RESEARCH PROGRAM ON
Dryland Systems

CGIAR

CGIAR Research Program on Dryland Systems

South 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.

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drylandsystems.org

A glimpse of Dryland Systems activities in South Asia

Table of Contents

A. KEY MESSAGES (1 ½ page)

- CRP-Dryland Systems (CRP 1.1) in South Asia is operating in 3 action sites in India namely Western Rajasthan (*Barmer, Jodhpur,* and *Jaisalmer* Districts), Andhra Pradesh (*Anantapur*, *Kurnool* Districts) and in Karnataka (*Bijapur* District) and 1 site in Chakwal district, Pakistan. Following the research framework defined in 2013, the team in South Asia has been focusing on: i) understanding system structure, function and creation of the baseline situations; ii) identification and implementation of context specific resilience building and intensification options; iii) strengthening innovation platform and value chains; iv) gender mainstreaming; v) data sharing. **(IDO's 1 to 6**).
- An integrated systems approach to bring practical solutions to the problems was implemented in three action sites in India and one in Pakistan. The approach targeted farmers livelihood systems and value chains.**Using household surveys of more than 1000 households** from 3 Indian action sites (available on ICRISAT's Data verse) ,five livelihood assets and their key indicators, farm typologies (recommendation domains) were identified. In the Indian action sites, we completed characterization and vulnerability assessment of households; quantification of risk in technology adoption; climate change impact on gender vulnerability; value chain analysis with gender focus on cash & food crops and livestock; feed resources assessment and technology prioritization studies;. Potato production feasibility in Andhra Pradesh and biodiversity assessment in Rajasthan (6 reports are in press and 3 journal papers drafted with one of these submitted) **IDO1, 2 &5**. In Pakistan, the characterization survey has been completed for Chakwal and the report finalized.
- Integrating typology specific promising technologies & diversification options for farming systems were promoted: Ex-ante analysis and participatory prioritization of constraints/opportunities were completed. Soil fertility assessment of action villages showed widespread plant nutrient deficiencies as major constraints to plant production. Soils were found deficient besides the macronutrients such as nitrogen (N) and phosphorus (P), in micro nutrients such as sulphur (S), boron (B) and zinc (Zn). The options for enhancing resilience and sustainable intensification of the system have been assessed through **>750 on-farm trials** by introducing suitable cultivars of cereals and legumes, balanced nutrition, soil & water conservation, dual purpose crops, agro-horti-forestry systems and high value commodities (fruits, vegetables, medicinal plants) incorporating risk management. Evaluated NRM and governance options for sustainable management of community based silvi-pasture systems and water resources. Five sites are developed as sites for learning of natural resource management and demonstrations of potential fodder grasses & multipurpose trees and dryland horticulture in *Rajasthan and Andhra Pradesh* on 50 ha community land. **IDO's 1 to 4.** Specifically our work in Rajasthan on Khadin water conservation systems, common silvi-pasture systems (especially in Barmer), agro-horti kitchen gardens, value chains of medicinal crops & small ruminant in Rajasthan, and rainwater management, soil test based balance nutrition and improved dual purpose crops in all the action sites has created lot of enthusiasm among the local stakeholders and community (http://www.icrisat.org/newsroom/latest-news/happenings/happenings1638.htm#5). In Chakwal, model based activities including land use, land cover mapping, crop simulation (APSIM) and catchment scale simulation (SWAT) were planned and implemented at target sites (Dhrabi watershed). (**IDO 1, 2, 4**). Through bilateral projects mapped to the CRP in Chakwal, on-farm trials were conducted on technologies to increase water use efficiency, land rehabilitation, wheat productivity improvement, diversification through cluster bean, oats, maize, etc. and edible cactus for livestock feed**. (IDO 1,2 & 4.)**
- Institutions for structuring and strengthening local initiatives & stakeholders' convergence and inclusive value chains are important features of our work. In this regard three Innovation platforms-IP (Rajasthan, Karnataka, Andhra Pradesh); 12 village development committees (VDCs) and 3 women livestock keepers sub-committees for management of CPRs were made functional (4 workshops of IP and 15 meetings of VDCs). A need based value chain for medicinal crops- Sankhpushpi (*Convolvulus pluricaulis)* which treats nervous disorders has been created as part of the project (linking farmers to industry)- farmers, ICRISAT/KVK/ Dabur India Ltd. **IDO 6**.

- Focus was given on women centered on-farm research activities through focusing on agri-horti kitchen garden, diversification to vegetables by around 140 farmers; the data is being collected for outcomes/impact. 4 women self-help groups are formed to manage CPRs, small ruminant marketing. In Chakwal women's capacity building focused on primary agro- processing and production technologies. IDO5.
- Synergies from ICRISAT's bilateral projects: such as Bhoochetana in Karnataka and Andhra Pradesh are creating a learning platform for the overall process of innovation and out scaling and impact of technologies on livelihood of smallholders. The benefits of soil-test based nutrient recommendations at sub-district level and seeds of improved cultivars, seed treatment, and integrated pest management options with soil and water conservation were evident in improved crop yields over farmers' practice varying from 19-57%. At district level, 65 training courses with 6,532 participants, 198 trainings at taluk level to train 17,090 trainees and 6123 village level trainings to train 3,24,239 farmers who were exposed to improved crop management technologies to enhance crop productivity on drylands. Nearly 1500 field days were organized during 2014-15 crop seasons and around 95,000 farmers benefited from these field days including 26961 women farmers in 30 districts.
- The impacts of systems research undertaken in these dryland and complex environments require the development of long term partnerships with the local stakeholders and constructive dialogue with the policy makers. But maintaining the continuity of activities and partnerships in future is a challenge given the funding cuts of late 2014. Moreover there has to be a minimum of 3 years period of collaboration with any NARS partner, but current CRP system of funding allows contract (MOU) only for one year – these are major constraints in developing meaningful partnerships. Despite delay in the implementation of DS activities in Pakistan, partners' participation in 2014 activity planning is encouraging. ICRISAT/ILRI shared the survey tool for implementation. In 2015 activity on gender, site similarity mapping and partner's skills development in system modeling is planned across India and Pakistan. However there is a strong need to strengthen the integration among the DS sites in India and Pakistan.

B. IMPACT PATHWAY AND INTERMEDIATE DEVELOPMENT OUTCOMES (IDOS) (1/4 page)

The web link to the impact pathways to for each of the four action sites is below. The base line data of about 1000 HHs from 3 Indian action sites has been hosted on the ICRISAT's data verse to which the web link has been provided below.

CRP-DS Characterization report:
http://drylandsystems.cgiar.org/sites/default/files/Inception%20Report_Dryland%20Systems.pdf
Household Level Baseline Data for Dryland System Agricultural Production System Research in South Asian action Villages (KURNOOL-District):
http://dataverse.icrisat.org/dvn/dv/crpds/faces/study/StudyPage.xhtml?globalId=hdl:11038/10143
Household Level Baseline Data for Dryland System Agricultural Production System Research in South Asian action Villages (ANANTAPUR-District)
http://dataverse.icrisat.org/dvn/dv/crpds/faces/study/StudyPage.xhtml?globalId=hdl:11038/10146
Household Level Baseline Data for Dryland System Agricultural Production System Research in South Asian action Villages (RAJASTHAN - STATE)
http://dataverse.icrisat.org/dvn/dv/crpds/faces/study/StudyPage.xhtml?globalId=hdl:11038/10152
Household Level Baseline Data for Dryland System Agricultural Production System Research in South Asian action Villages (BIJAPUR - District)
http://dataverse.icrisat.org/dvn/dv/crpds/faces/study/StudyPage.xhtml?globalId=hdl:11038/10167
A part of data has also been shared and kept at aWhere Database platform (an example):
Land Size: http://apps.awhere.com/reader/Default.aspx?id=7pxWd3P3N0GKdjseBnq31A

Impact Pathway:

Rajasthan: http://geoagro.icarda.org/en/default/visualization/crp/image/8-Jodhpur,%20Barmer%20and%20Jaiselmer%20districts,%20Rajasthan%20(India).jpg

Chakwal: http://geoagro.icarda.org/en/default/visualization/crp/image/9-Chakwal%20(Pakistan).jpg

Karnataka: http://geoagro.icarda.org/en/default/visualization/crp/image/10-Bijapur%20district,%20%20Karnataka%20(India).jpg

Andhra Pradesh: http://geoagro.icarda.org/en/default/visualization/crp/image/11-Anantapur%20and%20Kurnool%20districts,%20Andhra%20Pradesh%20(India).jpg

C. PROGRESS ALONG THE IMPACT PATHWAY

C.1 Progress towards outputs (2 pages)

With ICRISAT as major partner, other CG centres such as ICARDA, ILRI, IWMI, CIP and Bioversity and NARS- CAZRI, CRIDA, ANGRAU and UASD and NGOs in India and BARI, NARC and SSRI in Pakistan contributed towards outputs and outcomes as members of strategic partnership created for research for development.

