

MEDIUM-TERM PLAN 2005-2007

SUMMARY

A. HIGHLIGHTS OF CHANGES IN PROJECT PORTFOLIO FOR 2005

The last Strategic Planning at ICARDA started in 1996/7 and was completed in 1998. Historically ICARDA's 19 research projects, as shown in the ICARDA MTP 2004-2006, were formulated as part of this Strategy exercise and incorporated in 1997 into the TAC-approved MTP 1998 -2000.

In 2001/2 in response to the global initiative of TAC, ICARDA, together with AARINENA and the CAC NARS Forum, undertook a priority setting process for agricultural research in the region of Central and West Asia and North Africa (CWANA) with NARS, sister Centers and other stakeholders, which included sub-regional brainstorming workshops and a widely circulated questionnaire survey, and which culminated in a regional meeting in May 2002 at ICARDA. More recently in 2003, as part of the CGIAR-wide electronic priority setting exercise led by the Science Council, a CWANA stakeholder panel consultation was held which also informs ICARDA's visioning.

This year - 2004 - ICARDA began strategic visioning afresh. The exercise has started with a systematic scan of global and regional externalities to re-examine the socio-economic context, the political/institutional context, opportunities emerging from new science and technology, environmental trends and lessons learned by the Center.

The key driver for evolution in the Center's research agenda is our focus on poverty alleviation in the Dry Areas eco-region. The above priority setting exercises highlighted the key mega-problems of the Dry Areas in general and CWANA in particular as water scarcity, desertification, biodiversity loss and the need to diversify options to improve livelihoods.

Integral to this strategic visioning exercise is a review of our research project portfolio. This is being done within the above external context and taking into account the regional priorities of NARS and other stakeholders, ICARDA's responsibility to produce global public goods and to capitalize on new science, and our other comparative advantages. While this review of our research project portfolio is an on-going process within our strategic planning, it has had direct implications for the development of the Center's MTP 2005-2007. Our approach has been to incorporate the production of the MTP 2005-2007 within the strategic visioning process on the understanding that both are closely related and that new wisdom arising from the strategic visioning if not fully captured in the MTP 2005-2007 will be included in the MTP 2006-2008. Therefore, the current MTP 2005-2007 represents an "interim" MTP leading to ICARDA's next Strategic Plan.

In 2003 a Center-Commissioned External Review on 'Outreach' at ICARDA recommended that '*ICARDA undertakes a detailed review of the current breakdown of its research agenda, with the purpose to re-formulate the 19 MTP projects into a smaller number of inter-disciplinary projects that can effectively address the research needs of the major production systems in the dry areas*'.

ICARDA's current 19 projects (MTP 2004 – 2006), first incorporated into the TAC-approved MTP 1998 -2000, are listed below. The 19 MTP projects are nested within five themes, at that time the five themes of the CGIAR namely: Crop Germplasm Enhancement, Production Systems Management, Natural Resource Management, Socio-economics and Policy, and Institutional Strengthening.

19 Research Projects of ICARDA's Medium-Term Plan 2004 – 2006

Theme 1. Crop Germplasm Enhancement

Project 1.1. Barley Germplasm Improvement

Project 1.2. Durum Wheat Germplasm Improvement

Project 1.3. Spring Bread Wheat Germplasm Improvement

- Project 1.4. Winter and Facultative Bread Wheat Germplasm Improvement
- Project 1.5. Food Legume (Lentil, Kabuli Chickpea, and Faba Bean) Germplasm Improvement
- Project 1.6. Forage Legume Germplasm Improvement

Theme 2. Production Systems Management

- Project 2.1. Integrated Pest Management
- Project 2.2. Agronomic Management of Cropping Systems
- Project 2.3. Improvement of Sown Pasture and Forage Production
- Project 2.4. Rehabilitation and Improved Management of Native Pastures and Rangelands
- Project 2.5. Improvement of Small-Ruminant Production

Theme 3. Natural Resource Management

- Project 3.1. Water Resources Conservation and Management
- Project 3.2. Land Management and Soil Conservation
- Project 3.3. Agrobiodiversity Collection and Conservation
- Project 3.4. Agroecological Characterization

Theme 4. Socioeconomics and Policy

- Project 4.1. Socioeconomics of Natural Resource Management
- Project 4.2. Socioeconomics of Agricultural Production Systems
- Project 4.3. Policy and Public Management Research

Theme 5. Institutional Strengthening

- Project 5.1. Strengthening National Seed Systems

New Project Portfolio for ICARDA's MTP 2005-2007

Following extensive internal debate and discussion with the Center's Board of Trustees it was agreed to consolidate the current project portfolio into six integrated "megaprojects". Given the close links among human welfare, agricultural productivity, economic growth and the environment in the dry areas, ICARDA's research is designed as a single coherent poverty-focused program, sub-divided into six megaprojects, among which there are a multitude of cross-linkages and interactions. To focus ICARDA's research agenda around the key problems of the Dry Areas, the megaprojects have been designed with a greater synergy that will facilitate the research process and bring to bear the collective knowledge, expertise and resources available to the Center in tackling and solving the problems of the Dry Areas in the most effective and efficient manner possible. The structure of the six megaprojects ensures the continuity of the current research activities and additionally accommodates a number of new approaches and avenues in research direction. These newer avenues include: improved income generation from high value crops and by adding value to staple crop and livestock products; rehabilitating agriculture in conflict/post-conflict situations; and closer alignment of agricultural research with mainstream development programs through research for development applications.

Specifically the six megaprojects (MPs) are presented below. The first four MPs (MP1 – MP4) address specific thematic problems: management of scarce water resources; agrobiodiversity conservation and germplasm improvement; combating desertification; and the diversification of rural livelihoods. The last two MPs (MP5 and MP6) are cross-cutting in nature. MP5 supports the entire research agenda by providing the knowledge and feedback required to refine the targeting of research to alleviate poverty. MP6 focuses on the management, and dissemination to end users, of the research knowledge generated in MP1- MP5.

For each MP, we present a brief justification, the major elements of the project, and, to illustrate continuity, how the previous 19 MTP projects are integrated into the six MPs (shown in parentheses below). Activities within the Systemwide and Ecoregional Programs and the Challenge Programs are embedded within the MPs and are an integral part of the Center's Medium-Term Plan.

MP 1: Management of scarce water resources and mitigation of drought

By definition the Dry Areas are regions of water scarcity. In particular the region of Central and West Asia and North Africa (CWANA) is the most water scarce region in the world with 15 CWANA countries already below the water "poverty line" of < 1,000 m³/capita/year. Renewable water

resources are limited and rainfall is highly variable and unpredictable. This short-term climatic variability is likely to be exacerbated by longer-term climate change. Models of climate change predict that the WANA sub-region will become not only hotter but also drier, exacerbating water scarcity and increasing drought frequency. Countries with predominantly rural economies and high dependence on dryland agriculture will be at most risk as they are highly vulnerable to shifts in seasonal climatic patterns.

This project focuses on developing strategies for the more efficient and more effective use of limited water resources in agricultural production, but the issue of limited water availability flows throughout the entire research portfolio linking all six megaprojects.

Major elements of MP1 comprise:

- Assessment of available water resources and their use (3.1, 3.4, 4.1).
- Options for improving the productivity of water and for mitigating drought, including water resource management (3.1), drought tolerant and water-use efficient germplasm (utilizing outputs from MP2) (1.1, 1.2, 1.3, 1.4, 1.5, 1.6); and agronomic management of cropping systems (2.2).
- Policy and institutional research to create an enabling environment that supports the dissemination and adoption of water efficient technologies and drought mitigating practices (4.1, 4.3).
- Institutional strengthening and capacity building.

MP 2: Integrated gene management: Conservation, improvement and sustainable use of agrobiodiversity

Within the Dry Areas the CWANA region contains three major centers of plant diversity, where numerous species of temperate-zone agriculture originated and where their wild relatives and landraces are still found, and also considerable small ruminant biodiversity. These are a valuable source of genetic material for future germplasm enhancement. The *ex situ* collections developed and maintained by this project provide continuous and reliable access to genetic resources required to develop germplasm with higher and more stable yields, better resistance to evolving biotic and abiotic stresses (particularly drought and heat) including those emanating from climate change, and better end-use and nutritional quality. The exploitation of these genetic resources through breeding for the benefit of the poor is recognized as a key comparative advantage of ICARDA and other Centers in the CGIAR. At the same time, *in situ* conservation, through protection and habitat management, maintains naturally occurring and evolving populations of agriculturally useful species within their environment.

Major elements of MP2 comprise:

- *Ex situ* and *in situ* conservation, characterization and evaluation of agrobiodiversity including agriculturally useful plant species and small ruminant biodiversity (3.3, 2.5). (Linkage with MP4 in developing alternative income generating activities).
- Germplasm enhancement for higher and more stable yield, improved end-use and nutritional quality (linking to MP4), better biotic and abiotic resistance and adaptation to climate change (linking to MP1), including use of biotechnological tools and development of plant breeding methodologies (1.1, 1.2, 1.3, 1.4, 1.5, 1.6 and 2.1).
- Formal and informal seed production systems (Linking with MPs 3, 4 & 6) (5.1).
- Policy and institutional research in support of *in situ* conservation of agrobiodiversity (4.1, 4.3).
- Institutional strengthening and capacity building

MP 3: Improved land management to combat desertification

Desertification is defined by UNCCD as land degradation in the dry areas. The CWANA region encompasses a range of agro-ecosystems including drylands, irrigated lands, rangelands, mountains and deserts, that have evolved as a result of climatic extremes and a long history of human occupation and management. The land area of CWANA covers some 1.7 billion ha and an estimated 45% of the total area of irrigated and rainfed arable land together with the vast areas of rangelands is subjected to some degree of land degradation with consequent reductions in biological productivity. Some degradation occurs naturally, but in many areas the dominant processes are accelerated degradation resulting from human activities. They include overgrazing of rangeland, inappropriate land management that encourages soil erosion by wind and water, inappropriate irrigation management leading to salinization, and, more insidiously, degradation of

the natural vegetative diversity. The project aims to identify options for rehabilitating degraded land resources and, at the same time, to improve and strengthen systems of land management to control degradation and sustain future production

Major elements of MP3 comprise:

- Assessment of desertification (3.2, 3.4).
- 'Best-bet' technologies for the management of land, water (linking to MP1), vegetation (linking to MP2) and rangelands, especially the communal management of rangeland resources and the livestock grazing systems they support, to control degradation and combat desertification (2.2, 2.3, 2.5, 3.2)
- Policy and institutional research to create an enabling environment that supports the dissemination and adoption of technologies and management practices for combating desertification (4.1, 4.3).
- Institutional strengthening and capacity building.

MP 4: Diversification and sustainable improvement of rural livelihoods

Within Dry Areas the majority of the rural population is involved in the agricultural sector and the development of agriculture is recognized as the engine for national economic growth and development. Given the natural resource constraints in the ecoregion, especially in more marginal areas, productivity increases alone will not be sufficient to combat poverty and improve rural livelihoods (men and women). Innovative options are needed to diversify income generating opportunities available to rural households. Such options include those coming from diversifying cropping systems and from the utilization of high-value plant species (e.g. medicinal, horticultural and herbal species), and also those from increases in the quality and end-use value of agricultural commodities, both to improve food quality and nutrition in rural areas and add market value. The project contributes to the overall aim of developing productive and sustainable systems that conserve the resource base while supporting rural livelihoods in the dry areas.

Major elements of MP4 comprise:

- Research on household investment and marketing opportunities for value-added crop and livestock products (2.5, 4.2).
- Options to both increase and diversify the value of crop production, including alternative high-value crops, improved integrated production and pest management of crops, enhanced crop and feed/livestock production systems (linking with MP3 on management of rangeland feed resources), and improved quality and added value of end products (linking to MP2) (1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.4).
- Options to increase the productivity of livestock (small ruminants) and to diversify and increase the quality and value of their products (2.4, 2.5).
- Policy and institutional research to support diversification of income generating options and their adoption by various target groups (men and women) including private sector links (4.2, 4.3)
- Institutional strengthening and capacity building

MP 5: Poverty and livelihoods analysis

In the Dry Areas poverty in all its dimensions (economic, nutritional and natural resource - arable land and water) is widespread. In the CWANA region an estimated 70% of the poverty is in rural areas even though only some 43% of the total population lives there. The rural population is largely dependent on agriculture, which is facing a number of converging environmental trends that reduce options, drive migration and threaten the future sustainability of livelihoods, particularly in the most marginalized areas (e.g., mountains and desert margins). A deeper understanding of the determinants of this poverty, and of the livelihood strategies adopted by rural communities, is necessary to continually refine the targeting of ICARDA's research (MP1-MP4) and identify pathways out of poverty.

Using detailed analyses of the organization of households and communities, using a sustainable livelihoods approach, and the evaluation of the natural resources on which they depend, MP5 supports the entire research agenda by providing the knowledge and feedback needed to identify technical, institutional and policy options that support the development of sustainable livelihoods. The project will pay specific attention to the gender dimension of poverty and the structures that determine differential access to resources and income earning opportunities.

Major elements of this poverty-targeting project comprise:

- Analysis of the determinants of poverty and rural livelihood strategies, including gender analysis (4.2, 3.4).
- Assessments of the impact of agricultural research on poverty reduction in all its dimensions and across different sectors of rural society (4.2).
- Market and non-market valuation of the natural resources used by rural communities and analysis of the impact of NRM research on rural livelihoods (4.1, 3.4).
- Analysis of the returns to investments in the dry areas (4.3)
- Institutional strengthening and capacity building

MP 6: Knowledge management and dissemination for sustainable development

Given the importance of agriculture in national growth and development, the sound management of the knowledge generated from science and technology and its alignment/linkage into use by end-users for sustainable development is needed. Research outputs from MP5 are expected to inform this project on the gender specific approaches that may be needed in generating and disseminating knowledge to end users.

This MP includes research activities in knowledge management and dissemination that were not previously explicit in our research project portfolio. Major elements of MP6 comprise:

- Management and dissemination of information on technological, institutional and policy options.
- Institutionalization of participatory and community-based research approaches.
- Frameworks for up-scaling pro-poor innovations.
- Strengthening national seed systems (Linking with MPs 2, 3 & 4) (5.1).
- Dissemination of lessons learned from conflict/post-conflict rehabilitation of agriculture
- Development of scientific data bases, tools and methodologies.
- Development of innovative distance learning and other training methods.
- Strengthening research-extension linkages and enhancing extension capacity to serve end-users through new tools such as expert systems

The logframe descriptions of the six megaprojects in the Research Project Portfolio for 2005-2007 are presented in the attached Annex.

The Science Council has requested that convening Centers present separate logframes for their Systemwide and Eco-regional Programs (SWP/ERP). ICARDA is the convening Center for the ERP: ***Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus (CAC)***, and, accordingly, a complete profile of the ERP is presented as a separate programme in ICARDA's project portfolio in the attached Annex.

Eco-regional Program: Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus (CAC)

Through an ICARDA initiative, the ERP for CAC was established in 1998 by a consortium of nine CG Centers (CIMMYT, CIP, ICARDA, ICRISAT, IFPRI, ILRI, IPGRI, ISNAR, and IWMI). IRRI has since joined the ERP and ISNAR's program has merged with IFPRI. Hence, the consortium continues to have nine CG Centers participating. The CAC region consists of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan in Central Asia, and Armenia, Azerbaijan and Georgia in the Caucasus.

The ERP for CAC is organized under broad themes, with each theme sub-divided into activities, as follows.

1. Productivity of Agricultural Systems
 - 1.1 Germplasm Enhancement
 - 1.2 Strengthening National Seed Supply Systems
 - 1.3 Cropping Systems Management and Agricultural Diversification
 - 1.4 Livestock Production Systems and Integrated Feed/ Livestock Management
2. Natural Resource Conservation and Management
 - 2.1 Irrigation, Drainage, and Water Basin Analysis
 - 2.2 On-Farm Soil and Water Management

- 2.3 Rangeland Rehabilitation and Management
3. Conservation and Evaluation of Genetic Resources
 - 3.1 Plant Genetic Resources
 - 3.2 Animal Genetic Resources
4. Socioeconomic and Public Policy Research
5. Strengthening National Programs

These themes provide the overall framework in which specific projects are developed and implemented in partnership between NARS and CGIAR centers. In the program description in the attached Annex, the outputs and milestones include specification of which Centre/partner bears primary responsibility for its achievement. Each Center finances its own projects and the details of the component projects are reported within the MTPs of the Centers implementing those projects.

A Program Facilitation Unit (PFU) has been established in Tashkent, Uzbekistan, hosted by ICARDA's regional office for Central Asia and the Caucasus and staffed by an internationally recruited Unit Head supported by a locally recruited support staff. Of the nine Centers involved, four have posted staff in the region: ICARDA, IPGRI and IWMI have placed scientific staff in Tashkent, whereas CIMMYT has established a program office in Almaty, Kazakhstan. The PFU provides logistic support to the scientists involved in the various program activities. Some non-CGIAR centers have recently shown their interest to join the Consortium.

Funding for the PFU is the only financing received by the ERP and is reported separately from ICARDA's finances in the Center's financial plan.

The Head of the PFU reports to the Program Steering Committee (PSC), consisting of one representative from each of the nine participating CG Centers and the eight CAC NARS, a representative from the CGIAR Secretariat, and representatives from donors that support the Program.

The PSC meets annually to review on-going and new collaborative research initiatives for CAC and to ensure that they are within the framework established under the Program. It provides guidance on technical matters, monitors progress, reviews the results of research and helps in resolving the programmatic, operational and financial issues. It serves as a Forum for exchange of information and experiences among its partners. In addition, Regional Program Planning Meetings and the Steering Committee Meetings of the different projects/networks are conducted annually, including the national workshops for program review and monitoring.

The PSC is assisted by a small Executive Committee consisting of the two co-chairs of the Steering Committee, a donor representative and the Head of the PFU.

Highlights of 2003 results and 2004 developments within the ERP-CAC are presented within Section B, below.

