate the feasibility of technologies, and monitor their adoption. Many activities were carried out in the action site, which was divided between three locations based on the type of land: old land, new land, and salt-affected land. The activities during 2014 included collecting secondary data and reviewing previous and on-going studies on the target areas, reviewing the available collected data, conducting rapid rural appraisal and group discussions, preparing preliminary draft reports on site characterization, developing a questionnaire for the field detail survey, and analysing the available data, which were collected from farmers.

There are common technical problems in the three locations such as (1) problems related to irrigation, the high cost of chemical fertilizers, and the weakness of agricultural drainage, (2) the problems associated with applying pesticides, (3) the high prices of organic fertilizers, pesticides and seeds, and (4) exposing agricultural extension to new problems during their activities in the village. The overall picture revealed the many problems corresponding to men, women and youth in rural communities. Most of these problems are social and economic problems such as education, the early marriage of girls and the high cost of marriage, unemployment, the lack of various projects in the villages, and education for girls only reaching medium levels, focusing on commercial and secretarial studies.

Based on group discussions and literature, the problems faced in the community can be summarized as follows: rural families have very small agricultural holdings; young people are reluctant to work in agriculture; the unavailability of new agricultural projects in rural areas; and the shortage of public services, as well as the limited public health services, which do not meet the needs of families and households in the community. Poor extension services, difficult environments (unfavorable climate, poor soils, poor crop rotation, traditional cultural techniques, limited quality and quantity of water resources, limited budget income, shortage of loans, etc...), and unclear agronomic packages, are the main constraints which cause system vulnerability in the target area.

Capacity to innovate across all agricultural livelihood systems

Based upon a regional workshop held at the Dead Sea (section 3 below), there is now consensus among national partners within the NAWA region that **Innovation Platforms (IP)** are action oriented. Building upon the legitimized outputs of the learning alliance, they (i) test more contemporary avenues for social and

economic interaction, (ii) uncover (contextually relevant) refined approaches for participatory development of new technologies (technical, social, institutional), and (iii) seek avenues for broad dissemination and uptake of technologies that are developed, available, and of immediate priority and need to communities within a defined catchment area. Learning alliances provide legitimacy for the innovation platform to initiate the identification of entry points and opportunities for engagement, and in close collaboration with post-harvest and market access activity, they validate evidence and priorities for defined entry points.

The choice of invitees to the learning alliances that set the stage and scope for the IPs was consistent across NAWA, with learning alliances formed in the Meknes-Saïss action site of Morocco (three sub sites) and in two locations of Karak Governorate in Jordan. In Egypt, CRP-DS has leveraged investments made through a previous ICARDA grant from IDRC (Ottawa, Canada) through which a learning alliance was established in Egypt in 2013. Participants in all action sites were invited from a number of governmental ministries (Agriculture, Health, Education and Environment), microfinance institutions, and community based organizations, welfare societies/self-help groups, non-governmental organizations, developmental organizations (where they existed) and national institutions of research and learning (universities and technical schools).

Learning alliances were constituted in Egypt, Morocco, Tunisia and Jordan with the objective of defining the main research questions:

In **Jordan** the learning alliance met and tried to answer a large number of pertinent questions that the DS might address in its agro-pastoral research program. The catalogue of questions covered productivity, resilience, value chains and markets and gender. It also questioned the role of IPs in furthering this agenda. A Work Plan elaboration was proposed by merging and integrating activities into 3 clusters: Sustainable management of marginal ecosystems contributing to IDO 1 and IDO 4; Developing and scaling innovation capacity – Markets and Policies contributing to IDO 5; Cross-cutting gender inclusiveness contributing to IDO 6. The proposed **entry points for action (IP)** was 1) For Al Kresha: Regulatory permission to access and manage irrigation water, as well as access to improve the quality and range of public services, through contemporary forms of social and economic organization that limit tribal and clan frictions, and which provide a unified communal voice in negotiations with local government organs. And 2) for Al Erak: Improving production potential and profitability for olives (fresh and oil) through more inclusive and contemporary forms of social and economic organization, which appreciate the value of agricultural research, and exploit avenues for informing and tapping into agricultural research nationally and internationally. Facilitators have been identified for each of the innovation platforms, and action will begin in earnest in 2015.

In 2015 (budget dependent), the learning alliance will shift its focus towards informing research on the innovation platform, with an aim to better understand: (i) stakeholder interactions and shifting dynamics, (ii) the ability (capacity) for the platform to continuously and effectively innovate, (iii) the impact of the platform against the objectives defined for the platform (including policy related), as well as upon impact on “quality of life” for the beneficiaries targeted. (<http://drylandsystems.cgiar.org/content/ncare-icarda-meeting-reviewing-progress-and-planning-road-ahead-jordan>)

In **Tunisia** two learning alliances were established (Zoghmar and Beni Khedech), with members comprising a wide array of public, private and civil society organizations and key (champion) farmers. Critical (social, economic, environmental) challenges to household livelihoods were prioritized and key commodities produced by farm households were prioritized in terms of contribution to incomes, by level of production risk, and in terms of priorities for female (household) labour. In all action sites, a comprehensive study of the value chains for key commodities were undertaken in the post-harvest and market access activity, in

collaboration with national partners, and with identified challenges either validated or brought back to the learning alliance for further clarification. Two strong reports of key value chains within each Tunisian field site have been prepared and provide significant input and knowledge for the learning alliances and innovation platforms in each site.

In 2014, emphasis was placed on the diagnosis and selection of relevant stakeholders (main players) in the value chain of the selected crops (Sidi Bouzid Sheep and Olives and olive oil) in the selected sites (Sidi Bouzid and Beni Khedache, respectively), and on the mapping of challenges and opportunities for smallholder market access, with special emphasis on the institutional arrangements in collective marketing. These commodities were identified through an exercise of community prioritization within the learning alliances initiated at each field site, as a component of the innovation platform initiative, and in a manner that was consistent with future initiatives that assist in upscaling and outscaling technologies and best production practices which enhance inclusive livelihood systems. The initiative has delivered two planned outputs: (i) two reports on the diagnostic/challenges and selection of the relevant stakeholders in the value chain of each selected commodity, and (ii) a joint plan of work and log-frame through collaboration between ICARDA, national partners and national institutions. In addition, two learning alliances in each Tunisian field site have been struck and provided the basis for the striking of two innovation platforms within the sites, each with their own clearly identified entry points (c.f. Appendix 1).

In **Egypt**, given limited human resources and budget constraints, CRP-DS activities related to innovation platforms in the Nile Delta site were limited in 2014 to the identification and validation of an entry point for action. Taking on board knowledge and consensus from the learning alliance initiated in Egypt in 2013 (funded through a bilateral grant from CIDA, Ottawa, Canada), this entry point has now been defined as: Improvements in nutritional quality along the value chain, as a joint outcome of reduced post-harvest loss (economic gain), through wider options for access to seed, and adoption of more effective product handling, transport and storage practices, that are consistent with enhancements in the value of gender based services and roles.

A rapid, yet sound survey was initiated in late November within West Noubaria, and built upon past reports and research undertaken by the post-harvest and market access initiative in 2013 and early 2014. The primary aim of this survey was to validate early findings of high rates of post-harvest loss, for tomatoes in particular, and the underlying reasons for this loss. In addition, and of particular interest to CRP-DS, was an assessment of nutritional loss as a non-economic component of post-harvest loss, but one with significant cost for public health. The final report is expected by the end of January and will detail avenues for the innovation platform to consider in terms of options for broad scale dissemination and adoption of technologies and 'best' practices for mitigating post-harvest loss, while serving the public's interest in providing produce to market with enhanced nutritional quality.

C.3 Progress towards the achievement of outcomes (1 ½ page)

Conservation agriculture in agro-pastoral and rainfed livelihood systems:

- Within the IFAD-CLCA project, more than 50 on-farm trials and demonstrations were established using CA cropping packages. These demonstrations were effective in influencing farmers' decisions on adapting CA technologies.
- Last year, an unprecedented 850 ha of farm land was seeded using no-till seeders. Greater adoption of CA technologies will pave the way for more sustainable land, water, and energy management.

Intensifying rainfed livelihood system

- **Seed systems and dissemination:** Community based seed production enterprise promotes agro business in rural communities and improves access to new agriculture technologies, thus contributing to poverty alleviation, food security, and environmental resilience. A conservative estimate of a 10% increase in productivity resulted from farmers' access and use of 38MT of quality improved seed and associated packages over an estimated area of 500ha. At an estimated yield of 2MT/ha, the total estimated yield over the 500 ha is 1000 MT, with an additional 100MT of seed and grain from the 10% increase, resulting from the better access and use of improved technologies facilitated by the VBSE enterprises.
- **High value chain clusters:**
 - o One modern unit for onion storage has been installed and is operational
 - o One unit for potato freezing has been installed and is operational
 - o Five producer cooperatives are functional
 - o Value-chains of onion and potato have been improved
- **Land and water productivity in rainfed agro-systems:** A household survey conducted in the Tadla region showed that the adoption rates of supplemental irrigation and deficit supplemental irrigation packages were 72% and 20%, respectively. Deficit supplemental irrigation packages increased wheat yields in on-farm trials by 20% and saved irrigation water by 30%, compared to the full irrigation technique used by farmers.

Intensifying Irrigated crop livelihood system

The success of disseminating the mechanized raisedbed farming system in the Nile Delta was one of the most succeeded achievements of CRP-DS in the Nile Delta with a significant impact on farmers' income, whereas the introduced raisedbed (RB) machine developed by ICARDA played a very significant role to promote the adoption of the RB farming system. Thanks to the raisedbed machine, farmers saved 50% of seed rate, reduced 25% of their farming costs, achieved 25% water savings, and increased their yields by 25%. The adoption of MRB technology is increasing in the Sharkia Governorate, with approx. 4000 acres currently using this technology.

The Government of Egypt is currently seeking to promote this technology country-wide to save water used in agriculture, and increase crop yields. In this regards, several initiatives already started to scale out the raisedbed technology. One of these initiatives is the national wheat program, which adopted this technology and promoted it in many parts of Egypt. The wheat cultivated area in Egypt is estimated at three million acres. If appropriate policies are in place to scale out this technology, the economic, social, and environmental impacts are going to be huge (<http://phys.org/wire-news/177862923/arab-countries-take-a-new-direction-for-national-food-security.html>; <http://www.afedonline.org/Report2014/E/p44%20chp2.pdf>).

Improved farming system: The raisedbed technology was tested in 2014 for several crops, including wheat, cotton, berseem and sugarbeet in research conditions and on farmers' fields. For wheat and fababean crops, water savings were up to 25% and 20%, respectively. In addition, farmers increased their wheat grain yield by 25% and fababean by 15%. The associated farming cost under raisedbed was reduced by 25%. The project succeeded in increasing the amount of certified seed sold by the government and private companies by 8%, compared to 2009/2010. Thanks to the dissemination activities of CRP-DS in Nile Delta in 2014, the area grown on raisedbeds reached 31 times the area used in 2010 (29,167 ha in 2014 vs. 950 ha in 2010). (<http://www.agriculturesnetwork.org/what-we-do/training-documentation/cases/morocco-egypt-2013/egypt-learning-route/march-14-15-old-meets-new>)

<http://www.abc.org.br/IMG/pdf/doc-6117.pdf>

[http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual Cairo Egypt 5-5-2014.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual%20Cairo%20Egypt%205-5-2014.pdf)

http://www.ifad.org/operations/projects/regions/pn/pub/learning_routes.pdf

In addition:

- Promising lines of three lentil genotypes (Fami 29, 8852, FLIP 98 - 1 - 1 and FLIP - 67 L) were released at Gemmiza research station, and 15 kg of seeds were produced.
- At least nine tons of seed of three faba bean cultivars (Giza 51, Giza 370 and Giza 9) were produced.
- Increased crop production of field and vegetable crops, as a result of planting new adapted cultivars and applying the recommended technological packages.
- Integrated activities and integrated natural resource management led to improved farmer incomes, reduced costs, improved soil characteristics, and fertility for sustainable agriculture functions, and increased farmer 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.

C.4 Progress towards Impact (1/4 page)

Major impact is related to conservation agriculture where:

- Up-scaling of CA system within the ACIAR-CANA project to 1000 ha in semi-arid regions, and 150 ha in sub-humid region (<https://www.youtube.com/watch?v=P6FFbpP5Yw0>)
- 150 farmers adopted CA system
- The forage options mixture vetch-triticale and vetch adopted by farmers
- 500 farmers and NGOs trained on conservation agriculture (farm field school, field days and training)
- Local farmer association created, and three innovation platforms 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, Aired TV programs, leaflets, FFS, field days, trainings, and via websites.
- The interest showed by FAO towards upscaling of CA in CRP DS action sites would impact positively on farmer incomes. The MoA between FAO and ICARDA will be signed soon.

Among the impacts of ACIAR-CANA project, the following may be cited:

- **Science:** University teachers, researchers and students are increasingly involved in a number of scientific research activities dealing with different topics in relation with the CANA project. Some results of the CANA project have been shared in national and international congresses (communications and posters).
- **Community:** From the start of the project farmers have been encouraged to establish and develop contacts with other farmers and other members of their communities to seek solutions for the difficulties and problems they have encountered. These interactions have probably contributed to the creation of a local farm association, which is now involved in the joint purchasing of inputs, and the possibilities of machinery rental, etc.
- **Economic:** Although refined economic assessment is still underway, most farmers have concluded that one of the main advantages of the 'No Till' system lies in cost reductions through savings in labor, fuel consumption, and lower machinery use. Farmers who tested forage mixtures (vetch & triticale) have expressed interest, using it for dairy cattle. They registered a significant increase of

25% in milk yield and an improvement in the quality of the feed, as compared with conventional feed sources. The increase in milk yield is synonymous with economic gain and improvements in farmer livelihoods. The current high price of feed concentrates is another motivation for farmers to seek adequate forage alternatives that can be produced in their own environments.

- **Social:** The awareness about the need for farmer organizing has increased. A farmer association has been created around the platform. Farmers' degree of satisfaction should enhance a wider adoption of forage mixtures such as vetch/triticale by neighboring farmers, since the majority of Fernana farmers rely on dairy and sheep production as their main sources of their incomes.

D. GENDER RESEARCH ACHIEVEMENTS (1 page)

Women empowerment

- Within conservation agriculture initiatives in Tunisia (IFAD-CLCA project, ACIAR-CANA project), the following gender-specific capacity development impacts were achieved:
 - o 150 rural women trained on conservation agriculture (farm field school, field days and training)
 - o 1000 rural women (farmers, NGOs, students, researchers, extension service, policy makers, and private company) informed and targeted directly and indirectly by Radio broadcasts, Aired TV programs, leaflets, FFS, field days, training, and website.
- Creation of a women association for the development of the Zoghmar community, Sidi Bouzid, Tunisia (afdzoghmar@hotmail.com). Major objectives of this association are:
 - o Support individual and collective initiatives to create small scale development initiatives
 - o Contribute to the empowerment of women in Zoghmar
 - o Promote job opportunities for youth in Zoghmar
 - o Support government initiatives in implementing development projects
 - o Support an entrepreneurship spirit among youth
 - o Promote income-generating activities in Zoghmar
 - o Promote public-private partnerships
 - o Develop women's capacity development through trainings
 - o Reinforce women's representativeness in local and regional institutions.
- In Jordan, the creation of a local beneficiary women's committee (LBWC) for grey water use has the following mandates: To help local women network more effectively; to train other women (women-to-women learning approach); to help the project achieve the on-site training of households in best practices for grey water use; to work as a component of the project team under project coordination; and to introduce grey-water concepts within and outside the community. In terms of achievements, the LBWC has undertaken 28 training sessions with the wives of beneficiary households.
- In Jordan and Tunisia, 35-40% of technologies/NRM practices have an explicit target of women farmers.
- Initial exploratory visits and discussions with the Khreisha community and NCARE partners resulted in producing a village survey covering all 12 villages and a household survey which is conducted with 180 farmers (women and men) (<https://cgspace.cgiar.org/handle/10568/51890>). A report was produced identifying the constraints faced by women to benefit from micro-credit and training programs in the action site and recommendations to overcome these constraints. Another report was prepared identifying the work of organizations in Jordan which involves gender and agricultural development and can deliver development outcomes based on ICARDA's research findings.
- Medicinal plant cultivation reduces degradation and boosts household incomes in Jordan (<http://drylandsystems.cgiar.org/content/medicinal-plant-cultivation-reduces-degradation-and-boosts-household-incomes>)
- Promoting small-scale mechanized olive harvesting by women in the Karak action site (Jordan)

- Empowerment of women-led sheep milk processing units. Community inclusion: enhancing the resilience of dairy producers in southern Jordan.

Women's participation in the process of innovation platforms/value chain clusters in Tunisian site:

- Regarding the first site/commodity (Beni Khdeche / olive oil and olives), 43 males and 33 females participated in two learning alliances implemented during 2014. The Learning Alliances were established to identify constraints and opportunities related to agricultural production and the marketing of olives and olive oil in the olives sector, disaggregated by gender (including youth). These initiatives also identified priorities for future collaboration and participatory action for addressing these challenges.
- For the second site / commodity (Sidi Bouzid / Sidi Bouzid Sheep), two stakeholder workshops took place. The first one, implemented in December 2013, was for the launching of the innovation platform in Sidi Bouzid site (Zoghmar community). A total of 192 participants attended the workshop (38 women). Group discussions by gender (Women, men and youth) identified social, agricultural, economic, and environmental constraints faced by Zoghmar community. The second one in Zoghmar community had the objective to launch the sheep value chain in the Sidi Bouzid region; to identify strengths, weaknesses, opportunities and threats facing the sheep value chain, and to find ways and mechanisms to upgrade the sheep value chain in order to meet the expectations of farmers and to improve their income and livelihood. This included a total of 41 participants, of which 13 were females.
- In Jordan, learning was a central focus of other (gender sensitive) research undertaken in 2014 in both communities, where four learning alliances were piloted in collaboration with NCARE researchers. About 154 (119 males and 35 females) participants within the four learning alliance workshops identified constraints related to agricultural production and marketing across two principal commodities, olives and olive oil in El-Irak, and livestock and dairy products in Khrisha, disaggregated by gender (including youth). Priorities were also identified for future collaboration and participatory action for addressing these challenges and taking advantages from existing opportunities (<http://drylandsystems.cgiar.org/content/learning-alliances-case-studies-egypt-morocco-tunisia-and-jordan>).

Investigating the role of women in innovation

- In Morocco, two research studies were conducted in 2014: one on understanding the links between the factors which enable adoption and/or adaption of technologies, part of a cross CRP global study, entitled "Innovation and Development Through Transformation of Gender Norms in Agriculture and Natural Resource Management," and, another on "Gender Wage Gap: Working Conditions and Income of Agricultural Labour." The norms, agency, and innovations study was conducted in Betit, A'in Jom'a, and Sidi Sliman sites that differ in gender norms, economic, and biophysical dynamics to ensure diversified sampling. The findings of this study will inform how scientific and institutional interventions (related to crop rotations, women cooperatives, conservation agriculture, and new seeds varieties) in different contexts are affected, and in turn how they are also affected by gender norms and agency, as well as the role of innovations in moving households out of poverty. These considerations are important for IDOs (2, 4, 5 and 6). A workshop will be held with plant breeders and related scientists, and another workshop with development agencies and policy makers to deliver key learnings and co-plan subsequent research and interventions.
- The Gender Wage Gap study was similarly carried in the same sites to cover as diverse socio-economic, biophysical, and innovation dynamics as possible. Participant observation and interviews conducted in labour villages resulted in a survey questionnaire, which was administered with 200 men and 200 women labourers (APPENDIX 1). The survey aims at understanding the available work

opportunities in agriculture for men and women (full time and part time, during various times of the year), and how gender norms determine what is appropriate for men and for women to get paid for, and for how much. The ability of households to buy quality food is also assessed and perceptions of quality foods are explored. These research considerations are important for CRP DS IDOs (IDOs 2, 3, and 5). More broadly, the study also sheds light on operationalizing the proposed CGIAR Gender and Agriculture Research Network indicators for the Cross-CRP Gender and Empowerment IDO of Indicator 1: Women's Participation in Decision Making. A particular focus is placed on understanding who controls decisions behind participation in the labour force and expenditure of resulting incomes. A workshop will be held with policy makers and development organizations to relay findings and identify interventions that can deliver outcomes to empower women in their communities.