The establishment of the **baseline information** through household survey for all action sites is completed and data encoded. Based on survey data from **1000 HHs** from 3 action sites (available on ICRISAT's Data verse) on five livelihood assets and their key indicators, farm typologies (recommendation domains) were developed The data was analysed to characterize production systems in action villages specifically in terms of: farm typology; mapping smallholders' vulnerability; adoption of improved technologies and development of sustainability index (*3 journal papers under submission and another 3 reports in press*).
(www.ageconsearch.umn.edu/bitstream/165846/2/Kumar%20CP.pdf).

In addition, land use land cover maps for all action sites are complete (http://maps.icrisat.org/remotesensing/datasets.html). For some sites (e.g. ANANTAPUR) long term land use changes and (e.g. West Rajasthan) Khadin system have been mapped. (http://maps.icrisat.org/remotesensing/datasets.html). Preliminary results show that significant land use, land cover changes have strongly impacted the resources utilization pattern and system-structure/ functions in general. Feed resource assessment and technology prioritization completed in all action sites by ILRI (draft report available). Agro-biodiversity assessment has been completed by Bioversity International based on 80 focus group discussions and survey of 1200 households in 40 villages across three districts of Rajasthan. This includes information on dietary diversity of mothers and children in vulnerable households. Soil quality is an interface of multiple ecospheres and thus it is an important indicator of change in ecosystem services across time. In this regard 450 composite soil samples, disaggregated by land use type land landscape position, and 30 from each of the 15 action villages were collected and analysed for macro and micro nutrients. It showed widespread soil fertility related degradation as a major stumbling block in the action sites. As such, the incidence of deficiencies for available nutrients varied between 3 and 83% for phosphorus, 3% to 85% for calcium, 83% to 100% for sulphur, 40% to 95% for boron, 73% to 93% for zinc, 3% to 93% for copper. Soil potassium levels were adequate, while soil organic carbon was low in 37% to 97% farmers' fields indicating nitrogen deficiencies also. The result has been shared with the community and also used to guide soil nutrient input during 2014 crop trials. CIP has completed the survey to examine the feasibility of potato production in Andhra Pradesh, the report is yet to come.

In Chakwal, sites and interventions were identified based on the participatory rural appraisal (PRA) conducted by a multidisciplinary team; characterization survey has also been completed and report is being finalized. IWMI jointly with ICRISAT has produced three reports on household vulnerability, quantification of risk in technology adoption and climate change impact on gender vulnerability for three action sites in India. These reports are about to be published by ICRISAT. The irrigation investment option study is also under progress for identifying the feasible irrigation options for the small scale farmers, which can be useful for policy advocacy.

In Rajasthan, biomass assessment for woody and non-woody species was carried out. A total 1500+ geo-referenced location (covering all the landscape) form target villages were taken by field

traversing (almost 200 km) for altitude correction in Digital Elevation Model (DEM). Biomass of trees varied between 15.6 t /ha (Dhok) to 3.9 t/ha (Mansagar). On an average, across all the villages, shrub biomass was 0.9 t/ha. Crop biomass ranged between 4.1 t/ha (Didhoo) to 9.1 t/ha (Mansagar). Grass biomass was maximum in Mansagar village (5.7 t/ha) and minimum in Sakaria village (0.4 t/ha). Total biomass was maximum in Mansagar village i.e. 6.7 t/ha and minimum in Dedha village i.e. 3.0 t/ha. Biomass distribution among different components indicated that tree biomass maximum in target villages. This would help understand the biomass gap and plan strategies for its improvement.

Based on participatory constraint prioritization and ex-ante assessment, a number of activities related to **options for resilience building and intensification** were initiated. Participatory action site specific technologies identification study was completed (*two reports in press*). Based on above analysis **>750 on farm trials** of millet, sorghum, chickpea, cluster bean, moong bean, moth bean, maize, pigeon pea for improved cultivars, balanced nutrition and soil & water conservation were demonstrated on about 180 ha in dryland systems action villages by ICRISAT. Further in Rajasthan ICRISAT has introduced Chickpea and Barley in Khadin system as adaptation option. ICARDA has also evaluated these two on 20ha in existing systems for diversification. The analysis showed a significantly higher yield compared to farmer practices. Productivity enhanced on participating farmers' fields by 18% to >100% for different crops. The increment was much greater in Rajasthan. Soil test-based application of deficient secondary and micronutrients under the Bhoochetana initiative was scaled-up to about 28000 ha during 2013 and in about 90000 ha during 2014 across 13 districts of Andhra Pradesh and in more than million ha in 30 districts of Karnataka. The participatory trials under Bhoochetana showed productivity improvement of 10% to 57% on participating farmers' fields. Participatory trials for diversification to vegetables as kitchen garden with ~90 women farmers were also conducted in 4 action site villages, for which the data is being collected to assess the outputs/outcomes/impact. Grain and crop residues sample from the seed test are examined by ILRI in laboratory to see how such intervention impacts the livestock feed supply and system performances in general. Eight clones/hybrids for drought tolerance against two controls Kufri Pukhraj and Kufri Surya were evaluated at farmer's field in Jodhpur district for arid agro-ecology of Rajasthan by CIP. Among clones and varieties CIP-397006.18 was found promising based upon its overall yield performance, drought tolerance and acceptability of texture and taste. In Chakwal, model based activities like land use, land cover, crop simulation (APSIM) and Soil and Water Assessment Tool (SWAT) were applied at target sites (Dhrabi watershed). **IDO 1, 2, 4**. Calibrated and validated crop models for barley, chickpea, cotton, cluster bean, groundnut, mustard, and wheat in Rajasthan. Through Bilateral project mapped into CRP 1.1 in Chakwal, on-farm trials demonstrated potential increase in water use efficiency, land rehabilitation, wheat productivity by 20-30% and diversification through cluster bean, oats, maize, etc. and edible cactus for livestock feed**. IDO 1,2 & 4.**

Options for improved & sustainable management of common silvi-pasture systems and improved rain water management (Khadin system in Rajasthan and farm level rainwater harvesting as common intervention across all sites) were the major activities in 2014. Small khadin system (10 Nos constructed on 50 ha for rainwater harvesting & crop production in under extreme dry conditions (100-150mm rainfall) showed increase of productivity 2-4 times as compared to control. We have mapped the khadin system across 150 km area, completed the survey to analyze factors constraining khadin systems and organized a stakeholder's workshop (86 participants) to sensitize them for preserving and improving this important agro-ecologically appropriate land and water management systems of Indian Thar desert. Further ICRISAT implemented rangeland management options, NRM, improved species and governance mechanism for sustainable management of community based silvi-pastures systems ~on 50 ha (Jodhpur, Barmer and Jaisalmer in west Rajasthan and ANANTAPUR and Kurnool in AP). Bye laws and gender sensitive equitable institutional mechanism has been initiated by integrating promising species and local wisdom and few sites have shown very good results (https://gravisindia.wordpress.com/2015/01/19/icrisat-and-gravis-develop-models-for-sustainable-management-of-community-silvi-pasture-systems-in-jodhpur-barmer-and-jaisalmer/). In Rajasthan, together with most promising grasses (*Cenchrus*

ciliaris and *Lasiurus sindicus),* >7000 multi-purpose and arid fruit trees were also planted in the CPRs to make them economically viable. In each of these CPRs, rainwater harvesting structures were constructed for the provision of supplementary irrigation. Similarly 600 fruit plants were planted in Anantpur with more than 70% survivability (as at Dec 2014). ICARDA has also initiated work on developing a 10ha community based pasture in Jodhpur Rajasthan (https://gravisindia.wordpress.com/2014/12/12/gravis-developed-pasture-in-osian-block-with-the-support-of-icarda/).