B. OVERVIEW: HIGHLIGHTS OF 2003 RESULTS AND 2004 DEVELOPMENTS

Highlights are presented by region (CWANA, Sub-Saharan Africa, South and East Asia, and Latin America). Highlights of ICARDA's activities in CWANA are presented below under the CGIAR principal outputs.

CWANA

Germplasm Collection, Characterization and Conservation

- The germplasm holdings of mandate crops and their wild relatives at the Center exceeded 131,000 accessions in 2004, with the majority designated as 'In Trust' germplasm under the auspices of FAO. As part of the CG-wide Global Public Goods Initiative to upgrade gene banks, ICARDA is constructing additional cold store facilities to house our future collections. This upgrade program, started in 2003, will continue for three years and it increases the proportional

allocation of resources to this CGIAR output. Activities in germplasm collection, characterization (including molecular characterization), evaluation, maintenance and distribution (nearly 20,000 accessions were distributed in 2003) continued during the year, with collection focused in the CAC region.

- ICARDA is coordinating the implementation of a regional collaborative project on the Conservation and Sustainable Use of Dryland Agrobiodiversity with the NARS of Jordan, Lebanon, Syria and the Palestinian Authority and with IPGRI, ACSAD (Arab Center for Studies of Arid Zones and Dry Lands) and UNDP funded by GEF. A major thrust of the project is the development of *in situ* and on-farm conservation of the biodiversity of agriculturally useful species through the appropriate management of habitats. Innovative ways to sustainably use the biodiversity have been developed and are increasingly being adopted by the participating communities.

Germplasm Improvement

- The major thrust of germplasm enhancement in the mandate crops continues to be towards improving water use efficiency by exploiting our major holdings of dry-areas germplasm through selection and (pre-) breeding for drought tolerance. A wide range of approaches is employed including the use of molecular techniques and biotechnology. Increasingly enhanced drought tolerance is recognized as contributing, together with thermo-tolerance, to adaptation to the anticipated effects of climate change. A project to screen our extensive germplasm collections to identify and use new sources of heat and drought tolerance started with BMZ funding in 2003.
- A total of 29 varieties of cereal and legume crops were released by NARS in 15 countries in the dry areas in 2003.
- Within the HarvestPlus Challenge Program (CP), we aim to improve the nutritional quality of barley, lentil (Phase II crops) and durum wheat (Phase I) for the benefit of the poor, particularly women and children.
- Within the Generation Challenge Program, ICARDA has participated in commissioned research in all five Themes in 2004 and submitted concept notes responding to the CP's first call for proposals.
- Farmer participatory plant breeding research continued in 2003/4 with an increasing focus on institutionalization and has now included collaboration with NARS in Egypt, Eritrea, Jordan, Morocco, Syria, Tunisia and Yemen on barley and in Bangladesh, Nepal, Syria, Turkey and Yemen on chickpea and lentil.
- Since mid-2003 when CIMMYT withdrew support from the joint CIMMYT/ICARDA improvement program on durum and spring bread wheat in CWANA, ICARDA has had to carry the full cost of this research.

Sustainable Production Systems

- Research on water remains a high priority for the Dry Areas. The research is focused on water harvesting and renewable groundwater resources, the use of non-conventional water sources including saline water and treated effluent, and farm-level management practices for improved water-use efficiency in both rainfed and irrigated conditions. A major project on 'Options for coping with increased water scarcity in agriculture in the WANA region' co-funded by the Arab fund and IFAD started in 2004. In 2004 ICARDA continued water research in the CAC region particularly through the second phase of an ADB-funded project on On-farm Water and Soil Management
- ICARDA is a partner in the CP 'Water and Agriculture' with four approved projects (including the highest ranked project) in the first call for proposals – three of which are funded. Collectively in 2004 these new water projects have expanded our water research overall compared to 2003.

- Small ruminant research in 2003/4 focused on the development of market-oriented production and on adding value to dairy products, on-farm adaptive research and breed characterization. Research on small ruminant productivity and feed resources in Central Asia supported by IFAD concluded while a Phase II is sought following a policy workshop held in Tashkent in Oct 2003. Activities in Syria on market opportunities and on-farm adaptive research for small dairy sheep producers also continued with Japanese support. An epidemiologist was hired jointly by ILRI and ICARDA to manage the new joint IFAD-funded project “Small Ruminant Health – improved livelihoods and market opportunities for poor farmers in The Near East and North Africa Region”. In 2004 with Austrian support a project on diversification options from small ruminants was started.
- ICARDA is the CGIAR focal point for UNCCD. In 2003 we completed an inventory study for Thematic Network 1 (TN1) of the sub-regional program for West Asia (SRAP), initiated activities in pilot sites in four countries with support of the OPEC Fund, and also participated in the preparation of national action plans. As follow-up to the Ministerial Meeting on *Opportunities for Sustainable Investment in Rainfed Areas of WANA* in Rabat in June 2001, ICARDA now hosts the facilitator of an incipient rainfed agriculture network initiative. ICARDA with ICRISAT developed a Challenge Program pre-proposal on ‘Agriculture to Combat Desertification and Poverty (DDPA)’. Following a stakeholders meeting in August 2002 at ICARDA with support from IFAD and the Global Mechanism (GM) of UNCCD, the DDPA initiative is being pursued in a Consortium mode because of considerable NARS and donor encouragement. ICARDA hosts a GM-UNCCD-supported Environment Management Officer at its Tashkent Office. In 2004 ICARDA joined the Strategic Partnership Agreement for Implementation of the UNCCD in the Central Asian Republics and is a Member of the Task Force formed by ADB. In September 2003 ICARDA co-sponsored the VIIth International Conference on the Development of Dry Lands in Tehran with the International Dryland Development Commission.
- ICARDA is developing a repertoire of participatory approaches in natural resource management. In 2003, participatory techniques continued to be applied in natural resource valuation exercises with farmers, particularly for soil erosion, water resource depletion, agro-ecological characterization and in estimating water use efficiency. A BMZ-financed project on developing an integrated approach to sustainable land management in dry areas has been established at an integrated research site in Syria and uses participatory community approaches and model building to assist decision-making on options for resource users and planners.

Socioeconomics and policy research

- ICARDA’s attention to the issue of poverty alleviation continued in 2003 and the foundations were laid for increased research efforts in 2004 to clarify the connections between the determinants of poverty and ICARDA’s research. This is required to refine and strengthen the alignment of the Center’s research agenda with the over-riding goal of poverty alleviation in Dry Areas. The outcome of a cooperative project with the University of Massachusetts on household food systems, poverty, and the nutritional status of women and children is being written up in 2004. After identifying the type of malnutrition in this project, we are examining the impact of lysine fortified wheat flour on the nutritional status of rural families. The results of a complementary project on the organization of female agricultural labor in areas where crop production has been intensified through new technologies and increased exploitation of land and water resources will be published in 2004. ICARDA is developing project proposals for research on the potential for improving livelihoods through improving the quality, post-harvest processing and marketing of primary crop and livestock products.
- In 2003 in concert with the SPIA germplasm impact group ICARDA reported on the impact of its improvement research on barley and lentil and the resulting contribution to poverty alleviation. In 2004 ICARDA presented two case studies of the impact of natural resources research to a SPIA workshop on NRM Impact.

- IFAD agreed in 2004 to continue funding ICARDA in cooperation with IFPRI to work with NARS in eight countries of WANA in implementing a community approach to the development of integrated feed/livestock management strategies. The focus is on an increasing role of women in resource management, on household livelihood strategies and community level impacts of policy and property rights and on scaling up technical options in the low rainfall areas of WANA.
- With the appointment of natural resource economist in 2004 ICARDA has strengthened its capacity to address the human aspects of natural resource management at the farm and community levels. During 2003/4 a partnership with ESCWA (United Nations Economic and Social Commission for West Asia) continued on research on farmer allocation of pumped groundwater and the technical and economic efficiency of its use. Efforts focus on identifying ways and means, including local institutional arrangements, for the sustainable utilization of groundwater by farmers. In 2004 focus remains on water as the principal natural resource constraint in the dry areas.

Enhancing institutions

- ICARDA continues to emphasize economic and policy issues affecting the seed supply system in CWANA. The situation in Afghanistan has focused the Seed Unit's activities there in 2002/3. These included a 'Code of Conduct' workshop to provide a preliminary regulatory framework in the country, the injection of quality seed to kick-start the seed system, seed system development and considerable human resource development. In 2002/3, under the Future Harvest Consortium to Rebuild Agriculture in Afghanistan, ICARDA received funding from USAID to support quality seed activities, and needs assessments of various agricultural sectors. This had an effect on the distribution of the Center's funding over the CGIAR outputs within the MTP projects in 2002/3, with the bulk of these funds being attributed on Strengthening National Seed Systems. During 2004 the proportion of funding allocated to seeds systems has declined overall despite the receipt of three new projects (Protected Agriculture, Crop Demonstrations, and Village-based Seed Enterprises) in Afghanistan with a corresponding 'bounce-back' effect of the proportional allocation to other CGIAR outputs.
- ICARDA's research outputs are incorporated within national development projects such as in the Barani (rainfed) area of Punjab, Pakistan, and the Turkish South-East Anatolian GAP project.

Eco-regional Program: Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus (CAC)

Germplasm Improvement

Research activities on germplasm enhancement have focused on testing different crop varieties to identify promising breeding materials with resistance to both biotic and abiotic stresses.

- More than 45 promising varieties of different crops, including 26 of bread wheat, are presently being tested by the State Varietal Testing Commissions (SVTC). Five bread wheat varieties have been released from the joint Turkey/CIMMYT/ICARDA program with CAC NARS in 2003 - *Nurlu 99* and *Azametly 95* in Azerbaijan, and *Jamin*, *Zubkov* and *Azirbosh* in Kyrgyzstan.
- 1000 tons of new wheat variety *Dostlik* was planted for further seed multiplication during 2003/4 in Uzbekistan. 800 kg seed of barley varieties *Batyr-1* and 760 kg of *Batyr-2* have been planted this year for further seed multiplication in Northern Kazakhstan. In October 2003, a new variety *Zhibek Zholy* was also submitted to the SVTC. Barley breeders in Azerbaijan have succeeded in identifying a new promising variety *Baharly*. Last year, 5 tons of *Baharly* seed was produced. In Georgia, 800 kg of chickpea variety *Elixir* and 600 kg of lentil variety *Pablo* have been planted this year for further seed multiplication.
- International nurseries tested in CAC countries during 2003 include: wheat -14 nurseries (1560 entries), barley -6 nurseries (926), chickpea -4 nurseries (188 entries), lentil -4

nurseries (96 entries), vetch -2 nurseries (32 entries), faba bean -1 nursery (8 entries) and lathyrus-1 nursery (16 entries).

- About 510 IRRI rice lines were evaluated by the Uzbek Rice Research Institute during 2003. Of these, 136 lines showed acceptable performance and will be re-evaluated this year as well as used in crossing with local varieties. Seeds of six rice varieties from South Korea (*Hwaseongbyeo*, *Milyang-23*, *Jinbubyeo*, *Taebaekbyeo*, *Sangjubyeo* and *Odaebyeo*) were distributed among rice scientists of six CAC countries during 2003 and are being tested this cropping season.
- From the groundnut materials from ICRISAT, the national program in Uzbekistan entered ICGV 86155 as *Salomat* and ICGV 94088 as *Mumtoz* for general testing and release by SVTC. Tajikistan has submitted ICGV 94106 and ICGV 96066 to SVTC. In Azerbaijan, the national program has identified ICGV 93143 for irrigated conditions and ICGV 95245 for high rainfall areas. Some promising lines have also been identified in Georgia.
- In 2003, CIP supplied 11 *in vitro* clones of improved potato varieties to Uzbekistan, Kazakhstan, Kyrgyzstan and Tajikistan for their testing in the region. These varieties were developed in long day environments and they are resistant to viruses common in the CAC region.

Germplasm Collection

- Through the joint efforts of the Ministry of Agriculture and Water Management of Uzbekistan, USDA, ICARDA and IPGRI, Uzbek Gene Bank has been renovated and made fully functional. ICARDA provided technical backstopping to Uzbek Research Institute of Plant Industry (UZRIPI) for renovation and processing of seed samples for storage. More than 8,000 accessions have been rejuvenated and stored in the Gene Bank so far.
- Need based support for upgrading the storage facility of the gene banks at the Kyrgyz PGR Center, Tajik Academy of Agricultural Sciences, and Georgian Research Institute of Crop Husbandry (GRICH) has been provided.
- In 2003 two collection missions were organized with ICARDA. The first was in Armenia, where the participants collected 364 accessions of cereals, food legumes, fodder crops and their wild relatives. The second was in the Pamir Mountains, Tajikistan in collaboration with Tajik Academy of Agricultural Sciences. A total of 318 accessions of cereals, food legumes, fodder crops and their wild relatives were collected.
- During 2003, IPGRI carried out activities to improve conservation of forest genetic resources and to strengthen community institutions and use of plant genetic resources. Databases on fruit and nut species in Central Asia were developed and analyzed. Important initiatives have been undertaken on new project development, including '*In situ* conservation of crop wild relatives through enhanced information management and field application', 'Establishment of a national information sharing mechanism on the implementation of the Global Plan of Action on plant genetic resources for food and agriculture in Uzbekistan' as well as a full-size project on '*In situ* on-farm conservation of agro-biodiversity in Central Asia'.

Sustainable Production

During the period 2000-2003, the ADB project 'On-farm soil and water management for sustainable agricultural systems in Central Asia' was implemented by ICARDA with partners in Central Asia. Major results of the project are highlighted below:

- In rainfed semi-arid conditions of northern Kazakhstan, zero tillage during the fall proved to be more profitable and energy saving, provided adequate fertilizer was also applied. In rainfed conditions of southern Kazakhstan, conservation tillage was found to be more economical than the traditional practice of deep plowing. Technology including direct sowing with combine cultivator-drills was being accepted by farmers.
- In Turkmenistan conservation tillage contributed to resource saving and allowed timely planting.

- In Tashkent province of Uzbekistan, broadcasting of wheat under shallow cultivation compared to deep plowing was found to be more beneficial. This practice has now been adopted on large scale in both Uzbekistan and Tajikistan.

CIMMYT and partners showed that improved furrow irrigation for raised bed planted wheat can significantly improve water use efficiency in south-eastern Kazakhstan. The sowing of winter wheat on raised beds at Merke site, Jambul province, revealed considerable advantage of this practice coupled with improved irrigation technology. Seed rate of winter wheat was reduced almost by half (from 250 to 120 kg/ha) and the yield also increased significantly.

'Bright Spots' project was conducted by IWMI in three selected sites within Uzbekistan, where "best" performing farm units were identified and monitored. As a result of these studies, major conditions of "bright" spots were determined.

Policy

- Social Mobilization and Institutional Development (SMID) activities of IWMI are being continued at all pilot sites. During September-December 2003, 228 awareness-building meetings were organized with the participation of 3016 water users. Within the scope of the IWRMFV project SMID conducted 25 discussions involving a total of 60 people and 100 casual meetings with 130 people held in January, 2004. Water users and their Association (WUA) staff from Tajikistan visited WUAs in the Osh province of Kyrgyzstan. Training workshops for WUAs on Financial Management, Water Distribution and Operation and Maintenance Planning has been conducted for 6 pilot WUAs in Uzbekistan (1), Kyrgyzstan (4) and Tajikistan (1).

Enhancing NARS

All centers have made concerted efforts towards capacity building. It includes various kinds of training, study tours, participation in international, regional and national scientific meetings and workshops, supply of computers and other research equipment, etc. During 2003, the CAC Program has arranged 11 short and long term training courses with participation of 87 scientists, 4 study visits involving 6 scientists, 14 regional and national workshops involving 436 scientists, officials and farmers, and 3 International Conferences with participation of 237 scientists. A total of 766 persons from the CAC countries benefited from human resource development activities in 2003.

Other Regional Highlights

South and East Asia

- ICARDA is providing major support to integrated research on dryland resource management within the IFAD-funded Barani Village Development Project in Pakistan.
- ICARDA's cooperation in South Asia on lentil improvement is supported by ACIAR through a project in Nepal, which started in 2002 with the Centre for Legumes in Mediterranean Agriculture (CLIMA), Australia. In 2004 the impact on lentil production in Bangladesh of new cultivars was recognized by HE Minister of Agriculture of Bangladesh in a BARI/ICARDA Day. Strong links with NARS in germplasm improvement of cereals (barley and wheat) and food legumes (lentils, Kabuli chickpea, faba bean and low-neurotoxin grasspea) continue through germplasm exchange and training activities in Bangladesh, India, Nepal and Pakistan, and to a lesser degree with Bhutan, China, South Korea and Sri Lanka.

Sub-Saharan Africa

- Focusing on the poor in sub-Saharan Africa (SSA) in line with the CGIAR 'Plank' emphasizing SSA, ICARDA initiatives include the following: research on enhancing food security in the Nile Valley region (Sudan, Ethiopia and Eritrea) through the generation and dissemination of sustainable production technologies for cereals and cool season food legumes, supported by IFAD; support to Ethiopia in its research on grasspea with low neurotoxin content funded by DFID, UK concluded in 2003; and in Eritrea, in collaboration with DANIDA, a project on

integrated disease management to enhance wheat and barley production plus another project from the Challenge Program on Water and Agriculture on Improving Water Productivity of Cereals and Food Legumes in the Atbara River Basin of Eritrea. A project developed with the NARS of Mauritania on natural resource management started in 2003/4 from the CIDA-Africa funding, which is also being used for specific interventions in Eritrea, Ethiopia and Sudan.

- ICARDA actively participated in the process to develop the SSA Challenge Program but recent proposals on the location of the three Pilot Sites outside Mauritania and the Nile Valley countries might preclude our heavy future involvement.

Latin America

- ICARDA's cooperation in Latin America has focused on the provision of germplasm of its global mandate crops. A barley breeder operates from CIMMYT, Mexico for the genetic improvement of barley for the Andean region and for favorable environments globally.
- In 2003 an IFAD-funded project on strengthening institutional capacity to improve marketing of small ruminant products and income generation in dry areas of Latin America was started in partnership with FAO and NARS.