- Two main successes of integrating gender into biophysical scientists work include: 1) producing a three-year road plan for integrative research by the Gender Working Group (APPENDIX 2) with opportunities of yearly knowledge exchange and fine-tuning, and 2) the production of guidelines for assisting scientists in integrating gender into their work (APPENDIX 3). Some of the challenges in integrating gender are the limited staffing capacity to integrate gender into all biophysical scientific work. The guidelines were produced by the CRP to help scientists become proactive in integrating gender.
- The CRP gender mainstreaming performance in the Morocco region meets the requirement of gender mainstreaming through: 1) collecting sex-disaggregated data (for example the engendered baseline survey), 2) a norms study which acts as a benchmark to monitor the progress of the CRP, and 3) defining the gender wage gap (inequality) and underlying reasons in the target populations of the Saiss action site.
- In Egypt, research in different types of irrigated agriculture was conducted during May 2014-December 2014, drawing on participant observation, semi-structured interviews, and focus groups to understand how gender norms and agency affect womens' and mens' abilities to adopt innovations. Three surveys were designed. One qualitative survey attempted to explore in depth cases of women and men farmers. One village survey identified the types of households, and the roles of men and women in various crop types, market trends, and important agricultural events. A third survey with 400 farmers (200 women and 200 men) of differing land tenure status, who farm in different biophysical, institutional, and gender-norm contexts, was also completed and its data entered. This third survey is both qualitative and quantitative, and aims at quantifying the contribution of women to irrigation and agriculture more broadly, as well as identifying the most important innovations for men and for women, and the underlying reasons. The survey also addressed what types of assets these 400 farmers prefer to own. These considerations will shed light on important assets for men and women, and the underlying reasons. There has been a large body of literature during the past two decades linking women's empowerment and land ownership. However, there is limited amounts of land, and as such, understanding what other kinds of assets would empower women is crucial for realizing IDO 5.
- In Egypt, two main successes of integrating gender into biophysical scientists work include: 1), producing a three-year road plan for integrative research by the Gender Working Group with opportunities of yearly knowledge exchange and fine-tuning, and a narrow focus on three fields of technologies related to water, seeds, and livestock, and 2) the production of guidelines for assisting scientists in integrating gender into their work. Some of the challenges of integrating gender are the limited staffing capacity to integrate gender into all biophysical scientific work. The guidelines were produced by the CRP to help scientists become proactive in integrating gender. Each focal

point focused on one of the three areas of technologies related to water, seeds, and livestock to focus the research to a manageable level.

- The CRP gender mainstreaming performance in Egypt meets the requirement of gender mainstreaming through 1) collecting sex-disaggregated data (for example the 400 farmer survey), and through 2) identifying inequalities which lead to a gap between men and women input use, the adoption of innovations, participation in public life (such as water user associations), and asset ownership (beyond land).
- Two of the four national partners attending the Dead Sea working meeting were engaged in gender related research and provided a balanced perspective of the importance of the entry points defined for the piloting of an innovation platform within the Nile Delta site.
- Given the significant role of women in the production of vegetables within the Nile Delta site, and the role of nutrition for improved livelihoods and quality of life (particularly for children, expectant mothers and the elderly), there are significant gender implications for this initiative and ones which extend past the farm household.
- In Egypt, a system vulnerability study considered gender-differentiated data and analysis. Representatives of men, women, and youth participated in the focused group discussions where the problems faced by men, women and youth were identified. The questionnaire, which was developed for detailed surveys, will collect data and information according to men- and women-headed households, as well as utilization of labor by gender.
- In Egypt, and in collaboration with IWMI, discussions with communities and key informants resulted in producing surveys, which attempt to identify the gender-responsiveness of technologies, the roles of men and women in local agriculture, the links between gender, land tenure, and input use, and analysis of the extent of women's control over natural resources and participation in decision-making in different contexts. These considerations are particularly important to IDOs 2, 5, and 6. One of the main achievements of the study is showing that, contrary to widely-held assumptions in the literature and practice, which stipulate that women are actively involved in irrigation, their needs have been identified. A workshop with 5-10 scientists, and another with 3-5 development organizations and 3-5 policymakers, will be held to change mindsets and identify interventions towards responding to women's needs and roles.

E. PARTNERSHIPS BUILDING ACHIEVEMENTS (1/2 page)

1. Building partnership with NARS, development agencies, NGOs, and the private sector in Jordan, Tunisia, Egypt and Morocco.

National research systems:

Jordan:

- National Center for Agricultural Research and Extension (<http://www.ncare.gov.jo/>)

Egypt:

- ARC Egypt (Agricultural Research Center)
- University of Zagazig
- University of Ain Shams
- American University in Cairo.

Morocco:

- INRA: Institut National de la Recherche Agronomique, Morocco
- ENA Meknes : Ecole Nationale d'Agriculture de Meknes
- IAV Hassan II : Institut Agronomique et Vétérinaire Hassan II, Morocco.

Tunisia

- INRGREF: Institut National de la Recherche en Génie Rural, Eau et Forêt (National Research Institute of Rural Engineering, Water and Forest)
- IRA: Institut des Régions Arides (Arid Regions Institute)
- INRAT: Institut National de la Recherche Agronomique de Tunisie (National Agricultural Research Institute of Tunisia).

National development agencies

Jordan:

- Jordanian Ministry of Agriculture (<http://www.moa.gov.jo/ar-jo/home.aspx>)
- Agricultural Land Management Project Phase II (ARMP II) p. 2 (IFAD funded development project) (<http://www.slm.gov.jo/>).

Egypt:

- Ministry of Agriculture and Land Reclamation
- Ministry of Water Resources and Irrigation.

Morocco:

- Morocco Green Plan
- OCP Foundation
- Regional Direction of Agriculture of Meknes-Tafilalet (DRA)
- Provincial Direction of Agriculture of Meknes
- Extension Office (ONCA).

Tunisia

- **OEP:** Office de l'Elevage et des Pâturages (Livestock and Pasture Authority)
- **CRDA Sidi Bouzid and Medenine:** Commissariat Régional de Développement Agricole (Regional Directorate of Agricultural Development)
- **DG ACTA:** Direction Générale de l'Aménagement et de la Conservation des Terres Agricoles (General Directorate for Management and Conservation of Agricultural Land)
- **ODS:** Office de Développement du Sud (Office for South Development).

Farmers' associations and NGOs

Jordan:

- Majra wa Juaier farmers' association
- Bukaeen family cheese and Jameed making cooperative
- Alkheir wa alata cheese and Jameed making cooperative
- Alshuhadaa farmers' association
- NGO IRADA
- NGO Branches of Mercy.

Morocco:

- Seed growers association.

Tunisia:

- **GDA** : Groupement de Développement Agricole (Agricultural Development Association, NGO)
- **SMSA**: Société Mutuelle de Service Agricole (Cooperative for Agricultural Services)
- **ASPAE**: Association pour la Sauvegarde du Patrimoine Archéologique et Ethnographique de Boughrara (NGO)
- **ADESM**: Association des Etudes Stratégiques du Sud
- **AJZ** : Association des Jeunes de Zammour (Béni Khédache).

Egypt:

- 10th of Ramadan Water User Association
- Egyptian Company for Machineries and Metal works.

Bilateral projects mapped to CRP DS:

- Enhanced smallholder wheat-legume cropping systems to improve food security under changing climate in the drylands of West Asia and North Africa (<http://www.icarda.org/strengthening-wheat-legume-systems/teaser>)
- Middle East Water and Livelihood Initiative (<http://www.icarda.org/wli/>)
- Improving the Food Security and Climate Change Adaptability of Livestock Producers using the Rainfed Barley-based System in Iraq and Jordan (<http://www.icarda.org/barley-livestock-systems/teaser>)
- Phase III of the Australian-funded (ACIAR/AusAID), ICARDA-led project on conservation agriculture (<http://www.icarda.cgiar.org/blog/conservation-agriculture-project-phase-iii-launched#sthash.BS2v8QDJ.dpuf>)
- Conservation and Sustainable use of Dryland Agrobiodiversity in West Asia (Tunisia – Jordan) (IDO 4 NATURAL RESOURCES MANAGEMENT: More sustainable and equitable management of land, water resources, energy and biodiversity)
- Water and Livelihoods Initiative- Tunisia (USAID) (IDO4: Irrigation scheduling in saline conditions, water harvesting, Supplemental irrigation, alley cropping in rangelands, rangeland revitalization)
- Integrated Crop-Livestock Conservation Agriculture for Sustainable Intensification of Cereal-based Systems in North Africa and Central Asia (IFAD) (IDOs 1, 4 & 6)
- Enhancing the Conservation and Utilization of Plant Genetic Resources in Morocco (INRA Morocco) (IDO4)
- India – Morocco Food Legumes Initiative: Increasing Food Legumes Production by Small Farmers to Strengthen Food and Nutrition Security through Adoption of Improved Technologies and Governance within South-South Cooperation (IMFLI) (OCP-Foundation (Office Cherifian de Phosphate Foundation) (IDO 2&4)
- Integrated Natural Resources Management in Rainfed Agricultural Systems in Morocco (INRM) (INRA Morocco - CGIAR Contribution) (IDO 4)
- Optimizing Subsidiary Crop Applications in Rotations (OSCAR) (European Commission)
- Adapting Conservation Agriculture for Rapid Adoption by stallholder farmers in North Africa (CANA - ACIAR) - CSE-2011-025 (ACIAR) (IDO 4)
- Management of Water and Salinity in the Nile Delta: A Cross-scale Integrated Analysis of Efficiency and Equity Issues (ACIAR) (IDO 4)
- Integrated Agricultural Production Systems Nile Valley (IFAD) (IDO 2 & 6).

The most salient feature is the new partnership built between the CRP-DS Beni Khedache-Sidi Bouzid site and the new IFAD funded ***'Agro-pastoral and Associated Value Chain Development Project in the***

Governorate of Medenine, which is located within the CRP-DS site.

(http://operations.ifad.org/web/ifad/operations/country/project/tags/tunisia/1704/project_overview).

The total project cost is US\$ 36.9 million, which was approved on March 24, 2014. The goal of this project is to improve living conditions for vulnerable rural people and create new opportunities for employment by strengthening the resilience of agro-pastoral production systems. To that end, the project seeks to help public and private actors manage and develop local agro-pastoral value chains, including those for camelids and small ruminants.

The project has three components:

- Making agro-pastoral systems more resilient by reducing their vulnerability, improving production conditions for sheep, goats and camelids, and contributing to the sustainable management of pastoral resources
- Developing value chains linked to local agro-pastoral production systems, particularly for red meat (sheep, goat and camelid), and their byproducts (wool and leather), and creating incentives to develop a value chain for camel milk
- Building capacity to strengthen project management, coordination, and implementation by partners and beneficiaries.

The project will directly target small livestock breeders with fewer than 50 head of small ruminants or five head of camelids, and smallholder farmers with less than 20 ha of rainfed rangeland and other land. It will also target young people and women for start-ups of small income-generating projects and microenterprises.

2. Building partnerships with advanced research institutions and other centers

- CRP Water, Land and Ecosystems (<http://www.cgiar.org/consortium-news/cgiar-research-program-water-land-and-ecosystem-launched-today-at-planet-under-pressure/>);
- CRP Policies, Institutions and Markets (<http://www.ifpri.org/book-8234/ourwork/division/policies-institutions-and-markets-crp2>)
- WLI project: The partnership also includes community members through a participatory approach so that researchers can assure they are accountable to stakeholders. The WLI and CRP have several of the same partners, and also add partnerships from USAID, USDA and US Universities.
- In gender research, several initiatives are under discussion:
 - o Partnership with the University of Western Ontario, Canada, was developed with Dr. Bipasha Baruah (Canada Research Chair in International Women's Issues). The collaboration will result in a comparative paper between land rights in Egypt and India.
 - o Partnership was initiated with Eileen Alma the Director of the International Center for Women's Leadership at St. Francis Xavier University in Nova Scotia, Canada. The center expressed interest in offering leadership training for promising women in the region and writing funding proposals.
 - o Discussions were initiated with the American University of Beirut's graduate program, RCODE (Rural Community Development), to participate in the capacity development of students through lectures on campus and joint supervision on theses, especially through ICARDA's AFESD Scholarship Grants.
 - o As for CGIAR Center partnerships, ICARDA's Cairo office is currently hosting IWMI's office in Cairo, and conducting research work on gender in 2014. This work resulted in a successful CGIAR Gender Post Doc award to CRP DS that addresses the question of how water-related and agricultural innovations can support positive changes in gender relations and norms (enabling factors for women's empowerment) and livelihood improvements. The postdoc will work on these gender topics for 2015 and 2016. A first

publication is being prepared to present initial findings in the Journal of Culture and Agriculture.

- FAO-ICARDA International Technical Cooperation Network on Cactus (<http://www.cactusnet.org/>).

The most salient features in building partnerships with advanced institutions are:

1. The joint training workshop on system analysis and modeling with SupAgro, IAM Montpellier, University of Wageningen, and the University of Madrid
2. The joint training workshop on grazing lands with CIHEAM/IAM Zaragoza
3. The development of a research initiative to be funded by Agropolis, Montpellier (the SIAMG Project).

The SIMAG (Sustainable Intensification of Mediterranean Agriculture under Global changes) Project

This initiative will target the two action sites of Morocco and Tunisia. After meetings and discussions with the UMR System (Montpellier), INRA, IAM Montpellier, CIRAD and the LabEx Agro (Montpellier), a draft concept note has been submitted to Agropolis who accepted the principle of funding this initiative.

SIMAG aims at developing generic and flexible methods for: i) assessing the impacts of diversity at various scales on the eco-efficiency and stability of agricultural systems (AS), and its contribution to their sustainable intensification, ii) designing, in a participatory approach, adaptation strategies including innovations based on diversity (from crop to region) and best suited for some global change scenarios; iii) developing a set of indicators to assess the sustainability of these alternative AS; iv) modeling the more strategic AS and their performances, particularly in terms of eco-efficiency, stability and sustainability, and v) disseminating information and building the capacity of local partners and young scientists through training and the transfer of knowledge. SIMAG involves around ten participants other than Labex Agro research units. The Science Council (SC) of Agropolis Foundation welcomed the SIMAG initiative and authorized the development of a full project proposal for submission by March 2015. As can be seen from the list below, the reaction of the SC was generally favorable with some highlights on areas for improvement.

The development of the project is on-going with the following work packages:

- **WP1. Conception and management of the SIMAG framework for the analysis and design of dryland agricultural systems:**
 - Design of the SIMAG framework (diagnosis, scenario building, integrated assessment)
 - Management of the scientific agenda of the project (WP2 to WP6)
 - Development of scientific partnerships
 - Scientific advisory board.
- **WP2. Multi-scale diagnosis of diversity in relation with productivity, efficiency, and the resilience of agricultural systems:**
 - Task 2.1: A multiscale approach of diversity and performances of AS
 - Task 2.2: Levers of sustainable intensification at various scales, and conditions of out-scaling
 - Task 2.3: Present diversity and performances of AS in three case studies.
- **WP3. Scenarios of sustainable intensification of AS based on diversity at various scales**
 - Task 3.1: A method of participative building of scenarios of agricultural systems
 - Task 3.2: Co-construction of scenarios of sustainable intensification in three case studies.
- **WP4. Integrated assessment of scenarios of sustainable intensification**
 - Task 4.1: Models, typologies and data bases for the production of indicators of assessment of agricultural production and its externalities

- Task 4.2: Integrated assessment in three case studies.
- **WP5. Coordination of diagnosis, and participative scenario building and assessment in 3 case studies**
 - Construction of local partnerships
 - Data bases, local references
 - Coordination of participative activities.
- **WP6. Dissemination and capacity building**
 - Stakeholders, researchers, students.

F. CAPACITY BUILDING (1/2 page)

Impressive efforts for capacity development have been implemented with:

- Short-term training of trainers: 384, 19% women
- Short term training of farmers: 5447, 16 % women
- MSc degree training: 34, 41% women
- PhD degree training: 43, 51% women
- In addition, two regional training workshops have been achieved: (i) a training workshop on system analysis and modeling and (ii) a training workshop on grazing lands.

1. Short-term training

Trainings facilitated at CRP Action Site level	Short-term training of trainers				Short-term trainings of farmers: field days, farmer field schools, workshops			
	M	W	Total	% W	M	W	Total	% W
Action Site Jordan	61	22	83	27%	1462	420	1882	22%
Action Site Egypt	72	17	89	19%	150	30	180	17%
Action Sites Tunisia	120	13	133	9%	2469	420	2889	17%
Action Sites Morocco	58	21	79	27%	386	10	396	3%
Total	311	73	384	19%	4467	880	5347	16%

M=Men and W=Women

2. Degree students newly-enrolled in 2014

Trainings facilitated at CRP Action Site level	MSc Students				PhD Students			
	M	W	Total	% W	M	W	Total	% W
Action Site Jordan	6	4	10	40%	0	6	6	100%
Action Site Egypt	0	0	0	0%	1	1	2	50%
Action Sites Tunisia	12	6	18	33%	13	14	27	52%
Action Sites Morocco	2	4	6	67%	7	1	8	13%
Sub total	20	14	34	41%	21	22	43	51%

3. Detailed capacity development by site

a) Action Site: Jordan

Capacity building achievements (summary table). Detailed information is reported in the Annex table.

Trainings facilitated by CRP	Short-term training of trainers (2-5 days)		Short-term trainings of farmers: field days, farmer field schools, workshops		Long-term trainings Degree Students newly Enrolled (BSc, MSc, PhD)	
	Male	Female	Male	Female	Male	Female
Number of participants	61	22	1462	420	6	10

- 12 NCARE staff were trained on collecting sex-disaggregated data (eight women and four men)
- Two women graduate students below 34 were trained on collecting sex-disaggregated data
- Agro-ecological Monitoring group training course (Amman, Jordan). Number of males trained: Six (three each from Jordan and Tunisia)
- Alley cropping system group training course (Amman, Jordan). Number of males trained: Six (three each from Jordan and Tunisia)
- Training course for NARS on the sustainable improvement of forage resources in drylands (Zaragoza, Spain), Number of males trained: Three (one from Jordan and two from Tunisia)
- Sheep breeding: introducing scientific methods to monitor and record flock performance (Nine males)

- Advanced training on milk analysis (two males)
- Training of male farmers.

Topic	Number
Rangeland and grazing management	119
Sheep and goats management	92
Cropping & CA	185
Climate change mitigation	147
Farm management	33
Grey water	34
IPM	137
Irrigation	28
Olive Production	505
Organic Farming	10
Post-harvest	19
Small Ruminants Health	27
Tree Production	126

- Agro-ecological Monitoring group training course (Amman, Jordan), Jordan (two) and Tunisia (three) – women –see *Regional Training course 2014*
- Regional group training organized on “promoting in situ/on-farm conservation of plant genetic resources” in Addis Ababa, Ethiopia, for 11 days in December 2014 –see *Regional Training Courses 2014*
- Sheep breeding: introducing scientific methods to monitor and record flock performance (three females)
- Advanced training on milk analysis (five females)
- Training of farmers women.