As part of system approach looking at field-farm-landscape, we also created structures in the upstream in Jodhpur. That provided not only drinking water for animals, but controlled the erosion in 100 ha agricultural sandy land and resulted in 2-3 feet increase in ground water table in about 8 nearby bore wells. Further agro-horticulture system and creating/strengthening value chain of medicinal plants were implemented in targeted households based on typology; 10 unit of 50 to 100 plants of most suitable arid fruit + legumes intercrop together with rainwater harvesting structure (Tanka/farm pond) of 25000 to 50000 liter capacity have been implemented in participatory approach.

Pitcher-irrigation technique of watering has helped in successful establishment of horticulture plants (lemon, pomegranate, *Ziziphus mauritiana, Cordia myxa*) in dry areas, which uses 4-5 times less water than standard watering practices.

Another 50 units of agro-horti kitchen gardening with 10-20 multiple fruit plants for poor women farmers were implemented in Rajasthan. Participatory trials for diversification to vegetables as kitchen gardens with about 90 women farmers were conducted in Andhra Pradesh. An economically important and naturally occurring medicinal plant Sankhpushpi (*Convolvulus pluricaulis)* was identified and successfully introduced through 15 on-farm trials in Barmer by ICRISAT and KVK-Barmer. To develop the value chain an MOU was signed r with a major private herbal company- Dabur India Ltd to buy back from the farmers. The introduction of Sankhpushpi could generate additional about US$ 500 per ha, thus farmers are quite motivated. ICARDA evaluated 25 cactus pear accessions (were shipped from Brazil (5 pads per accessions) and 15 accessions from Italy (6 pads per accessions) in India as well as in Pakistan on-station and on-farm before large scale multiplication.

Conceptualization of bio-economic modelling of farming systems using attributes from DS household survey data and also rich Village Dynamics in South Asia (VDSA) data set is progressing. At latter stage this framework will be used to contextualize, integrate and optimize interventions for the dryland systems action sites.

Innovation platforms (IPs) for the Action Sites set up and agreed between partners, in three clusters: West Rajasthan, Anantapur and Bijapur. In collaboration with local partners we identified: Government Line Departments, NGOs, Regional Research Centres, Universities and Private Sectors as major actors. The members representing the different actors are diverse both in gender and technical background. We have 33 registered active members for the west Rajasthan cluster, 30 for Anantapur-Kurnool cluster and 25 members for Bijapur clusters. The terms of references for IPs has been developed and a total of six IPs workshops has been organized to aim to bring together local private and public stakeholders in order to create an enduring basis for structuring initiatives, and institutionalize convergence process so to help realize a sustainable implementation and subsequent impacts of Dryland Systems Research on intensification and system's resilience.

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

As part of implementing integrated systems approach shaped by problem solving "in practice", detailed characterization of livelihood systems (5 capitals), land use land cover mapping, agro-biodiversity survey, household vulnerability, risk assessment, feasibility studies, ex-ante assessment for different potential interventions has helped in planning and targeting the needs based technological and institutional interventions in systems perspective in all sites in India and Pakistan. Implementation of farm typology specific interventions including NRM, integrated crop management, diversification through resilient and high value crops (agro-horti systems with 10 to 200 fruit plants), common property resource management linked to fodder and water have already created a broader base for overall dryland system research activities. That has generated interest and acceptance among farmers and other major stakeholders and would lead us to deliver expected IDOs. DS R4D activities for enhancing resilience and sustainable intensification directly benefitted about 2000 farmers in 4 action sites through on-farm trials on crop productivity enhancement, management of green and blue water, diversification through agro-forestry and agro-horti systems, medicinal plants, and vegetable crops. Six community based silvi-pasture systems being developed on 60 ha community land in Rajasthan and Andhra Pradesh are the learning sites on sustainable management of CPRs through NRM, agronomic practices and gender sensitive equitable governance mechanism.

The information generated through remote sensing based mapping and study of factors affecting sustainability of traditional khadin systems (rainwater harvesting systems under 100 to 200 mm rainfall situations) in Jaisalmer district of Rajasthan was shared with development actors, community and policy institutions through multi-stakeholders workshop. The diversification options being assessed under khadin system in post rainy season this year are being monitored by the innovation platform. That would facilitate its adoption and upscaling.

This year we identified an economically very important drought hardy native medicinal plant-Sankhpushpi (*Convolvulus pluricaulis)* and introduced its cultivation on farmers' field in Barmer district of Rajasthan. A consortium was formed through an MOU among ICRISAT, local Farm Science Center (KVK) and a big private company-Dabur India Ltd. to integrate this high value crop in the farming system and develop equitable value chains. This work will continue and is likely have major implications for improving smallholders' livelihood systems under extreme dry areas.

The innovation platforms (IPs) for the Action Sites set up and agreed between partners (Government Line Departments, NGOs, Regional Research Centres, Universities and Private Sectors as major actors) in three clusters: Western Rajasthan, Andhra Pradesh and Bijapur. These IPs have brought together the local private and public stakeholders in order to create an enduring basis for structuring initiatives, and institutionalize convergence process so to help realize a sustainable implementation and subsequent impacts of Dryland Systems Research on intensification and system's resilience. It provides regular opportunity of feedback and sharing the outputs. Feedback mechanism is helping in better designing and targeting of interventions and sharing of outputs with major stakeholders for scaling up and out.

Bhoochetana in Karnataka and Andhra Pradesh are creating a learning platform for the overall process of innovation and out scaling and impact of technologies on livelihood of smallholders. The benefits of soil-test based nutrient recommendations at sub-district level and seeds of improved cultivars, seed treatment, and integrated pest management options with soil and water conservation were evident in improved crop yields over farmers' practice varying from 19-57%. Achieving research outcomes for systems depend on action sites database establishment, engaging the community and building trust. To deliver outcomes, at district level, 65 training courses with 6,532 participants, 198 trainings at taluk level to train 17,090 trainees and 6123 village level trainings to train 3,24,239 farmers who were exposed to improved crop management technologies to enhance crop productivity on drylands. Nearly 1500 field days were organized during 2014-15 crop seasons and around 95,000 farmers benefited from these field days including 26961 women farmers in 30

districts. During 2013 and 2014 about seven million ha areas was covered in this program http://www.icrisat.org/what-we-do/Resilient Dryland Systems/Bhoo-Chetana/home.html. Bhoochetana initiative was scaled-up in ~28000 ha during 2013 and in ~90000 ha during 2014 across 13 districts of Andhra Pradesh. The participatory trials under Bhoochetana in Andhra Pradesh showed productivity improvement of 10% to 50% on participating farmers' fields.

C.3 Progress towards Impact (1/4page)

Using systems tools the CRP Dryland systems has been able to demonstrate implementation of integrated systems approach shaped by problem solving "in practice" for improving farmers livelihood systems and value chains. The innovation platforms are the main vehicle for the impacts. The institutional innovations like village development committees, women livestock keepers committee for CPRs management, women groups for livestock marketing and innovation platforms have helped in strengthening local capacity and creating impacts as increased productivity and income. Development of Shankhpushpi (medicinal plant) based value chain has opened new avenues for enhancing farmers income and farm resilience.