C. MEASURES OF PROGRESS/ACHIEVEMENT

Due to strategic changes in the project portfolio in the MTP 2005-2007, megaproject output indicators have been revised, but the six new megaprojects include the intermediary targets (project milestones) of the former 19 MTP projects.

Project milestones to measure progress for 2005 through 2007 are given within the Research Project Portfolio for 2005-2007 in the attached Annex. With restricted funding now accounting for around two thirds of the budget, the timely attainment of milestones is increasingly contingent upon successful project funding.

Shifts in the regional distribution of ICARDA's research, evident in the financials for 2005-2007, emanate from more accurate assessments of the specific regional location of individual grants rather than any shift in emphasis.

D. COLLABORATION

Challenge Programs

ICARDA is participating in all three pilot Challenge Programs:

CP Water and Food: ICARDA has received funding for three projects through the competitive grants program: two in the Karkeh River Basin and one in the Nile River Basin, in Eritrea. These are included under MP1: Management of scarce water resources.

HarvestPlus: ICARDA is responsible for two projects on identifying barley and lentil germplasm with high concentration of b-carotene, iron, and zinc (included under MP4: Diversification of options).

Generation: ICARDA is a full member of the CP Consortium and is involved in a series of research activities (included under MP2: Integrated Gene Management).

Systemwide and Ecoregional Programs

ICARDA leads the Ecoregional Program for Sustainable Agricultural Development in Central Asia and the Caucasus (EP-CAC) and continues to participate in six Systemwide Programs: SGRP, SLP, SP-IPM, CAPRi, PRGA, and the Comprehensive Assessment of Water Management in Agriculture, convened by IWMI.

Other Collaboration

ICARDA is co-convenor with ICRISAT of a Challenge Program pre-proposal on Desertification, Poverty and Drought (DDPA), that is evolving into a Consortium mode.

The Center has a joint appointment with IFPRI and in 2004 recruited two joint appointments – one with IWMI on marginal quality water and the other with ILRI on small ruminant health.

ICARDA leads the Future Harvest Consortium to Rebuild Agriculture in Afghanistan (FHCRAA) and has formed a similar Consortium to Rebuild Agriculture in Iraq.

ICARDA began managing competitive grant funding in 2002/3 under a USAID grant to rebuild agriculture in Afghanistan. Based on the success of this model DFID Afghanistan in 2004 funded ICARDA's management of the Research for Alternative (for opium cultivation) Livelihoods Fund (RALF). ICARDA, on behalf of FHCRAA, also manages a USAID-funded project for CIP on potato improvement in Afghanistan. ICARDA manages a Moroccan Competitive Grant Facility for part of the Moroccan CGIAR contribution.

To supplement ICARDA's critical mass, the Center is outsourcing some specific research to centers of excellence in the region - for example in the development of computer expert systems (Central Laboratory for Computer Expert Systems (CLAES), Egypt); in genetic transformation of cereals and legumes (Agricultural Genetic Engineering Research Institute (AGERI), Egypt), and in Hessian fly resistance (INRA, Morocco). The research with CLAES and AGERI is organized through Twinning Agreements.

E. COSTING CENTER PROJECTS

2003 and 2004 financials are for 19 Medium-Term Projects, whereas the MTP 2005-2007 is for six Megaprojects.

ICARDA's current estimate of 2004 financing of US\$ 29.14 million is 9.1 % higher than the previous estimate for 2003 of US\$ 26.72 million submitted in the financial plans in August 2003 (see attached financial table). Based on current estimates of anticipated funding, the research agenda requirement in 2005 is US\$ 26.97, which represents a 7.4 % decrease from our current estimated 2004 expenditure.

In computing project costs, ICARDA's indirect costs allocation rate is 22% which is allocated across all six megaprojects in the project portfolio, on a proportional basis.

The project annual cost changes represent an increase to account for inflation. ICARDA does not expect any significant changes in local currency exchange rates.

Non-financial contributions include visiting scientists from France and Japan.

F. CENTER STAFFING

ICARDA jointly appointed two scientists with other Centers in 2004 – one with IWMI on marginal quality water and the other with ILRI on small ruminant health – these joint positions supplement the existing joint appointment with IFPRI of a property rights specialist. Additionally in 2003/4 ICARDA recruited two wheat breeders to replace those withdrawn by CIMMYT from the joint CIMMYT/ICARDA wheat improvement program in CWANA. In response to the External Program and Management Review, in 2004 ICARDA recruited a senior Natural Resource Economist, a legume germplasm curator and a CAC germplasm coordinator, and plans to hire a legume pathologist. In 2003/4 staff turnover occurred in several positions (Director of Germplasm Improvement Program, Rangeland Scientist; and Forage and Feed Legume Production Specialist) without any overall change in emphasis. Additionally in 2004 ICARDA hired a coordinator for the Future Harvest Consortium to Rebuild Agriculture in Afghanistan and aims to recruit a Director of International Cooperation. In 2004 ICARDA anticipates hosting a total of eight associate experts/junior professional officers from Australia, Denmark, France, Japan and Switzerland.

Several modalities are being explored to support critical mass in specific areas of research. Short-term consultants are being used to supplement core staffing in priority areas including faba bean breeding. Senior Scientific Advisors appointed as 'Mentors' provide support on biotechnology, water research, stress physiology and climate change. NARS scientists have been, and will continue to be, appointed, as needed, as Affiliate Research Fellows to conduct specific research activities.

G. CENTER FINANCIAL INDICATORS

In submitting the agenda for 2005-2007, it is assumed that the mode of project financing is not a constraint. Assuming full funding, ICARDA does not foresee any constraints on project activity due to financial reasons.

ICARDA Medium-Term Plan 2005-2007 Overview
SUMMARY OF FINANCING PLAN: 2003 Actuals and 2004 Estimates

PROJECT NUMBER AND TITLE	2003 Actuals		2004 Estimates	
	Total	%	Total	%
Theme 1: Germplasm Enhancement				
1.1 Barley Germplasm Improvement	1.33	5.3%	1.68	5.8%
1.2 Durum Wheat Germplasm Improvement	0.89	3.5%	1.08	3.7%
1.3 Spring Bread Wheat Germplasm Improvement	0.50	2.0%	0.97	3.3%
1.4 Facultative and Winter Bread Wheat Germplasm Improvement	0.56	2.2%	0.62	2.1%
1.5 Food Legume Germplasm Improvement	2.03	8.1%	2.31	7.9%
1.6 Forage Legume Germplasm Improvement	0.51	2.0%	0.59	2.0%
Sub-Total	5.82	23.1%	7.26	24.9%
Theme 2: Production Systems Management				
2.1 Integrated Pest Management	1.68	6.7%	1.85	6.3%
2.2 Agronomic Management	1.05	4.2%	2.19	7.5%
2.3 Sown Pasture and Forage Production	0.86	3.4%	0.95	3.3%
2.4 Native Pasture and Rangeland Management	1.11	4.4%	1.43	4.9%
2.5 Small Ruminant Production	1.19	4.7%	1.89	6.5%
Sub-Total	5.89	23.4%	8.31	28.5%
Theme 3: Natural Resource Management				
3.1 Water Resource Management	2.08	8.3%	3.88	13.3%
3.2 Land Management and Soil Conservation	1.03	4.1%	0.98	3.4%
3.3 Biodiversity Conservation	3.25	12.9%	4.22	14.5%
3.4 Agroecological Characterization	0.58	2.3%	0.72	2.5%
Sub-Total	6.94	27.6%	9.80	33.7%
Theme 4: Socio-economics and Policy				
4.1 Socioeconomics of Natural Resource Management	0.31	1.2%	0.47	1.6%
4.2 Socioeconomics of Agricultural Production System	1.33	5.3%	1.39	4.8%
4.3 Policy and Public Management Research	0.28	1.1%	0.40	1.4%
Sub-Total	1.92	7.6%	2.26	7.8%
Theme 5: Institutional Strengthening				
5.1 Strengthening of National Seed System	4.59	18.2%	1.51	5.2%
TOTAL	25.16	100%	29.14	100%

ICARDA Medium-Term Plan 2005-2007 Overview
SUMMARY OF FINANCING PLAN: 2005-2007 Plan

PROJECT NUMBER AND TITLE	2005 Proposal		2006 Proposal		2007 Proposal	
	Total	%	Total	%	Total	%
MP1 Management of scarce water resources and mitigation of drought in dry areas	3.60	13.0%	3.74	13.0%	3.89	13.0%
MP2 Integrated gene management: Conservation, improvement and sustainable use of agrobiodiversity in dry areas	8.19	30.4%	8.52	30.4%	8.86	30.4%
MP3 Improved land management to combat desertification	2.04	7.6%	2.12	7.6%	2.21	7.6%
MP4 Diversification and sustainable improvement of rural livelihoods in dry areas	7.63	28.3%	7.94	28.3%	8.25	28.3%
MP5 Poverty and livelihood analysis in dry areas	1.66	6.2%	1.73	6.2%	1.80	6.2%
MP6 Knowledge management and dissemination for sustainable development in dry areas	3.70	13.7%	3.85	13.7%	4.00	13.7%
CAC Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus (CAC)	0.15	0.6%	0.16	0.6%	0.16	0.6%
TOTAL	26.97	100.0%	28.05	100.0%	29.17	100.0%

ICARDA Medium-Term Plan 2005-2007

Annex

Research Project Portfolio

- Megaproject 1:** Management of Scarce Water Resources and Mitigation of Drought in Dry Areas.
- Megaproject 2:** Integrated Gene Management: Conservation, Enhancement and Sustainable Use of Agrobiodiversity in Dry Areas.
- Megaproject 3:** Improved Land Management to Combat Desertification.
- Megaproject 4:** Diversification and Sustainable Improvement of Rural Livelihoods in Dry Areas.
- Megaproject 5:** Poverty and Livelihood Analysis in Dry Areas.
- Megaproject 6:** Knowledge Management and Dissemination for Sustainable Development in Dry Areas.
- Ecoregional Program:** Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus.

Megaproject 1: Management of Scarce Water Resources and Mitigation of Drought in Dry Areas

Overview:

By definition the Dry Areas are regions of water scarcity. In particular the region of Central and West Asia and North Africa (CWANA) is the most water scarce region in the world with 15 CWANA countries already below the water "poverty line" of < 1,000 m³/capita/year. Renewable water resources are limited and rainfall is highly variable and unpredictable. This short-term climatic variability is likely to be exacerbated by longer-term climate change. Models of climate change predict that the WANA sub-region will become not only hotter but also drier, exacerbating water scarcity and increasing drought frequency. Countries with predominantly rural economies and high dependence on dryland agriculture will be at most risk as they are highly vulnerable to shifts in seasonal climatic patterns.

This project focuses on developing strategies for the more efficient and more effective use of limited water resources in agricultural production, but the issue of limited water availability flows throughout the entire research portfolio linking all six megaprojects.

Major elements of MP1 comprise:

- Assessment of available water resources and their use.
- Options for improving the productivity of water and for mitigating drought, including water resource management, drought tolerant and water-use efficient germplasm (utilizing outputs from MP2), and agronomic management of cropping systems.
- Policy and institutional research to create an enabling environment that supports the dissemination and adoption of water efficient technologies and drought mitigating practices.
- Institutional strengthening and capacity building.

Goal: Improved management of scarce water resources and mitigation of drought to increase sustainable agricultural production in the dry areas.

Indicator: Target communities receive higher and more sustainable benefits from scarce water resources.

Purpose: Increased agricultural production in the dry areas through efficient and sustainable use of scarce water resources and mitigation of drought.

Indicators: Improved productivity of rainwater, irrigation and marginal-quality water at the farm and the basin levels.
Improved water and soil quality parameters.

Output 1: Assessment of available water resources, including precipitation, surface water, ground and marginal water, and the productivity, benefits and costs at different scales (plant, field, farm, and basin) of their use in agriculture in the dry areas.

Indicators: Information on current and future quantity and quality of water resources available for agriculture in the region.
Costs and benefits of using different water resources in agriculture for various crops and farming conditions.
Constraints to improved water resources allocation and use in agriculture.

Milestones:

2005:

- Assessment of the quantity and quality of water resources in an integrated research site in Syria completed.
- Assessment of rainwater distribution and probabilities in the Karkeh river basin of Iran completed (*CP-Water and Food*).
- Assessment of wastewater used for irrigation in Syria completed.
- Assessment of rain and irrigation water productivity in rainfed benchmark site in Morocco and in irrigated benchmark site in Egypt completed.
- Study on potential water harvesting areas, productivity and consequences of implementation in WANA completed (*within SWIM Comprehensive Assessment of Water*)
- Study of potential supplemental irrigation areas, productivity and consequences of implementation in WANA completed (*within SWIM Comprehensive Assessment of Water*)

- Assessment of wheat yield gap in WANA completed (*within SWIM Comprehensive Assessment of Water*)
- Inventory of the status and intensity of marginal water for agricultural production in WANA developed (*in cooperation with IWMI*).

2006:

- Inventory of short and medium term projections of current water supplies available for irrigation in CWANA completed.
- Assessment of water productivity in Euphrates and Amu Daria river basins completed (*CP-Water and Food*).
- Assessment of irrigation water productivity in one site in Sudan and Iraq completed.
- Costs and benefits of potential water harvesting assessed in Jordan, Saudi Arabia and Libya.
- Cost and benefits of supplemental irrigation assessed in Morocco, Algeria, Tunisia, and Syria.
- Long-term water productivity using GIS-based watershed model assessed in Northern Syria.
- 'Bright spots' for sustainable options for marginal quality water use in crop production in CAC identified (*Ecoregional Program for CAC, in cooperation with IWMI*).
- International workshop on agricultural management of marginal-quality water resources held (*in cooperation with IWMI*).

2007:

- Scenarios of potential consequences and changes in cropping patterns in response to water availability developed and an assessment of their effects on household food security completed.
- Recommendations for improved water productivity in CWANA available (*CP-Water and Food*).
- Assessment of potential improvement in water productivity from use of water-use efficient practices in irrigated, rainfed (supplemental irrigation) and rangeland (water harvesting) completed.
- Guidelines for scaling-up improved water harvesting and supplemental irrigation options for WANA available.
- Study of environmental impacts of marginal water use for CWANA completed (*in cooperation with IWMI*).

Output 2: Options for improved productivity (economic, social and environmental) of rainwater, irrigation and marginal-quality water in rainfed and irrigated systems through water harvesting, supplemental irrigation, agro management, and improved germplasm and cropping systems

Indicators: Increased productivity of rainwater in the rainfed environments.
Increased productivity of irrigation water.
Increased community involvement in management of common water resources.
Crops and varieties with improved water productivity distributed, tested and used in dry areas.

Milestones:

2005:

- Potential agronomic management practices for improved rainwater use and crop productivity and sustainability in dry highlands of Iran documented.
- Use of Phosphogypsum in barley-based cropping system for improved rainwater and crop productivity in an integrated research site in Syria documented.
- Benchmark site for water harvesting established in Jordan and existing rangeland systems characterized.
- Pilot sites and community arrangements for micro catchments in Syria and Jordan established.
- Benchmark site for improving irrigation water productivity established with community participation and baseline information collected in Egypt, Sudan and Iraq.
- Baseline information and trials for irrigated agricultural productivity established in Lower Karkeh River Basin, Iran (*CP-Water and Food*)
- Pilot demonstration farms for improved water productivity in CAC established (*Ecoregional Program for CAC*)
- Responsive and input-use efficient faba bean and wheat lines adapted to improved irrigation management identified.

2006:

- Improved options for increasing rain water productivity using supplemental irrigation developed, tested and verified in Morocco and Karkeh River Basin, Iran (*CP-Water and Food*).
- Report on assessment of alternative crops, rainwater productivity and systems sustainability in CAC completed (*Ecoregional Program for CAC*).

- Improved water harvesting techniques identified and tested in Jordan.
- Microcatchment water harvesting techniques evaluated under community management in Syria and Jordan.
- Improved options/practices of irrigation management, germplasm, and cropping patterns tested in Egypt.
- Simulation models for the spatial extrapolation and generalization of benchmark results on water and crop productivity validated through use of GIS.
- Responsive and input-use efficient faba bean and wheat lines adapted to improved irrigation management tested in farmers' fields at bench mark sites.

2007:

- Options and guidelines for scaling up in Morocco, Syria, Tunisia, and Algeria and Karkeh River Basin available (*CP-Water and Food*).
- Options for efficient water harvesting in the range-crop-livestock system in Jordan available.
- Guidelines for scaling up in Jordan, Libya and Saudi Arabia available.
- Assessment of adoption and potential impact of improved packages, including germplasm and management, of options on productivity, profitability and sustainability completed.
- Guidelines developed for scaling up benchmark site results for Egypt, Iraq and Sudan
- Demonstrations of recommended water saving technologies in the CAC conducted (*Ecoregional Program for CAC*).

Output 3: Methods, options and strategies for drought characterization, preparedness and mitigation in the dry areas.

*Indicators: Regional network on drought functional.
Methodology for developing appropriate options and strategies for drought preparedness and mitigation used by NARS.
Policy makers informed of appropriate strategies for drought preparedness and mitigation.
Improved drought, heat and cold tolerant germplasm tested and used by NARS.*

Milestones:

2005:

- GIS-based methodology for mapping drought and dry spells in CWANA developed.
- Network on Drought Management for the Near East, Mediterranean and Central Asia established and activities started.

2006:

- Historical drought incidence mapped in Karkeh River Basin, Iran, using SPI method (*CP-Water and Food*).
- Assessment of the effectiveness of existing strategies, measures and policies in drought preparedness and mitigation in CWANA completed.
- Drought tolerant barley, bread and durum wheat and food and forage legume lines and crop management options evaluated with NARS.
- Potential options for drought preparedness and mitigation evaluated with NARS.

2007:

- Drought risk mapping in Karkeh River Basin, Iran completed (*CP-Water and Food*).
- Map of drought tolerant crops and varieties available in CWANA developed
- Drought tolerant lines of barley, wheat and legumes and crop management options tested on farmers' fields.
- Conference on drought mitigation organized.