Topic	Number
Rangeland and grazing management	7
Climate change mitigation	15
CA & Cropping	26
Aromatic and medicinal plants	42
Olive Production	91
Food processing	114
Grey water	125

- One MSc Student (men) at University of Jordan (Mr. Moatasam AL Gaied): Evaluation of the effect of water harvesting interventions on vegetation cover and productivity of rangeland in Jordan, using digital imaging and remote sensing techniques, case study in Al-Majdiyya
- One MSc Student (men) at Hashemite University (Mr. Alaadinne AL Hyasat): Enhancing sustainability and fodder production of lowland pastures in arid agro-pastoral ecosystems of Jordan

- One MSc Student (women) at the Mediterranean Agronomic Institute of Chania. Chania, Greece Accomplished 2014. (Maha Addas, Syrian Shanklish and its quality)
- One PhD student (woman) in Palermo University (Ms. Sawsan Hassan): Promote Cactus Pear as Multiple Purpose Crop to Improve Livelihoods of Poor Farmers in West Asia.
- One MSc (woman) on Adapting SWAT Model to Assess the Impact of Harvesting Interventions on Runoff and Soil Erosion in an Arid Environment: Case of Jordan (completed)
- Two MSc students (women) from Florida University in the field of small scale grey water system installation and promotion
- On-the-Job training for four PhD students (women) from Florida University in the field of small scale grey water system installation and promotion
- Ms. Amelia Elizabeth (ALTZ-STAMM), Ph.D. (female) An Assessment of Water User Associations in the Jordan Valley, September 2014 –May 2015
- Mr. Motasem Elkayed , Jordan, M.Sc., Evaluation of the Effect of Water Harvesting Interventions on Vegetation Cover and Productivity of Drought-resistant Shrubs in Majidyia – Jordan, 01 September 2014 –31 August 2015
- Mr. Yahia Mustafa Bani-Kalaf, Jordan , M.Sc., Stabilizing and Increasing Rainfed Wheat Yields with Supplemental Irrigation in a Mediterranean Climate, 2014-2015
- Mr. Almouthana Aziz Hassan, Syria, MSc, Comparative Economic Analysis Between the Production and Use of Traditional Tuber and Micro Tuber for Plant Tissue Culture Technology in the Production of Selected Crops, 2014-2015
- Mr. Nibal Al Dibiat, MSc, Adapting Strategies with Food Shortage Problems, 2014-2015.

b) Action site: Egypt

Trainings facilitated by CRP	Short-term training of trainers (2-5 days)		Short-term trainings of farmers: field days, farmer field schools, workshops		Long-term trainings Degree Students Newly Enrolled (MSc, PhD)	
	Male	Female	Male	Female	Male	Female
Number of participants	72	17	150	30	1	1

Several capacity development activities were undertaken in 2014, including field days, harvest days, and technical training sessions. Technical training workshops were organized for researchers, extension officers, and farming communities.

- In collaboration with FAO, young scientists were trained on AquaCrop Model - *see Regional Training courses*.
- In collaboration with ARC-Egypt, three researchers and ten extension officers (including five women) were trained on raisedbed technology (RB) and how to transfer this technology to farmers.
- About 180 famers (150 men and 30 women) through various field days, harvest days and farmer schools were trained on RB. The farmer training started with key farmers, then core farmers, and finally whole farmer communities.
- Training was conducted for men and women focused on agriculture and development from different parts of the Arab world on integrating gender issues in their development work.
- An ARC team of 30 (five women and 25 men) enumerators, which also included graduate students, were trained in collecting sex-disaggregated data and also in probing why the answers were as such (APPENDIX 3). The head of the women unit at ARC was trained in analyzing qualitative data (APPENDIX 2).
- Four national partner focal points from ARC-Egypt participated in a four-day regional working meeting at the Dead Sea, Jordan, in September 2014, along with other CRP-DS national partners from Morocco, Tunisia and Jordan who are engaged in innovation platform initiatives: <http://drylandsystems.cgiar.org/events/innovation-platforms-dryland-systems-development-strategic-framework>

<http://drylandsystems.cgiar.org/content/opening-session-initiating-development-innovation-platform-framework>

<http://drylandsystems.cgiar.org/content/innovation-platforms-what-innovation>

One objective of this workshop was to impart knowledge on international experience with innovation platforms, as well as differing conceptualizations of innovation platforms. A second objective was for national focal points to agree upon a mutual definition and understanding of innovation platforms within the NAWA region, and to initiate discussion on entry points within the action sites in their country of origin.

- Five MSc and PhD students (on going: two at Kfer Sheik University, two at Ain Shams University, and one at Cairo University) are working under the umbrella of water and salinity management in the Nile Delta. Drs. Atef Swelam Biju George from ICARDA and Dr. Francois Molle from IWMI formed part of the supervision teams. The students have developed their workplans and have commenced their research activities in the field. It is expected that the capacity of the young Egyptian scientists will benefit from their interactions with scientists from ICARDA and IWMI.
- Two staff members from ARC (men) and NWRC recently visited Australia and participated in the International River Basin Symposium held in Canberra. It was a great opportunity for those researchers to interact with the scientific community in Australia.
- A number of meetings were held with the project stakeholders and farmers' groups to enhance the relationship to eventually transfer the knowledge base developed in this project, once the analysis is completed.
- A training course on the management of salt-affected soil, targeted at young researchers and technicians for up to 25 participants for five days (22 men and 3 women), was organized at Sakha Agriculture Research Station.
- One training course on socio-economics and the management of fish ponds, focusing on young researchers and scientists involved in CRP-DS activities, was organized. *See Regional Training courses 2014.*
- A member of the field-level intervention attended a four week water productivity and salinity management training course, funded by JICA in Amman, Jordan – *please refer to Regional Training Courses 2014.*
- A number of informal and on-the-job training programs on the use of equipment to monitor flow, groundwater levels, and salinity were organized and involved 15 participants, two of whom were women. This helped to increase the overall capacity among partner organizations on the use of various instruments.
- One scientist (female) from the national research team participated in a training course on "Impact Assessment and Livelihood Analysis in Systems Research," organized by SEPRP, and held in Amman, Jordan, during 02-14 November 2014. *See Regional Training courses 2014.*
- Four research assistants (two women and two men) were trained on collecting sex-desegregated data.
- Ms. Hanadi Abdelrazig, Sudan, PhD, Knowledge, attit. & practices of vegetable farmers in Sudan, 2014-2016.
- Mr. Mohamed Y Daffalla, Sudan, PhD, Bed planting as water saving technique for wheat production in vertisol soil of new halfa scheme, E. Sudan, 2014-2016.

b) Action Site: Morocco

Trainings facilitated by CRP	Short-term training of trainers (2-5 days)		Short-term trainings of farmers: field days, farmer field schools, workshops		Long-term trainings Degree Students Newly Enrolled (MSc, PhD)	
	Male	Female	Male	Female	Male	Female
Number of participants	58	21	386	10	9	5

- Agro-ecological monitoring held in Amman, April 3-12, 2014 – see *Regional Training courses*.
- Crop modelling for identification of promising agricultural technologies: the use of the APSIM model, June 2014- see *Regional Training courses 2014*.
- Innovation platforms; On-farm trials: design and analysis. (ICARDA), Amman, September 2014 - see *Regional Training courses 2014*.
- 12 INRA staff were trained on collecting sex-disaggregated data (six men and six women), six were below the age of 34.
- Two Research assistants (women) were trained on collecting sex-disaggregated data.
- Five (two men and three young women) were trained on the methodology of Norms, Agency, and Innovations in Agriculture and NRM methodology (a cross-CRP study).
- Members of CRP DS from INRA Morocco participated in the International Congress on Natural Resources in Morocco, June 2014.
- Members of CRP DS from INRA Morocco participated in the International Congress on Food Legume Rotation under CA in Canada, July 2014.
- Members of CRP DS from INRA Morocco participated in the International Congress on Environment and Natural Resources in Morocco, September 2014.
- Participation of the NARS activity leader (one male) in the 5th Phosphorus in Soils and Plants Symposium and the Sustainable Phosphorus Summit in Montpellier (September 2014).
- Six courses on Water and Land Productivity have been organized in different locations involving: 300 farmers (all men) and 60 development agents, technicians, and engineers benefitted from the courses (ten women and 50 men).
- 65 farmers (35 farmers at Ain Jemaa and 30 farmers at Sidi Slimane Moule El Kifane (all men) were trained on Cereal and food legumes-IPM.
- Two Farmers Field School for diagnosis of broomrape on faba bean established to use chemical management at Ain Jemaaa innovation Platform. A total of 60 farmers (all men) were trained.
- One workshop was implemented in collaboration with the value chain cluster activity. The objective of this workshop is to identify the research priorities for the two identified communities. Then, to categorize the main constraints and opportunities for the two selected commodities such as the onion and potatoes. The total number of participants (farmers, universities, cooperatives, decision makers and researchers) at this event was 24 (all of them males).
- A total of four training courses benefiting 66 participants from six countries have been organized. The areas covered were variety maintenance, quality seed production by pioneer farmers, seed cleaning and treatment, and seed business management – See *Regional Training courses 2014*.
- Two PhD students (one man and one woman) are preparing a PhD thesis on CA in relation with CRP-DS- CA activity.
- Three PhD Students (all men) are involved, either fully or partially, on economic modeling.
- A female MSc student was supervised under the Livestock productivity activity. The follow-up of farms was implemented as part of the Master of Science thesis conducted by the student.
- One MSc student (male) thesis on Cereal and Food Legume Systems Adaptation.
- One Master thesis (male) and one training for a BSc (male) student on Water and Land Productivity was achieved.
- One researcher (male) participated with an oral presentation in an international conference.

- In addition, three MSc students (females) from the ENA Meknes finalized their final study project “*Projets de Fin d’Etudes-PFE*” in order to obtain an Engineering Diploma in the field of agricultural economics. The thematic areas covered by these agricultural economics engineers are the following:
 - PFE 1: Feasibility Study of a Dry Onion Development Project in the Area of El Hajeb
 - PFE 2: Feasibility Study of an Aggregation Project for an Integrated Development of the Dry Onion Industry in El-Hajeb community
 - PFE 3: Contribution to the Evaluation of Energy Consumption of Onion and Potato in the province of El Hajeb.
- Mr. Rachid Boulamtat, Morocco, Ph.D. Management of Chickpea Pod Borer using Host Plant Resistance and Botanical Pesticides, 01 June 2014-30 September 2015.
- Mr Marouane JBILOU, Morocco Ph.D., Water Resources modeling of the Oum Er Rbia Basin using Global Hydrological Datasets, May 2014 – December 2017.
- Mr. Fouad Elame, Morocco, PhD, Towards a Sustainable System of Governance: Strategies for integrated Water Management, 2014-2016.

c) Action site: Tunisia

Trainings facilitated by CRP	Short-term training of trainers (2-5 days)		Short-term trainings of farmers: field days, farmer field schools, workshops		Long-term trainings Degree Students Newly Enrolled (MSc, PhD)	
	Male	Female	Male	Female	Male	Female
Number of participants	120	13	2469	420	25	20

Training of NARS scientists (120 men)

- Agro-ecological Monitoring group training course (Amman, Jordan). Number of males trained: six (three each from Jordan and Tunisia) – *See Region Training courses*.
- Alley cropping system group training course (Amman, Jordan). Number of males trained: six (three each from Jordan and Tunisia) – *See Regional training courses 2014*.
- Training course for NARS on the sustainable improvement of forage resources in drylands, jointly organized by CIHEAM/IAMZ Zaragoza and ICARDA/CRP-DS (Zaragoza, Spain): involved 18 male scientists from different CRP-DS flagships (http://www.iamz.ciheam.org/ingles/cursos14-15/RecursosForrajes_ING.pdf) – *See Regional Training Courses 2014*.
- Phyto-ecological Data Analysis for Assessing Rangeland Productivity, group training course (Mednine, Tunisia). Number of males participants: 20 (all from Tunisia) - *See Regional Training Courses 2014*.
- Regional group training organized on “Promoting In-situ/On-farm Conservation of Plant Genetic Resources” in Addis Ababa, Ethiopia for 11 days in December 2014 – *See Regional Training Courses 2014*.
- An introductory SWAT workshop was organized and coordinated by ICARDA and Texas A&M University in Amman (January 2014). Ten participants from targeted sites attended the workshop and links were established to facilitate the use of SWAT across the three sites.
- A Tunisian WLI Stakeholders Meeting was conducted, involving policy makers, farmers, and local NGO’s to gather community needs before implementing land and water conservation practices in Tunisia (25 participants).
- Four scientists participated in training on grey water reuse in Jordan (July 2014).
- On-the-job training for selection of soil and water conservation techniques (ten participants).
- On-the-job training on the implementation of hill lakes (four scientists, three farmers), a farmer initiative with support from NARS and ICARDA, with NGO participation
- Sheep breeding: introducing scientific methods to monitor and record flock performance (nine males).

- Thirteen investigators from INRAT and IRA trained on surveys and data collection.
- Training of four specialists from INRAT and IRA on data entry.
- Advanced training on milk analysis (two males).
- Six extension agents and three scientists attended training programs in Morocco.
- Five team members attended training programs in Australia (machinery, risk management, weed management, forage crops).
- Six visits of Australian experts.
- Two team members of the world congress on CA in Canada in June 2014.
- Feed Assessment Tool (FEAST) training was conducted by Dr. Jane Wamatu (ICARDA-DSIPS). It was held from October 7-9, 2013, at INRAT with the participation of 21 scientists.

Farmer training (2469 men)

- Managing feed resources in Jordan's agro-pastoral production systems: 21 farmers from Jordan.
- Grazing Management under Water Harvesting Systems: 23 farmers from Jordan.
- Promote cactus pear as multiple purpose crop to improve the livelihood of farmers: 49 farmers from Jordan.
- On-site training days for households on grey water use were conducted to present different issues related to water management and the best management practices dealing with the different aspects of grey water reuse (irrigation scheduling, grey water treatment, water quality): 27 families, 125 members from local community trained.
- Rangeland and grazing management (119).
- Sheep and goats management (92).
- CA & cropping (185).
- Climate change mitigation (147).
- Farm management (33).
- Grey water (34).
- IPM (137).
- Irrigation (28).
- Olive Production (505).
- Organic Farming (10).
- Post-harvest (19).
- Small Ruminants Health (27).
- Tree Production (126).
- Six training programs organized with the attendance of 284 stakeholders (ACIAR-CANA Project).
- Five farmer field schools organized with close to 400 farmers (ACIAR-CANA Project).
- Feed Assessment Tool (FEAST) training was conducted by Dr. Jane Wamatu (ICARDA-DSIPS). It was held from October 7-9 October 2013 at INRAT, with the participation of 20 farmers.
- Field Day: Integrated Crop-Livestock Conservation Agriculture. Wheat and forage in rotation, Chouarnia, Makthar Delegation, Siliana Governorate. Tuesday 20th of May 2014. More than 65 people attended, among them 34 farmers, 14 technicians, and administrators.
- Field Day – Zero Tillage Seeder Calibration (Sept 2014). More than 20 farmers attended this field day.
- 500 farmers and NGOs trained on conservation agriculture (farm field school, field days and training), within the ACIAR-CANA Project in Tunisia.
- Local farmer associations created and three innovation platforms implemented in Zoghmar, Tunisia.
- 15,000 people (farmers, NGOs, students, researchers, extension service, policy makers, and private company) informed and targeted directly and indirectly by Radio broadcasts, aired TV programs, leaflets, FFS, field days, training, and websites within the ACIAR-CANA Project in Tunisia.

Training NARS scientists (13 women):

- Training course for NARS on the sustainable improvement of forage resources in drylands, jointly organized by CIHEAM/IAMZ Zaragoza and ICARDA/CRP-DS (Zaragoza, Spain): 11 female scientists from different CRP-DS flagships – *See Regional Training courses 2014*.
- Managing feed resources in Jordan's agro-pastoral production systems: four female participants (Jordan) – *See Regional Training Courses 2014*.
- Grazing Management under Water Harvesting Systems: seven female participants (Jordan).
- Promote cactus pear as multiple purpose crop to improve the livelihood of farmers: one female participant (Jordan).
- Advanced training on milk analysis (five females).

Training of farmers (420 women)

- Rangeland and grazing management (7).
- Climate change mitigation (15).
- CA & Cropping (26).
- Aromatic and medicinal plants (42).
- Olive Production (91).
- Food processing (114).
- 26 training courses for local community members have been organized by women associations: 125 members from the local community were trained (grey water).

PhD (male): 13

- One PhD Student at Tsukuba University (Japan) (Mr. Ben Othman M.).
- M. Ben Zaied: enrolled for PhD at University of Carthage who received trainings.
- Sghaier: enrolled for PhD at the University of Gabès.
- PHD student Walid ben Khelifa: SWAT Modeling on Water Balance in Arid Regions, INRGREF, INAT, ICARDA.
- Ridha Ibidhi (PhD): Determination of Water Productivity and Water Footprint for Small Ruminants Raised in Different Production Systems in Tunisia (Faculty of Sciences of Bizerte, Tunisia).
- Anis Gamoudi (PhD): Matching Sheep Genotypes to Improve Productivity and Quality End Products.
- One PhD student trained on soil analysis and bio-physical modeling.
- H. Jarray: enrolled for PhD at University of Sfax and received trainings.
- A. Hachani: enrolled for PhD at University of Carthage and received trainings.
- Mohamed Abdeladhim: enrolled for PhD at the University of Sfax (Management and Economic Sciences Faculty).
- Three Moroccan PhD students are being trained (two in Morocco Hassan II University on bio-physical modeling, and one in France on systems research in general, and bio-economic modelling in particular).

MSc (male): 12

- One MSc Student at Faculté des Sciences de Gabès, Tunisie (Mr. Boubakri A.).
- One MSc Student at Faculté des Sciences de Gabès, Tunisie (Mr. Tlili A.).
- MSc. Student. Mohamed Bouhlal: Impact of Grey Water Reuse on Water, Soil and Plants.
- Seif Allah Abbassi (Msc Degree): Fattening Practices and Implications for a Breeding Program.
- One MSc Student at University of Jordan (Mr. Moatasam AL Gaied): Evaluation of the Effect of Water Harvesting Interventions on Vegetation Cover and Productivity of Rangeland in Jordan, using Digital Imaging and Remote Sensing Techniques, case study Al-Majidyia.
- One MSc Student at Hashemite University (Mr. Alaadinne Al Hyasat): Enhancing Sustainability and Fodder Production of Lowland Pastures in Arid Agro-pastoral Ecosystems in Jordan.
- S. Harabi: enrolled for MSc at the University of Tunis.

- N. Bakkay: enrolled for MSc at University of Carthage.
- F. Mokh: enrolled for PhD at the University of Carthage, and received trainings.
- S. Enneb: enrolled for MSc at University of Carthage.
- W. Tlig : enrolled for MSc at University of Carthage.
- Ben Sedrine D. :MSc Student at CIHEAM/IAMM.

PhD (female): 14

- One PhD student in Palermo University (Ms. Sawsan Hassan).
- Enneb Sameh (2014) – INAT: Irrigation déficitaire à l'eau salée de la fève en milieu aride : Effet sur la croissance, le rendement la productivité de l'eau et la salinité du sol.
- Tlig Warda (2014) – INAT: Irrigation déficitaire à l'eau salée : étude de cas de la carotte irriguée à la goutte à goutte dans le Sud Tunisien.
- Samia Hrabî – Fac Sc. Tunis : Délimitation des zones de recharge des nappes dans l'observatoire de la Jeffara.
- Naweb Halifa – INAT: Changement du comportement des ouvrages en gabion dans le bassin versant d'Oum Zessar.
- Nessrine Bakkey – INAT : Etude des risques d'inondation dans la région de Tataouine.
- Amel Hachani - UNU: Contribution to the Study of Water Stress on Olive Growing under the Effect of Climate Change in South East of Tunisia.
- Chirine Cherif (PhD): Sheep Response to Trace Minerals in Diet – Feeding Behavior, Digestion and Production Performance (Faculty of Sciences of Bizerte, Tunisia).
- Mariem Rouatbi (PhD): Interactions between Parasite Infestation and Reproduction in Sheep and Goats (Institut National Agronomique de Tunisie, Tunisia).
- Afef Merai: Antagonism Linking Milk Production and Reproduction in some Mediterranean Dairy Sheep Breeds (Institut National Agronomique de Tunisie, Tunisia).
- Yosra Ressaïsi (PhD): Livestock Farming System Modeling under Harsh Conditions (ESA- Chott Mariem).
- Imène Baazaoui (PhD): Impact of MAPs on Meat Sheep Quality and Animal Health Status (Faculty of Sciences of Bizerte, Tunisia).
- Ms. Selma Etteieb, Tunisia, PhD, Improving Pastoral Community Livelihoods Through Sustainable Rangeland Management in the Middle East, 2014-2016.
- Ms. Wala Jlassi, Tunisia, PhD, Crop Growth Modelling and Optimizing the Water and Fertilizer Uses in Conservation Agriculture for Durum Wheat, 2014-2016.