The dryland system R4D activity in South Asia is also interactively working with and drawing experiences of ICRISAT and other centers from bilateral projects: such as Bhoochetana in Karnataka and Andhra Pradesh. In 2013/2014, 7 million ha area was covered under Bhoochetana in Karnataka and 100 thousand ha in Andhra Pradesh under improved management practices and that resulted in 19-57% increase in crop yields.

D. GENDER RESEARCH ACHIEVEMENTS (1 page)

On gender, CRPs research envisages to move beyond gender disaggregation to empowerment. The sex- disaggregated household and agro-biodiversity database which we collected helps to understand gender roles and relations and develop strategies and ways to empower women. In 2014, gender disaggregated information was generated as part of baseline characterization of the action sites, participation in decision making and access and control, household vulnerability analysis, quantification of risk in technology adoption and climate change impact on gender vulnerability, value chain analysis with gender focus on cash & food crops and livestock; feed resources assessment and technology prioritization studies and agro biodiversity and dietary diversity assessment. Based on these gender analyses, a number of technological and institutional interventions were planned and implemented for mainstreaming gender to empower women and youth and marginalized groups.

- The gender focused activities were very much integrated in DS action activity plans for 2014 particularly in Rajasthan and Andhra Pradesh. Chakwal and Bijapur focused more on capacity strengthening of women farmers and youth.
- Women focused agriculture and livestock value chain study has been completed for western Rajasthan action site (draft report available) with the aim to empower women in the existing value chains.
- The information on household dietary diversity is very useful to design strategies for improving women's access to food and their nutritional security.
- Women based multi-species agri-nutrition gardens under arid conditions are being assessed in 6 action villages in western Rajasthan. This is to demonstrate it as model for improving food and nutrition security of women and children in extreme dry regions which are also affected by high male migration.
- Women and youth are motivated and facilitated as part of collective action to manage research for development interventions in all the 4 action sites in India and Pakistan. Women are active members in such village development committees (VDC) formed under CRP 1.1. In all the VDC meetings there was 22-45% participation of women folks in all the action villages.
- Rural women lead farmers are promoted as change agents in CRP action villages. Two of such women Manibai from Dhok village in Barmer district and Geeta Devi from Govindpura village in Jodhpur district of western Rajasthan were recognized by ICRISAT as rural women leaders. (http://issuu.com/icrisat/docs/happenings_1640).

- Demonstration and evaluation of agro-horti based kitchen garden in Rajasthan and vegetable based kitchen garden was an exclusively women focused activity. Under this activity during 2014, about 60 women farmers in Rajasthan were encouraged to establish agro-horti kitchen garden with 10 to 20 arid fruit plants and vegetables; 90 women were supported to grow vegetables in 50 m^2 to 200 m^2 area in Andhra Pradesh. Data is being collected to synthesize results.
- Women were encouraged to lead the participatory governance structure for management of common property resources (CPRs) in 6 villages in Rajasthan and Andhra Pradesh for fodder production linked to livestock-based activity which is the domain of women. Livestock keeper women were motivated to form self-help groups in 4 villages to develop and manage CPRs in four action villages in western Rajasthan and Andhra Pradesh, India. The women committees has started functioning; but the full establishment of CPRs will take 1 or 2 seasons to evaluate outcomes and impacts.
- The women and youth were particularly targeted in all our capacity strengthening activities on different components of the farming systems like, soil test based nutrition, integrated crop management, diversification through local and high yielding crop fruits, vegetables, kitchen garden for higher and diverse nutrition, value chain, marketing, CPRs management, etc. In 2014, 32 % of the 1055 farmers trained in Rajasthan were women. Similarly in Andhra Pradesh 25% of the 660 farmers and 28% of the 742 farmers trained on various components in Karnataka were women. Besides technological components, women are important part of organization capacity development through collective action for NRM (5 SHGs), seed production (2 SHGs), marketing (2 SHGs).
- In Chakwal, two hands on trainings for rural women on making eight value-added products were organized by BARI and SSRI for 66 women.
- Though the gender is integral part of most of DS activities but there is need to do better reporting and communication on gender outputs. Strategic gender research would also need to be included in our future activities.
- In the regions of Rajasthan and Chakwal in particular, cultural norms require that most interactions with rural women must be undertaken by female project team members.

E. PARTNERSHIPS BUILDING ACHIEVEMENTS (1 page)

- ICRISAT, ILRI, ICARDA, IWMI, Bioversity international and CIP partnering with NARES and local NGOs developed strategic partnership to achieve outputs and outcomes of CRP 1.1. The possibility was explored that World Agroforestry Centre (ICRAF) should be partner in in South Asia as well to strengthen our agro-forestry activities.
- Strong partnership with Local rural communities was created through Village development committees, SHGs for institutionalize sustainable management of CPRs- water, pastures technology evaluation and enhanced market access.
- Strategic partnership with GRAVIS in Rajasthan was strengthened for implementation of systems research at village level and collective action for NRM, CPRs management and integrated approaches. Central Arid Zone Research Institute (CAZRI) has been well integrated as a strong partner in CRP 1.1. Partnership with Swami Keshwan and Rajasthan Agricultural University and Rajasthan State Agricultural Implement Testing Center at Hanumangarh was established for establishing trials to validate modeling scenario predicted outputs.
- The engagement with major stakeholders like state line departments, institutions, industry, NGOS and community through innovation platforms in Indian action sites was the major vehicle for upscaling the ideas of systems approach and feedback for better target our research. We have 33 registered active members for west Rajasthan cluster, 30 for Anantapur-Kurnool cluster and 25 members for Bijapur clusters. There is a challenge to convert these platforms into sustainable partnerships. We are exploring to form district level committees with major role for local stakeholders.
- A new partnership was built among ICRISAT, KVK Barmer, Dabur India Ltd and farmers in Barmer to create and strengthen value chain for medicinal plant cultivation and marketing.
- In Chakwal the ICARDA has strong partnership with BARI, NARC and SSRI for implementation of CRP 1.1 and mapped bilateral projects.

- We have now established partnership with Rajasthan State Agricultural Implement Testing Center at Hanumangarh for establishing trials to validate our modeling scenario predicted outputs.
- AF Ecology Center (AFEC) to pilot improved common property resources management practices in 3 action site villages in Kurnool (Yerraguntla and V. Bonthirala) and Anantapur (Mallapuram village) districts.
- During the 2014 in Andhra Pradesh, new NGO partners were identified to reach out to large number of farmers and participatory evaluation of science-led interventions on farmers' fields. The identified partners were Rural Studies and Developmental Society (RSDS) in Yerraguntla village in Kurnool district, Community Organizing for Rural Upliftment Society (CORUS) in Bonthirala village in Kurnool district and AFEC in Mallapuram and Kurlapally villages in Anantapur district. Partnership was also built with NARS operating in the region i.e. Acharya NG Ranga Agricultural University (ANGRAU). Similarly in Bijapur the partnership was strengthened with university of agricultural science- Dharwad and NGO-SBMMAS for implementing integrated systems approach.
- IWMI has taken up implementation of micro irrigation water scheduling and fertigation in PPP mode with Jain Irrigation System Ltd. (JISL). Weather based crop and livestock insurance is being assessed in Karnool with Bajaj Allianz and eemousam-weather risk management services pvt. Ltd. in a PPP mode.
- This year we have developed an interface with CRP dryland cereals. One activity each on context specific integrated crop management have been planned collaboratively with CRP DC for pearl millet in Rajasthan and sorghum in Bijapur. These activities will be implemented in 2015.