Output 4: Policy and institutional options for improved water use and irrigation demand management

*Indicators: Improved policy options for water allocation and use in agriculture developed and delivered to NARS and policy makers.
Community institutional options for irrigation water management in use.
Land tenure systems conducive to improved water resource management in the marginal lands proposed.*

Milestones:

2005:

- Regional workshop for natural resource valuation held.
- Water supply and water demand policies in CWANA critically reviewed and documented (*CP-Water and Food*).
- Water user associations and water allocation systems in CWANA reviewed and documented.

2006:

- Market and non-market resource valuation methods developed/adapted.
- Factors affecting the demand for irrigation water quantified
- Inventory of water allocation and management in the CAC completed (*Ecoregional Program for CAC*).
- Access to water and up-stream/down-stream trade-offs assessed.

2007:

- Guidelines for scarce water valuation documented for use by NARS.
- Alternative policy options for improved water demand management developed and communicated to NARS and policy makers.
- Alternative institutional options for improved water demand management developed and communicated to NARS.

Output 5: Enhanced human capacity to improve water use in agriculture in dry areas.

Indicators: Number of participants in training courses, and workshops and meetings.
Number of training modules developed.
Number of courses, workshops and relevant meetings.

Milestones:

2005-2007

- MSc students conduct graduate research in Syria and Iran (*CP-Water and Food*).
- PhD students conduct graduate research on communal management of water harvesting (*CP-Water and Food*).
- Annual training course on improving water use efficiency in CWANA.

2005:

- Training course on the use of marginal water in agriculture.
- Workshop to promote communal management of water harvesting and supplemental irrigation.

2006:

- Training course on water valuation.
- Regional workshop to promote improved water productivity at basin level in Iran (*CP-Water and Food*).

2007:

- Training course on participatory water management for CWANA.
- Regional workshop/conference for the optimization of scarce water use in the dry areas.

Users and Beneficiaries:

The ultimate beneficiaries are farm households and communities in rainfed marginal dry lands and irrigated areas in dry areas. The main users are national researchers, technicians, policy makers and others concerned with water issues. Regional and international organizations and development agencies working in CWANA region can also benefit from the improved technological, institutional and policy options.

Collaborators:

- National research and extension programs in Central and West Asia, North Africa, sub-Saharan Africa (Sudan, Ethiopia and Eritrea), and South Asia (Pakistan).
- ACSAD (Arab Center for the Studies of Arid Zones and Dry Lands); ESCWA (UN Economic and Social Commission for West Asia); University of California Davis, University of Delaware, and Purdue University, USA; Karlsruhe University, Germany; Wageningen University and Research Center, Netherlands; United Nations University; UNESCO; FAO; CIHEAM (International Centre for Advanced Mediterranean Agronomic Studies) in Bari, Italy, and Zaragoza, Spain; INRA (Institut National de la Recherche Agronomique), France; ICBA (International Center for Biosaline Agriculture), UAE.

System Linkages:

- ICARDA and IWMI share a joint appointment in marginal water management and are cooperating within projects in Central Asia.
- **Challenge Program on Water and Food**, through three projects (specific cooperation is indicated under milestones above):
 - *Improving On-farm Agricultural Water Productivity in the Karkheh River Basin* (with IWMI).
 - *Strengthening Livelihood Resilience in Upper Catchments of Dry Areas by Integrated Natural Resources Management* (with CIAT).
 - *Improving Water Productivity of Cereals and Food Legumes in the Atbara River Basin of Eritrea* (with CIAT).
- **Systemwide Programmes and other CG Consortia:**
 - ICARDA is participating in the Comprehensive Assessment of Water, led by IWMI, in cooperation with ICRISAT.
 - ICARDA is the convening center for the Ecoregional Program for Central Asia and the Caucasus.

Cost:

2005: US\$ 3.60 million
2006: US\$ 3.74 million
2007: US\$ 3.89 million

Financing Plan:

Unrestricted core. Restricted funding from: CP Water and Food; Comprehensive Assessment of Water; Asian Development Bank; AFESD (Arab Fund for Economic and Social Development); FAO; IFAD (International Fund for Agricultural Development); Governments of Iran, Morocco and Pakistan; UNCCD Sub-Regional Action Program for West Asia; SDC (Swiss Agency for Development and Cooperation); USAID Linkage Funds.

Megaproject 2: Integrated Gene Management: Conservation, Enhancement and Sustainable Use of Agrobiodiversity in Dry Areas

Overview:

Within the Dry Areas the CWANA region contains three major centers of plant diversity, where numerous species of temperate-zone agriculture originated and where their wild relatives and landraces are still found, and also considerable small ruminant biodiversity. These are a valuable source of genetic material for future germplasm enhancement. The *ex situ* collections developed and maintained by this project provide continuous and reliable access to genetic resources required to develop germplasm with higher and more stable yields, better resistance to evolving biotic and abiotic stresses (particularly drought and heat) including those emanating from climate change, and better end-use and nutritional quality. The exploitation of these genetic resources through breeding for the benefit of the poor is recognized as a key comparative advantage of ICARDA and other Centers in the CGIAR. At the same time, *in situ* conservation, through protection and habitat management, maintains naturally occurring and evolving populations of agriculturally useful species within their environment.

Major elements of MP2 comprise:

- *Ex situ* and *in situ* conservation, characterization and evaluation of agrobiodiversity including agriculturally useful plant species and small ruminant biodiversity (linkage with MP4 in developing alternative income generating activities).
- Germplasm enhancement for higher and more stable yield, improved end-use and nutritional quality (linking to MP4), better biotic and abiotic resistance and adaptation to climate change (linking to MP1), including use of biotechnological tools and development of plant breeding methodologies.
- Formal and informal seed production systems (Linking with MPs 3, 4 & 6).
- Policy and institutional research in support of *in situ* conservation of agrobiodiversity.
- Institutional strengthening and capacity building:

Goal: Improved conservation and use of agrobiodiversity to increase sustainable agricultural production in the dry areas.

Indicator: Target communities receive higher and more sustainable benefits from increased productivity and production of targeted crops.

Purpose: Improved livelihoods of resource poor farmers from the conservation, improvement and sustainable use of agro-biodiversity of plants and animals and the adoption of improved varieties and associated technologies.

Indicators: Genetic material used by NARS and extension systems to develop production systems that are demonstrably productivity increasing and resource conserving.

Germplasm and germplasm improvement and conservation practices used by NARS.

Output 1: Biological resources conserved *ex situ* and available for use.

Indicators: Number of target species conserved
Number of accessions in the active collection
Number of bio-control agents tested and conserved

Milestones:

2005-2007:

- Collection mission conducted in a CWANA country.
- 10,000 seed samples distributed from the gene bank to users on request each year.
- 100% of incoming and outgoing seed samples health tested each year.
- Range species conserved *ex situ* and a different set of accessions characterized each year for yield/quality.
- Bio-agents for the control of at least two major pests/pathogens identified each year and efficacy of different bio-agents for Sunn pest tested.
- Over 200 fungal isolates maintained in long-term storage

2005:

- New cold stores fully functional (*in cooperation with SGRP*)
- Global Inventory of Barley Genetic Resources available on Internet (*in cooperation with SGRP*)

2006:

- All gene bank accessions bar-coded.

2007:

- Global database of wheat wild relatives available on Internet (*in cooperation with SGRP*)

Output 2: Technical, institutional and policy options to support *in situ* conservation of agro - biodiversity

Indicators: Number of target species conserved in pilot areas.
Area of natural or semi-natural habitat in which wild species are conserved and sustainably managed in situ.
Area of on-farm conservation of landraces.

Milestones:**2005:**

- Agro-biodiversity surveys completed in Jordan, Lebanon, Palestine and Syria and threats identified and documented.
- Local knowledge of indigenous management practices and uses of plant and animal genetic resources in Jordan, Lebanon, Palestine and Syria gathered and documented and income generation options based on local agrobiodiversity identified and implemented at the community level.
- Policy recommendations to sustain agro- biodiversity conservation at the community level developed and suggested to national decision-makers and other stakeholders in Jordan, Lebanon, Palestine and Syria.
- International Conference on Options for Sustainable Management of Agro-biodiversity.

2007:

- Target areas and project sites for *in situ* conservation of agrobiodiversity identified in WANA
- Initial socio-economic surveys of targeted farming systems in WANA completed
- Survey of current policies relevant to agrobiodiversity conservation at the community level in WANA completed.

Output 3: Genetic diversity characterized and documented for traits relevant for use in dry areas agriculture.

Indicators: Number of accessions characterized/evaluated.
Number of traits characterized/evaluated.
Number of accessions and traits documented in the GRU database.
Number of breeds of small ruminants genetically and phenotypically characterized
Number of major pathogens and insect pests in CWANA characterized

Milestones:**2005-2007:**

- Different subsets of at least 500 accessions of crop wild relative and landraces characterized for reaction to at least 5 major diseases and insects each year.
- Variability of two pests in two countries characterized each year.
- Two viral diagnostic kits developed each year.
- Different subsets of at least 1000 crop wild relative and landrace accessions characterized for response to major abiotic stresses each year (*CP-Generation*)

2005:

- Workshop on small ruminant characterization.

2006:

- Sub-sets of wheat and barley collected from drought-stressed sites identified using GIS.
- A set of accessions characterized in the field for a number of international crop descriptors.
- Characterization of small ruminants breeds of CWANA documented.

2007:

- Subsets of lentil and chickpea accessions collected from drought-stressed sites identified using GIS.
- Genetic diversity of crop collection subsets characterized using molecular markers.
- Genetic characterization of small ruminant breeds along the “Silk Route” documented.

Output 4: Genetic variability enhanced through pre-breeding to reduce genetic vulnerability and meet present and future crop improvement needs

Indicators: Increased use of wild relatives in the crossing program
Increased use of synthetic wheat and derivatives in the breeding program
Number of useful traits transferred from landraces and wild relatives.
Number of lines with useful genes introgressed from landraces and wild relatives.
Number of species of potential interest as feed legumes for dry areas and marginal land rehabilitation evaluated and characterized
Increased genetic diversity of cereals, food and feed legumes.

Milestones:

2005:

- New germplasm accessions with resistance/tolerance to abiotic and/or biotic stresses identified and utilized in crosses.
- Disease and insect tolerant germplasm identified in tetraploid derivatives from crosses of durum wheat with close wild relatives.
- Durum wheat advanced lines and genetic stocks developed from crosses with *T. dicoccoides* and other tetraploids available.
- Cyst nematode resistance and cold tolerance from wild chickpea combined with large-seed size in a kabuli background.
- Increased use of landraces and synthetics to broaden the genetic base of biotic and abiotic stress tolerance in bread wheat.
- Drought tolerant barley germplasm derived from crosses with *Hordeum spontaneum* identified and utilized in the crossing block.
- Variation for Fe, Zn, and B-carotene content in the grain described in barley germplasm accessions and accessions with high content identified (*CP-HarvestPlus*).
- Faba beans lines with low tannin content and *Orobanche* resistance combined with resistance to different diseases developed.

2006:

- Number of durum advanced lines and genetic stocks developed from crosses with *T. urartu* and *T. monococcum* available.
- Development of new generation of synthetics based on CWANA adapted durum wheat lines and *Ae. tauschii* initiated.
- *H. spontaneum* accessions with resistance to major barley diseases identified and utilized in crosses.
- Micronutrient dense barley accessions utilized in the crossing block (*CP-HarvestPlus*).
- Wild Lathyrus accessions from Bangladesh, Ethiopia, and Nepal screened for neurotoxin (β -ODAP), protein, amino acids and resistance to biotic and abiotic stresses.
- Interspecific-derived chickpea lines evaluated for stress resistance.
- Faba beans lines with low tannin content and *Orobanche* resistance combined with resistance to different diseases shared with NARS.

2007:

- Hexaploid lines with valuable traits produced from bread wheat crosses with synthetics developed from 'Haurani' durum wheat and Syrian *Ae. Tauschii*.
- Durum wheat advanced lines and genetic stocks developed from crosses with *Aegilops* species available.
- Synthetics derivatives routinely used to broaden the genetic base of stress tolerance in bread wheat.
- New wild types of forage legume species with desirable traits distributed to NARS.
- New barley lines with various combinations of biotic and abiotic stress resistance derived from crosses with *H. spontaneum* identified and distributed to NARS.
- New barley lines with high content of iron, zinc, and B-carotene derived from crosses with *H. spontaneum* and landraces identified and distributed to NARS (*CP-HarvestPlus*).
- Adapted faba bean lines with low tannin content and *Orobanche* resistance combined with resistance to different diseases identified by NARS.

Output 5: Improved germplasm with high and stable yield, superior end-use and nutritional quality, and better biotic and abiotic stress resistance/ tolerance, and that are adapted to climate change and targeted agro- ecological zones.

Indicators: Improved germplasm of cereals and legumes with desirable traits distributed to farmers and NARS.
Number of nurseries distributed to NARS
Number of lines selected by NARS
Number of lines used as parental material by NARS
Number of released varieties and area covered by improved varieties
Area of forage legumes introduced into cereal-based rotations

Milestones:

2005:

- Barley lines for malt use identified and used by local industry.
- Decentralized screening of barley for specific diseases established in Morocco (net blotch), Tunisia (scald), and Eritrea (spot form-net blotch).
- Barley germplasm with high concentration of B-carotene, iron, and zinc in the grain identified and distributed. (*CP-HarvestPlus*).
- At least two new varieties of barley identified through participatory plant breeding (PPB) in two countries.
- PPB initiated in Eritrea (*CP-Water and Food*).
- Scaling-up of PPB of barley continued to other provinces in Syria and begun in Jordan.
- Informal seed multiplication of barley started in Jordan and Egypt. Informal seed production started in Eritrea (*CP-Water and Food*).
- Elite bread and durum wheat germplasm for dry and favorable conditions combining high yields with resistance to rusts, Hessian fly and Septoria leaf blotch and tolerance to drought, cold and heat developed. Specialized disease and insect resistance gene pools distributed to NARS.
- Bread and durum wheat genotypes with resistance to key biotic and abiotic stresses and acceptable end-use quality identified.
- Development and delivery to NARS of improved food legume (faba bean, lentil and kabuli chickpea) germplasm with suitable combinations of characters targeted for various agro-ecological conditions.
- Participatory selection of food legume germplasm conducted with NARS.
- Combined sources of resistance for biotic and abiotic stresses identified in food legume germplasm.
- Gene pyramiding for key diseases of food legumes initiated.
- Micronutrient-rich (Zn, Fe, B-Carotene) lentil genotypes identified (*CP-HarvestPlus*).
- Improved lines of forage vetches with low anti-nutritional factors (ANFs) (tannins and β -cyano-alanin) identified.
- Improved lines of vetches as feed resources increased and used in dry areas (*SLP*).

2006:

- New barley lines with various combinations of abiotic and biotic stress resistance and improved feed, food, and malt characteristics obtained and distributed.
- Breeding for micronutrient-dense grain started (*CP-HarvestPlus*).
- Scaling-up of PPB begun in Eritrea.
- Links established between informal and formal barley seed system in Syria.
- Elite bread and durum wheat germplasm with improved grain quality developed.
- Specialized bread and durum wheat nurseries for agronomic traits and end-use quality distributed to NARS.
- Distribution by NARS in CAC countries of seed of newly released varieties of chickpea and lentil (*Ecoregional Program for CAC*).
- Micronutrient-dense lentil germplasm distributed to NARS (*CP-HarvestPlus*).
- Improved lines of vetches and chicklings used in run-off strip water-harvesting at different benchmark sites.
- Quality parameters of herbage, grain and straw of forage legumes assessed.
- Regional variety trials of low neurotoxin grasspea varieties distributed to NARS. (*SLP*)

2007:

- New barley lines with various combinations of abiotic and biotic stress resistance and improved feed, food, and malt characteristics obtained and distributed.
- At least ten new varieties of barley identified through PPB in five countries.
- Large scale seed production of PPB barley varieties in Syria.

- Elite bread and durum wheat germplasm combining good end-use quality, high yield, and adaptation to continental and high altitude areas and temperate/ coastal climate conditions carrying yellow and leaf rust resistance; Hessian fly and Russian Wheat Aphid resistance available to NARS.
- Specialized bread and durum wheat nurseries for agronomic traits and end-use quality made available to NARS.
- Specialized disease and insect resistance gene pools of bread and durum wheat made available to NARS.
- New bread and durum wheat varieties with resistance to key biotic and abiotic stresses and acceptable end-use quality identified and released by NARS.
- Release by NARS of new varieties of food legumes with combined resistance to key stresses.
- Lentil lines with combined resistance to rust, wilt, Stemphylium blight and Ascochyta blight and appropriate phenological adaptation distributed to NARS.
- NARS identify micronutrient-dense lentil germplasm for multi-environmental testing and development of segregating populations (*CP-HarvestPlus*).
- Chickpea lines with combined resistance to Ascochyta blight and Fusarium distributed to NARS.
- Client participatory approach involving small-scale limited-resource farmers in testing of production and end-uses of forage legumes assessed.
- Molecular markers for low neurotoxin content of grasspea legumes identified.
- Appropriate strategy developed for maintenance of genetic purity of low neurotoxin lines of grasspea.
- Improved germplasm of underground vetch tested with NARS in marginal lands and in rotation with barley.

Output 6: Biotechnological tools for breeding for resistance/tolerance to biotic and abiotic stresses.

Indicators: Increased use of biotechnological tools (including marker-assisted selection (MAS), doubled haploid lines) for the production of new varieties.

Number of wheat and barley populations developed by doubled haploid techniques.

Number of wheat populations and quantitative trait loci (QTL) identified.

Number of traits where MAS is routinely used in the breeding programs.

Milestones:

2005-2007

- Routine production of doubled haploid lines in wheat and barley.
- Somaclonal variants produced for grasspea.

2005:

- Inter-specific crosses with maize tested for doubled haploid production in wheat, and with *H. bulbosum* tested for doubled haploid production in barley.
- Commencement of the development of mapping populations for Hessian fly and yellow rust resistance by doubled haploid technique in spring bread wheat.
- Marker assisted selection (MAS) in barley and chickpea tested.
- 12-14 genome mapping populations of durum wheat developed for different agro-ecological areas and attributes, and three genetic linkage maps generated.
- Genes identified for cold tolerance in lentil.
- Transformation of chickpea lines using fungal resistance and abiotic stress resistant genes.
- Transformation of bread wheat lines using abiotic stress resistant genes.