MSc (female): 6

- One MSc student in Brazil (Ms. Nefzaoui Meriam).
- One MSc Student at Mediterranean Agronomic Institute of Chania. Chania, Greece. Accomplished 2014. (Maha Addas, Syrian Shanklish and its quality).
- One MSc on adapting SWAT model to assess the impact of harvesting interventions on runoff and soil erosion in an arid environment: case of Jordan (completed).
- Two MSc students from Florida University in the field of small scale grey water system installation and promotion.
- Besma Rebhi (Msc Degree): Mapping of Small Ruminants under Different Production Systems in Sidi-Bouazid Governorate.

4. Forage resources in drylands: major drivers and future scenarios (Zaragoza (Spain), 27-31 October 2014)

A course on "Forage resources in drylands: Major drivers and future scenarios" was jointly organized by CRP Dryland System and the Mediterranean Agricultural Institute of Zaragoza (IAMZ)/CIHEAM in Zaragoza (Spain), 27 to 31 October 2014. Grasslands constitute one of the most important ecosystems in drylands.

These areas are no longer seen exclusively as livestock production enterprises, but as ecosystems providing multiple services that are extremely important for the global environment and human well-being. These include the provision of forage, increased water infiltration and soil fertility, carbon sequestration, and tourism and recreation, to name just a few. Thereby, appropriate grassland management is also an adaptation strategy for climate change, as it mitigates the risks associated with prolonged drought periods and unreliable rains that characterise drylands in the Mediterranean region and elsewhere. As such, there is an urgent need to assess the consequences of climate and land use changes on the provision of ecosystem services by dryland grasslands, and to develop realistic future scenarios for these ecosystems. Such scenarios will help to design appropriate policies for better management of natural resources under global environmental change. The objective of this course is to provide participants with a detailed assessment of the multiple ecosystem services provided by dryland grasslands, with a particular emphasis on the production of forage in Mediterranean regions. The course will introduce the main factors driving the structure, functioning and the provision of ecosystem services, and will discuss future scenarios for them. At the end of the course, participants:

- Had a broad understanding of the main ecosystem services provided by dryland grasslands.
- Understood the major abiotic, biotic and socio-economic factors driving the structure and functioning of dryland grasslands.
- Knew the main factors limiting forage production and other services.
- Gained knowledge on the main strategies for improving and restoring the provision of ecosystem services.
- Became aware of the consequences of climate and land use changes for grasslands and the services they provide.
- Gained new insights on likely future scenarios for the provision of ecosystem services.

Outstanding lecturers participated in the course. They were: H. BEN SALEM, ICARDA/DSIPS, Aman (Jordan); DELGADO, CITA-GA, Zaragoza (Spain); M. LOUHAICHI, ICARDA/DSIPS, Amman (Jordan); F. MAESTRE, University of Rey Juan Carlos, Madrid (Spain); NEFZAOU, ICARDA, Tunis (Tunisia); PORQUEDDU, CNR-ISPAA, Sassari (Italy); J. PUIGDEFÁBREGAS, CSIC-EEZA, Almería (Spain); O. SALA, Arizona State Univ., Tempe (US); F. VOLAIRE, CEFÉ-CNRS, Montpellier (France).

A group of carefully-selected trainees, numbering 30 participants, were closely linked to drylands and to dryland system CRP. They are from different regions, including North Africa and West Asia, West and East Africa, South Asia, and Europe.

The training focused on the following topics.

- **Major drivers of ecosystem structure and functioning in drylands, with special focus in Mediterranean environments** (*Fernando T. Maestre, Universidad Rey Juan Carlos, Semiarid Ecology and Global Change Lab, Móstoles, Spain*).
- **Ecosystem services: Land and biodiversity conservation** (*Fernando T. Maestre, Universidad Rey Juan Carlos, Semiarid Ecology and Global Change Lab, Móstoles, Spain*).
- **The use of fodder shrubs and trees, alley cropping** (*Fergus Sinclair, ICRAF*)
- **Strategies of forage species to cope with summer drought/designing resilient and sustainable grasslands for a drier future** (*Florence Volaire, INRA, CEFÉ/CNRS, Montpellier, France*)
- **Ecosystem services in grasslands** (*Osvaldo Sala, School of Life Sciences, Arizona State University, USA*)
- **Ecosystem Services in Grasslands: Paradigm Change from Supply to Demand** (*Osvaldo Sala, School of Life Sciences, Arizona State University, USA*)
- **Global Scenarios** (*Osvaldo Sala, School of Life Sciences, Arizona State University, USA*)
- **Global Biodiversity Scenarios/ Socio-economic and Ecological Drivers Affecting Biodiversity Change in the Next Century** (*Osvaldo Sala, School of Life Sciences, Arizona State University, USA*)

- **Forage Resources in Drylands: Major Drivers and Future Scenarios, Consequences of Climate and Land Use Changes on Grassland Ecosystem Services** (*Juan Puigdefabregas, Estación Experimental de Zonas Áridas (CSIC): puigdefa@eeza.csic.es*)
- **Major Drivers and Constraints of Forage Production Environmental Drivers of Plant Production in Drylands** (*Claudio Porqueddu – CNR-ISPAAAM – Sassari, Italy. c.porqueddu@cspm.ss.cnr.it, Ali Nefzaoui, CRP-DS North Africa and West Asia Flagship coordinator, a.nefzaoui@cgiar.org*)
- **The Role of Forage Legumes and their Strategic Use in an Integrated Management System** (*Claudio Porqueddu – CNR-ISPAAAM – Sassari, Italy. c.porqueddu@cspm.ss.cnr.it*)
- **The use of Mixtures of Different Functional Groups** (*Claudio Porqueddu – CNR-ISPAAAM – Sassari, Italy. c.porqueddu@cspm.ss.cnr.it*)
- **Rehabilitation and Restoration of Ecosystem Services in Grasslands** (*Mounir Louhaichi, ICARDA, m.louhaichi@cgiar.org*)
- **Integrated Crop-Livestock Production Systems** (*Hichem BEN SALEM, Director DSIPS Program – ICARDA, h.bensalem@cgiar.org*)

5. Sustainable intensification and resilience of Agricultural Systems: An Integrated Assessment and Modeling of Agricultural Systems (IAAS) Approach (November 24-28, 2014 – Hammamet – Tunisia)

An international training course on integrated system assessments and modeling approaches to sustainable intensification and resilience of agricultural systems was organized by ICARDA CRP - Dryland Systems, in Hammamet (Tunisia), 24-28 November, 2014. The course benefited from insightful input lectures, given by renowned scientists of the field from Montpellier-SupAgro, CIHEAM-IAMM, Wageningen University, Technical University of Madrid, and ICARDA. Course participants included researchers from CRP-DS, its R&D partners and other system-focused CRPs such as Humidtropics. More than half of the participants were young and female researchers. The course structure was orientated towards achieving intermediate development outcomes of the CRP, such as resilient livelihoods in marginal areas, sustainably improved income, more social equity in access to foods, and management of natural resources in dry areas. The course content included three interrelated parts:

- (1) Systematic presentations and discussions on concepts and methods for integrated system assessment and modeling of agricultural systems from field to regional scales
- (2) Case-based demonstration on how a model-based integrated systems approach performs an ex-ante impact assessment, thereby supporting decision making processes to improve agricultural profitability and environmental sustainability
- (3) Discussions on how the integrated systems approach can be used for structuring the complexity of agricultural systems in the CRP-DS's Mediterranean action sites, helping to answer research questions on options for improving livelihood resilience and enhancing sustainable intensification.

Input lectures and exciting discussions demonstrated that solving complex problems related to agricultural system sustainability genuinely requires a multi-scale and multi-dimensional research approach. This is a common challenge in agricultural systems research. Relevant systems concepts and theories (e.g. theories of complex systems, system hierarchy) and protocols can help researchers to structure the complexity of target agricultural systems to identify problems and design problem-solving oriented agricultural systems research. The course used SEAMLESS (System for Environmental and Agricultural Modeling: Linking European Science and Society) as a demonstrative integrative framework. SEAMLESS serves firstly as a multi-scale and multi-dimensional approach to structure complex agricultural systems, and secondly, as a framework for linking quantitative system models linked to an integrated framework that can substitute mental models of decision makers and stakeholders involved in policy making.

Participants benefited from a generic five-step protocol to conceptualize a problem and integrate it into an agricultural system analysis and research design. The protocol supported researchers' identification of

sustainability problems, potential drivers, research questions, hypotheses, system conceptualization, and used tools (ranging from qualitative/expert-based to sophisticated quantitative tools) and impact indicators that allowed the measurement of system-level outcomes. The use of the protocol ensured a coherent relationship among these steps. Structurally, the agricultural system can be conceptualized as it consists of decision-making, technical, and bio-physical sub-systems. The functional analysis of agricultural systems clarify the material flows, and farmers' actions that connect the system components and help determine the whole system performance. With an orientation to the defined problem, research questions, and successful indicators expected, as well as the available resources (e.g. time, available skills), participants can now initiate a better organized discussion process on the selection of the right tools that can be effectively used within an integrated assessment framework to support policy-making toward achieve the CRP's development outcomes. At best, the agricultural system analysis and research should be done in an iterative and participatory manner to maximize science-practice complementarity and co-benefits.

An important lesson learnt from the course is that integrated system assessment and modeling essentially needs integrated databases. While there is no surprise that the database necessarily covers a range of socio-economic and biophysical data, the two important features learnt are (1) the common spatial and scale framework, and (2) common farm typology. The first feature focuses on the identification of the central level of analysis/modeling, the lower level of components/processes give insights for explaining system performance, and the upper level allows key drivers to be represented. The second common feature focuses on relevant farm typologies that help represent farm heterogeneity across an action site.

Provided the generic system approach and framework, course participants learned how agro-ecological and bio-economic models can be used in an interactive manner within the integrated assessment framework to substitute limited human mental capacity in policy decision-making, which often involves the answering of different WHAT-IF questions that require an understanding and evaluation of different trade-offs. The learning aims are not concrete methods or technologies of these quantitative models, but rather the "boundary" features of these models in the context of integrated assessments, such as: model assumptions, underlying theories, level of specification and application, data requirements and outputs, utilities that models can help to integrate assessments relevant to expected research outcomes, and related technical challenges that one should be aware of during application. Agro-ecological models are useful for measuring agricultural production and environmental impacts - both are important for sustainable intensification assessment. Bio-economic models can bring both multi-disciplinary information and consistency in farmers' decision-making and account for tradeoffs and synergies between agricultural production and the environment. The coupling of these two model types can give a consistent framework to undertake agricultural policy assessments, taking into account the effects of external shocks or stresses, and helping stakeholders analyze the nexus of food, water, land and energy.

The process of this five-day course was extremely exciting with effective facilitation by trainers, interactive discussions, and dynamic working groups. Each group/participant expressed their expectations on how this training would help to redesign his activity in CRP-DS by using a systems approach. Interactive discussions and group works were conducted in parallel with the input lectures. Besides critical, but constructive discussions on the generic integrated framework approach and disciplinary models, much of the discussions focused on how concepts and approaches could be mobilized to analyze sustainable intensification and resilience in the two test cases. The Meknes-Sais Action site (Morocco) has opportunities for sustainable intensification of vegetable and cereal production, but viable options for effectively leveraging positive changes are still unknown. The Beni Khedache-Sidi Bouzid Action Site (Tunisia) is facing high poverty, inappropriate assets base, and high livelihood vulnerability. The participants were also concerned about how to represent social and institutional features in the dry areas studied - in the modeled system and assessing important social aspects in the modeled outcomes (e.g. the poverty context, social equities in benefiting production and environmental services across communities, especially women and children). Fulfilling these challenging tasks would need other complementary approaches/tools, such as agent-based analysis and modeling, which can be an important instrument in the tools box needed by the CRP.

At the end of the workshop participants appreciated and developed a personal basic understanding of how an integrated research framework and its components can contribute towards developing a systems analysis, including identification of suitable approaches, design and the development of methods and assessment of innovations within the CRP-DS program. Certainly, developing an in-depth understanding of specific model components is beyond the scope of this course, which is just the beginning of a journey to that expected brain gain.

Participant suggestions to CRP-DS PMU:

- (i) To consider this group as the embryo for a thematic research on system analysis and modeling; this group may be reinforced by the appointment of additional scientists from CG centers involved, and selected NARS
- (ii) To plan for in-depth workshops by flagship that may be implemented by the same team of experts aiming to draft the skeleton of specific models.

G. RISK MANAGEMENT (less than 1/2 page)

1. *Uncertainty in CRP-DS funding:* The budget cut operated for 2015 will impact on the NAWA region and on ICARDA's credibility toward its NARS partners. This is the case for Jordan. Initiatives and activities being undertaken within the *Jordan* action site hold potential for knowledge sharing and beneficial impact upon quality of life for marginalized communities in NAWA and beyond. Suspension of funding in 2015 for the Jordan action site has clear implications for the ability to re-engage at a later date, given issues of diminished trust with communities, civil society partners, and national partners. In addition, and if goodwill of the community allows, resumption of initiatives after a period of lapse is surely to incur greater costs and therefore a larger call for funding. There are good arguments, therefore, in favor of bridge funding for 2015, which permits a small number of strategic initiatives to be maintained until more secure financial resources are mobilized in order to ramp up activities and initiatives.
2. *Environment-related risks:*
 - Climate *related* risks: Climate related risk like extremely dry years cannot be mitigated but can impede outcomes and impacts
 - Political environment risks: Instability in the Middle East region is a great threat to the successful adoption of innovations (like CA practices) by farmers. We have already witnessed this in Iraq and Syria. This project created a dedicated, core group of farmers, extension agents and scientists in Iraq and Syria. This dedicated group is still leading the CA promotion and machinery development efforts despite the difficulties.
3. *Research management related risks:*
 - At the System Level, the main risk lies in the inherent complexity of systems research. The holistic approach, which involves research for development, and which involves a wide range of partners, poses challenges of producing the research products but also engaging in a process of multi-stakeholder partnership to validate and scale out the use of these products.
 - Risks inherent to ICARDA as a leading Center: Delayed budget release, heavy financial management procedures, and low commitment of ICARDA scientists.
4. *Risks related to NARS and country partners:*
 - As example, the key assumption for the successful implementation of conservation agriculture is that governments will invest in CA and enact favorable policies, and that manufacturers invest in low-cost zero till seeders.
 - **Seed system and dissemination:** VBSE is a business-oriented undertaking involving risk taking under an enabling policy environment. Such undertaking requires strong commitment, and technical and financial support from authorities. The VBSE development is linked to

structured seed system studies and active field days to sensitize policy makers and to promote policy changes.

- **Gender:** Policy makers may not be interested in empowering women or increasing their income due to economic constraints. In anticipation of these risks, win-win arguments will be used to not only address women's empowerment, but also policy-makers' own priorities.

H. LESSONS LEARNED (1 page)

- Without the full involvement of NARS partners, CRP-DS will not be successful in the NAWA region. Indeed, NARS are contributing to the implementation of the program financially and scientifically. Similarly, without the full involvement and dedication of ICARDA scientists, the program will not reach its objectives; and here more efforts are needed.
- Involving advanced research Institutions (ARIs) is beneficial to all parties. This has been clearly demonstrated through the two initiatives achieved during 2014 by involving CIHEAM (IAMM, IAMZ), SupAgro (Montpellier, France), LabEx Agro (Montpellier, France), and others (see section Building partnership).
- The uncertainty in funding and the fluctuating long-term vision of CRP-DS may contribute to impediments of the CRP-DS.
- Implementing systems research is not an easy task and requires a change in mindsets and better collaboration between all CG centers. The change in mindsets needs time, and boosting the collaboration between centers must be part of the agenda of CRP-DS PMU.
- A common template for reporting is used and may need to be revised to better fit with systems research. The current template is adequate for commodity-oriented research, but may be not be adequate for systems research.

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

CRPs concer ned by this indicat or	Indicator	Glossary/guidelines for measuring the indicator	Deviati on narrati ve	2014		2015
				Target	Actual	Target
KNOWLEDGE, TOOLS, DATA						
All	1. Number of flagship “products” produced by CRP	<ul style="list-style-type: none">- 8 products related to rangeland monitoring and management, namely: Identification and characterization of key rangeland species well suited for rangeland rehabilitation in the drylands; Developed new techniques for rangeland mapping using near earth remote sensing; Evaluated impact of rest and/or grazing management on rangeland vegetation; Capacity development of stakeholders on various aspects on rangeland ecology and management including ecological monitoring and agro-forestry practices; Promoting cactus pear (<i>Opuntia ficus-indica</i>) as an alternative and sustainable livestock feed in West Asia; Local knowledge assessment focusing on climate change and gender aspects in West Asia (Badia); Published the PREDICTS database: a global database of how local terrestrial biodiversity responds to human impacts; Published manuals for rangeland monitoring and assessment- Climate Change and Drought Atlas for Jordan (IFAD-funded and ICARDA-implemented Project: “Improving food security and climate change adaptability of livestock producers using the Rainfed Barley-based system in Iraq and Jordan”). The Atlas provides concrete answers to specific questions: "where will it get hotter and drier, by how much and when, what other effects can be expected?". The Atlas, with its set of 339 maps, offers a very comprehensive characterization of past and expected climatic change in Jordan in terms of changes of temperature and precipitation patterns, changes in atmospheric water demand, climatic zones and growing periods, historical drought and wetness periods and long-term precipitation and temperature trends (2010-2040). The results of a trend analysis of coarse-gridded precipitation data for the period 1901–2010, obtained from the Global Precipitation Climatology Center, indicates that the decline in annual precipitation has been going on for a long time and that these trends are significant in all of Jordan- The modified Jameed processing method (OFID and IFAD funded projects taken up within CRP DS). The improved processing package developed by ICARDA is now outscaled to 15 villages in El-Karak action site. Each of these villages is typically composed of 10,000 inhabitants and the sheep population for each village can go up to 20,000 milking ewes. The targeted milk processing units are women-led and employ women. Therefore, more than 90 women are directly impacted by this work. The new processing package, while preserving the authenticity of the indigenous end products, save on energy, water, increase income by 8% and allow a higher diversification of the processed products.- Development of a raisedbed machine together with a full technical package helped farmers saving 50% of seed rate, reduced 25% of farming cost, achieved 25% of water saving and increased the yield by 25% in the Nile Delta. The area grown on raisedbed reached 31 times the area which was grown in 2010: http://ifad-un.blogspot.com/2013/03/old-meets-new.html	+230 %	10	23	15