F. CAPACITY BUILDING (1/2 page)

- Under Bhoochetana (Karnataka and Andhra Pradesh) a consortium of partners (4050 persons) were trained in soil-test based fertilizer recommendations, participatory evaluation of cultivars and innovative delivery systems for knowledge and inputs in scaling-up model. Furthermore, 2300 field days were held to share the knowledge amongst the farmers. These resulted in 141,540 farmers trained including 39,385 women in Karnataka. A further 62,125 women were exposed to science-led improved technologies to enhance crop productivity on drylands. In Andhra Pradesh, about 465 district, division and village level trainings were conducted across 13 districts and ~9500 line staff, farmers and stakeholders were trained in soil fertility management.
- For Rajasthan action site 17 trainings, two workshops and two exposure visits we organized, where 1055 farmers and stakeholders including 22% women participated. In Bijapur, with support from UASD, 13 training were organized where 968 farmers (24% women) participated.
- In AP, a total of 9 training programs were conducted in on the topics of soil test-based balanced nutrition, INM, IPM, varieties, diversification, NRM etc. for 254 farmers (including 68 women farmers). Four field days were participated in by ~ 390 farmers including 90 women.
- Trainings were conducted on micro irrigation system management, irrigation scheduling, fertigation to the farmers in Mannur and Balagnur of Bijapur district on 16 and 17th Dec. 2014. Farmers from orchids (Citrus, banana) were trained covering 100 participants. In addition, exposure visit to the JISL was organised with 28 farmers (5 women) from Dec 26-28, 2014 to Ananthapur and Kurnool action sites on high density planting of mango, nursery raising, banana tissue culture and Mango nursery planting.
- The two-day workshop on ICARDA bilateral project was organized, proceedings released by CAZRI: http://rajasthanpatrika.patrika.com/news/canal-water-management-policy-focused-on-creating/1177234.html
- In Chakwal, 6 field days were organized in collaboration NARC, BARI, SSRI on varietal evaluation, spineless cactus and rangeland management, 410 farmers participated. Two trainings (three days) were organized on value addition to fruits and vegetables, 66 rural women participated. Three national partners received training on crop modelling.
- For CGIAR and partners, a course was held for the application of Remote Sensing and GIS in agriculture 12 Participants from ESA countries (11 males and 1 female) attended.

RISK MANAGEMENT (less than 1/2 page)

List the three major risks that may hinder the expected delivery of results by the CRP and describe the mitigation actions taken to manage these risks.

- Creating and sustaining partnerships need long term commitments with partners, but CRP plans are for one year. We have to always look for bilateral which again have more donor orientation. This year in IRT, we plan to explore joint proposals for bilateral projects.
- Extreme climate situations (severe drought in many regions of India) has affected outputs. We have focused on diversification of interventions including livestock, perennial component and value chains
- Ensuring true participation of the community and local government- resource & time, local policy and political preferences

G. LESSONS LEARNED (1 page)

- The pilot demonstration with micro irrigation investments for orchards and other agro-horti and agro-forestry systems have longer term benefits. Hence some of such activities will have to spread over the years.
- Similarly the interventions on integrated farming systems along with rainwater harvesting systems, management of CPRs are successfully implemented, but will need time to show outcome/impact and sustainability.
- The trial area for different varieties should be such that farmer could easily handle and operate. Proper demarcation between different varieties to recognize and produce seed separately. Need to ensure farmers selection and availability of all inputs well ahead of time.
- There are also cases where partners require overall lists of activities and associated costs for multi-year rather than annual activities planning. In view of financial uncertainty and the present tradition of annual planning of activities this needs to be addressed.
- Despite efforts exerted to improve the technical capacity of national implementing partners, timely delivering quality output is an issue of concern. This will impact outputs and thus indirectly the indicator. More interventions in capacity building are required.
- Most farmers are not aware of potential, achievable and actual yields of the crops under their weather and soil conditions. In absence of knowledge of yield gaps, they do not know how much further improvements they can expect to achieve with improved management. This project fills this important knowledge gap.
- Biomass estimation of woody components requires great deal of precision as non-destructive methods especially in case of trees require accurate equations. Biomass measurement of woody components will be further refined.
- For greater impacts, we need to increasingly involve industry and increased dialogue for policy influencing.

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

	Indicator	Glossary/guidelines for defining and measuring the indicator, and description of what the CRP includes in the indicator measured, based upon the glossary	Deviation narrative (if actual is more than 10%	2013		2014		2015
				Target	Actu	Target	Actual	Target
KNOWLEDGE, TOOLS, DATA								
All	Survey	Multiple livelihood assets based farm typologies (recommendation domains) developed for Rajasthan, Andhra Pradesh and Karnataka *(www.ageconsearch.umn.edu/bitstream/165846/2/Kumar%20CP.pdf)*			Survey of 1000 HHs complete	Analysis of 1000 HH surveys in 3 action sites	Recommendation domains developed for 3 action sites	NA
	Conceptual understanding	Development of comparative sustainability index for different farm typologies (Journal paper submitted)				For one action site	SI developed for Andhra Pradesh	NA
	Soil fertility data	Soil quality analyzed for macro and micro nutrients-, disaggregated by land use type land landscape position.				Samples from 15 villages	450 composite soil samples-30 from each of the 15 action villages	Soil nutrient recommendation for 15 villages
	Data and publication	Characterization of production systems in action villages specifically in terms of: farm typology; constraints, priority interventions, ex-ante analysis, technology assessment done (3 draft reports available and 3 journal papers submitted).				Action sites character-rized	3 Indian action sites characterization completed and data for Chakwal being analyzed	Finalise corrections in 3 journal publications

	Survey and data	Agro-biodiversity assessment and dietary diversity of mothers and children in vulnerable households in three districts of Rajasthan				Survey 40 villages	Survey of 1200 households in 40 villages - draft report	1 published report
	Geo-tagged biomass data	Biomass assessment for woody and non-woody species carried out in Rajasthan					Total 1500+ geo-referenced location from target villages taken by field traversing (~200 km) for altitude correction in Digital Elevation Model (DEM).	1500 geotagged datapoints
	Survey data	A feasibility study of potato production in Andhra Pradesh-Anantpur and Kurnool carried out				70 farmers	Based on survey of 67 farmers	1 report
	Survey data and report	Household Vulnerability mapping and quantification of risk in technology adoption		Socio-economic survey and analysis	Completed survey and analysis	2 reports completed	Both reports completed and in process for publication	NA
	Survey data and report	Study on irrigation investment options in Anantapur and Bijapur				Report on irrigation investment options	Completed survey and draft report available	NA
	GIS maps	In addition to land use land cover maps for all action sites, for some sites (e.g. ANANTAPUR) long term land use changes and (e.g. West Rajasthan) Khadin system (rainwater harvesting) have been analyzed http://maps.icrisat.org/remotesensing/datasets.html). (http://maps.icrisat.org/remotesensing/datasets.html). Preliminary result shows that significant land use land cover changes have strongly impacted the resources utilization pattern and system-structure and functions in general.			15 action watershed		Khadin system in Jaisalmer (150 km)	Site similarity mapping in 4 action sites

	Data describing spatial and temporal dynamics	In Chakwal- model base analysis of land use, land cover, crop growth (APSIM) catchment hydrology (SWAT) were applied at target sites in Dhrabi watershed. Rajasthan-Calibrated and validated crop models for barley, chickpea, cotton, cluster bean, groundnut, mustard, and wheat and developed scenarios (ICARDA)				2 sites	Models calibrated and applied in 2 sites	Activity would continue to develop suitable cropping system scenarios for 2
All	2. Number (from 11) of flagship products produced that have explicit	From the above 11 'DS products' 5 of these explicitly target gender and all are related to NRM management.				11	11	
All	3. Number (from 11) of flagship products produced that have been assessed for likely gender-disaggregated impact	From the above 11 'DS products' 5 of these explicitly target gender for assessing impact on women and youth.				5	5	