2006:

- QTL identification for drought stress in barley (*CP-Generation*).
- QTL identification and MAS for drought tolerance and grain quality in durum wheat established; 200 additional markers developed for saturation of chromosomal regions controlling drought tolerance and grain quality.
- Genes identified for cold tolerance in chickpea.
- QTL map available for agronomic traits of lentil.
- Transformation of lentil lines using fungal resistance and abiotic stress resistant genes.
- Transformation of durum lines using abiotic stress resistant genes.

2007:

- Mapping populations for QTL analysis for resistance to Hessian fly and yellow rust in wheat developed.
- Commencement of the development of mapping populations of bread wheat for heat and drought tolerance by doubled haploid technique.

- Gene identification for drought tolerance in barley (*CP-Generation*).
- Micro-array test for drought screening and temperature extremes in durum wheat established and genes identified.
- Genes identified for drought tolerance in chickpea.
- QTL mapping for agronomic traits in lentil.

Output 7: Methodologies to enhance the efficiency of germplasm development and dissemination

Indicators: Screening methodologies for biotic and abiotic stresses in food legumes improved.
 Use of efficient designs and field plot techniques in the germplasm development and evaluation.
 Application of most efficient techniques in screening forage legumes for drought tolerance and high water-use efficiency.
 Use of stress physiology and morpho-physiological traits in the breeding program.
 Use of participatory breeding methods in varietal development, evaluation and dissemination.

Milestones:

2005-2007

- Participatory plant breeding and varietal selection conducted in collaboration with NARS in two additional countries/year

2005:

- Utilization of improved designs in breeding programs and international nurseries assessed.
- Dryland breeding methodology that produces genotypes of barley and durum wheat combining high productivity, resistance to drought and temperatures extremes, and yield stability available.
- Identification of drought tolerant lines using selection for physiological and morpho-physiological adaptive traits associated with crop adaptation under stress in durum and barley breeding program (*CP-Generation*)
- Methodologies for estimating heritability under spatial variability, repeatability of G x E interaction and models of crop response to climatic variables established.

Output 8: Seed of promising ICARDA/NARS varieties distributed to farmers through formal and informal seed systems

Indicators: Farmers have access to high quality seed of ICARDA/NARS varieties.

Milestones:

2005-2007

- Annually 20 MT of high quality seed produced and distributed.

2005:

- Production and marketing of seed with farmers' groups initiated on a sustainable basis in one ICARDA crop in one country.
- Studies on economics of seed production and marketing initiated.

2006:

- Production and marketing of seed with farmers' groups initiated on a sustainable basis in two ICARDA crops in two countries.
- Seed policy advice provided to Governments of two countries.

2007:

- Production and marketing of seed with several farmers' groups initiated in several ICARDA crops in several countries.
- Private sector participation in seed industry increased through creation of awareness and training.

Output 9: Enhanced capacity of national agricultural research systems.

Indicators: Number of NARS scientists, technicians, farmers, extension agents acquainted with the improved technologies and practices.
 Number of NARS trained on breeding methodologies, selection and screening techniques, data management and analysis.
 Number of training courses and NARS staff trained.
 Number of NARS graduate students co-supervised.
 Number of research coordination meetings and joint technical conferences/workshops held with NARS.

Milestones:
2005-2007

- 20 individual researchers trained on specific methodologies each year (including participatory plant breeding, advanced statistical techniques and data management for crop improvement, genetic conservation and documentation, breeding for abiotic stress resistance, host plant resistance breeding and pest characterization, use of marker-assisted selection, and biosafety).
- Two short-courses conducted annually on improved methodologies in germplasm conservation and improvement including the above topics.
- 10 graduate students enrolled annually to study aspects of integrated gene management.
- Two international meetings/workshops per year on an aspect of integrated gene management.

Users and Beneficiaries:

The sustainable livelihoods of farmers, especially resource-poor farmers in dry areas, will improve from adoption of improved varieties specifically adapted to their conditions. Livestock owners in marginal lands, who interrupt their continuous cereal cropping with forage crops, will benefit through increased feed supply for livestock. NARS breeders will benefit from improved efficiency of germplasm enhancement for dry areas and from the conserved and documented genetic resources. Consumers will benefit from improved nutritional quality and the low prices of end products.

Collaborators:

- National research and extension programs in Central and West Asia, North Africa, sub-Saharan Africa (Eritrea, Ethiopia, Mauritania, Sudan), Latin America (Argentina, Mexico and Peru), South and East Asia (Bangladesh, China, India, Korea, Nepal, Pakistan, Vietnam), and Southern Europe.
- *Australia*: University of Brisbane; University of Adelaide; Cooperative Research Centre for Molecular Plant Breeding; Southern Cross University; Cooperative Research Centre for Innovative Grain Food Products; Center for Legumes in Mediterranean Agriculture (CLIMA), Perth; University of Western Australia; NSW Department of Primary Industry, Tamworth, NSW; Victorian Institute of Dryland Agriculture, Horsham, Victoria; University of Sydney, Plant Breeding Institute, Cobbity, NSW; Australian Winter Cereal Collection, Tamworth.
- *Austria*: University of Natural Resources and Applied Life Sciences (BOKU); Federal Institute of Agrobiology (FIA).
- *Belgium*: University of Ghent.
- *Canada*: Agriculture Canada, Laval University, McGill University, University of Saskatoon, University of Alberta.
- *Denmark*: Risoe National Laboratory; Danish Institute of Agricultural Sciences (DIAS).
- *Egypt*: Agricultural Genetic Engineering Research Institute (AGERI), Cairo.
- *France*: Paris Sud University, INRA.
- *Germany*: University of Hamburg, University of Hohenheim; University of Frankfurt; IPK Gatersleben.
- *India*: National Bureau for Plant Genetic Resources (NBPGR); Indian Agricultural Research Institute (IARI).
- *Italy*: University of Bologna, Tuscia University, Institute of Nematology, Bari.
- *Japan*: JICA; JIRCAS, University of Kyoto.
- *Jordan*: University of Jordan, Jordan University of Science and Technology (JUST).
- *Morocco*: University Hassan II.
- *Russia*: All Russian Institute of Agricultural Biotechnology; N.I. Vavilov Research Institute of Plant Industry (VIR), St Petersburg.
- *Spain*: University of Barcelona, University of Lerida, IRTA-Lerida, University of Cordoba, Barcelona University.
- *Syria*: Aleppo University, Damascus University, Tishreen University.
- *Switzerland*: Swiss Centre for International Agriculture (ZIL), Federal Institute of Technology Zurich (ETHZ); Federal Research Station for Plant Production (RAC).

- *UK*: Scottish Crop Research Institute; CABI Bioscience; University of Birmingham.
- *USA*: North Dakota State University, Oregon State University, Colorado State University, Kansas State University, Oklahoma State University, University of Missouri, University of Minnesota, University of Vermont, University of Wisconsin-Madison, USDA-ARS Washington State University, Cornell University, Purdue University, Minnesota State University, University of California (Davis)
- *Other partners*: FAO; CIHEAM (International Centre for Advanced Mediterranean Agronomic Studies).

System Linkages:

- ICARDA and CIMMYT cooperate in wheat improvement; ICARDA and ICRISAT cooperate in chickpea improvement.
- **Challenge Programs:** ICARDA participates in all three Challenge Programs (specific cooperation is indicated under milestones above):
 - *Challenge Program on Water and Food*, through project on Improving Water Productivity of Cereals and Food Legumes in the Atbara River Basin of Eritrea (with CIAT).
 - *HarvestPlus*: on biofortification of barley, lentils and wheat.
 - *Generation*: ICARDA is a partner in the Generation Consortium.
- **Systemwide Programmes and other CG Consortia:** ICARDA participates in the following programs (specific cooperation is indicated under milestones above):
 - ICARDA is the convening center for the Ecoregional Program for Central Asia and the Caucasus, and participates in other programs as follows:
 - Systemwide Program on Participatory Research and Gender Analysis System (PRGA).
 - Systemwide Livestock Program (SLP).
 - Systemwide Program – Integrated Pest Management (SP-IPM).
 - Systemwide Genetic Resources Research Programme (SGRP) and SINGER.
 - International Crop Information System (ICIS).

Cost:

2005: US\$ 8.19 million
 2006: US\$ 8.52 million
 2007: US\$ 8.86 million

Financing Plan:

Unrestricted core. Donor attributed funding from European Commission; Japan. Restricted funding from: Challenge Programs on Water and Food, HarvestPlus and Generation; ACIAR (Australian Centre for International Agricultural Research); GRDC (Grains Research and Development Corporation), Australia; Grain Foods CRC (Cooperative Research Centre), Australia; Danida, Denmark; European Commission; BMZ, Germany; University of Saskatchewan, Canada; CCLF (CGIAR-Canada Linkage Fund); Italy; ETHZ-ZIL, Switzerland; Governments of Iran, Morocco and Pakistan; Rural Development Administration (RDA), Korea; USAID Linkage Funds; USAID CCGI (Cereals Comparative Genomics Initiative); USDA; AFESD (Arab Fund for Economic and Social Development); IFAD (International Fund for Agricultural Development); GEF (Global Environment Facility)/UNDP; World Bank ICT Global Public Goods.

Megaproject 3: Improved Land Management to Combat Desertification

Overview:

Desertification is defined by UNCCD as land degradation in the dry areas. The CWANA region encompasses a range of agro-ecosystems including drylands, irrigated lands, rangelands, mountains and deserts, that have evolved as a result of climatic extremes and a long history of human occupation and management. The land area of CWANA covers some 1.7 billion ha and an estimated 45% of the total area of irrigated and rainfed arable land together with the vast areas of rangelands is subjected to some degree of land degradation with consequent reductions in biological productivity. Some degradation occurs naturally, but in many areas the dominant processes are accelerated degradation resulting from human activities. They include overgrazing of rangeland, inappropriate land management that encourages soil erosion by wind and water, inappropriate irrigation management leading to salinization, and, more insidiously, degradation of the natural vegetative diversity. The project aims to identify options for rehabilitating degraded land resources and, at the same time, to improve and strengthen systems of land management to control degradation and sustain future production

Major elements of MP3 comprise:

- Assessment of desertification.
- 'Best-bet' technologies for the management of land, water (linking to MP1), vegetation (linking to MP2) and rangelands, especially the communal management of rangeland resources and the livestock grazing systems they support, to control degradation and combat desertification.
- Policy and institutional research to create an enabling environment that supports the dissemination and adoption of technologies and management practices for combating desertification.
- Institutional strengthening and capacity building.

Goal: Improved management of land to combat desertification and to sustain agricultural production.

Indicator: Target communities receive higher and more sustainable benefits from improved land management.

Purpose: Sustainable, efficient and equitable management of natural resources in areas affected or prone to land degradation.

Indicators: Number of adopted technological, institutional and policy options (TIPOs) for avoiding or reversing desertification.

Status and trend of natural resources in areas prone to or affected by land degradation.

Output 1: A holistic Integrated Natural Resources Management (INRM) approach for combating desertification.

Indicators: INRM framework and toolbox available for NARS and other stakeholders.

Milestones:

2005: INRM toolbox available

2007: INRM toolbox used by NARS and other stakeholders

Output 2: Assessment of the location, extent, driving forces, causes, impacts and consequences of desertification in dry areas

Indicators: Number of comprehensive joint assessments of natural resources and land degradation conducted by ICARDA and NARS partners.

Level of understanding on desertification and strategies to cope with it by ICARDA and NARS partners.

Milestones:

2005:

- "Hot spots" of desertification (where risks are greatest) assessed and the extent of land degradation in different agro-ecosystems in the dry areas characterized.
- Provisional guidelines available for meso-scale land degradation assessment using remote sensing and field surveys.
- Spatial frameworks for land degradation assessment in Karkheh river basin, Iran, developed (*CP Water and Food*).

- Methodology for cause-effect analysis of land degradation available.
- Rapid tool for assessing damages by water and tillage erosion at field level developed and tested.
- Market and non-market valuation of land degradation and environmental services completed in Morocco and Tunisia

2006:

- Revision of GLASOD map of land degradation assessment for CWANA completed
- Socio-economic and environmental characterization of rangeland using GIS measured in six areas in CWANA.
- Characterization completed of five “bright spots”, where desertification has been successfully controlled.
- Information on valuation of costs of land degradation and environmental services made available to policy makers.
- Sets of indicators of desertification established.
- Monitoring and early-warning systems for desertification established.

2007:

- Analysis of the relationship between ecological conditions and management of rangelands reported.
- Sets of indicators of desertification used by NARS and other stakeholders.
- Satellite-based system available for CWANA to monitor drought and land degradation.

Output 3: ‘Best-bet’ technologies for the management of land, vegetation and rangeland resources, including the livestock grazing system they support, to prevent and reverse land degradation and improve household livelihoods and security.

Indicators: Number of ‘best-bet’ land, vegetation and rangeland management technologies formulated, and evaluated for the environmental and socio-economic merits.

Number of ‘best-bet’ land and vegetation technologies used by NARS and other partners.

Milestones:

2005:

- Three ‘best bet’ technologies (e.g. conservation tillage, direct sowing with/without mulch, soil conservation, water harvesting, contour tillage, integrated soil fertility management, cropping pattern, integration of trees, manure, compost, etc....) identified in participation with end users.
- Two or three indigenous forage species with valuable traits (high water use efficiency) tested on farmers’ fields in two countries in the Arabian Peninsula.
- Major seed quality constraints identified in rangeland species
- Seed technology units functional in three countries of the Arabian Peninsula improving quantity and quality of seeds of range and forage species.

2006:

- Additional three ‘best bet’ technologies identified in participation with end users.
- Two ‘best-bet’ technologies in use by land users at pilot sites.
- Constraints and opportunities for adoption and impact (economic and environmental) analyzed and documented.
- Guidelines for land management options available.
- Guidelines for seed production of rangeland species formulated.
- Improved lines of amphiarpic legumes developed and used in rejuvenation of marginal lands.

2007:

- Additional three ‘best bet’ technologies identified in participation with end users.
- Additional two ‘best-bet’ technologies in use by land users at pilot sites.
- *Ex ante* impact analysis of proven technologies on reversing land degradation completed.
- Guidelines for assessing the economic and environmental impacts of improved land management options made available to NARS.
- At least two native and exotic pasture and forage germplasm and one management option to improve ecosystems health identified in two countries.
- Guidelines for seed production (including storage, seed quality) of rangeland species disseminated.

Output 4: Community-based land management measures.

Indicators: Number of community-based land management measures formulated, and evaluated for the environmental and socio-economic merits.

Number of community-based land management measures used by NARS and other partners.

Milestones:

2006:

- Community-based approaches (e.g. rangeland management options, watershed management, groundwater use arrangements...) for combating land degradation available.
- Collective and non-collective action approaches to rotational grazing and flock management tested in two countries in CWANA.
- Community institutions in Syria and North Africa complete grazing management plans.

2007:

- Assessment of adoption of grazing management options in communities in Syria and North Africa evaluated by survey.

Output 5: Improved policy and institutional options for developing enabling environment to enhance private and public investment in dryland development and to combat desertification.

Indicators: Level of consideration of desertification and sustainable land management at the agenda of research, development and decision making organizations in CWANA.

Number of policy and institutional options to support sustainable land management available to policy makers.

Number of organizations which are monitoring and tackling land degradation.

Number of workshops, seminars and other media to raise awareness and convey information on institutional and policy options to decision makers

Milestones:

2005:

- Collaborative linkages with partners through regional research and development programs and other mechanisms institutionalized.
- Dialogue with decision makers on desertification, including national programs, UNCCD and others, established.
- National, regional and international experiences reviewed and documented and gaps analyzed in 13 CWANA countries.
- Regional workshops/seminars held to raise awareness and convey information on experience and gap analysis

2006:

- Impact of policies and institutional settings on desertification and the welfare of rural people evaluated in four countries.
- The role of property rights and communal management policies on land degradation and community livelihood of communally-used natural resources established (*in cooperation with IFPRI*).
- Alternative property rights and communal management options for common property identified (*in cooperation with IFPRI*).
- Regional workshops/seminars held on impact of policies and institutional arrangements on desertification.

2007:

- Institutional and policy options to prevent/reverse desertification and facilitate better land management identified and presented to policy makers.
- Options for management of communal rangelands determined in participation with six communities and two governments (*in cooperation with IFPRI*).
- Long-term drought management and desertification control and strategies linked with national and regional research & development programs.
- Regional mechanism for drought and desertification monitoring and assessment institutionalized

Output 6: Enhanced human capacity to manage natural resources in areas affected/prone to land degradation.

Indicators: Number of participants in training and workshops/meetings.
Number of training modules developed.
Number of courses, workshops and relevant meetings.

Milestones:

2005-2007

– Two graduate students annually enrolled to study aspects of desertification.

2005:

– Dissemination material and training modules available

2006:

– Training of CWANA researchers and other stakeholders about the importance and impact of land degradation, INRM approaches and conservation strategies

2007:

– Tools for analyzing and coping with land degradation used by 5 NARS.
– Guidelines for up-scaling successful technological, institutional and policy options made available to NARS.

Users and Beneficiaries:

The ultimate beneficiaries are farm households and communities in areas affected by or prone to land degradation in rainfed, irrigated, rangeland and mountain areas in dry areas. The main users are national research and extension programs, development agencies, policy makers and others concerned with land degradation issues in dry areas, as well as regional and international organizations and development agencies in dry areas.

Collaborators:

- National research and extension programs in Central and West Asia, North Africa, sub-Saharan Africa (Eritrea, Ethiopia, Mauritania, Sudan), and Asia (Pakistan).
- UNCCD Secretariat and Global Mechanism, and Regional and Sub-regional Action Programs (RAPs and SRAPs) of the UNCCD.
- FAO; UNEP.
- Laboratory of Experimental Geomorphology (LEG), Catholic University of Leuven, Belgium; University of Bonn, Germany; WOCAT Consortium; Wageningen University, Netherlands.