		<p>http://www.procasur.org/biblioteca/index.php/features/learning-routes/learning-routes-1/2013-1/sustainable-water-management-in-egypt/120-sharkia-systematisation-document-eng/file</p> <p>http://www.icarda.org/new-technologies-food-security-arab-countries</p> <p>http://www.scidev.net/global/biotechnology/news/egypt-wheat-experiment-produces-dramatic-yield-boost.html</p> <p>http://www.agriculturesnetwork.org/what-we-do/training-documentation/cases/morocco-egypt-2013/egypt-learning-route/march-14-15-old-meets-new</p> <p>http://www.abc.org.br/IMG/pdf/doc-6117.pdf</p> <p>http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual%20Cairo%20Egypt%205-5-2014.pdf</p> <p>http://www.ifad.org/operations/projects/regions/pn/pub/learning_routes.pdf</p> <ul style="list-style-type: none"> - Salinity and orobanche tolerant fababean cultivars were identified and dissemination of the improved agronomic package in farmer was started in 2014. The improved production package included the following: Orobanche tolerant cultivars Giza 843 and Misr 3 compared to the Orobanchi susceptible Giza 3; Planting under zero tillage system; Delaying sowing date to mid-November; Seed rate (80-90 kg/ha); and Spraying with Glyphosate at reduced rate 34 g/ha + NPK two times at flowering and 3 weeks after. The results showed that Faba bean seed yield in demonstration fields was higher than that at farmer fields. Cultivars Giza-843, Misr-3 and Giza-3 seed yield means in the demonstration fields were higher than farmer fields by 39, 59 and 67%, respectively. - Three lentil genotypes (Fami 29, 8852, FLIP 98 - 1 - 1 and FLIP - 67 L) promising lines were released at Gemmiza research station and 15 kg of seeds were produced. - Two value chain reports for olives and sheep in Tunisia/ Two learning alliances initiated; <p>http://drylandsystems.cgiar.org/content/learning-alliances-sustaining-adoption-new-innovations</p> <p>http://drylandsystems.cgiar.org/content/learning-alliances-case-studies-egypt-morocco-tunisia-and-jordan</p> <ul style="list-style-type: none"> - Four innovation platforms struck; <p>http://drylandsystems.cgiar.org/events/innovation-platforms-dryland-systems-development-strategic-framework</p> <p>http://drylandsystems.cgiar.org/content/opening-session-initiating-development-innovation-platform-framework</p> <p>http://drylandsystems.cgiar.org/content/innovation-platforms-what-innovation</p> <ul style="list-style-type: none"> - Influence of acacia trees on near-surface soil hydraulic properties in arid Tunisia. By improving the near-surface soil hydraulic properties, <i>Acacia raddiana</i> trees can positively affect the water availability for the below-canopy herbaceous cover, which is of crucial importance in water-limited environments (De Boever M., D. Gabriels, M. Ouessar, W. Cornelis; 2014. Influence of acacia trees on near-surface soil hydraulic properties in arid Tunisia. Land Degradation & Development, published online: 18 AUG 2014 DOI: 10.1002/ldr.2302) - Impact of climate change on olive in Medenine, Tunisia. A model based on hydraulic balance and taking into account some parameters as slope, soil type, climate conditions has been developed. Three CC scenarios have been investigated for the periods 2020-2050. The extension 'ModelBuilder' of ARCGIS allowed automatic combination of inputs. Maps of vulnerability of olive to CC was possible when the water balance software "BUDGET" is coupled to the system. Simulations show a clear decrease of areas suitable to olive tree cropping in the Medenine Governorate. (Ouessar M., A. Zerrim 2014. Analyse de la vulnérabilité de l'olivieraie au changement climatique (CC) dans le gouvernorat de Médenine moyennant un outil SIG. Revue des Régions Arides - Numéro Spécial, 33: 33-37) 				
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		<ul style="list-style-type: none"> - Modeling tool to evaluate and assess desertification risk. A spatial and integrated approach/method in order to better assess and target actions against desertification risks in the Tunisian arid zones consisting in overlaying two spatial information plans by ArcGIS. The first plan concerns the output of the environmental modelling LEIS (Local Environment Information System). The second plan arises from a mapping of location of actions already implemented against desertification risks in the study area. The approach, applied with the cooperation of the local actors, showed its simplicity and its acceptance. It tries to help to take measures susceptible to favor an effective and better targeted intervention to combat desertification (M. Fétoui and al., 2014. Revue des Régions Arides - Numéro Spécial- n° 33 (1/2014)) - Impact analysis of water harvesting techniques (WHT) on rural livelihood conditions under climatic and socio-economic scenario and profitability of investing in WHT in Oum Zessar, Tunisia (WLI Tunisia). An Integrated Impact assessment (IIA) framework, based Extended cost-benefit analysis (ECBA) and Sustainable Livelihoods Approach (SLA) shows that Social capital is the most dominating followed by physical capital mainly in Beni Khedache. Financial capital seems to be not representative due to the low crop and livestock incomes. Projections indicate that the livelihood assets will be changed during 2013-2030 period with the slow increment of physical, human and social capital. Natural capital will decrease due to agricultural intensification and poor land management. The ECBA shows that WHT works are profitable with an IRR of 24 % and an NPV (at 12 % discount rate) of 1380 US \$. The inclusion in the analysis of the off-site benefits improves the economic profitability to 1680 US\$. The WHT works are apparently beneficial at private and social levels for local population within the watershed (Abdeladhim M., Sghaier M., Ouessar M. and Ben Zaied M. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014) - Participatory assessment of land and water policies in Beni Khedache, Tunisia. Land privatization and agricultural subsidies has had negative effects such as land fragmentation and increasing pressure on water and land resources. Most of the traditional agrarian system has disappeared and replaced by a system characterized by competition for natural resources, and in particular land and water use. Several policies have influenced NRM in Tunisia. In fact, Natural capital decreases while social capital increases more rapidly than human, physical and financial capitals. The stakeholder's expectation of the impact in the future for the scenario of full implementation of Water and Soil Conservation (WSC) strategy was very positive with higher scores for overall indicators. WSC technologies, Protected land, Biodiversity, Capacity to adapt and Knowledge & skills indicators got a higher score (Ouessar Mohamed, Bechir Riadh, Abdeladhim Mohamed Arbi, Telleria Roberto. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014) - Assessing the vulnerability of agro-pastoral systems in Tunisian arid zones (food security, coping strategies and adaptation to drought). The farming system is family-based oriented toward self-consumption and to feed livestock. Households save by precaution a part of products in order to use it during dry years. In fact, the food strategy varies from one year to another depending on the rainfall of the year. The olive oil is the first agricultural product to be able to meet the food needs of households and in the second rank cereal products. Livestock products are generally intended for sale and are regarded as the main activity of generating farm income of households. The analysis shows that the production of olive is sufficient to cover need of the HH; in rainy years the average production of cereal crops is sufficient and insufficient during drought years; in dry years rangelands do not cover animal needs and herders are forced to purchase feeds. Off-farm activities appear as an essential factor to compensate the decrease of agricultural income (Mondher Fetoui, Riadh Béchir, Mohamed AbdelAdhim & Mongi Sghaier, 2014. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014) 				
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		<ul style="list-style-type: none"> - Impact of deficit irrigation with saline water on yield, soil salinization and water productivity of barley in arid regions of Tunisia. Studies were conducted for two years to determine the effects of irrigation regimes with saline water (7.6 dS/m) on soil salinity, yield and water productivity of barley in the arid region of Tunisia. Barley was grown on a sandy soil and drip-irrigated with well water having an ECi of 7.6 dS/m. The results showed that soil salinity was significantly affected by irrigation treatments. Higher soil salinity was maintained in the root zone with DI-50 treatment than full irrigation (FI). DI-Dev, DI-Dev+Mat and DI-Mat treatments resulted also in low ECe values. This highest soil salinity accompanied with DI-50 treatment reduced barley yield significantly. However, regulated deficit treatments provide acceptable yields compared to full irrigation treatment. The lowest WP values occurred under the full irrigation treatment, while the highest values were obtained under 50 % deficit irrigation treatment. ((Fathia El Mokh, Kamel Nagaz Revue des Régions Arides - Numéro Spécial - n° 35 (3/2014) - Actes du 4ème Meeting International "Aridoculture et Cultures Oasisennes : Gestion des Ressources et Applications Biotechnologiques en Aridoculture et Cultures Sahariennes : perspectives pour un développement durable des zones arides, 17-19/12/2013). - Investigating anti-oxidant properties of camel milk in Southern Tunisia. The aim of this study was to investigate the radical-scavenging properties towards a stable radical cation, ABTS, of Camelus dromedaries whey proteins (CWP) separated onto a cation-exchanger by fast protein liquid chromatography. The highest activities were found for CWP and fraction F1 mainly composed of α-lactalbumin. (El Hatmi Halima, Jrad Zeineb, Khorchani Touhami, Dary Annie and Girardet Jean-Michel 2014. Fast protein liquid chromatography of camel α-lactalbumin fraction with radical scavenging activity. Emir. J. Food Agric. 2014. 26 (4): 309-316 ; doi: 10.9755/ejfa.v26i4.16178) 				
All	2. % of flagship products produced that have explicit target of women farmers/NRM managers	<ul style="list-style-type: none"> - <u>Community inclusion: enhancing the resilience of dairy producers in southern Jordan</u> - Climate change - Introduction of small-scale olive harvesters signifies that less time is spent tending to, and harvesting, olive trees also means additional time women can devote to other livelihood strategies – including dairy production and the growing of vegetables, helping to raise overall household incomes. Quantified outputs expected for next harvesting season. - Grey water installation and use led by local beneficiary women's committee (LBWC) for grey water use promoting women-to-women learning approach; help the project achieve the on-site training of the households in best practices for grey water use. - Cactus pear (<i>Opuntia ficus-indica</i>) as an alternative and sustainable livestock feed in West Asia - Camel milk anti-oxidant (Tunisia) 	+150 %		23 %	40 %
All	3. % of flagship products produced that have been assessed for likely gender-disaggregated impact	<ul style="list-style-type: none"> - Sheep milk processing and marketing - Olive harvesting and processing - Grey water installation and use 			13 %	25 %
All	4. Number of "tools" produced by CRP	Blogs/ Websites (24) <ul style="list-style-type: none"> - Blog on cactus as a sustainable and versatile plant for the dry areas: http://icarda.org/drylandstinking/Cactus-sustainable-and-versatile-plant-dry-areas - Blog (Tunisia): on cactus as a multipurpose species (fodder, cash crop) (CGIAR Talking Science Competition): http://dialogues.cgiar.org/blog/how-much-cactus-is-in-your-lipstick/ 			24 blogs	20 blogs

		<ul style="list-style-type: none"> - Blog on reversing degradation in rangelands by promoting sustainable forage species: http://www.icarda.org/reversing-degradation-rangelands-promoting-sustainable-grassforage-species - Blog (Jordan): Field day on Grazing Management <i>under Water Harvesting Systems</i>: http://www.icarda.org/wli/news_Field-day-on-Grazing-Management.html - Blog (Jordan): Managing feed resources in Jordan's agro-pastoral production systems: http://www.icarda.org/wli/news_Field-day-on-Grazing-Management.html - Website (all Flagships): FAO-ICARDA International Technical Cooperation Network on Cactus Pear http://www.cactusnetwork.org/home.html - Blog on ICARDA/OFID funded project inception workshop to improve rangeland managements of more fertile dryland rangelands (landscape depressions): http://drylandsystems.cgiar.org/content/promoting-sustainable-solutions-overcome-feed-shortages - Blog on a farmer field day on managing feed resources in an agro-pastoral production system (Jordan): http://drylandsystems.cgiar.org/content/managing-feed-resources-jordan%E2%80%99s-agro-pastoral-production-systems - Sheep milk Value addition - cactus as a sustainable and versatile plant for the dry areas - reversing degradation in rangelands by promoting sustainable forage species - Field day on Grazing Management under Water Harvesting Systems - Managing feed resources in Jordan's agro-pastoral production systems - Community inclusion: enhancing the resilience of dairy producers in southern Jordan - Deficit irrigation: a policy option for natural resource planning - Scaling-up Dryland Systems' Innovations - Investing in Rangelands: Agro-Ecological monitoring of Jordanian 'action sites' - Reinforcing best-bet grazing practices - Sheep breeding: introducing scientific methods to monitor and record flock performance - Exploring ways to increase flock fertility in Jordanian action sites - Medicinal plant cultivation reduces degradation and boosts household incomes - Conservation agriculture: higher yields, lower costs - Changing mindsets - ACIAR-CANA Project website (Conservation agriculture) http://www.cana-project.org/ <p>Leaflets/ Factsheets (15)</p> <ul style="list-style-type: none"> - Cactus pear utilization and management in English and Arabic - Louhaichi M. and M. Abu Zanat. 2014. Mediterranean saltbush: mitigating highly saline soils. ICARDA's publication (Factsheet) http://www.icarda.org/sites/default/files/Mediterranean-saltbush-Factsheet.pdf - Louhaichi M. and A.O. Belgacem. 2014. <i>Cenchrus ciliaris</i>: A resilient, drought-tolerant forage species to alleviate feed shortages and feeding costs. ICARDA's publication (Factsheet) http://www.icarda.org/sites/default/files/Bufel-grass-Factsheet.pdf - Louhaichi M. and M. Neffati. Louhaichi. 2014. <i>Retama raetam</i>: A resilient, pioneer plant for rangeland rehabilitation and stable ecosystems. ICARDA's publication (Factsheet) http://www.icarda.org/sites/default/files/Retama-Shrub-Fact-Sheet.pdf - Louhaichi M. and A.O. Belgacem. 2014. <i>Stipa lagascae</i>: A heavy, adaptable grass that provides 				15 leaflets / factsheets	20 leaflets/ factsheets
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		<p>high quality hay. ICARDA's publication (Factsheet) http://www.icarda.org/sites/default/files/Stipa-lagascae-Factsheet.pdf</p> <ul style="list-style-type: none"> - Ben Salem, H. and M. Louhaichi. 2014. Promoting Cactus as an alternative and sustainable livestock feed. ICARDA's publication (Factsheet) : http://www.icarda.cgiar.org/sites/default/files/Cactus-for-Livestock-Fact-WEB.pdf - Improving Jameed processing (Ar and En) - Cactus pear utilization and management in English and Arabic - Integrated Crop-Livestock Conservation Agriculture for Sustainable Intensification of Cereal-based Systems in North Africa and Central Asia (2013 - 2016). - Conservation Agriculture for Sustainable Intensification of Cereal-based Systems in North Africa (in Arabic). - Conservation Agriculture and Livestock in the semi-arid regions of Tunisia (in Arabic). - Orobanche control (Arabic version) (ACIAR-CANA Project) - Integrated Crops-Livestock Conservation Agriculture for Sustainable Intensification of Cereal-based Systems in North Africa and Central Asia (English and Arabic version) (IFAD-CLCA Project) - L'Agriculture de Conservation pour une intensification durable des systèmes de production céréalières en Afrique du Nord (French and Arabic version) (ACIAR-CANA Project) - Agriculture de Conservation et Elevage en zone semi-aride de la Tunisie (French and Arabic version) (ACIAR-CANA Project) <p>Manuals (10)</p> <ul style="list-style-type: none"> - Five VegMeasure User's Manuals (Field data collection, Image Positioning Tool, Accuracy Assessment, Image Classification, Image Processing Using Algorithms) - Boufaroua M., Balawneh A. 2014. Booklet on safe grey water reuse at Households - Boufaroua M., Balawneh A. 2014. Productive use of grey water in home farming - Improving Jameed processing poster for producers (Ar and En) - Enhancing sheep reproduction through cactus-based feed diets - Weed management guide for conservation agriculture (Arabic version) under press (ACIAR-CANA Project) <p>Reports (27)</p> <ul style="list-style-type: none"> - Local Knowledge Assessment Focusing on Climate Change and Gender Aspects (Jordan): https://apps.icarda.org/wsInternet/wsInternet.aspx/DownloadFileToLocal?filePath=Dryland_Systems/Local_Knowledge_Assessment_Focusing_on_Climate_Change_and_Gender_Aspects.pdf&fileName=Local_Knowledge_Assessment_Focusing_on_Climate_Change_and_Gender_Aspects.pdf - Characterization of Zoghmar site: Diagnosis and analysis of the current situation - Diagnosis of the current situation of the hill lake watershed Kef Hamem - Ghiglieri G., A. Carletti, M. Ouessar 2014. Conception technique du système de Recharge Artificielle de l'aquifère du Trias (Oum Zessar, Tunisia). Wadis-Mar project Report. - van den Bosch S., C. Ritsema, R. Hessel, M. Ouessar 2014. Determining the saturated vertical hydraulic conductivity of retention basins in the Oum Zessar watershed, Southern Tunisia. Scientific Report, WAHARA project. - Ghiglieri G., A. Carletti, M. Ouessar 2014. Conception technique du système de Recharge Artificielle de l'aquifère du Trias (Oum Zessar, Tunisia). Wadis-Mar project Report. 			10 manuals	10 manuals
					27 reports	20 reports