	Survey tool, PRA assessment data, institutional knowledge	Analyse drivers for sustainable management of CPRs- khadins & common pasture. Assess and prototype innovative options of collective action and governance of CPRs: Tool developed; a PRA and survey khadin farmers and CPRS user was conducted on barriers, drivers of change, interaction of social, ecological and market factors in their governance				Develop survey tool, survey, framework for governance structure	Survey covered 50 khadin farmers in 14 villages and 60 CPRs users in 3 villages.	Analysis and report on drivers of sustainable management of khadins and CPRs
	Model and ex-ante analysis	Bio-economic modeling of farming systems using attribute from DS household survey data and also rich Village Dynamics in South Asia (VDSA)				1 action site framework developed	Data set developed, framework conceptualized	Bio-economic model and tradeoff analysis for Bijapur
All	5. Number (from 2) of tools that have an explicit target of women farmers	From the 2 too produce, both are relevant to targeting gender				2	2	
All	6. Number (from 4) of tools assessed for likely gender-disaggregated impact	Household analysis and technology adaptation strategies for gender to climate change in Andhra Pradesh and Karnataka				2	2	

All	7. Number of open access databases maintained by CRP	**Data sets: Baseline information** of **1000 HHs** from 3 Indian action sites and 6 districts (available on ICRISAT's Data verse) http://drylandsystems.cgiar.org/sites/default/files/Inception%20Report_Dryland%20Systems.pdf http://dataverse.icrisat.org/dvn/dv/crpds/faces/study/StudyPage.xhtml?globalId=hdl:11038/10143 http://dataverse.icrisat.org/dvn/dv/crpds/faces/study/StudyPage.xhtml?globalId=hdl:11038/10146 http://dataverse.icrisat.org/dvn/dv/crpds/faces/study/StudyPage.xhtml?globalId=hdl:11038/10152				4 action site data archived	4 data set on ICRISAT Data verse	Where platform for baseline and outputs
All	8. Total number of users of these open access databases	Databases open access to South Asian partners only – once publication is complete, the data will become open access.					All partners	

All	9. Number of publications in ISI journals produced by CRP	1. Chander Girish, Wani S P, Kanwar L Sahrawat, Dixit Sreenath, Venkateswarlu B, Rajesh C, Narsimha Rao P and Pardhasaradhi G 2014. Soil test-based nutrient balancing improved crop productivity and rural livelihoods: case study from rainfed semi-arid tropics in Andhra Pradesh, India. Archives of Agronomy and Soil Science 60(8): 1051–1066. 2. Chander Girish, Wani S P, Sahrawat Kanwar L and Rajesh C 2014. Enhanced nutrient and rainwater use efficiency in maize and soybean with secondary and micro nutrient amendments in the rainfed semi-arid tropics. Archives of Agronomy and Soil Science DOI: 10.1080/03650340.2014.928928 3. Chennamaneni SR, Wani S P, Chander Girish and Sahrawat Kanwar L. 2014. Balanced nutrient management for crop intensification and livelihood improvement: A case study from watershed in Andhra Pradesh, India. Communications in Soil Science and Plant Analysis 45: 2515-2528 4. Gumma M K, Thenkabail P S, Andrew N, Maunahan A, Islam S. (2014), Mapping seasonal rice cropland extent and area in the high cropping intensity environment of Bangladesh using MODIS 500 m data for the year 2010. ISPRS Journal of Photogrammetry and Remote Sensing. 91(5), 98-113. (IF: 3.3) 5. Gumma MK, Kajisa K, Irshad A M, Whitbread A M, Nelson A, Arnel R, Palanisamy K (2014). Temporal changes in land use by irrigation source in TamilNadu and management implications. Environmental monitoring and Assessment in press 6. Holzworth, D.P. *et al*., Whitbread*, et al.*, 2014. APSIM - Evolution towards a new generation of agricultural systems simulation. Environmental Modelling & Software 62, 327-350. 7. Nageswara Rao V, Meinke H, Craufur, P Q, Parsons D, Wani S P, Kropff M J and Rego T J 2014. Strategic double cropping on Vertisols: a viable rainfed cropping option in the Indian SAT to increase productivity and reduce risk. European Journal of Agronomy 62 pp. 26-37				13	13+6	10

		8. Nageswara Rao V, KALPANA SASTRY R*, Craufurd P, Meinke H, Parsons D, Rego T J, Rathore A. (2014) Cropping systems strategy for effective management of Fusarium wilt in safflower. Field Crops Research 156 191–198. (Impact factor: 2.608) http://dx.doi.org/10.1016/j.fcr.2013.11.013 9. Sahrawat K L, Murthy K V S, SHIRISHA K, and Wani S P 2014. Quality Control in Soil Testing Using the Internal Standards: Temporal Variability in Organic Carbon and extractable Nutrient Elements. Communication in Soil Science and Plant Analysis. Pp.1- 10. Sahrawat K L, HANGULA M N, UMA DEVI M, Rai K N, Reddy B V S and Wani S P 2014. Comparative evaluation of ground and unground pearl millet and sorghum grain samples for determining total iron and zinc. Communications in Soil Science and Plant Analysis 45:1259-1268. 11. Tesfamariam T, Yoshinaga H, Deshpande S P, Srinivasa Rao P, Sahrawat K L, Ando Y, Nakahara K, Hash C T and Subbarao G V 2014. Biological nitrification inhibition in sorghum: the role of sorgoleone production. Plant and Soil 379:325-335. 12. Thenkabail P S, Gumma M K, Teluguntla P S, Irshad A M (2014) Hyperspectral Remote Sensing (Imaging Spectroscopy) of Vegetation and Agricultural crops. Photogrammetric Engineering and Remote Sensing. 80(8), 697-709. (IF: 2.1) 13. Thenkabail P S, Gumma M K, Teluguntla P S, Irshad A M (2014) Hyperspectral Hyperion Images and Spectral Libraries of Agricultural Crops. Cover Page. Photogrammetric Engineering and Remote Sensing. 80(8), 697-709. (IF: 2.1)						

	Non ISI	14. Kumar Shalander and Chand Khem (2014). Assessing impact of Climatic Variability on Crop Yields in Rajasthan. Annals of Arid Zone, 51 (3&4): 211-214 15. Haileslassie Amare, Craufurd Peter 2012.Challenges in the Dryland Agricultural Production Systems of South Asia: Research Priorities and Strategies. Annals of Arid Zone, 51 (3&4): 203-210 published in 2014 16. Ramilan, T., DakshinaMurthy, K., Nedumaran, S, Haileslassie, A., Whitbread, A, Bantilan, C., Kumar, S and Wani, S. P (2014) An Alternative Insurance Index for Climate Risk in Semi-Arid Agriculture using a Crop Simulation Model, Abstract, Proceedings of SLCARP International Symposium, Colombo. 17. Kumar, Shalander, Haileslassie Amare, Thiagarajah Ramilan; Wani Suhas P. (2014). Assessing different farming systems for enhancing farm income and resilience in extreme dry region of India. *www.ageconsearch.umn.edu/bitstream/165846/2/Kumar%20CP.pdf* 18. ICRISAT-GRAVIS 2013. Value chain analysis with gender focus on food and cash crops and livestock, ICRISAT, Patancheru, 502 324, India 19. ICRISAT-GRAVIS 2014. Climate Change, Gender and Adaptation Strategies in Dryland Systems of South Asia- A Household Level Analysis in western Rajasthan						
1,2,3, 4, 6	10. Number of strategic value chains analyzed by CRP	1. Value chain analysis with gender focus on cash & food crops and livestock; 2. Feed resources assessment and technology prioritization studies (Draft report available) 3. Medicinal plant Sankhpushpi (*Convolvulus pluricaulis)*				4 value change studies	Value chains study completed- 4 commodities and fodder	4 value change studies continued