System Linkages:

- **Challenge Programs:** The project participates in the Challenge Program on Water and Food through a project on *Strengthening Livelihood Resilience in Upper Catchments of Dry Areas by Integrated Natural Resources Management*, in cooperation with CIAT.
- **Systemwide Programmes and other CG Consortia:**
 - Ecoregional Program for Central Asia and the Caucasus.
 - Systemwide Program on Collective Action and Property Rights (CAPRI).
 - Consortia on Integrated Natural Resource Management (INRM).

Cost:

2005: US\$ 2.04 million

2006: US\$ 2.12 million

2007: US\$ 2.21 million

Financing Plan:

Unrestricted core. Donor attributed funding from Japan. Restricted funding from: Challenge Program on Water and Food; Asian Development Bank; Governments of Iran, Mauritania, Morocco and Pakistan; SDC (Swiss Agency for Development and Cooperation); AFESD (Arab Fund for Economic and Social Development); IFAD (International Fund for Agricultural Development); FAO; Global Mechanism of the UNCCD.

Megaproject 4: Diversification and Sustainable Improvement of Rural Livelihoods in Dry Areas

Overview:

Within Dry Areas the majority of the rural population is involved in the agricultural sector and the development of agriculture is recognized as the engine for national economic growth and development. Given the natural resource constraints in the ecoregion, especially in more marginal areas, productivity increases alone will not be sufficient to combat poverty and improve rural livelihoods (men and women). Innovative options are needed to diversify income generating opportunities available to rural households. Such options include those coming from diversifying cropping systems and from the utilization of high-value plant species (e.g. medicinal, horticultural and herbal species), and also those from increases in the quality and end-use value of agricultural commodities, both to improve food quality and nutrition in rural areas and add market value. The project contributes to the overall aim of developing productive and sustainable systems that conserve the resource base while supporting rural livelihoods in the dry areas.

Major elements of MP4 comprise:

- Research on household investment and marketing opportunities for value-added crop and livestock products.
- Options to both increase and diversify the value of crop production, including alternative high-value crops, improved integrated production and pest management of crops, enhanced crop and feed/livestock production systems (linking with MP3 on management of rangeland feed resources), and improved quality and added value of end products (linking to MP2).
- Options to increase the productivity of livestock (small ruminants) and to diversify and increase the quality and value of their products.
- Policy and institutional research to support diversification of income generating options and their adoption by various target groups (men and women) including private sector links.
- Institutional strengthening and capacity building.

Goal: Productive and sustainable agricultural systems that conserve the natural resource base while supporting rural livelihoods in dry areas

Indicator: Target communities receive higher and more sustainable benefits from diversification of options.

Purpose: Diversification and improvement of crop and livestock production options that reduce risk and increase productivity, product quality and income while conserving the natural resource base in the dry areas.

Indicators: ICARDA's and NARS research targeted to diversifying options to generate income and reduce risk.
Increased adoption of technologies to diversify options for income generation by farmers and other stakeholders.

Increased and more stable household income.

Increase in quantity and quality of crop and livestock products.

Output 1: Improved market opportunities for value-added crop and livestock products in the dry areas accessible to NARS and other stakeholders.

Indicators: National and international market information database available to NARS and other stakeholders

Published guidelines on market opportunities and niches for value-added crop and livestock products available to NARS policy makers and other stakeholders.

Milestones:

2005:

- Market opportunities for crop products and livestock (lamb and milk) products evaluated in CWANA and Latin America.
- Market survey on appropriate crop variety traits for local chickpea product *Leb lebe* making completed.
- Demand for livestock products assessed and used to re-define production orientation and changes needed in marketing.
- Two market databases for greenhouse crops developed in Afghanistan and Yemen.

- Methods for analyzing market opportunities for small farmers and producers developed in Iran (*CP-Water and Food*) and Latin America.
- Advantages and disadvantages of local networks and arrangements for accessing markets by smallholder farmers analyzed in Syria, North Africa and Latin America.

2006:

- Export market opportunities for milk derivatives and value-added crop products identified and documented in at least two countries each in CWANA and Latin America.
- Fodder markets in at least two countries assessed.
- Constraints to market access by small farmers and producers determined in selected cases.
- Community-based innovations for linking smallholder farmers and producers to markets evaluated.
- Priorities for agricultural research and extension that respond to market and farmer demand identified.

2007:

- Marketing niches for value-added crop products identified and shared with NARS and farmers.
- Market information mechanism for farmers and policy briefs for policy makers to support market improvement developed.
- Market penetration strategies for value-added livestock products tested with NARS in Latin America and West Asia documented.

Output 2: Options to increase the productivity of agricultural systems and to diversify income generating opportunities available to rural households, by diversifying cropping systems and increasing the quality and end-use value of crop products.

Options include adding value to cereals, legumes and fodder crops; improving the integrated production and pest management of crops; and diversifying cropping systems to include high-value crops (horticultural, oilseed, medicinal, herbal, and fodder crops). Systems include production under protected (controlled) environments such as greenhouses.

Indicators: Increased benefit/cost ratios of value-added crop enterprises.
 Number of options for increased quality tested and transferred to NARS.
 Number of options for increased production of crop product tested and transferred to NARS.
 Number of options for diversifying cropping systems tested and transferred to NARS.

Milestones:

2005 -2007

- Three to five IPM options developed and tested by NARS and farmers at the farm level each year.

2005:

- Opportunities for expanding research in malting barley reviewed. High b-glucans barley lines identified, 400 entries analyzed for iron, zinc and carotene in the grain, and parents for crossing blocks identified (*CP HarvestPlus*).
- Durum wheat cultivars assessed for end-product *frike* production
- Ten micronutrient-rich (Zn, Fe, B-carotene) lentil genotypes identified (*CP HarvestPlus*).
- Ten winter chickpea cultivars tested on-farm.
- IPM on-farm pilot sites and Farmer Field Schools for different cropping systems developed: three for *Ascochyta* blight control in chickpea, four for Hessian fly and six for Sunn pest control in wheat, and six for *Orobanche* control in faba bean.
- Impact of mechanical weed control on input-use efficiency and profit margins in food legumes documented.
- Guidelines produced with NARS for identification of pests and bio-control agents, application of solarization and integrated production and protection management (IPPM) of major cash crops under protected agriculture in the Arabian Peninsula.
- Guidelines on greenhouse type, installations, covering materials, management and maintenance of cooling and ventilation systems produced for Arabian Peninsula.
- Protected agriculture facilities (plastic houses) established in farmers fields: five in Afghanistan and 18 in Yemen.
- *Oil crops:* Performance of olive cultivars and major olive pests and diseases assessed and safflower adaptation documented
- *Medicinal and herbal crops:* Germination characteristics assessed and major diseases and pests affecting selected medicinal plants identified.
- *Horticultural crops:* Options for fig virus control identified for one country in CWANA

- Guidelines and recommendations disseminated among NARS for soil-less culture packages for four high cash crops under protected agriculture.
- Ten accessions of alternative forage species tested in two-three countries.
- On-farm testing of indigenous forages with valuable attributes (high water-use efficiency) in two or three countries of Arabian Peninsula.
- Feed qualities of indigenous forages determined using animals (feeding/grazing) in one or two countries of Arabian Peninsula.
- Validation of APSIM model for the profitability of cropping systems completed.
- Land suitability assessments in pilot sites available.

2006:

- IPM on-farm pilot sites and farmers field schools for different cropping systems developed: two for barley leaf blight and one for barley yellow dwarf virus.
- Cropping systems productivity trends in long-term rotations monitored on-farm in Egypt.
- Impact of alternative crops and management options on household income in CAC documented (*Ecoregional Program for CAC*).
- Profitability of conservation tillage in lentil/wheat system assessed.
- Demonstrations at 28 pilot sites of new packages of IPPM in protected agriculture.
- Crop and cultivar responses to soil-less culture under protected agriculture tested with NARS and private growers in Arabian Peninsula.
- Protected agriculture facilities established in farmers' fields: ten in Afghanistan and seventeen in Yemen.
- *Oil crops*: Safflower cultivars tested and components to control olive plants diseases assessed.
- *Medicinal and herbal crops*: Components to control medicinal plants diseases and pests identified.
- *Horticultural crops*: Improved tissue culture protocols on date palm identified.
- Ten accessions of alternative forage species tested in two or three countries.
- Agronomic options to increase yield and quality of forage under rainfed and supplementary irrigation tested in at least two or three countries.
- Simulation models for profitability of cropping systems tested in 2-3 benchmark sites in WANA.
- CWANA map of cropping systems developed.

2007:

- Barley lines for malt identified and used by local industry, segregating populations distributed to four target countries, and farmer-participatory breeding for bio-fortified crops initiated. (*CP HarvestPlus*)
- Four micro-nutrient-dense lentil genotypes identified by NARS and farmers tested in on-farm multi-location trials, and segregating populations developed. (*CP HarvestPlus*)
- Six promising chickpea genotypes with desirable traits for *Leb Lebe* tested in multi-location on-farm trials.
- Adoption and potential impact of improved crop production and protection packages on productivity and profitability of field crops assessed.
- Economic impact of input-use efficiency on lentil/wheat cropping systems documented.
- Statistical methodologies for evaluating two-course wheat trials developed and long-term crop-livestock experiments analyzed.
- Adoption and potential impact of improved packages for high cash crop production under protected agriculture assessed.
- *Oil crops*: Integrated management packages for olive production in selected dry areas released.
- *Medicinal and herbal crops*: Agronomic options established for 3-4 medicinal plants.
- *Horticultural crops*: Nutritional needs of date palm during specific developmental stages quantified.
- Three alternative forage cultivars and agronomic options to improve productivity tested on farm in two or three countries.
- Production and profitability of different crop options quantified.

Output 3: Technologies to increase the productivity of livestock and to diversify and increase the quality and value of their products through improved breeding, feeding, health and reproductive management practices tested with NARS and farmers in CWANA.

*Indicators: Numbers of technologies that improve small ruminant productivity are available to NARS.
Productivity of systems that adapt and use the technologies is increased.*

Milestones:

2005:

- Community-based research sites established in CWANA and Latin America.
- Tested options for livestock production systems in at least one CWANA country assessed.
- Breeding out-of-season to improve the targeting of market opportunities for lambs and for milk derivatives in West Asia assessed.

2006:

- Three workshops on small ruminant production, markets and income generation in the dry areas held.
- Technologies integrating non-conventional feeds and agro-industrial by-products to improve small ruminant feeding and productivity documented for NARS and farmers.

2007:

- Least cost diets for small ruminant fattening and increasing milk productivity tested and available to NARS and farmers in West Asia.
- Options for improved crop/livestock integration systems available.
- Effect of feeding unconventional feeds on milk quality documented.

Output 4: Options for adding value to crop and livestock products through improved post-harvest handling and processing accessible to NARS and farmers.

Indicators: Number of tested post-harvest handling and processing technologies that can reduce losses, and produce larger quantity and/or quality of crop and livestock products are available to NARS and farmers.

Increased market margins of added-value crop and livestock products.

Number of prototype research sites and households where technologies are tested.

Milestones:

2005:

- Assessment of losses in food legumes caused by storage insect pests and different storing equipment done.
- Impact of post-harvest handling on quality of conserved fodder in at least 2-3 countries assessed.
- Technologies to produce diversified milk derivatives with market opportunity developed in West Asia.
- Community based seed units established in at least 2 countries.

2006:

- Durum wheat end-product *frike* laboratory established and quality tested.
- Community-based units providing quality seed of ICARDA crops to farmers in at least 3-4 countries established.

2007:

- Effective and economic storage system for food legumes demonstrated on farm.
- International seminar on value-added production technologies for small ruminants held.
- Community based seed units providing high quality seed to farmers in at least 6-8 countries established.

Output 5: Policy and institutional options to support diversification of options for income generation including links to the private sector.

Indicators: Guidelines on national policy formulation and institutional changes to support diversification of options, market improvement and community-based production organization to generate income available to NARS and policy makers.

Number of community-based producers' organizations for testing, production, processing and marketing

Milestones:

2005:

- Review of policies and regulations for the import and export of milk derivatives reviewed for West Asia.

- Role of traditional milk processing institutions assessed in one country in CWANA.

2006:

- Farmers' organization promoted in two countries in CWANA for production, processing and marketing of milk derivatives.

2007:

- Workshop for policy makers to discuss avenues to efficiently support and promote organization of farmers on production diversification and income generation held.

Output 6: Knowledge and information to enhance the diversification of income generation options and reduce risk through training, networking and access to information accessible to NARS and other stakeholders (producers, handlers, marketers, policy makers).

Indicators: Guidelines and training materials on diversification of options to generate income developed and available to NARS and farmers.

Number of technical and professional staff of NARS and farmers trained in diversification of options for income generation.

Number of community-based, national, regional networks and partnerships established to exchange knowledge and information in CWANA.

Milestones:

2005-2007

- Two-four farmer field schools organized in at least two countries each year.
- Ten farmers' field days organized in five countries each year.
- At least 40 NARS scientists and 400 farmers trained in rural agro-business each year.
- Six training courses on greenhouse installation, crop production under protected agriculture and IPPM held in three countries in the Arabian Peninsula each year.
- Dissertation research by five MSc and two PhD students conducted each year.

2005:

- Four workshop for growers on protected agriculture methodologies held in Afghanistan and Yemen.

2006:

- Four workshop for growers on protected agriculture methodologies held in Afghanistan and Yemen.

Users and Beneficiaries:

Ultimate beneficiaries are producers, handlers, marketers and consumers of crop and livestock and their products. The main users are national researchers, policy makers, and others concerned with improving rural livelihoods.

Collaborators:

- National research and extension programs in Central and West Asia, North Africa, sub-Saharan Africa (Eritrea, Ethiopia, Mauritania, Sudan), South Asia (Pakistan) and Latin America (Mexico and Brazil).
- USA: Kansas State University; USDA-ARS, Sydney, Montana; Montana State University; Oklahoma State University; Purdue University; University of Vermont; USDA, Washington State University; University of Wisconsin-Madison; GL-CRSP (Global Livestock-Collaborative Research Support Program), University of California, Davis.
- University of Natural Resources and Applied Life Sciences (BOKU), Austria; Agriculture & Agri-Food Canada; KVL (The Royal Veterinary and Agricultural University), Denmark; Danish Institute of Agricultural Sciences (DIAS) and Risoe National Laboratory, Denmark; INRA-Rennes, France; JICA, Japan; Federal Institute of Technology (ETH), Switzerland; CABI Bioscience, UK; Natural Resources Institute, University of Greenwich, UK; Macaulay Institute, UK.
- FAO; IAEA (International Atomic Energy Agency); CIHEAM (International Centre for Advanced Mediterranean Agronomic Studies)

System Linkages:

- ICARDA and ILRI share a joint appointment in implementing a project on small ruminant health and market opportunities in the Near East and North Africa.

- **Challenge Programs:** The project participates in the Challenge Programs on Water and Food and HarvestPlus (specific cooperation is indicated under milestones above).
- **Systemwide Programmes and other CG Consortia:**
 - Ecoregional Program for Central Asia and the Caucasus.
 - FHCRAA (Future Harvest Consortium for Rebuilding Agriculture in Afghanistan)
 - Systemwide Livestock Program (SLP).
 - Systemwide Program – Integrated Pest Management (SP-IPM)

Cost:

2005: US\$ 7.63 million
 2006: US\$ 7.94 million
 2007: US\$ 8.25 million

Financing Plan:

Unrestricted core. Donor attributed funding from Japan. Restricted funding from: Challenge Program on Water and Food; HarvestPlus; Systemwide Livestock Program (SLP); ACIAR (Australian Centre for International Agricultural Research); AFESD (Arab Fund for Economic and Social Development); Government of Austria; Asian Development Bank; Danida, Denmark; FAO; Government of France; IFAD (International Fund for Agricultural Development); Governments of Iran, Morocco and Pakistan; Government of Japan; SDC (Swiss Agency for Development and Cooperation); DFID (Department for International Development), UK; USAID Linkage Funds; USDA/FAS; USAID/Chemonics RAMP (Rebuilding Agricultural Markets Project in Afghanistan).

Megaproject 5: Poverty and Livelihood Analysis in Dry Areas

Overview:

In the Dry Areas poverty in all its dimensions – economic, nutritional and natural resource (arable land and water) – is widespread. In the CWANA region an estimated 70% of the poverty is in rural areas even though only some 43% of the total population lives there. The rural population is largely dependent on agriculture, which is facing a number of converging environmental trends that reduce options, drive migration and threaten the future sustainability of livelihoods, particularly in the most marginalized areas (e.g., mountains and desert margins). A deeper understanding of the determinants of this poverty, and of the livelihood strategies adopted by rural communities, is necessary to continually refine the targeting of ICARDA's research (MP1-MP4) and identify pathways out of poverty.

Using detailed analyses of the organization of households and communities, employing a sustainable livelihoods approach, and the evaluation of the natural resources on which they depend, MP5 supports the entire research agenda by providing the knowledge and feedback needed to identify technical, institutional and policy options that support the development of sustainable livelihoods. The project will pay specific attention to the gender dimension of poverty and the structures that determine differential access to resources and income earning opportunities.

Major elements of this poverty-targeting project comprise:

- Analysis of the determinants of poverty and rural livelihood strategies, including gender analysis.
- Assessments of the impact of agricultural research on poverty reduction in all its dimensions and across different sectors of rural society.
- Market and non-market valuation of the natural resources used by rural communities and analysis of the impact of NRM research on rural livelihoods.
- Analysis of the returns to investments in the dry areas.
- Institutional strengthening and capacity building.

Goal: Sustainable improvement of the welfare of poor people in dry areas.

Indicator: Measurable improvements in the livelihoods of the rural poor in the dry areas.

Purpose: More effective and better targeted research that contributes to development of sustainable livelihoods of the rural poor in dry areas.

Indicators: Research priorities for targeting the poor in dry areas are identified.

NARS and other stakeholders are using the tools and methodologies developed by ICARDA.

Evidence that poverty and livelihoods analysis and impact assessments are considered in the development of NARS research priorities and programs.

Assessments of the impact of technological, institutional and policy options on the livelihoods of the poor.