		<ul style="list-style-type: none"> - K. Nagaz, F. El Mokh (2014). Report on agronomic activities in the Oum Zessar watershed, Southern Tunisia. Scientific Report, WADIS-MAR project. - Ouessar M., M. Ben Zaied, H. Chakroun, B. Essifi, A. Assas, F. Abdelli, M. Blaghji (eds) 2014. Actes du Séminaire sur les Systèmes d'Information Géographique pour l'Etude de l'Environnement. Revue des Régions Arides - Numéro Spécial 33 (1/2014), 142 pp. - A policy brief will be presented to the Ministry of Agriculture of Jordan. The purpose is to feed the current discussion on barley subsidies in the country - A complete farm household bio-economic model that depicts small holder farmers' decision making in a systems context combining crops, livestock and the environment under different policy, market and climate change scenarios - Loss S., Haddad A., Desbiolles J., Cicek H., Piggin C., (2015). The Practical Implementation of Conservation Agriculture in the Middle East. ICARDA publication. (In preparation) - <u>Development of conservation cropping systems in the drylands of northern Iraq</u> - <u>Barley-livestock systems - better climate change resilience for farmers</u> - Assessing impacts of land policies on the production systems and livelihoods in the Southeast of Tunisia: http://drylandsystems.cgiar.org/sites/default/files/Policy%20report%20IRA%20BK%20site%20Tunisia_Final.pdf - Local knowledge of pastoral and agro-pastoral communities for managing uncertainties in Southeastern Tunisia- the case of Béni Khédache: http://drylandsystems.cgiar.org/sites/default/files/Progress%20Report_Local%20Knowledge_IRA%202014.pdf - System vulnerability analysis – General methodology, data collection, field work and workplan: http://drylandsystems.cgiar.org/sites/default/files/Progress%20Report_System%20Vulnerability_IRA%20BKSite%20TUN.pdf - The olive oil value chain in Béni Khédache, Southeastern Tunisia – Potential, constraints and main operators: http://drylandsystems.cgiar.org/sites/default/files/Report%20IRA%202014_Value%20chain%20olive%20oil%20BK Tunisia_CRP-DS_F.pdf - Explanatory Report of Buffalo's Milk Value Chain in Egypt: Study Case in Nubaria, Sharkia and Port Said Regio (Egypt). By Mohamed Abd Alnaby Dosokki; Ragab Hassan Ahmed and Hisham Alam, Boubaker Dhehibi; Shinan Kassam; Girma Tesfahun Kassie and Aden Aw-Hassan - Explanatory Report of Orange Value Chain in Egypt: Study Case in Nubaria Region (Egypt) by Mohamed Abd Alnaby Dosokki; Ragab Hassan Ahmed and Hisham Alam; Boubaker Dhehibi; Shinan Kassam; Girma Tesfahun Kassie and Aden Aw-Hassan - Value Chain Analysis of Tomatoes In Sharkia Governorate (Egypt) by Mohamed Abd Alnaby Dosokki; Ragab Hassan Ahmed and Hisham Alam; Boubaker Dhehibi; Shinan Kassam; Girma Tesfahun Kassie and Aden Aw-Hassan - Analysis of the Sheep value chain in Zoghmar community, Governorate of Sidi Bouzid (Tunisia) by Dhraief MZ, Oueslati M, Daly H, Abassi S, Baazaoui I, Bedhief S.; Boubaker Dhehibi; Shinan Kassam and Aden Aw-Hassan - The olive oil value chain in Beni Khedache site, Médenine, South East of Tunisia: Potential, constraints and main operators by Abdeladhim MA., Riadh B., Fetoui M., Sghaier M.; Boubaker Dhehibi; Shinan Kassam and Aden Aw-Hassan - The onion crop situation in the zone of El Hajeb (Morocco) by Khalil Allali, Boubaker Dhehibi; Shinan 				
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		<p>Kassam; Girma Tesfahun Kassie and Aden Aw-Hassan</p> <ul style="list-style-type: none"> - Situation of the potato crop (Morocco) by Khalil Allali, Boubaker Dhehibi; Shinan Kassam; Girma Tesfahun Kassie and Aden Aw-Hassan - Etude de faisabilité du projet d'agrégation pour la valorisation de l'oignon dans la zone d'El Hajeb (Morocco) by Khalil Allali, Boubaker Dhehibi; Shinan Kassam; Girma Tesfahun Kassie and Aden Aw-Hassan - Projet de valorisation de la culture de pomme de terre dans la zone d'El Hajeb (Morocco): Etude de faisabilité du projet by Khalil Allali, Boubaker Dhehibi; Shinan Kassam; Girma Tesfahun Kassie and Aden Aw-Hassan - Consommation énergétique des cultures d'oignon et de pomme de terre dans la province d'El Hajeb (Morocco) : Vers une efficacité énergétique des exploitations maraichères by Khalil Allali, Boubaker Dhehibi; Shinan Kassam; Girma Tesfahun Kassie and Aden Aw-Hassan <p>Media (8)</p> <ul style="list-style-type: none"> - ICARDA implements projects to rise the agricultural sector in Jordan - NCARE and ICARDA, implementation of dryland agriculture projects - Workshop on sensory evaluation of olive oil in Karak - Workshop on controlling olive fruit flies in El-Irag - Workshop on olive fruit flies in El-Irag - Olive fruit flies and its control in El-Irag - Workshop on olive harvesting in Karak - Training pruning olive trees in El-Karak <p>Working papers (1)</p> <ul style="list-style-type: none"> - Enhancing the Dairy Processing Skills and Market Access of the Rural Women in Jordan 			8 media	15 media
All	5. % of tools that have an explicit target of women farmers	<ul style="list-style-type: none"> - Blog (Tunisia): on cactus as multipurpose plant (fodder, cash crop) http://dialogues.cgiar.org/blog/how-much-cactus-is-in-your-lipstick/ (CGIAR Talking Science Competition) - Blog on cactus as a sustainable and versatile plant for the dry areas: http://icarda.org/drylandstinking/Cactus-sustainable-and-versatile-plant-dry-areas - Blog on reversing degradation in rangelands by promoting sustainable forage species http://www.icarda.org/reversing-degradation-rangelands-promoting-sustainable-grassforage-species - Grey water reuse at households (Booklet: Boufaroua M., Balawneh A. 2014. Booklet on safe grey water reuse at Households) and productive use of grey water in home farming (Bouklet: Boufaroua M., Balawneh A. 2014. Productive use of grey water in home farming) - Enhancing the Dairy Processing Skills and Market Access of Rural Women in Jordan. - The bio-economic model addressing gender issues in terms of division of labor, economic empowerment and nutrition. - Workshop on olive harvesting in Karak - The bio-economic model is expected to address gender issues in terms of division of labor, economic empowerment and nutrition - Local Knowledge Assessment Focusing on Climate Change and Gender Aspects - The impacts of different technological, policy and marketing innovations and climate change on women and youth will be assessed and a report produced. 			20 %	30 %

All	6. % of tools assessed for likely gender-disaggregated impact	<ul style="list-style-type: none"> - Local knowledge assessment focusing on gender aspects (Jordan)(https://apps.icarda.org/wsInternet/wsInternet.aspx/DownloadFileToLocal?filePath=Dryland_Systems/Local_Knowledge_Assessment_Focusing_on_Climate_Change_and_Gender_Aspects.pdf&fileName=Local_Knowledge_Assessment_Focusing_on_Climate_Change_and_Gender_Aspects.pdf) - Report on Assessment of Project's Beneficiaries' Use of Grey water in Agriculture - The impacts of different technological, policy and marketing innovations and climate change on women and youth will be assessed and a report produced. 			10 %	20 %
All	7. Number of open access databases maintained by CRP	<ul style="list-style-type: none"> - SWAT modeling database: 1 data base is accessible in NCARE Jordan (dry land area), and 1 in DG-ACTA in Tunisia for hill lakes. - <u>AFAWA</u> Feed database. The data base was developed based on data collected in NAWA mainly Syria and other regions like CA - Climate change maps Iraq and Jordan (<u>Iraq climate maps (Present)</u>, <u>Iraq climate maps (Future scenarios)</u>, <u>Jordan climate maps (Historical climate)</u>, <u>Jordan climate maps (Current climate)</u>, <u>Jordan climate maps (Projected changes)</u>) - Baseline survey for the characterization of the rural households, their resources and production systems and to identify the causes of system vulnerability and local coping mechanisms used by HH and communities in the 4 sites (Jordan, Egypt, Tunisia, Morocco). Data already collected (500 questionnaires per site) and will be made available online as open access once cleaned - Survey documenting gender inclusiveness in Jordan, Egypt and Morocco is under processing and will be made available online as open access once cleaned - Socio economic survey database on Marketing System for Olives and Olive Oil in Karak-Jordan, Beni Khedache, Tunisia, sheep in Zoghmar and vegetables in Nile Delta, Egypt and Meknes in Morocco. This data base will be made available online as open access once cleaned - Animal nutrient deficiency. 100 wool samples were collected 50 feed samples and 100 blood samples (Jordan, Tunisia). The database will be made available online as open access once cleaned - <u>Survey on Livestock production and feeding systems is being conducted in Jordan and Tunisia, it will be made available once cleaned</u> - Database containing household information and secondary data related to the small ruminant sector in Jordan. This database is available in Excel format. - Database (Jordan, Tunisia) compiled with detailed information on agrobiodiversity status and threats in target monitoring areas in the action sites. This is necessary information that is pre-requisite to any management plans to be devised and implemented for the rangeland and water management. 			10 databases in progress	15 data base
All	8. Total number of users of these open access databases	<ul style="list-style-type: none"> - 20 NARS and other CG centers (estimation) - 10 development agencies (estimation) 				
All	9. Number of publications in ISI journals produced by CRP	<p>ISI Journals (35)</p> <p><u>Ababneh, H.S., Ababneh, M.M., Hananeh, W.M., Alsheyab, F.M., Jawasreh, K.I., Al-Gharaibeh, M.A., Ababneh, M.M., 2014. Molecular identification of chlamydial cause of abortion in small ruminants in Jordan. Trop Anim Health Prod 46, 1407-1412.</u></p>			35	40

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1,2,3, 4, 6	10. Number of strategic value chains analyzed by CRP	<ul style="list-style-type: none"> - Jordan (Al Kresha): Regulatory permission to access and manage irrigation water, as well as access to improved quality and range of public services - Jordan (Al Erak): Improving production potential and profitability for olives (fresh and oil) - Egypt: Tomatoes, - Egypt: Buffalo Milk - Egypt: Citrus - Morocco: Onion - Morocco: Potatoes - Tunisia (Zoghmar): Barbarine sheep - Tunisia (Beni Khédache): Olive - Tunisia (Beni Khédache): figs 			10	12																																			
1,5,6,7	11. Number of targeted agro-ecosystems analysed/characterised by CRP	<ul style="list-style-type: none"> - Agro-pastoral system (Tafilah-Salamya site, Jordan – Beni Khedache-Sidi Bouzid site, Tunisia) - Intensive rainfed system (Meknes Saies site, Morocco) - Intensive irrigated system (Nile Delta site, Egypt) 		3	3	3																																			
1,5,6,7	12. Estimated population of above-mentioned agro-ecosystems	<table border="1"> <thead> <tr> <th></th><th>Meknes, Morocco</th><th>BK – SB, Tunisia</th><th>Tafilah-Salamya, Jordan/Syria</th><th>Nile Delta, Egypt</th><th>Karkhe River Basin, Iran</th><th>Total</th></tr> </thead> <tbody> <tr> <td>Area, km2</td><td>1.694</td><td>17.92</td><td>36.6</td><td>39.3</td><td>50</td><td>145.514</td></tr> <tr> <td>Population, million</td><td>0.714</td><td>1.527</td><td>8.3</td><td>36.49</td><td>3.6</td><td>50.631</td></tr> <tr> <td>% Rural</td><td>20</td><td>41</td><td>65</td><td>60</td><td>38</td><td></td></tr> <tr> <td>Rural population, million</td><td>0.143</td><td>0.627</td><td>5.395</td><td>21.894</td><td>1.368</td><td>29.426</td></tr> </tbody> </table> <p>The total rural population is estimated to about 29 million</p>		Meknes, Morocco	BK – SB, Tunisia	Tafilah-Salamya, Jordan/Syria	Nile Delta, Egypt	Karkhe River Basin, Iran	Total	Area, km2	1.694	17.92	36.6	39.3	50	145.514	Population, million	0.714	1.527	8.3	36.49	3.6	50.631	% Rural	20	41	65	60	38		Rural population, million	0.143	0.627	5.395	21.894	1.368	29.426				
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INNOVATION PLATFORMS							
All	13. Number of trainees in short-term programs facilitated by CRP (male)	<p>Training of trainers (311)</p> <ul style="list-style-type: none">- Agro-ecological Monitoring group training course (Amman, Jordan): Number of males trained: 6 (Jordan 3 and Tunisia 3)- Alley cropping system group training course (Amman, Jordan): Number of males trained: 6 (Jordan 3 and Tunisia 3)- Training course for NARS on the sustainable improvement on forage resources in drylands, jointly organized by CIHEAM/IAMZ Zaragoza and ICARDA/CRP-DS (Zaragoza, Spain): 18 male scientists from different CRP-DS flagships (http://www.iamz.ciheam.org/ingles/cursos14-15/RecursosForrajes_ING.pdf)- Phyto-ecological Data Analysis for Assessing Rangeland Productivity, group training course (Mednine, Tunisia): Number of males participants: 20 (Tunisia)- Regional group training organized on “promoting <i>in situ</i>/on-farm conservation of plant genetic resources” in Addis Ababa, Ethiopia for 11 days in December 2014.- An introductory SWAT workshop was organized and coordinated by ICARDA and Texas A&M University in Amman (January 2014). 10 Participants from targeted sites attended the workshop and links were established to facilitate the use of SWAT across the three sites.- A Tunisian WLI Stakeholders Meeting was conducted involving policy makers, farmers, local NGO’s to gather community needs before implementing land and water conservation practices in Tunisia (25 participants).- 4 scientists participated in training on grey water reuse in Jordan (July 2014).- On job training for selection of soil and water conservation technique (10 participants)- On job training on the implementation of hill lakes (4 scientists, 3 farmers): Farmers’ initiative and support from NARS & ICARDA with NGO participation- <u>Sheep breeding: introducing scientific methods to monitor and record flock performance</u> (9 males)- 13 investigators from INRAT and IRA trained on surveys and data collection- Training of 4 specialists from INRAT and IRA on data entry- Advanced training on milk analysis (2 males)<ul style="list-style-type: none">- -6 extension agents and 3 scientists attended training programs in Morocco- - 5 team members attended training programs in Australia (machinery, risk management, weed management, forage crops)- -6 visits of Australian experts- -2 team members the world congress on CA in Canada in June 2014- <i>Feed Assessment Tool (FEAST)</i> training was conducted by Dr. Jane Wamatu (ICARDA-DSIPS). It was held from October 7th to 9th 2013 at INRAT with the participation of 21 scientists. <p>Farmers training (4467)</p> <ul style="list-style-type: none">- Managing feed resources in Jordan’s agro-pastoral production systems: 21 farmers from Jordan- Grazing Management under Water Harvesting Systems: 23 farmers from Jordan- Promote cactus pear as multiple purpose crop to improve the livelihood of the farmers: 49 farmers from Jordan- On-site training days for households on grey water use were conducted to present different issues related to water management and the best management practices dealing with the different aspects of grey water reuse (irrigation scheduling, grey water treatment, water quality): 27 families, 125 members			311	300	
						4467	5000

		<p>from local community trained</p> <ul style="list-style-type: none"> - Rangeland and grazing management (119) - Sheep and goats management (92) - CA & cropping (185) - Climate change mitigation (147) - Farm management (33) - Grey water (34) - IPM (137) - Irrigation (28) - Olive Production (505) - Organic Farming (10) - Post-harvest (19) - Small Ruminants Health (27) - Tree Production (126) - 6 training programs organized with 284 stakeholder attendance (ACIAR-CANA Project) - 5 farmer field schools organized with close to 400 farmer attendance (ACIAR-CANA Project) - <i>Feed Assessment Tool (FEAST)</i> training was conducted by Dr. Jane Wamatu (ICARDA-DSIPS). It was held from October 7th to 9th 2013 at INRAT with the participation of 20 farmers. - Field Day: Integrated Crop-Livestock Conservation Agriculture: Wheat and forage in rotation: Chouarnia, Makthar Delegation, Siliana Governorate. Tuesday 20th of May 2014; More than 65 people attended among them: 34 farmers; 14 technicians and administrators - Field Day – ZT Seeder Calibration (Sept 2014), more than 20 farmers attended this field day - 500 farmers and NGOs trained on conservation agriculture (farm field school, field days and training) within ACIAR-CANA Project in Tunisia - Local farmers association created and 03 innovation platforms implemented in Zoghmar, Tunisia - 15000 people (farmers, NGOs, students, researchers, extension service, policy makers, and private company) informed and targeted directly and indirectly by Radio broadcasts, Aired TV programs, leaflets, FFS, field days, training, web site within ACIAR-CANA Project in Tunisia 				
All	14. Number of trainees in short-term programs facilitated by CRP (female)	<p>Training NARS scientists (73):</p> <ul style="list-style-type: none"> - Training course for NARS on the sustainable improvement on forage resources in drylands, jointly organized by CIHEAM/IAMZ Zaragoza and ICARDA/CRP-DS (Zaragoza, Spain): 11 female scientists from different CRP-DS flagships - Managing feed resources in Jordan's agro-pastoral production systems: 4 female (Jordan) - Grazing Management under Water Harvesting Systems: 7 female (Jordan) - Promote cactus pear as multiple purpose crop to improve the livelihood of the farmers: 1 female participant (Jordan) - Advanced training on milk analysis (5 females) <p>Training of farmers (880)</p> <ul style="list-style-type: none"> - Rangeland and grazing management (7) - Climate change mitigation (15) 			73	70
					880	1500

		<ul style="list-style-type: none"> - CA & Cropping (26) - Aromatic and medicinal plants (42) - Olive Production (91) - Food processing (114) - 26 training course for local community members have been organized by women associations: 125 members from local community trained (grey water) 				
All	15. Number of trainees in long-term programs facilitated by CRP (male)	<p>PhD (male): 21</p> <ul style="list-style-type: none"> - 1 PhD Student at Tsukuba University (Japan) (Mr. Ben Othman M.) - M. Ben Zaied: enrolled for PhD at Univ of Carthage and received trainings - Sghaier: enrolled for PhD at the Univ of Gabès - PHD student Walid ben khelifa: SWAT MODELING on water balance in arid regions, INRGREF, INAT, ICARDA - Ridha Ibdhi (PhD): Determination of water productivity and water footprint for small ruminants raised in different production systems in Tunisia (Faculty of Sciences of Bizerte, Tunisia) - Anis Gamoudi (PhD): Matching sheep genotypes to improve productivity and quality end products. - 1 PhD student bring training on soil analysis and bio-physical modelling - H. Jarray: enrolled for PhD at University of Sfax and received trainings - A. Hachani: enrolled for PhD at Univ of Carthage and received trainings - Mohamed Abdeladhim: enrolled for PhD at the Univ of Sfax (Management and economic sciences faculties - 3 Moroccan PhD students are being trained (Two in Morocco Hassan II University on bio-physical modelling and one in France on systems research in general and bio-economic modelling in particular). - <p>MSc (male): 20</p> <ul style="list-style-type: none"> - 1 MSc Student at Faculté des Sciences de Gabès, Tunisie (Mr. Boubakri A.) - 1 MSc Student at Faculté des Sciences de Gabès, Tunisie (Mr. Tilili A.) - MSC. Student: Mohamed Bouhlal: Impact of grey water reuse on water, soil and plants - Seif allah Abbassi (Msc Degree): Fattening practices and implications for a breeding program. - 1 MSc Student at University of Jordan (Mr. Moatasam AL Gaied): Evaluation the effect of water harvesting interventions on vegetation cover and productivity of rangeland in Jordan, using digital imaging and remote sensing techniques , case study Al_Majidyia - 1 MSc Student at Hashemite University (Mr. Alaadinne Al Hyasat): Enhancing sustainability and fodder production of lowland pastures in arid agro-pastoral ecosystems of Jordan - S. Harabi: enrolled for MSc at the Univ of Tunis - N. Bakkay: enrolled for MSc at Univ of Carthage - F. Mokh: enrolled for PhD at the Univ of Carthage and received trainings - S. Enneb: enrolled for MSc at Univ of Carthage - W. Tlig : enrolled for MSc at Univ of Carthage - Ben Sedrine D.: 1 MSc Student at CIHEAM/IAMM 			21	25
					20	20
All	16. Number of trainees in long-term programs	<p>PhD (female): 22</p> <ul style="list-style-type: none"> - 1 PhD student in Palermo university (Ms. Sawsan Hassan) 			22	25