1,5,6,7	11. Number of targeted agro-ecosystems analysed/characterized by CRP	1. Agro-pastoral and mixed rainfed systems in Rajasthan 2. Intensive rainfed system - mixed crop, livestock system in Andhra Pradesh and Bijapur 3. Mixed crop livestock systems in Chakwal		Survey tools, survey	Tools Deve-loped and survey comple-ted	Characterization of AEs	Agro-ecosystems in 3 Indian action sites characterized; Data being analyzed for Chakwal	3
1,5,6,7	12. Estimated population of above-mentioned agro-ecosystems	Rajasthan: Jodhpur, Barmer, Jaisalmer Andhra Pradesh: Anatpur, Kurnool Karnataka: Bijapur					Rajasthan 3 districts: 7.0 million Anantpur and Kurnool: 7.1 million Bijapur: 2.1 million Chakwal	16.1 m people
CAPACITY ENHANCEMENT AND INNOVATION PLATFORMS								

All	13. Number of trainees in short-term programs facilitated by CRP (male)	**Gender inclusive capacity building programs in CRP 1.1 action sites:** • Integrated nutrient management, IPM, context specific package, Agro-horti-forestry system, management of silvi-pasture systems, marketing system in Rajasthan (ICRISAT/GRAVIS/CAZRI) • Micro irrigation system maintenance, irrigation scheduling, fertigation (IWMI): 2 trainings and 1 exposure visit, 17th & 26-28 Dec • In Bijapur, with support from UASD, 13 training were organized where 968 farmers (24% women) participated. • Stakeholders trained on organoleptic test for hybrids/varieties selection through participatory approach (CIP): one training • Trainings to farmers on soil test-based balanced plant nutrition, improved varieties, IPM, vermicomposting, soil & water conservation, fodder in Andhra Pradesh • Two training on value addition to fruits and vegetables (Chakwal) • Chakwal: 4 trainings and 7 field/farmer days on participatory varietal evaluation, spineless cactus and rangeland management				700 farmers 600 farmers	17 trainings+ 10 on hands on exposures for 1055 farmers 100 farmers (Bijapur)+ 28 farmers (Anantpur) 986 farmers 50 farmers 700 farmers 66 rural women 410 farmers and stakeholders	>3000
	Number of farmers trained	Bhoochetana: in Karnataka, at district level, 65 training courses with 6,532 participants, 198 trainings at taluk level to train 17,090 trainees and 6123 village level trainings to train 3,24,239 farmers who were exposed to improved crop management technologies to enhance crop productivity on drylands. Nearly 1500 field days were organized during 2014-15 crop season and around 95,000 farmers benefited from these field days including 26961 women farmers in 30 districts. In Andhra Pradesh, about 465 trainings at district, sub-division and village level were conducted across 13 districts and about 9500 line staff, farmers and stakeholders were trained in soil fertility management.					324239 farmers in Karnataka 9500 farmers and line staff were trained	>300000 farmers trained
		A stakeholder's workshop organized to sensitize them for preserving and improving khadin system- agro-ecologically appropriate land and water management systems of Indian Thar desert (Draft report available)					86 stakeholders	>200

All	14. Number of trainees in short-term programs facilitated by CRP (female)	As above					Overall 23 % were the female Agro-processing-value addition (only women)	
All	15. Number of trainees in long-term programs facilitated by CRP (male)	International Gender workshop at Dubai Training in integrated systems modelling in Amman (India and Pakistan) Training on crop modelling (India and Pakistan)					5 2 10	12 20 30
All	16.Number of trainees in long-term programs facilitated by CRP (female)	International Gender workshop at Dubai					1	

1,5,6,7	17. Number of multi- stakeholder R4D innovation platforms established for the targeted agro-ecosystems by the CRPs	The innovation platforms (IPs) for the Action Sites set up and agreed between partners (Government Line Departments, NGOs, Regional Research Centers, Universities and Private Sectors as major actors) in three clusters: *Western Rajasthan, Andhra Pradesh and Bijapur*. These IPs have brought together the local private and public stakeholders in order to create an enduring basis for structuring initiatives, and institutionalize convergence process so to help realize a sustainable implementation and subsequent impacts of Dryland Systems Research on intensification and system's resilience.		Start process to establish 3 IPs	Identi-fied stake-holder mem-bers, deve-loped OR, esta-blish IPs	Establish IPs, organize workshops	3 IPs established, 3 workshops organized; plan of activities and outputs shared, linkages strengthened (about 200 stakeholders participated)	3 IP's will continue in India
	Number village level groups and women's participation	At village level, 12 village development committees (VDCs) and 3 women livestock keepers' sub-committees for management of CPRs are made functional (15 meetings of VDCs). In all the VDC meetings there was 22-45% participation of women folks in all the action villages.				12 VDC for participatory implementation of the project	12 VDC's were continued	12 VDC's
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES								
All	18. Number of technologies/NRM practices under research in the CRP (Phase I) Number of improved practices, farmers and area covered	**Options for resilience building and intensification**: on-farm assessment of integrated crop management, improved cultivars, balanced nutrition, IPM and soil & water conservation- millet, sorghum, chickpea, barley, cluster bean, moong bean, moth bean, maize, pigeon pea, groundnut, maize, lentil, cumin, etc. in Rajasthan, AP and Karnataka (Farm type specific)-Develop context specific packages and systems module (ICRISAT led consortium) New introduction of barley and lentil under khadin system cultivated on conserved moisture			220 on-farm trials were conducted as entry point		>750 on-farm trials in about 180 ha conducted and result shared with IPs (18->100% yield increase). The learnings from action villages have been up scaled by GRAVIS, AFEC and other IP partners in another 500 ha	>500 on-farm trials and linked to state government for more trials

		Crop diversification activity by ICARDA: Barley and chickpea has been provided to 24 chickpea farmers and 34 barley farmers in three districts covering area of more than 19 ha in total. Crops are in field now and are performing well in selected sites.					24 +34 demonstrations of chickpea and barley in the existing systems in Rajasthan	
	Diversification and increased resilience	Integrating perennial component for resilience, income & nutrition in Rajasthan: • Agro-horti system with tanka (RWHS of 25 50k l): 100-200 arid fruit trees (10 units) also linked to fodder • Agro-horti nutrition garden by women: 10-20 fruit plant of multiple species (95 units) • Pitcher irrigation technique of watering has helped in successful establishment of horticulture plants (lemon, pomegranate, *Ziziphus moritiana, Cordia myxa*) in dry areas, which uses 3-4 times less water for irrigation.					10 farmers 95 women farmers • Our partners have up scaled this agro-horti kitchen garden concept in 450 households in the	These models will be further assessed and up scaled
	High value commodity and Linking farmers to industry for improved market access	Introduction of high value medicinal plant Sankhpushpi (*Convolvulus pluricaulis:* identified and successfully introduced through 15 on-farm trials in Barmer by ICRISAT and KVK-Barmer. To develop the value chain an MOU was signed with a major private herbal company- Dabur India for buy back and quality improvement					15 in action villages and 40 farmers in nearby villages: It has tremendous potential to increase farm income and resilience	Strengthen the partnership and create innovation platform
	Alternative feed source	ICARDA evaluated 25 cactus pear accessions (were shipped from Brazil (5 pads per accessions) and 15 accessions from Italy (6 pads per accessions) in India as well as in Pakistan					On station and on farm	continue
	Diversification option	Clones/hybrids for drought tolerance against two controls Kufri Pukhraj and Kufri Surya were evaluated at farmer's field in Jodhpur district for arid agro-ecology of Rajasthan					10 on-farm trials	10 on-farm trials-intensification through potato in DS Jodhpur