Research results used in developing national public investment programs and national poverty reduction strategies in dry areas.

Output 1: Causes of poverty and determinants of livelihood strategies in the dry areas are quantified, documented and accessible to stakeholders.

Indicators: Indicators (measures) of various dimensions of rural poverty defined, documented (data bases, GIS and maps) and accessible to users.

Determinants (including environmental, social, economic, institutional determinants) of livelihood strategies within different agroecological and production systems identified, documented and accessible to users.

Potential pathways out of poverty identified, documented and accessible to users.

Milestones:

2005:

- Results from household livelihood analysis in four project sites (*CP Water and Food*)
- Status and intensity of rural poverty quantified in selected communities.
- Analysis of the determinants of child nutritional status in different livelihood systems and household typologies published and results disseminated.

- Evaluation of households' use of natural resources (rangelands) in relation with their livelihood strategies completed.
- Impact of micro-credit on rural livelihoods in Syria documented.
- Methodology for resource poverty mapping at regional level tested.
- Livelihoods analysis using the sustainable livelihoods framework completed in different production systems in four project sites (*CP Water and Food; Ecoregional Program for CAC*).
- Analysis of rural livelihoods strategies and options under different production systems completed.
- Reports on livelihoods analysis in three project sites published.

2006:

- The dynamics of poverty in selected locations in the dry areas analyzed.
- Map of agricultural production systems in CWANA completed.
- Opportunities for and risks involved in different livelihood strategies in selected sites analyzed.
- Women's access to resources and the opportunities for and constraints to women-led livelihood activities analyzed in selected project sites.
- Returns to investments in dry areas of selected countries in CWANA and their effects on rural livelihoods and poverty alleviation evaluated.

2007:

- GIS data bases and poverty mapping completed for selected areas.
- Assessments of potential livelihood options (pathways out of poverty) in selected project sites.

Output 2: Impacts of agricultural research on poverty reduction in the dry areas quantified and accessible to stakeholders.

Indicators: Frameworks and methodologies for assessing adoption and impact (ex post and ex ante) developed, documented and made accessible to users.

Factors affecting (positively and negatively) the adoption of agricultural technologies identified.

Results of the ex ante and ex post impact assessments of agri-technological, institutional and policy options, and their implications for future research and development, documented and made accessible to users.

Milestones:

2005:

- Studies of the rate and intensity of the adoption of specific agricultural technology options completed.
- Major constraints hindering technology adoption analyzed and measures to overcome these proposed.
- *Ex ante* assessment of the impacts of technological options in selected sites in dry areas published.
- Methods for assessing research impact on poverty (including poverty impact indicators) developed.
- Agricultural research priorities targeting women identified in selected communities.
- Baseline information, using secondary information and formal surveys, for monitoring research impact on poverty alleviation compiled.

2006:

- Policy and institutional options affecting the technology adoption analyzed.
- *Ex post* assessments of the impact of technological options on household income and its distribution in project sites completed.
- The potential adoption of technological options estimated.

2007:

- Adoption indicators of technologies in CWANA region reported.
- The potential impact of technological options on poverty reduction quantified.
- Methods for assessing research impact on poverty disseminated.

Output 3: Impacts of natural resource management (NRM) research on rural livelihoods and environmental sustainability quantified and made available to stakeholders.

Indicators: Frameworks and methodologies for evaluating natural resources, using market and non-market valuation methods, developed and made accessible to users.

Assessment of the role of natural resource endowments as a determinant of rural poverty at the macro-level

Factors affecting (positively and negatively) the adoption of NRM options identified.

Results of the ex ante and ex post impact assessments of NRM technological, institutional and policy options, and their implications for future research and development, documented and made accessible to users.

Milestones:

2005:

- Framework and alternative methods for evaluating natural resources used by rural households developed and tested.
- NRM technologies and communities in selected project sites characterized (*within project convened by Standing Panel on Impact Assessment (SPIA)*).
- Adoption indicators, constraints and major factors contributing to the adoption process identified.
- Assessment of the impact of NRM technologies on productivity, production costs and herd size in crop-livestock systems completed in selected project sites.

2006:

- Natural resources in selected sites evaluated using appropriate valuation methods.
- Adoption of NRM technologies in selected project sites quantified and farmers' perceptions of the environmental impact of NRM technologies recorded.
- The environmental impact of NRM technologies quantified in selected project sites.
- Benefits, costs and internal rate of returns to the investment in NRM technologies quantified and documented.

2007:

- Guidelines for natural resource valuation and assessing the impact of natural resource technologies made available.
- Analysis of the potential large-scale adoption of NRM technologies completed.

Output 4: The impact of community-based and participatory research approaches on improving rural livelihoods quantified and made available to stakeholders.

Indicators: Frameworks and methodologies for participatory and community-based research approaches developed and made accessible to users.

The impact of participatory and community-based approaches on the uptake of innovations and rural livelihoods analyzed and made available to NARS.

Milestones:

2005:

- Typology of alternative participatory approaches and practices in different projects documented
- Interests of different stakeholders in alternative participatory methods documented.
- The gaps in participatory research capacity identified and strategy for capacity building developed.
- Impacts of participatory research approaches on technology dissemination, local capacity and livelihoods evaluated.

2006:

- The trade-offs between efficiency and equity within alternative participatory and conventional research approaches evaluated.
- Approaches for strengthening rural capacities and harnessing local knowledge and institutions in enhancing livelihoods options evaluated.
- The influence of land tenure and property rights on alternative participatory and community-based approaches evaluated.

2007:

- The impact of participatory approaches on the improvement of rural livelihoods in selected project sites documented.

Output 5: Priorities for public investment to improve rural livelihoods and alleviate poverty in dry areas identified (*in cooperation with IFPRI*).

Indicators: The returns to investments in the dry areas and their effects on rural livelihoods and poverty alleviation evaluated and results made available to decision makers.

Milestones:

2005:

- Costs and benefits of investments in dry areas quantified in selected project sites.
- Performance indicators of the effects of investment options on rural livelihoods developed

2006:

- Comparative analysis of investment options in selected project sites and calculation of returns to investment completed.
- The effect of investments in dry areas on rural livelihoods and poverty in selected project sites quantified, and results shared with NARS, policy makers and donor community

2007:

- Returns to investments in dry areas documented.
- Guidelines for effective investments options in dry areas developed.

Output 6: Capacity of national research and extension programs in the application of poverty and livelihood analysis and impact assessment enhanced.

Indicators: Frameworks, tools and methodologies for poverty and livelihood analyses used by NARS.
Frameworks, tools and methodologies for assessing impacts of agricultural and NRM research used by NARS.
Regional and sub-regional networks on poverty and livelihoods analysis for dry areas established.

Milestones:

2005-2007

- Annual training courses and “on-the-job” training through joint projects.
- Graduate research students in research related to poverty and livelihood analysis and impact assessment jointly supervised.

2005:

- NARS capacity in rural poverty and livelihoods analysis and impact assessment, and development of priorities for training and capacity building assessed.
- Inventory of regional and international networks and organizations dealing with poverty and livelihoods analysis compiled and NARS partners connected to websites and other information sources related to poverty and livelihood analysis.

2006:

- Regional training workshop on poverty and livelihoods analysis.
- Regional network of NARS and other research partners in poverty and livelihoods analysis established.

2007:

- International workshop/conference on poverty and livelihood analysis in the dry areas.

Users and Beneficiaries:

Immediate users of the methodologies/approaches in poverty and livelihood analysis, natural resource valuation and impact assessment developed by the project are ICARDA researchers and NARS, national planners and decision makers. The international aid community and development agencies can benefit directly from the estimates of returns to research investment in the dry areas to better target poverty reduction.

Because of the problem-solving participatory research approach employed, the immediate beneficiaries are the resource users involved in the case studies. The approaches and methodologies developed in these studies will be disseminated for use by NARS and other partners.

Both ICARDA and NARS researchers will benefit from the feedback provided by the project, through better targeting of their research and greater awareness of the problems and constraints faced by farm households. Farmers will, in turn, benefit from the development of appropriate technologies and solutions to production problems that take into account their needs and constraints. The information generated from the analysis of rural poverty and the micro-studies of farm households will ensure that technical solutions are developed in response to different needs of the rural poor.

Collaborators:

- National research and extension programs in Central and West Asia, North Africa, sub-Saharan Africa (Eritrea, Ethiopia, Mauritania, Sudan), South Asia (Pakistan) and Latin America (Mexico and Brazil).
- CIRAD (Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement), France.
- University of Massachusetts, USA

System Linkages:

- ICARDA and ILRI share a joint appointment in livestock epidemiology, and ICARDA and IFPRI share a joint appointment in property rights and collective action.
- **Challenge Programs:** The project participates in the Challenge Program on Water and Food through a project on *Strengthening Livelihood Resilience in Upper Catchments of Dry Areas by Integrated Natural Resources Management*, in cooperation with CIAT.
- **Systemwide Programmes and other CG Consortia:**
 - Ecoregional Program for Central Asia and the Caucasus.
 - Systemwide Program on Collective Action and Property Rights (CAPRI).
 - Systemwide Program on Participatory Research and Gender Analysis (PRGA)
 - CGIAR Consortium for Spatial Information
 - Participation in Systemwide project on assessment of impacts of NRM research, convened by Standing Panel for Impact Assessment (SPIA).

Cost:

2005: US\$ 1.66 million

2006: US\$ 1.73 million

2007: US\$ 1.80 million

Financing Plan:

Unrestricted core. Restricted funding from: Challenge Program on Water and Food; Asian Development Bank; DFID (Department for International Development), UK; Governments of Iran and Pakistan; SDC (Swiss Agency for Development and Cooperation); AFESD (Arab Fund for Economic and Social Development); IFAD (International Fund for Agricultural Development).

Megaproject 6: Knowledge Management and Dissemination for Sustainable Development in Dry Areas

Overview:

Given the importance of agriculture in national growth and development, the sound management of the knowledge generated from science and technology and its alignment/linkage into use by end-users for sustainable development is needed. Research outputs from MP5 are expected to inform this project on the gender specific approaches that may be needed in generating and disseminating knowledge to end users.

This MP includes research activities in knowledge management and dissemination that were not previously explicit in our research project portfolio. Major elements of MP6 comprise:

- Management and dissemination of information on technological, institutional and policy options.
- Institutionalization of participatory and community-based research approaches.
- Frameworks for up-scaling pro-poor innovations.
- Strengthening national seed systems (linking with MPs 2, 3 & 4).
- Dissemination of lessons learned from conflict/post-conflict rehabilitation of agriculture
- Development of scientific data bases, tools and methodologies.
- Development of innovative distance learning and other training methods.
- Strengthening research-extension linkages and enhancing extension capacity to serve end-users through new tools such as expert systems.

Goal: Improved welfare of people in dry areas through better use of knowledge and technologies for sustainable agricultural production.

Indicator: Measurable improvements in agricultural production and rural livelihoods in dry areas.

Purpose: Increased use by stakeholders of global public goods generated by ICARDA for agricultural development.

Indicators: ICARDA's research outputs and knowledge are accessible to and used by stakeholders for the development of sustainable agricultural production in the dry areas.

Output 1: Enhanced access by end users to technology, institutional and policy options for sustainable agricultural production including through the use of participatory approaches and public/private partnerships.

Indicators: Number of technology, institutional and policy options made accessible to end users.
Number of media messages developed and distributed.

Milestones:

2005, 2006 & 2007:

- Technology options developed by ICARDA and partners documented for target environments
- Technology options made available to end users in target environments.
- Opportunities identified for linking ICARDA's research activities with development programs as a means of delivering research outputs to end users.

2005:

- Constraints to up-scaling innovations identified and disseminated to donors and government institutions.
- Experiences of community-based participatory approaches, farmer research groups, etc., documented and disseminated.
- Video, TV and other media messages prepared for delivery of information on weed control in chickpea and winter sowing of chickpea.
- Inventory of capability of NARS for technology transfer made.
- Collaboration among IARCs in knowledge dissemination using on-line learning resources explored.
- AARINENA-RAIS Network activities assessed.

2006:

- Framework for up-scaling pro-poor innovations developed.
- Participatory plant breeding approach institutionalized in national breeding programs of at least three countries.

- Video, TV and other media messages prepared for delivery of information on mechanized harvesting of lentil, supplemental irrigation and water use efficiency, and integrated production and protection management (IPPM) techniques for cash crop production under protected agriculture.
- Available on-line learning resources made accessible to NARS through collaboration among IARCs.
- Harmonization efforts (on varieties and seeds) in CWANA assisted by the Seed Network.

2007:

- Guidelines for up-scaling pro-poor innovations developed and disseminated.
- Measures, policies and regulations for effective technology transfer within and between countries of the CWANA region identified and disseminated.
- Community-based technology testing and dissemination approach institutionalized in national programs of at least five countries.
- Video, TV and other media messages prepared for delivery of information on application of fertilizer and organic manure, and management of date palm.
- Options to reorganize the Seed Network as a regional association, consultative seed group or forum explored.

Output 2: Strengthened seed systems through increased private sector participation and alternative delivery systems.

Indicators: Effective seed systems in CWANA countries providing farming communities with high quality seed of adapted varieties.

Milestones:

2005 -2007

- Limited quantities of Breeder Seed of improved crop varieties produced and distributed to NARS.
- NARS assisted in variety maintenance and breeder seed production.
- Assistance (business plans, financial analyses, etc) provided to small seed companies in CWANA countries.

2005:

- Innovative pro-poor seed delivery approaches for marginal areas proposed.
- Impact of policy changes in seed sector analyzed.
- Country studies for the harmonization of seed policies and regulations conducted in one sub region of CWANA.
- National consultation meetings held in sub-region.
- Three seed technology units in the Arabian Peninsula established.
- National staff trained in seed industry development aspects (seed enterprise management, alternative seed systems, IPR, quality assurance).

2006:

- Farmer/community-based seed production and marketing schemes designed.
- Country studies conducted in second sub region of CWANA.
- National consultation meetings held in second sub-region.
- One sub-regional consultation meeting conducted.
- National staff trained in seed industry development aspects.

2007:

- Community seed production approaches in marginal areas scaled-up.
- Countries advised regarding effective seed program development.
- Country studies conducted in third sub-region of CWANA.
- National consultation meetings held in third sub-region.
- One sub-regional consultation meeting conducted.
- Document on harmonization of policies and regulations finalized.
- National staff trained in seed industry development aspects.

Output 3: Improved natural disaster or post-conflict preparedness and mitigation.

Indicators: Effective disaster response mechanisms formulated and disseminated.

Milestones:

2005 - 2007:

- Seed of adapted germplasm of ICARDA mandate crops provided to countries in post-conflict and disaster situations.

2005:

- Lessons learned from the activities of the Future Harvest Consortium for Rebuilding Agriculture in Afghanistan (FHCRAA) documented.
- Need assessments completed and research and training priorities identified for rehabilitation of agricultural research and production in Iraq.
- Framework for information on crop varieties and seed availability developed and disseminated.

2006:

- Need assessments completed and research and training priorities identified for rehabilitation of agricultural research and production in Palestine and Sudan, as necessary

2007:

- Comprehensive report produced on potential alternative livelihoods for poppy producers in Afghanistan, based on outputs from projects supported by RALF (Research on Alternative Livelihoods Fund).
- GIS database and maps of suitable crop varieties by agroecologies developed.

Output 4: Enhanced management and delivery of research products and knowledge.

Indicators: Methodologies, computer expert systems and databases available to users.

Milestones:**2005:**

- Wheat expert system developed and accessible to subject matter specialists and other users.
- CLIMAP software tool developed.
- International Barley Information System (IBIS) operational within ICIS (International Crop Information System).
- Soil database developed.
- Meteorological database linked to applications.
- Integrated Library Management System developed.
- Development of Virtual Library initiated.

2006:

- Faba bean expert system developed and accessible to subject matter specialists and other users.
- Expert system on production and protection of some cash crops developed and tested.
- Soil database accessible to users.
- Five on-line modules in bio-computing accessible to users.
- Knowledge Portal launched.

2007:

- Expert system for management of date palm developed and tested.
- ICIS for chickpea and lentil operational and accessible to users.
- Information “warehousing and mining” tools and techniques made available.
- Multi-media and video streaming delivery systems operational.

Output 5: Enhanced capacity of national research and extension programs to better manage knowledge and technology transfer.

Indicators: Number of on-line training materials and resources developed and available to users.

Number of national research and extension staff trained.

Milestones:**2005 - 2007:**

- Training of extension staff on use of agricultural expert systems.
- Courses in technology dissemination held for selected countries in CWANA.
- National information professionals trained in management of e-documents and web databases.

2005:

- Training needs for the 21st century identified in cooperation with national programs in CWANA.
- ICARDA's input to CGIAR on-line resource web site developed.
- ICARDA's input to standards for CGIAR learning materials developed.

2006:

- E-learning and web-based training materials developed.

2007:

- New CG on-line learning resources submitted

- Distance learning institutionalized.
- Educational meteorological software CLIMCHART developed

Users and Beneficiaries:

The ultimate beneficiaries and users of the knowledge and the technologies are farmers and farming communities in dry areas. Other beneficiaries and users include national agricultural research and extension systems, national seed systems, policy makers, development agencies and the public and private sector.

Collaborators:

- National research and extension programs, national seed programs, national agricultural universities, national libraries, NGOs and other institutes in the public and private sector in the dry areas.
- FAO; International Seed Testing Association (ISTA); International Union for the Protection of New Varieties of Plants (UPOV); Central Laboratory for Agricultural Expert Systems, Egypt.
- CGIAR partners: Inter-Centre Training Group (INTG); ICT-KM projects, FHCRAA; Consortia for Iraq and Sudan

System Linkages:

• Systemwide Programmes and other CG Consortia:

- FHCRAA (Future Harvest Consortium for Rebuilding Agriculture in Afghanistan)
- Consortia for Iraq and Sudan
- Inter-Centre Training Group (INTG)
- ICT-KM projects.