	facilitated by CRP (female)	<ul style="list-style-type: none"> - Enneb Sameh (2014)– INAT : Irrigation déficitaire à l’eau salée de la fève en milieu aride : Effet sur la croissance, le rendement la productivité de l’eau et la salinité du sol. - Tlig Warda (2014) – INAT : Irrigation déficitaire à l’eau salée : étude de cas de la carotte irriguée à la goutte à goutte dans le Sud Tunisien - Samia Hradi – Fac Sc. Tunis : Délimitation des zones de recharge des nappes dans l’observatoire de la Jeffara. - Naweb Halifa – INAT : Changement du comportement des ouvrages en gabion dans le bassin versant d’Oum Zessar - Nessrine Bakkey – INAT : Etude des risques d’inondation dans la région de Tataouine. - Amel Hachani - UNU: Contribution to the study of water stress on olive growing under the effect of climate change in South East of Tunisia. - ChirineCherif (PhD): Sheep response to trace minerals in the diet – feeding behavior, digestion and production performance (Faculty of Sciences of Bizerte, Tunisia) - Mariem Rouatbi (PhD): Interactions between parasite infestation and reproduction in sheep and goats (Institut National Agronomique de Tunisie, Tunisia) - AfefMerai: Antagonism linking milk production and reproduction in some Mediterranean dairy sheep breeds(Institut National Agronomique de Tunisie, Tunisia) - Yosra Ressaissi (PhD): Livestock farming system modeling under harsh conditions (ESA- Chott Mariem). - Imène Baazaoui (PhD): Impact of MAPs on meat sheep quality and animal health status (Faculty of Sciences of Bizerte, Tunisia). <p>MSc (female): 14</p> <ul style="list-style-type: none"> - 1 MSc student in Brazil (Ms. Nefzaoui Meriam) - 1 MSc Student at Mediterranean Agronomic Institute of Chania. Chania, Greece Accomplished 2014. (Maha Addas, Syrian Shanklish and its quality) - 1 MSc on adapting SWAT model to assess the impact of harvesting interventions on runoff and soil erosion in an arid environment: case of Jordan (completed) - 2 MSc students from Florida University in the field of small scale grey water system installation and promotion - Bisma Rebhi (Msc Degree) : Mapping of small ruminants under different production systems in Sidi-Bouزيد Governorate. 			14	20
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1,5,6,7	17. Number of multi-stakeholder R4D innovation platforms established for the targeted agro-ecosystems by the CRPs	<p>Learning Alliances (LA): Learning alliances provide legitimacy for the innovation platform to initiate (identification of entry point and opportunities for engagement) and in close collaboration with the post-harvest & market access activity, they validate evidence and priority for the defined entry points. Learning alliances initiated include:</p> <ul style="list-style-type: none"> - Morocco (Meknes) – 3 field sites - Tunisia (Sidi Bouzid – Zoghmar) - Tunisia (Medenine – Beni Khedech) - Egypt (Nile Delta and adjoining region): initiated December 2013 under a CIDA funded grant - Jordan (Al Kresha) - Jordan (Al Erak) <p>http://drylandsystems.cgiar.org/content/learning-alliances-sustaining-adoption-new-innovations http://drylandsystems.cgiar.org/content/learning-alliances-case-studies-egypt-morocco-tunisia-and-jordan</p> <p>Innovation Platforms (IP): Innovation platforms are action oriented – building upon the legitimized outputs of the learning alliance, they (i) test more contemporary avenues for social and economic interaction, (ii) uncover (contextually relevant) refined approaches for participatory development of new technologies (technical, social, institutional) and (iii) seek avenues for broad dissemination and uptake of technologies developed, available, and of immediate priority and need to communities within a defined catchment area.</p> <p>http://drylandsystems.cgiar.org/events/innovation-platforms-dryland-systems-development-strategic-framework http://drylandsystems.cgiar.org/content/opening-session-initiating-development-innovation-platform-framework http://drylandsystems.cgiar.org/content/innovation-platforms-what-innovation</p> <p>Defined entry points for action (IP):</p> <ul style="list-style-type: none"> - Jordan (Al Kresha): Regulatory permission to access and manage irrigation water, as well as access to improved quality and range of public services - Jordan (Al Erak): Improving production potential and profitability for olives (fresh and oil) - Egypt: Tomatoes, Buffalo Milk and Citrus - Morocco: Onion and Potatoes - Tunisia (Zoghmar): Barbarine sheep, cactus - Tunisia (Beni Khédache): Olive, figs <p>observation</p> <ul style="list-style-type: none"> - -Iran was included in the 2014 target for LA, but was not engaged due to embargo related issues - -Given social and geographical complexity, Tunisian and Jordanian sites required 2 LA's each. - -Iran was included in the 2014 target for IP, but was not engaged due to embargo related issues - -Given social, economic and geographical complexity, the Tunisian and Jordan sites required 2 IP's each. - 2015: Learning alliance / Nurture and maintain the existing Learning Alliances (contingent upon budget and strategic decision regarding the Jordan action site) - 2015: IPs/ Build upon the progress in 2014 to strengthen the existing innovation platforms and to initiate action (contingent upon budget and strategic decision regarding the Jordan action site) <p>Partners of the Benchmark Program are researchers from ICARDA, NARS, and Universities. The partnership also</p>	5	8	8
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		<p>includes the community members through a participatory approach so that researchers can assure they are accountable to the stakeholders. The WLI and CRP have several of the same partners and also adds partnerships from USAID, USDA and US Universities.</p> <p>To increase regional impact three thematic approaches to agricultural development were implemented. The three approaches include: Planning tools for Site Specific Decision Making; Modeling, Economics of Natural Resource Management, and Socio-Economics. Utilizing this cross disciplinary approach the WLI can amplify south-south partnerships and build the capacity of areas with similar ecological landscapes, community structures, and economic approaches to investing in water and land management.</p> <p>Utilizing these three thematic programs the WLI (and CRP) is transitioning itself into a program where numerous cross disciplinary programs may launch from the research phase to the out-scaling (or technology transfer) phase. Based on achievements in 2014 the WLI is positioning itself into a platform to launch numerous achievements of the IWLMP program and to integrate them with appropriate communities.</p> <p>A National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty was held in Tunisia in September 2014. In this event, policy makers, Provincial development institutions, International Organizations and National Research Institutions focused on Tunisian research on water resources for rural development to share priorities and challenges of implementing these priorities. ICARDA hosted the event and shared capacities and interim results from the Water and Livelihoods Initiative (WLI) and Dry land Systems (CRP-DS) programs. Participants have understood national and provincial priorities for rural development in Tunisia as they relate to water management and natural resources management. Participants have also understood ICARDA's implemented programs and gained an understanding of where there are gaps between existing programs and national priorities to focus on that in the program of 2015 and how to introduce innovative soil and water conservation techniques. CRP-DS will focus in 2015 in Tunisian sites which are promising.</p>				
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT						
All	18. Number of technologies/NRM practices under research in the CRP (Phase I)	<p>Mechanical and physical :</p> <ul style="list-style-type: none"> - Enhancing pastoral resources using different water harvesting techniques in Al- Majidyya site (Jordan) - Enhancing pastoral resources using water harvesting techniques and direct seeding in El Bhaier (Beni Khedache, Tunisia) - Harvesting machines for small-scale olive producers (Jordan) - Second prototype of small Rama seeder produced and tested at Mushagher (Jordan) and Palestine - Manufacturing local low-cost seeders in Algeria, Morocco and Tunisia (CANA-ACIAR Project) - <u>Enhancing the Dairy Processing Skills and Market Access of Rural Women in Jordan.</u> - Development of a raisedbed machine together with a full technical package helped farmers saving 50% of seed rate, reduced 25% of farming cost, achieved 25% of water saving and increased the yield by 25% in the Nile Delta. The area grown on raisedbed reached 31 times the area which was grown in 2010: http://ifad-un.blogspot.com/2013/03/old-meets-new.html http://www.procasur.org/biblioteca/index.php/features/learning-routes/learning-routes-1/2013-1/sustainable-water-management-in-egypt/120-sharkia-systematisation-document-eng/file http://www.icarda.org/new-technologies-food-security-arab-countries http://www.scidev.net/global/biotechnology/news/egypt-wheat-experiment-produces-dramatic-yield-boost.html 			8	8

		<p>http://www.agriculturesnetwork.org/what-we-do/training-documentation/cases/morocco-egypt-2013/egypt-learning-route/march-14-15-old-meets-new</p> <p>http://www.abc.org.br/IMG/pdf/doc-6117.pdf</p> <p>http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual Cairo Egypt 5-5-2014.pdf</p> <p>http://www.ifad.org/operations/projects/regions/pn/pub/learning_routes.pdf</p> <ul style="list-style-type: none"> - Water and Salinity management to combat land degradation: The program is operating on four different levels: farm, mesqa (tertiary), meso, and macro levels. <p>Biological</p> <ul style="list-style-type: none"> - Establishment of cactus gene bank for screening cold tolerant and multi-purpose species (discovery phase) linked to CRP 7 (Jordan) - Establishment of alley cropping (on station and on farm). (proof of concept phase) (Tunisia, Jordan) - Introduction of new crops (Medicinal and Herbal Plants) that were not traditionally cultivated in Karak (<i>Crocus</i>, <i>Salvia</i>, <i>Thymus</i>) (Jordan) - Application of integrated pest management for olive trees - At least 5 promising fodder species have been identified and characterized. The aim is to ensure that these species play an integral role in national rehabilitation strategies, and ultimately help to reverse the devastating levels of degradation that inflict many rangeland areas (Tunisia): http://www.icarda.org/reversing-degradation-rangelands-promoting-sustainable-grassforage-species http://www.icarda.org/sites/default/files/Retama-Shrub-Fact-Sheet.pdf http://www.icarda.org/sites/default/files/Mediterranean-saltbush-Factsheet.pdf http://www.icarda.org/sites/default/files/Bufel-grass-Factsheet.pdf http://www.icarda.org/sites/default/files/Stipa-lagascae-Factsheet.pdf - Cereals and food legumes-Adaptation (Morocco): On-farm trials were conducted to select the high yielding and more adapted lines of cereals and food legumes to the conditions of Meknes-sais action site; Farmers were involved in selection lines of cereals and food legumes. More than 40 farmers and researchers, including 6 women participated in the evaluation of more than 70 advanced elite lines of cereals and food legumes proposed by ICARDA's breeders in two farmers' fields. In the case of Bread wheat, most of the lines tested presented good yield performance as compared to the check variety Achtar. One line (BT 10 : QIMMA-12/PASTOR-6//QIMMA-12) exceed the check while 6 lines presented a yield equivalent to that of Achtar. This line and 3 others (SHUHA-7/SHUHA-14/3/ALTAR 84/AEGILOPS SQUARROSA (TAUS)//OPATA; HUBARA-3*2/SHUHA-4; QIMMA-12/PASTOR-6//QIMMA-12) were also selected by farmers. For durum wheat, four lines (Ivigni3/Ainzen-1//Maamouri-3; Icakassem2; Icamor, Icamoram7, & Lahnmi and Icajihan2013) out-yielded the highest yielding check variety Tomouh, The lines selected by farmers are also among the top yielding lines identified. For Barley, the highest yielding lines Lanaceur, G1 and Firdous, were also the top lines identified by farmers. The lines of food legumes selected by farmers are Super Aguadulce and Khalil for faba vean, FLIP 07-33C for checkpea and 2009S96111-1 for lentil. - Cereal and legumes-IPM (Morocco): Different combination of methods of pest management were tested in farmers' fields and compared to farmers' practices. One IPM option was developed to manage diseases and weeds in bread wheat farms with fungicides and herbicides that gave yield advantage of 9.3 and 7.2 q / ha for Amal and Arrihane varieties respectively. One IPM option consisting of two hoeing combined with grass killing herbicide at 4 leaf stages of faba bean at Ain Jemaa gave 3.2t/ha grain yield. At Sidi Slimane, a grain yield of 3t/ha was obtained for faba bean with 			7	7
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		<p>two hoeing and herbicide application compared with 1.1 t/ha of farmers weed management practices. Out of 20 bread wheat lines tested, two elite lines (E33P39 and E33P45) showed high levels of resistance to yellow rust disease at Douyet -Meknès (SAÏS). The selected lines will be further evaluated for yield potential in the Action site. Major diseases and insect pests during the cropping season were identified for wheat and barley. One field day was organized with the participation of 65 farmers , development agents and researchers The event was posted on CRRA Meknes web site in Arabic http://inrameknes.info/ and by national TV (RTM), Mekès-radio and MAP (Maghreb Arab Press)</p> <p>Chemical :</p> <ul style="list-style-type: none"> - The studied fertility strategy showed the integration of inorganic N with biofertilizer could save appreciable amount of inorganic nitrogen added to sandy soil and Bacillus biofertilizers can compensate at least 25% of applied inorganic nitrogen, recommended for wheat grown in sandy soil (Nile Delta) - A new fertilization management (Nile Delta) for field crops grown in sandy soils was investigated to develop a decision support model for fertilization management to be used as useful tool by agronomists and the extension service for more sustainable on-farm management and agriculture production. Field trials on of soil fertility in ne land were conducted in 2014 and the obtained results showed that: Integration of inorganic N with biofertilizer could save appreciable amount of inorganic nitrogen added to sandy soil ; Biofertilizer namely, Bacillus polymyxa and a mixture of it and Azospirillum not only could compensate 25% or even more of applied inorganic nitrogen, recommended for wheat grown in sandy soil but also gave higher yield and better yield attributes ; Economics of compensation of inorganic nitrogen with biofertilizers is very promising. <p>Management and cultural practices</p> <ul style="list-style-type: none"> - Promote cactus pear as multiple purpose crop to improve the livelihood of poor farmers in West Asia (discovery phase) - The Influence of Soil Volume (Root Confinement) on Root and Canopy Growth, Root Turnover and Canopy vs Root Ratio of <i>Opuntia ficus-indica</i> (L) - The influence of planting methods of <i>Opuntia ficus-indica</i> (L) on root and canopy growth, root turnover and canopy – root ratio - Sustainable development of lowlands in pastoral ecosystems (proof of concept) - Management and cultural practices of cactus (Jordan) - Better understanding of the highly diversified weed flora in three experimental sites. Identification of dominant weed species and weed problems. - Conservation agriculture: impact on increased soil organic matter biodegradability due to higher crop residues under CA and increased soil stability in Jordan, Tunisia and Morocco - Identify constraints to adoption of CA smallholder farmers and ways of enhancing adoption (ACIAR-CANA Project) (weblink) - Identify and test improvement in seeding machinery, and in weed and biomass management of CA systems (ACIAR-CANA project) - Supplemental irrigation on cereals at Zoghmar, Tunisia - Alley cropping system with cactus as alleys, Zoghmar, Tunisia - Use of remote sensing (WLI project) in Tunisia <p>Livestock management</p> <ul style="list-style-type: none"> - Livestock management 			2	3
					12	12

		<ul style="list-style-type: none"> - Community-based selection of improved rams (An initial screening was done at 4-6 months of age and the final selection for admission for breeding was done at 12 months of age. Selection is carried out based on the simplified data analyzed. The joint selection process strengthens the linkages between farmers and researchers) - Documentation of ethnopractices assessing the naturel vegetation resources on animal health status. - Identification of sheep flock management practices to meet lamb markets demand. - mapping of the diversity of animal production systems across the action site documenting species, breeds, cross-breeding with relation to husbandry practices while considering heterogeneity of the natural environment (so far, 142 observations collected supported by a livestock production system survey and GPS-tagged photos of the animals present) (Tunisia) - Determination of nutrient deficiencies in small ruminant flocks through samplings corresponding to 5 animals in each of 30 flocks over 4 seasons. Samples are related to blood, wool/fibre, drinking water, soil of grazing land, feed grazed and feed distributed (Tunisia) - Seasonal characterization of the small ruminants feeding system in the action site (completed) (Tunisia) - current feeding calander and gaps analysed for nutrient deficient for improving feeding calanders for 50 folcks, major nutrient deficiencies identified (Tunisia) - Determination of water footprint and water productivity of animal products in the action site using the following model (Tunisia): $WF[a, c, s] = WF_{feed}[a, c, s] + WF_{drink}[a, c, s] + WF_{serv}[a, c, s]$ <p>Where $WF_{feed}[a, c, s]$, $WF_{drink}[a, c, s]$ and $WF_{serv}[a, c, s]$ represent the water footprint of an animal for animal category a in country c in production systems s related to feed, drinking water and service water consumption, respectively. Service water refers to the water used to clean the farmyard, wash the animal and carry out other services necessary to maintain the environment. The WF of an animal and its three components can be expressed in terms of m³/yr/animal, or, when summed over the lifetime of the animal, in terms of m³/animal. For meat, following the method of Hoekstra et al., 2011, the WF of meat will be calculated based on the WF of the animal at the end of its lifetime, the water consumed for processing the slaughtered animal into meat, the amount of meat derived from one animal, and the relative value of meat compared to the value of other products derived from the animal. The WF of meat expressed on L/Kg of carcass weight.</p> <p>For milk production per production system and country were calculated as:</p> $P_{milk}[a, c, s] = MY[a, c, s] * DC[a, c, s]$ <p>Where $P_{milk}[a, c, s]$ represent production of milk in country c and production system s respectively (ton/yr), $MY[a, c, s]$ milk yield per animal in country c and production system s (ton/animal), $DC[a, c, s]$ the number of animal in country c and production system s. WF of milk expressed on L/Kg of milk.</p> <ul style="list-style-type: none"> - Use of selected rams for genetic improvement. - Field veterinary survey documenting seroprevalence and agents responsible of toxoplasmosis in the sheep flocks (150 blood and tissue samples collected from flocks and slaughter houses) - Local knowledge and traditional etno-veterinary practices - Livestock management surveys documenting community based flock management under low input production systems developed. - Assessment of water productivity of dairy cattle in Morocco (The study showed that the average economic water productivity per cubic meter of water used in livestock is 0.05 US \$. This value appears to be very limited as compared to previous studies in irrigated areas of Morocco (0.18 to 0.25 US \$). This 			15	15
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		<p>difference can be explained by by higher costs generated by cattle production in the current study (feed concentrates' prices have jumped sharply whereas farm gate milk price has remained quite steady) and to the traditional management of forage crops and feeding of cattle)</p> <ul style="list-style-type: none"> - Sero-prevalence and risk factors of abortive diseases assessed by a random sampling in 20 sheep flocks representing a total population of nearly 40,000 ewes spread over an area of 53 km², revealed an overall sero-prevalence of 5% and 39% for chlamydia abortus and Q-Fever. <p>Tools</p> <ul style="list-style-type: none"> - Development of non-destructive technique for estimating biomass (proof of concept) - Assessment and monitoring of rangeland health and trend in NAWA region using near earth remote sensing (VegMeasure) http://www.vegmeasure.org/ - Smart phone app for vegetation canopy cover estimation which could be used as a main input for an early warning system (discovery phase) http://research.engr.oregonstate.edu/ecomonitoring/node/1/ - Data compiled from different sources to form The PREDICTS database: a global database of how local terrestrial biodiversity responds to human impacts (open access dataset) http://onlinelibrary.wiley.com/doi/10.1002/ece3.1303/abstract - Smart phone app for vegetation canopy cover estimation which could be used as a main input for an early warning system (discovery phase) - A complete farm household bio-economic model that depicts small holder farmers' decision making in a systems context combining crops, livestock and the environment with detailed bio-physical and socio-economic relationships under different policy, market and climate change scenarios. To this effect, an intensive field work was conducted to study infiltration processes under contrasting soils under CA and conventional tillage. Soil profiles description was conducted for major soils of the site. Furthermore, soil organic matter requirement analysis is underway. - Comprehensive description of the production systems and livelihoods, with major indicators of the socio-economic and biophysical aspects of production systems of 6 field-sites in Morocco - Cereal aggregation in in Meknes, Morocco: Elements describing the regulatory framework in Morocco for promoting aggregation of cereal producers; experiences with cereal aggregation; and proposals for organizing local farmers from Meknes-Tafilalet region to aggregate themselves around government-supported aggregation project (report). The report also contains a discussion of the problematic elements inherent to the grain sector, and a debate among the various stakeholders in relation to the most convenient way to aggregate their production. 			8	8
All	19. % of technologies under research that have an explicit target of women farmers	<p>Mechanical and physical :</p> <ul style="list-style-type: none"> - Introduction and adoption of innovative technique of grey water reuse: ICARDA's design for grey water units implemented and scientists and beneficiaries trained (Jordan, Tunisia) - Harvesting machines for small-scale olive producers (Jordan) - In Jordan 27 Grey Water Treatment units (GWT) were constructed. A comprehensive program for networking, awareness, and dissemination has been implemented since the installation of the grey water treatment units. The results of the water sample analyses showed that using media-size volcanic tuff as a filtration media is more effective than using media-size gravel. Moreover, grey water quality after treatment was within the permissible limits of the Jordanian standards for the use of grey water for irrigation. The treated grey water is mostly used to irrigate olive gardens and meets up to 60% of home garden demand for irrigation requirement and has reduced their water related expenditures by 35% - Enhancing the Dairy Processing Skills and Market Access of Rural Women in Jordan. 			50 %	60 %