	Water productivity and high yielding cultivars	Through Bilateral project mapped into CRP 1.1 in Chakwal, on-farm trials demonstrated potential to increase in water use efficiency, land rehabilitation, wheat productivity by 20-30% and diversification through cluster bean, oats, maize, etc. and edible cactus for livestock feed					40 demonstrations on rainwater harvesting; On station trials on wheat 2 ha trial on spineless cactus for feed	continued
	NRM options, inclusive governance structure for sustainable management of CPRs	ICRISAT implemented rangeland management options, NRM, improved species and governance mechanism for sustainable management of community based silvi-pastures systems on ~ 60 ha (Jodhpur, Barmer and Jaisalmer in west Rajasthan and ANANTAPUR and Kurnool in AP). Bye laws and gender sensitive equitable institutional mechanism has been initiated by integrating promising species and local wisdom and few sites have shown very good results (https://gravisindia.wordpress.com/2015/01/19/icrisat-and-gravis-develop-models-for-sustainable-management-of-community-silvi-pasture-systems-in-jodhpur-barmer-and-jaisalmer/). Focus activities are soil and water conservation; reseeding of degraded communal grazing areas; introduction of multipurpose trees; equitable governance structure for CPR management.		Identify sites and sensitize community	Sites identified and community sensitize, no objection obtained		5 sites (50ha) by ICRISAT and 1site (10ha) by ICARDA The same approach was up scaled in other 15 villages (covering about 200ha) through GRAVIS and other development actors	To be Continued to institutionalize the improved NRM and governance structure for CPRs
	Perennial component for higher resilience and income	Enhancing viability and sustainability of CPRs: 7000 multi-purpose and arid fruit trees were planted in participatory mode in the CPRs to make them economically viable. In each these CPRs rainwater harvesting structures are included for the provision of supplementary irrigation. Similarly 600 fruit plants were planted in Anantpur with more than 70% survivability.			Community sensitized and planting material identified		7600 economical trees integrated into 6 CPRs	Monitor existing plantings

	Balanced soil nutrition, water conservation and high yielding cultivars	ICRISAT is implementing large bilateral projects- Bhoochetana in Karnataka and Andhra Pradesh (AP). Several NRM related technologies with the objectives of increasing productivity; resources use efficiency and mitigating land degradation under on farm experiments and out scaling. The technologies are focusing on : soil analysis and mapping; soil test-based S, B and Zn interventions; evaluations of new varieties of groundnut, finger millet, soybean, sorghum, pearl millet, sunflower, castor ; BBF landform interventions; zero tillage; aerobic compost preparation techniques; Vermi-compost production techniques, biomass generation through gliricidia, animal health camps and breed improvement in about 20 districts. http://www.icrisat.org/what-we-do/Resilient Dryland Systems/Bhoo-Chetana/home.html			43 districts: 7 million ha areas in Karnataka and 30000 ha in AP	30 districts of Karnataka; 13 districts of AP	30 districts in Karnataka and 90000 ha in AP	30 districts in Karnataka and 90000 ha in AP
	Improved runoff based farming systems	*Improving traditional rainoff based farming (khadin system) in Rajasthan*: Small khadin system (10 Nos constructed on 50 ha for rainwater harvesting & crop production in under extreme dry conditions (100-150mm rainfall) showed increase of productivity 2-4 times as compared to control. We have mapped the khadin system across 150 km area and working with stakeholders. Partners have up scaled this concept on >300 rainfed farm households. http://icrisatintranet/pimd/pa/haps/2014/1638.pdf					10 small new khadin systems assessed as integrated farming systems; One large khadin in Jaisalmer. Our partner GRAVIS has up scaled this improved khadin model in for 300 farmers in western Rajasthan	12 small khadins and 1 large khadin-NRM, governance structure Upscaling through local stakeholders

All	19. Number (from 18) of technologies under research that have an explicit target of women farmers	All the above technology have strong gender (women farmers) component.					Overall 23 %	
All	20. Number (from 18) of technologies under research that have been assessed for likely gender-disaggregated impact					9	9	15
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 CRP's recommendations	Agro-pastoral and mixed system in Rajasthan: As part of system approach looking at field-farm-landscape, we have created structures in the upstream in Jodhpur. That provided not only drinking water for animals, but controlled the erosion in 100 ha agricultural sandy land and resulted in 2-3 feet increase in ground water table in about 8 nearby bore wells.				1 agro-ecosystem	1 agro-ecosystem 100 ha area	2 agro-ecosystem >1000 ha
1,5,6,7	22. Number of people who will potentially benefit from plans, once finalised, for the scaling up of strategies	The 4 action sites are amongst the most densely populated dryland areas in the work with generally small farm sizes. The potential impacts are enormous as demonstrated by the Bhoochetna scale up project.						>20 million people
All, except 2	23. Number of technologies/ NRM practices field tested (phase II)							

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)							
1,5,6,7	25. Number (from 24) of above nnovations/approaches/opti ones that are targeted at decreasing inequality between men and women							
1,5,6,7	26. Number of published research outputs from CRP utilised in targeted agro-ecosystems						all	

All, except 2	27.Number of technologies/NRM practices released by public and private sector partners globally (phase III)	Demonstration/introduction of Hybrid model for weather based crop and livestock insurance in a PPP mode.				Weather based crop and livestock insurance for 50 farmers on pilot basis in association with Bajaj Allianz	PPP for weather based crop and livestock insurance was completed during Kharif 2014. 25 farmers to claim for deficit rainfall during the period.	Continued in 2015
POLICIES IN VARIOUS STAGES OF DEVELOPMENT								
All	28. Numbers of Policies/ Regulations/ Administrative Procedures Analyzed (Stage 1)	We are generating evidence on CPRs management, Khadin system, agri-horti systems, crop-livestock issues. Policy						
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							
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	➢ 250 ha area under on-farm trials ➢ 100 ha under CPRs ➢ 900 ha under improved khadins ➢ 200 ha under agro-horti garden ➢ 40 ha under medicinal plant cultivation ➢ Bhoochetana claims > 7 m ha in Karnataka alone in 2014 using improved practices. This is yearly coverage and that includes other best practices (improved seeds, seed treatment, etc.) in addition to balanced plant fertilization.					Action sites R4D 1490 ha Scale up projects 7m ha in Karnataka 0.1 m ha AP	Action sites R4D 1500 ha Scale up projects 7m ha in Karnataka 0.5 m ha AP

All	34. Number of farmers and others who have applied new technologies or management practices as a result of CRP research	About 750 farmers were directly benefitted through various interventions via productivity enhancement and diversification. Our partners up scaled different diversification and context specific package to another 500 farmers. The improved khadin system approach and small agro-horti nutrition garden was up scaled by our partners to > 700 households The dryland system R4D activity in South Asia is also interactively working with and drawing experiences of ICRISAT and other centers from bilateral projects: such as Bhoochetana in Karnataka and Andhra Pradesh. In 2013/2014, at district level, 65 training courses with 6,532 participants, 198 trainings at taluk level to train 17,090 trainees and 6123 village level trainings to train 3,24,239 farmers who were exposed to improved crop management technologies to enhance crop productivity on drylands. Nearly 1500 field days were organized during 2014-15 crop seasons and around 95,000 farmers benefited from these field days including 26961 women farmers in 30 districts.					Trainings >300000 farmers Field days 95000 farmers	Trainings and field days >0.5 m farmers

Annex 2: Performance indicators for gender mainstreaming with targets defined

Performance Indicator	CRP performance approaches	CRP performance meets requirements	CRP performance exceeds requirements
1. Gender inequality targets defined	Sex-disaggregated social data is being collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations in Rajasthan	Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations And The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs) In all the four action sites	Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations And The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs) And CRP targets changes in levels of gender inequality to which the CRP is or plans to contribute, with related numbers of men and women beneficiaries in main target populations In capacity strengthening programs at least 25% are women Women are part of the institutional mechanism experimented to manage CPRs and increase technology uptake.
2. Institutional architecture for integration of gender is in place	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy - CRP M&E system has protocol for tracking progress on integration of gender in research	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS and funds allocated to support their interaction. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy - CRP M&E system has protocol for tracking progress on integration of gender in research And A CRP plan approved for capacity development in gender analysis	CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS and funds allocated to support their interaction. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy - CRP M&E system has protocol for tracking progress on integration of gender in research And A CRP plan approved for capacity development in gender analysis And The CRP uses feedback provided by its M&E system to improve its integration of gender into research

CGIAR

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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