		<p>Biological</p> <ul style="list-style-type: none"> - Establishment of cactus gene bank for screening cold tolerant and multi-purpose species (discovery phase) linked to CRP 7 (Jordan) - On farm dissemination of high yielding cactus pads (dissemination phase) (Jordan) - Introduction of new crops (Medicinal and Herbal Plants) that were not traditionally cultivated in Karak (<i>Crocus</i>, <i>Salvia</i>, <i>Thymus</i>) (Jordan) - Salinity and orobanche tolerant fababean cultivars were identified and dissemination of the improved agronomic package in farmer was started in 2014. The improved production package included the following: Orobanche tolerant cultivars Giza 843 and Misr 3 compared to the Orobanche susceptible Giza 3; Planting under zero tillage system; Delaying sowing date to mid-November; Seed rate (80-90 kg/ha); and Spraying with Glyphosate at reduced rate 34 g/ha + NPK two times at flowering and 3 weeks after. The results showed that Faba bean seed yield in demonstration fields was higher than that at farmer fields. Cultivars Giza-843, Misr-3 and Giza-3 seed yield means in the demonstration fields were higher than farmer fields by 39, 59 and 67%, respectively (Egypt) - Three lentil genotypes (Fami 29, 8852, FLIP 98 - 1 - 1 and FLIP - 67 L) promising lines were released at Gemmiza research station and 15 kg of seeds were produced (Egypt) - At least 9 ton of seeds of three faba bean cultivars (Giza 51, Giza 370 and Giza 9) were produced (Egypt) - Three communities have been supported to initiate Village-based seed production and marketing. A total of 38MT of quality seed of Faba bean, Chickpea and lentil varieties have been produced and marketed for further seed multiplication and crop production. The 38 MT is enough to cover a total of 500 ha of crop production areas. The number of farmers who used improved seeds are 69 (59 female and 10 male). These seeds were cultivated in 50 ha. <p>Management and cultural practices</p> <ul style="list-style-type: none"> - Promote cactus pear as multiple purpose crop to improve the livelihood of poor farmers in West Asia (discovery phase) - The influence of planting methods of <i>Opuntia ficus-indica</i> (L) on root and canopy growth, root turnover and canopy – root ratio - Management and cultural practices of cactus (Jordan) - Enhancing pastoral resources using different water harvesting techniques (Jordan) - Better understanding of the highly diversified weed flora in three experimental sites. Identification of dominant weed species and weed problems. - Identify constraints to adoption of CA smallholder farmers and ways of enhancing adoption (ACIAR-CANA Project) (weblink) <p>Livestock management</p> <ul style="list-style-type: none"> - Livestock management - Community-based selection of improved rams (An initial screening was done at 4-6 months of age and the final selection for admission for breeding was done at 12 months of age. Selection is carried out based on the simplified data analyzed. The joint selection process strengthens the linkages between farmers and researchers) - Documentation of ethnopractices assessing the naturel vegetation resources on animal health status. - Identification of sheep flock management practices to meet lamb markets demand. - Use of milk fat separator in Jordan (Milk fat separation is an essential step in Jameed manufacturing. The 			100 %	100 %
					50 %	60 %
					73 %	80 %

		<p>rational method is consuming a lot of labor in addition to time and resources (water and electricity). The use of milk fat separator enabled women processors to use skim milk instead of full cream milk. By this, there is no need for churning to obtain a skimmed fermented milk. Churning of full cream fermented milk need a lot of cold water and ice and time. Number of processing units that benefited from this technology is 15)</p> <ul style="list-style-type: none"> - Determination of nutrient deficiencies in small ruminant flocks through samplings corresponding to 5 animals in each of 30 flocks over 4 seasons. Samples are related to blood, wool/fibre, drinking water, soil of grazing land, feed grazed and feed distributed (Tunisia) - Seasonal characterization of the small ruminants feeding system in the action site (completed) (Tunisia) - current feeding calendar and gaps analysed for nutrient deficient for improving feeding calendars for 50 flocks, major nutrient deficiencies identified (Tunisia) - Local knowledge and traditional ethno-veterinary practices - Livestock management surveys documenting community based flock management under low input production systems developed. - <u>Sero-prevalence and risk factors of abortive diseases</u> assessed by a random sampling in 20 sheep flocks representing a total population of nearly 40,000 ewes spread over an area of 53 km², revealed an overall sero-prevalence of 5% and 39% for <i>chlamydomphila abortus</i> and Q-Fever. <p>Tools</p> <ul style="list-style-type: none"> - A complete farm household bio-economic model that depicts small holder farmers' decision making in a systems context combining crops, livestock and the environment with detailed bio-physical and socio-economic relationships under different policy, market and climate change scenarios. To this effect, an intensive field work was conducted to study infiltration processes under contrasting soils under CA and conventional tillage. Soil profiles description was conducted for major soils of the site. Furthermore, soil organic matter requirement analysis is underway. - Comprehensive description of the production systems and livelihoods, with major indicators of the socio-economic and biophysical aspects of production systems of 6 field-sites in Morocco 			25 %	40 %
All	20. % of technologies under research that have been assessed for likely gender-disaggregated impact				30 %	40 %
1,5,6,7	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	<ul style="list-style-type: none"> - Agro-pastoral system (Tafilah-Salamya site, Jordan – Beni Khedache-Sidi Bouzid site, Tunisia) - Intensive rainfed system (Meknes Saies site, Morocco) - Intensive irrigated system (Nile Delta site, Egypt) - 			3	3

	CRP's recommendations					
1,5,6,7	22. Number of people who will potentially benefit from plans, once finalised, for the scaling up of strategies	30 millions			30 million	30 million
All, except 2	23. Number of technologies /NRM practices field tested (phase II)	<p>Mechanical and physical :</p> <ul style="list-style-type: none"> - Introduction and adoption of innovative technique of soil and water conservation technique: Valerani, Continues / Intermittent Single-furrow Plowing Implement (adopted by national development institutions) in Jordan - Introduction and adoption of innovative technique of soil and water conservation technique: hill lakes: NARS staff trained and adapted the technology in dry areas (Jordan, Tunisia) - Introduction and adoption of innovative technique of grey water reuse: ICARDA's design for grey water units implemented and scientists and beneficiaries trained (Jordan, Tunisia) - Introduction and adoption of innovative technique of soil and water conservation technique Semi-Circular Bunds (Jordan, Tunisia) - Introduction and adoption of innovative technique of soil and water conservation technique Check dams for aquifer recharge and plantation (Jordan, Tunisia) - Introduction and adoption of innovative technique of soil and water conservation technique Terraces: Terraces are constructed on sloping land to reduce soil erosion and retain runoff water (Jordan, Tunisia) - Combining water harvesting techniques and Supplemental irrigation (Tunisia) - Irrigation water deficit and Irrigation water scheduling (Tunisia, Morocco) - In Jordan 27 Grey Water Treatment units (GWT) were constructed. A comprehensive program for networking, awareness, and dissemination has been implemented since the installation of the grey water treatment units. The results of the water sample analyses showed that using media-size volcanic tuff as a filtration media is more effective than using media-size gravel. Moreover, grey water quality after treatment was within the permissible limits of the Jordanian standards for the use of grey water for irrigation. The treated grey water is mostly used to irrigate olive gardens and meets up to 60% of home garden demand for irrigation requirement and has reduced their water related expenditures by 35% - Implementation of hill lake (capacity of 7,000 m3) with farmers' initiative and support from NCARE & ICARDA, cultivation of barley and vegetable crops and data collection (Jordan) - Prototype ZT seeders completed by two workshops in Mosul (Iraq), and 16 new seeders planned for 2014/15; Kits to convert 40 farmer seeders to ZT were provided; Four Iranian ZT seeders evaluated. - Testing different types of ZT seeders (ICARDA, Spain, Australia) in Tunisia, Algeria and Morocco (CANA-ACIAR Project) <p>Biological</p> <ul style="list-style-type: none"> - On farm dissemination of high yielding cactus pads (dissemination phase) (Jordan) - Rangeland rehabilitation - Application of integrated pest management for olive trees - Salinity and orobanche tolerant fababean cultivars were identified and dissemination of the improved agronomic package in farmer was started in 2014. The improved production package included the 			12	12
					7	7

		<p>Brucellosis -78332 sheep and 28232 goats; Anthrax -57061 sheep and 19450 goats; Enterotoxaemia- 21140 sheep and 21339 goats; Sheep Mastitis monitoring using California Mastitis Test -CMT).</p> <ul style="list-style-type: none"> - Use of selected rams for genetic improvement. - Local knowledge and traditional etno-veterinary practices - Prepare silage from corn and sorghum stalks increased farmers' income, availability of animal forage in summer with higher nutrition value and saved environment from burning corn and sorghum residues in Egypt. 				
1,5,6,7	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)	<ul style="list-style-type: none"> - Agro-pastoral system (Tafilah-Salamya site, Jordan – Beni Khedache-Sidi Bouzid site, Tunisia) - Intensive rainfed system (Meknes Saies site, Morocco) - Intensive irrigated system (Nile Delta site, Egypt) 			3	3
1,5,6,7	25. % of above innovations/approaches /options that are targeted at decreasing inequality between men and women	<p>Almost all technologies above and particularly the following:</p> <ul style="list-style-type: none"> - Milk fat separators - Olive trees harvesting machines - IPM for olive orchards - Livestock management - Medicinal, aromatic and herbal plants - Vegetable cropping - Cactus cropping and uses 			30 %	40 %
1,5,6,7	26. Number of published research outputs from CRP utilised in targeted agro-ecosystems	<p>Mechanical and physical :</p> <ul style="list-style-type: none"> - Introduction and adoption of innovative technique of soil and water conservation technique: Valerani, Continues / Intermittent Single-furrow Plowing Implement (adopted by national development institutions) in Jordan - Introduction and adoption of innovative technique of soil and water conservation technique: hill lakes: NARS staff trained and adapted the technology in dry areas (Jordan, Tunisia) - Introduction and adoption of innovative technique of grey water reuse: ICARDA's design for grey water units implemented and scientists and beneficiaries trained (Jordan, Tunisia) - Introduction and adoption of innovative technique of soil and water conservation technique Semi-Circular Bunds (Jordan, Tunisia) - Introduction and adoption of innovative technique of soil and water conservation technique Check dams for aquifer recharge and plantation (Jordan, Tunisia) - Introduction and adoption of innovative technique of soil and water conservation technique Terraces: 			12	12

		<ul style="list-style-type: none"> - Enhancing pastoral resources using different water harvesting techniques (Jordan) - <u>Flexible crop production packages</u> that emphasized ZT as the most important principle of CA because it produces an immediate cost saving while enabling early sowing, which boosts crop growth, water use efficiency, and grain yield. Although it is very difficult to get recent updated figures especially from the areas under conflict, but available numbers point to at least 22,000 ha under conservation agriculture. - Supplemental irrigation package on wheat in the outscaling site of Tadla: 7 farmers used the package of supplemental irrigation and 2 field days organized for 50 farmers to enhance their awareness on the importance and use of deficit supplemental irrigation and improved crop management to increase wheat yield and save irrigation water - Hatem CHEIKH M'HAMED, Houcine ANGAR, Mohamed ANNABI. 2014. Conservation agriculture as alternative to reduce impact of climate change for smallholder in North Africa: Tunisian case. 6th World Congress on Conservation Agriculture. Winnipeg/Canada, 22-25 juin 2014. http://www.ctic.org/media/pdf/WCCA/04_Hatem%20Cheikh%20M%27Hamed.pdf - Houcine Angar, HayetMàroufi, Mohamed Ali Hannechi, Slim Arfaoui, Sonia Msahli, Walid Hamdi, RadhouanNciri and Halim Ben Haj Salah. 2014. Adoption of Conservation Agriculture in Tunisia: Approches and Strategies Implemented. 6th World Congress on Conservation Agriculture. Winnipeg/Canada, 22-25 juin 2014. http://www.ctic.org/media/pdf/WCCA/01_Houcine%20Angar(1).pdf - Houcine Angar, Hatem Babba and Halim Ben Haj Salah. Comparison of Soil Compaction Under Conventional Agriculture and Conservation Agriculture Practices. 6th World Congress on Conservation Agriculture. Winnipeg/Canada, 22-25 juin 2014. http://www.ctic.org/media/pdf/WCCA/01_Houcine%20Angar.pdf - Mohamed Jadlaoui, Ghazoua Haouari, AnisBoussalmi, Rabeh Kalboussi. 2014. Design and agronomic assessment of an implement for conservation agriculture bed planting in Tunisia. 6th World Congress on Conservation Agriculture. Winnipeg/Canada, 22-25 juin 2014. http://www.ctic.org/media/pdf/WCCA/03_Mohamed%20Jadlaoui.pdf <p>Livestock management</p> <ul style="list-style-type: none"> - Livestock management - Use of milk fat separator in Jordan (Milk fat separation is an essential step in Jameed manufacturing. The rational method is consuming a lot of labor in addition to time and resources (water and electricity). The use of milk fat separator enabled women processors to use skim milk instead of full cream milk. By this, there is no need for churning to obtain a skimmed fermented milk. Churning of full cream fermented milk need a lot of cold water and ice and time. Number of processing units that benefited from this technology is 15) - Livestock health services (Foot and mouth disease vaccine -222133 Sheep and 40648 goats; Peste des Petits Ruminants vaccine -142238 sheep and 35961 goats; Sheep pox -190280 sheep and 39388 goats; Brucellosis -78332 sheep and 28232 goats; Anthrax -57061 sheep and 19450 goats; Enterotoxaemia- 21140 sheep and 21339 goats; Sheep Mastitis monitoring using California Mastitis Test -CMT). - Use of selected rams for genetic improvement. - Local knowledge and traditional etno-veterinary practices - Prepare silage from corn and sorghum stalks increased farmers' income, availability of animal forage in summer with higher nutrition value and saved environment from burning corn and sorghum residues in Egypt. 				6	6
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All, except 2	27. Number of technologies/NRM practices released by public and private sector partners globally (phase III)	<ul style="list-style-type: none"> - Milk fat separator - Zero till seeders - Small scale olive harvester - Improved rams - Soil and water conservation technologies - Small ruminant feeding practices - Small ruminant health control - Community-based seed production - Conservation agriculture practices - Supplemental and deficit irrigation - Cactus production and transformation 			11	13
POLICIES IN VARIOUS STAGES OF DEVELOPMENT						
All	28. Numbers of Policies/ Regulations/ Administrative Procedures Analyzed (Stage 1)	<ul style="list-style-type: none"> - Impact analysis of water harvesting techniques (WHT) on rural livelihood conditions under climatic and socio-economic scenario and profitability of investing in WHT in Oum Zessar, Tunisia (WLI Tunisia). An Integrated Impact assessment (IIA) framework, based Extended cost-benefit analysis (ECBA) and Sustainable Livelihoods Approach (SLA) shows that Social capital is the most dominating followed by physical capital mainly in Beni Khedech. Financial capital seems to be not representative due to the low crop and livestock incomes. Projections indicate that the livelihood assets will be changed during 2013-2030 period with the slow increment of physical, human and social capital. Natural capital will decrease due to agricultural intensification and poor land management. The ECBA shows that WHT works are profitable with an IRR of 24 % and an NPV (at 12 % discount rate) of 1380 US \$. The inclusion in the analysis of the off-site benefits improves the economic profitability to 1680 US\$. The WHT works are apparently beneficial at private and social levels for local population within the watershed (Abdeladhim M., Sghaier M., Ouessar M. and Ben Zaied M. National Workshop on Water Resources and Livelihoods in the Dry Areas Considering Climate Uncertainty. Hammamet, Tunisia, 25-26 September, 2014) - "Assessment of cereal producers in Meknès-Tafilalet region" (Morocco). This research elaborates on establishing the problem of cereal aggregation nationwide, vis-à-vis finding alternative way to address the issues. The report also focuses on field implementation of an aggregation project of cereal producers in Meknes-Tafilalet region. The report contains elements describing the regulatory framework in Morocco for promoting aggregation of cereal producers; experiences with cereal aggregation; and proposals for organizing local farmers from Meknes-Tafilalet region to aggregate themselves around government-supported aggregation project. The report also contains a discussion of the problematic elements inherent to the grain sector, and a debate among the various stakeholders in relation to the most convenient way to aggregate their production. - "Is solar energy a viable option to replace liquefied petroleum gas (Morocco)? A case of irrigated areas using groundwater in Morocco". This research will be presented to the Ministry of Agriculture of Morocco for discussion. This paper will also be published in an international peer-review journal. - "The Moroccan wheat Sector (Morocco): What if there is no more tariff protection?". - "The wheat seed system in Morocco". - "Barley subsidies in Jordan: The effects on small ruminant production, food security and 			10	10

		<p>development of the livestock sector” (Jordan). This research presents an analysis of agricultural policies in Jordan in support of the small ruminant sector (sheep and goat). This analysis includes a discussion of the different types of support provided by the government and their impact on livestock heard, cereal production and productivity, cereal imports, and household incomes. The report is being prepared to be published in an international peer-review journal.</p> <ul style="list-style-type: none"> - “Groundwater tariffing policy (Jordan): effects on household livelihoods and groundwater consumption in Jordan”. Research almost finalized and will be presented to the Ministry of Water and Irrigation of Jordan for discussion. - “Farmers’ perceptions of water policies and development projects: A case study from Jordan”. This research, produced in collaboration with NCARE, focuses on farmers’ perceptions of policies and regulations to improve wellbeing and water security in Jordan. To this end, we conducted focus group discussion methodology, covering topics of agricultural policies, groundwater and irrigation management in two Jordanian small rural villages. We found that in Jordan the government has been able to make farmers aware of water policies, regulations and laws, but their implementation lack farmer participation and ownership. We argue that in the short term the government will have to substantially involve the local communities in the formulation and implementation of projects if more efficient, equitable and rational use of water and other natural resources is to be achieved. - “Land policies, production systems and livelihoods in South-East Tunisia”. This research analyzes from a historical viewpoint the profound changes that linked to different government system and resulting land tenure schemes that have affected social and economic dynamics of local populations. The document provides policy makers with an overview of different dynamics overtime linking contrasting behaviors of sedentarization, privatization and fragmentation of land, decline of pastoral activities and rangelands, agricultural development, extension of irrigated perimeters and changes in uses of natural resources. - “ICARDA’s promising technologies, and implications for policies needed to enhance CWANA regional food security under alternative future climate scenarios”(All the flagship). 				
All	29. Number of policies / regulations / administrative procedures drafted and presented for public/stakeholder consultation (Stage 2)					
All	30. Number of policies / regulations / administrative procedures presented for legislation(Stage 3)					
All	31. Number of policies / regulations / administrative					

	procedures prepared passed/approved (Stage 4)					
All	32. Number of policies / regulations / administrative procedures passed for which implementation has begun (Stage 5)					
OUTCOMES ON THE GROUND						
All	33. Number of hectares under improved technologies or management practices as a result of CRP research	Around 22000 ha and 100,000 sheep and goat <ul style="list-style-type: none"> - 15,000 ha under zero till conservation agriculture in the field sites and other related production system in West Asia - 3300 ha for improved olive production techniques and management in the field sites - 3000 ha - Around 200 hectares that belong to the Ain Jemaa enterprise in Meknes. - Fernana: 100 ha (2014)/ CANA PROJECT/ continuing area - Zogmar: 50 ha (2014) : WLI and CRP project/ new area - Siliana: 900 ha (2014) / CLCA project/ continuing area 			22500	50000
All	34. Number of farmers and others who have applied new technologies or management practices as a result of CRP research	<ul style="list-style-type: none"> - Jordan: 60 - Tunisia: 300 - Morocco: 200 - Egypt: 500 			1060	3000

Annex 2: Performance indicators for gender mainstreaming with targets defined

Performance Indicator	CRP performance approaches requirements	CRP performance meets requirements	CRP performance exceeds requirements
1. Gender inequality targets defined	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations - 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) 	<ul style="list-style-type: none"> - Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations - 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) - 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
2. Institutional architecture for integration of gender is in place	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - 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 - A CRP plan approved for capacity development in gender analysis 	<ul style="list-style-type: none"> - 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 - A CRP plan approved for capacity development in gender analysis - The CRP uses feedback provided by its M&E system to improve its integration of gender into research



RESEARCH
PROGRAM ON
Dryland Systems

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

Dryland Systems engages in integrated agricultural systems research to address key socioeconomic and biophysical constraints that affect food security, equitable and sustainable land and natural resource management, and the livelihoods of poor and marginalized dryland communities. The program unifies eight CGIAR Centers and uses unique partnership platforms to bind together scientific research results with the skills and capacities of national agricultural research systems (NARS), advanced research institutes (ARIs), non-governmental and civil society organizations, the private sector, and other actors to test and develop practical innovative solutions for rural dryland communities.

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

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