Cost:

2005: US\$ 3.70 million

2006: US\$ 3.85 million

2007: US\$ 4.00 million

Financing Plan:

Unrestricted core. Restricted funding from: CGIAR ICT-KM program; European Commission; FAO; JICA (Japan International Cooperation Agency); AFESD (Arab Fund for Economic and Social Development); Government of Austria; Asian Development Bank; IFAD (International Fund for Agricultural Development); Governments of Iran, Morocco and Pakistan; SDC (Swiss Agency for Development and Cooperation); DFID (Department for International Development), UK; USAID/Chemonics RAMP (Rebuilding Agricultural Markets Project in Afghanistan).

Ecoregional Program: Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus

Overview:

The Central Asia and the Caucasus (CAC) region consists of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan in Central Asia, and Armenia, Azerbaijan and Georgia in the Caucasus. Through an ICARDA initiative, the Ecoregional Program for CAC was established in 1998 by a consortium of nine CG Centers (CIMMYT, CIP, ICARDA, ICRISAT, IFPRI, ILRI, IPGRI, ISNAR, and IWMI). IRRRI has since joined the program.

The Ecoregional Program for CAC is organized under broad themes, with each theme sub-divided into activities, as follows.

1. Productivity of Agricultural Systems
 - 1.1 Germplasm Enhancement
 - 1.2 Strengthening National Seed Supply Systems
 - 1.3 Cropping Systems Management and Agricultural Diversification
 - 1.4 Livestock Production Systems and Integrated Feed/ Livestock Management
2. Natural Resource Conservation and Management
 - 2.1 Irrigation, Drainage, and Water Basin Analysis
 - 2.2 On-Farm Soil and Water Management
 - 2.3 Rangeland Rehabilitation and Management
3. Conservation and Evaluation of Genetic Resources
 - 3.1 Plant Genetic Resources
 - 3.2 Animal Genetic Resources
4. Socioeconomic and Public Policy Research
5. Strengthening National Programs

These themes provide the overall framework in which specific projects are developed and implemented in partnership between NARS and CGIAR centers. In this program description the outputs and milestones include specification of which Center/partner bears primary responsibility for its achievement. Each Center finances its own projects and the details of the component projects are reported within the MTPs of the Centers implementing those projects.

Goal: Improved food security, economic growth, environmental sustainability and poverty alleviation in the countries of Central Asia and the Caucasus (CAC).

Indicators Measurable improvements in sustainable livelihoods in selected communities in CAC.
Measurable improvements in agricultural production.

Purpose: Sustainable increases in the productivity of crop and livestock systems through the generation and transfer of appropriate production technologies, natural resource management practices and the conservation of genetic resources, and by strengthening national agricultural research systems and fostering cooperation among them as well as with the international agricultural research community.

Indicators: Productivity increased through release and adoption of improved varieties of crops.
Crop diversification through adoption of new crops and increased cropping intensity.
Increased efforts on collection, evaluation, documentation and conservation of valuable genetic resources that originated in the region
Improved on-farm water use efficiency.
Strengthened capacity building of NARS, including human resource development.
Enhanced regional partnership for agricultural research for development (ARD).

Output 1: Improved productivity and sustainability of key cereals and legumes that are important for food security (ICARDA, CIMMYT).

Indicators: Number of improved varieties of wheat, barley, and food and feed legumes released by NARS in CAC countries

New breeding materials made available to national programs.

Milestones:

1.1 Winter and facultative wheat germplasm improvement (CIMMYT-ICARDA-Turkey Program)

2005-2007:

- 3-4 new lines of facultative and winter wheat submitted to State Varietal Testing Committee (SVTC).
- Seed production of new released varieties of facultative and winter wheat increased in all CAC countries.
- Traveling workshop for on-farm demonstrations of facultative and winter wheat organized in three countries.

1.2 Breeding spring wheat germplasm and establishment of shuttle breeding program (CIMMYT)

2005: 100 lines selected from the Mexico-Kazakhstan shuttle breeding program for spring wheat for multilocation testing in the region.

2006: 20 lines of spring wheat selected for advanced yield testing.

2007: Five lines of spring wheat selected for on-farm testing.

1.3 Barley germplasm improvement (ICARDA)

2005-2007:

- Two new barley lines submitted to SVTC annually.
- Seed production of new released varieties of barley increased in at least four CAC countries.
- Traveling workshop for on-farm demonstrations and joint evaluation organized in at least three countries.

1.4 Food and feed legume improvement (ICARDA)

2005 - 2007

- Three new lines of lentil, faba bean and Kabuli chickpea and one of vetch and grasspea submitted to SVTC annually.
- Seed production of new released food and feed legume varieties increased in at least four CAC countries.
- Traveling workshop for on-farm demonstrations and joint evaluation organized in at least three countries.

Output 2: Diversification of agricultural production systems (ICRISAT, CIP, IRRI).

Indicators: Number of new options for diversification from groundnut, potato and rice through introduction of new varieties.

Cropping intensity increased.

Milestones:

2.1 Introduction and promotion of groundnut in cereal-based cropping systems (ICRISAT)

2005:

- Preliminary evaluation of improved groundnut varieties for yield and local adaptation at the research station completed.
- A training course on efficient groundnut production for research and extension personnel conducted in the region.
- Two lines submitted to SVTC and tested on farmers' fields.

2006:

- Multilocation evaluation of the selected 6-8 improved groundnut varieties completed and promising varieties identified.
- Designated personnel in participating countries trained in methods of groundnut seed production.
- One lead scientist from each participating country trained in various aspects of groundnut research and production at ICRISAT Center, India.

- A bulletin on package and practices of groundnut cultivation printed in Russian and distributed among farmers.

2007:

- Farmer's participatory evaluation of selected 3-4 improved groundnut varieties completed and preferred varieties identified.
- Basic seed of farmer preferred varieties increased for large scale commercial seed production of groundnut.
- Booklet on groundnut recipes printed in Russian and made available for sale to general public.

2.2 Improving and sustaining rice productivity (IRRI)

2005:

- A new set of around 500 breeding lines of rice to be evaluated through INGER network
- Two scientists complete on-the-job training at IRRI in modern breeding and CNRM
- A publication on rice research and development in Central Asia is brought out

2.3 Potato crop improvement (CIP)

2005:

- Elite potato clones with high level of resistance to viruses and excellent cooking and processing quality established.
- 19 families of TPS evaluated.
- Descriptive databases and catalogue of advanced breeding lines of potato published and made available to NARS.

2006:

- TPS families of potato for long days developed.
- 5-10 CIP-derived varieties identified and incorporated in local seed systems.
- Strategies for improving formal and informal potato seed systems in key countries validated.

2007:

- Multilocation trials established for adaptation testing of potato.
- Strategies for improving formal and informal seed systems in key countries evaluated.
- Key control components against aphids and Colorado Potato Beetle (CPB) identified and tested.

Output 3: Integrated natural resource management for improved soil and water productivity (ICARDA, IWMI).

Indicators: Number of Pilot Water Users Associations established for efficient management.

Principles of integrated water resource management (IWRM) applied and made functional within the project area.

Irrigation water use reduced and on-farm water productivity increased by about 15% in the project areas.

Legumes introduced in predominant cotton and wheat rotations.

Number of conservation agriculture practices adopted by farmers.

Milestones:

3.1 On-farm water and soil fertility management (ICARDA)

2005:

- Pilot farmers identified for participatory research on improved soil and water conservation (12), water saving irrigation technologies (12), economically efficient conservation tillage practices (10) and alternative crop rotations (10) and farmer managed trials established.
- 4 pilot farms identified and trials on sustainable use of marginal water established.
- At least 8 scientists from each country to have participated in individual and group training, workshops, etc. annually.
- Rapid appraisal and enterprise budgeting completed.

2006:

- Additional 12 farmers identified for participatory research on improved soil and water conservation and water saving irrigation technologies and second year trials established.
- 25 farmers actively involved in participatory research on economically efficient conservation tillage practices and alternative crops and rotations.

- “Recommendation domains” (agroecological target areas) described and information disseminated.
- Wide-scale on-farm testing and demonstration of technologies in partnership with development projects in the region initiated.

2007:

- Technical advisory notes on “best bet” technologies developed and disseminated.
- Recommended technologies transferred to extension and consultative services (ECS) through demonstration sites for dissemination on 5-10% of targeted area.
- Graduate research training completed in four countries.
- Wide-scale on-farm testing and demonstration of technologies in development projects in the region further expanded.
- Analysis of the potential effects of policy changes completed and appropriate policy options identified and a workshop organized.

3.2 Integrated Water Resource Management in Fergana Valley (IWMI)

2005:

- Project Planning Workshop with stakeholder involvement organized and protocols signed.
- Three peer reviewed scientific articles published.
- Social Mobilization and Institutional Development (SMID) Field Teams launched.

2006:

- Project Planning Workshop with stakeholder involvement organized and protocols signed
- Three peer reviewed scientific articles published.
- Canal Management Organizations (CMO) created.
- Water Users Association (WUA) and CMO support system developed.

2007:

- Guidelines for implementation based on lessons of integrated water resource management (IWRM) published.
- Mechanisms of support Systems organized.
- Two scientific publications brought out.
- MIS being used by WUAs and CMOs.
- Water Allocation Models being used by CMOs and WUAs.
- Analytical Research Report on water laws of the countries prepared and shared with policy makers.

3.3 Sustainable Agriculture Practices in the Drought-Affected Region of Karakalpakstan (ICARDA)

2005:

- Five pilot farmers identified for participatory research on water use efficiency, intensive cropping and conservation tillage practices.
- Water saving technologies demonstrated to 50 farmers.
- Equipment for permanent bed planting, tested and modified for technology demonstration.
- 20 farmers and around 10 researchers/technicians trained in water use efficient, intensive cropping and conservation tillage practices and three field days organized.

2006:

- 50 farmers trained in water saving technologies and relevant manuals disseminated.
- Improved cultural practices adopted by 50 farmers in the region.
- Crop diversification options adopted by 50 farmers in the project area.
- Wrap-up workshop involving stakeholders and donors organized.

3.4 Development of sustainable cropping practices for high latitude spring wheat and irrigated facultative/winter wheat (CIMMYT)

2005: Progressive technologies for irrigated (bed planting) and rainfed (zero tillage) areas tested on-farm in eight countries.

2006: New technologies applied for commercial use in two countries.

2007: New technologies applied for commercial use in three countries.

Output 4: Strengthened national genetic resources programs (ICARDA, IPGRI).

Indicators: Number of effective national programs established in the region, capable of applying methodologies and tools for sustainable and enhanced conservation and use of agro-biodiversity

Increase in ex situ holdings of field crop germplasm and functional genetic resource conservation facilities developed in each CAC country

Number of plant breeders using more effectively the genetic resources from the region in their screening and breeding programs.

Milestones:

4.1 Enhancing the use of agro-biodiversity to mitigate ecosystems degradation, salinity and promote crop diversification (IPGRI)

2005:

- Methodologies for complementary conservation of fruit trees (Pistachio and other priority species) and for addressing socioeconomics of fruit crops developed.
- Germplasm catalogue on melon varieties completed and available through the Internet.

2006:

- At least one PGR permanent University course with curricula developed in Russian and one PGR short course, on an average, held each year.

2007:

- Number of wild relatives, landraces, species effectively conserved; through *in-situ*/on farm and through *ex-situ* methods.
- Methodology to guide partners on *in-situ*/on farm and *ex-situ* conservation is available.
- *In-situ* conservation procedures for use by farmers and communities and national programs for crops and their wild relatives are available.
- Effective plant genetic resources documentation and information systems are available, disseminated and adopted by national programmes.

4.2 Genetic Resource (PGR) Conservation, Documentation and Utilization (ICARDA)

2005-2007:

- Four training courses conducted each year in documentation, gene bank management, plant collection techniques and English language for CAC PGR units.

2005:

- Base collection assembled in one location.
- National databases completed and operational.
- Ecogeographic data captured in ICARDA data base for georeferenced plant collection sites.

2006:

- Eco-geographic gaps in worldwide collections of field crop accessions from CAC identified and targeted collection missions to those areas undertaken.
- Trait specific representative subsets of accessions identified using ecogeographic data and subsets screened for tolerance to limiting factors.

2007:

- *Ex situ* germplasm storage facilities established in each CAC country.
- Web-based regional database completed and accessible on internet.
- Results of collection missions and screening of subsets published.

Output 5: Institutional strengthening through the capacity building of national agricultural research systems (NARS), including human resource development.

Indicators: Number of technologies for increased productivity and sustainability generated

Number of young scientists trained in English language and priority areas of research.

Milestones:

5.1 ICARDA Regional Program for Central Asia and Caucasus

2005-2007

- One regional planning and coordination meeting held annually.
- One regional conference, one regional training course and one regional traveling workshop held annually
- Dissemination of knowledge, new technologies and varieties through publications and websites.
- National meeting for yellow rust and Sunn pest held biennially.

5.2 International MSc Program in Water and Environmental Research at Tashkent Institute of Irrigation and Melioration (TIIM) (IWMI)

2005:

- 25 lectures on application of RS/GIS for water resources research delivered by IWMI staff.
- Two supervised students successfully defend their MS thesis.
- Two additional students supervised.

2006:

- 10 lectures on application of RS/GIS for water resources research delivered by IWMI staff.
- Two supervised students defend their MS thesis successfully.

Output 6: Enhanced cooperation among agricultural research and educational institutions at the national and regional level and with other international organizations.

Indicators: Number of activities undertaken by the Regional Forum for CAC.

Partnership among NARS in the region, and with the scientists of international community strengthened.

Number of technical assistance and cooperative projects operational.

Number of IARCs joining the Consortium.

Milestones:

2005 - 2007:

- Organization of conferences, seminars, English training courses, workshops facilitated.
- Knowledge of new technologies and varieties disseminated through publications, reports and web site.
- Publication of quarterly CAC-Newsletter

Users and Beneficiaries:

The program's outputs will be of direct benefit to farm households by increasing on-farm production, diversifying production options and increasing farm incomes from marketed products. The diversification of agriculture will enhance household diets and nutrition. Increased production and better market linkages will lead to increased food supplies for both rural and urban consumers and greater food security.

The conservation of genetic resources is of global importance as an international public good as well as providing a continuous source of material for future use by NARS and farmers in improving agricultural productivity. Improved management of the natural resources will have an immediate impact on agricultural production today and sustainability in the long run.

The main users are national agricultural research systems and policy makers. The program will have a direct impact on the efficiency and effectiveness of national agricultural research systems through human resource capacity building and will lay the foundations for a shift towards a demand driven, problem oriented, multidisciplinary and participatory approach to agricultural research. The transfer of advanced scientific methods and techniques to national programs will ensure that NARS' research is sustainable beyond the program.

Collaborators:

- National research and extension programs, seed programs and agricultural universities in the CAC region.
- Centre for Legumes in Mediterranean Agriculture (CLIMA), Australia; N. I. Vavilov Institute of Plant Industry, Russia; USDA/ARS (United States Department of Agriculture/Agricultural Research Services); FAO; International Center for Biosaline Agriculture (ICBA); Central Asia and Caucasus Association of Agricultural Research Institutions (CACAARI).

Cost and Financing Plan:

Funding from the CGIAR to support the Program Facilitation Unit (PFU) is the only financing received directly for the Ecoregional Program and is reported separately within ICARDA's financial plan.

The costs of all other activities are supported through the portfolio of projects listed above. Each Center finances its own projects and the details of the component projects are reported within the MTPs of the Centers implementing those projects. The financing contributed through these projects is presented in the table below.

Ecoregional Program: Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus

FINANCING PLAN: 2003 Actuals, 2004 Estimates, and 2005-2007 Plan

CGIAR Outputs and Sub-Projects	2003 Actuals		2004 Estimates		2005 Proposal		2006 Proposal		2007 Proposal	
	Total	%	Total	%	Total	%	Total	%	Total	%
1. Germplasm Improvement										
1.1 Crop Diversification (ICARDA)										
Attributed funding from Japan	50,000	1.9%	50,000	1.6%	50,000	1.2%	50,000	1.2%	50,000	1.3%
Attributed funding from EC:										
- Durum wheat	317,000	12.1%	198,167	6.3%	198,167	4.7%	198,167	4.8%	198,167	5.2%
- Food Legumes	752,000	28.8%	407,481	13.0%	407,481	9.7%	407,481	9.9%	407,481	10.7%
- Barley	0		305,920		305,920		305,920		305,920	
1.2 Restoring Food Security (CIMMYT)	300,000	11.5%	300,000	9.6%	300,000	7.2%	300,000	7.3%	300,000	7.9%
1.3 Food Legumes for Diversification (ICRISAT)	<i>na</i>		<i>na</i>		30,000		30,000		40,000	
1.4 Improving and sustaining rice productivity (IRRI)	20,300	0.8%	30,000	1.0%	15,500	0.4%		0.0%		0.0%
1.5 Potato crop improvement (CIP)	<i>na</i>		<i>na</i>		<i>na</i>		<i>na</i>		<i>na</i>	
Sub-Total	1,439,300	55.1%	1,291,568	41.4%	1,307,068	31.3%	1,291,568	31.4%	1,301,568	34.1%
2. Germplasm Collection										
2.1 Enhanced Use of Agro-biodiversity (IPGRI)	321,492	12.3%	117,111	3.7%	1,256,976	30.1%	1,256,976	30.5%	1,256,976	32.9%
2.2 Conservation and sustainable use of agrobiodiversity (ICARDA)										
- PGR Conservation (Australia)	195,000	7.5%	170,000	5.4%	91,386	2.2%	91,386	2.2%	91,386	2.4%
- Attributed funding from EC	0		606,886		606,886		606,886		606,886	
Sub-Total	516,492	19.8%	287,111	9.2%	1,348,362	32.3%	1,348,362	32.8%	1,348,362	35.3%
3. Sustainable Production										
3.1 Integrated Water Resources Management (IWMI)	187,540	7.2%	252,407	8.1%	500,000	12.0%	500,000	12.2%	500,000	13.1%
3.2 International MS Program in Water (IWMI-TIIM)	0		0		15,000		15,000		15,000	
3.3 On-Farm Water and Soil Fertility Management (ICARDA)	89,000	3.4%	382,850	12.3%	308,575	7.4%	308,575	7.5%	0	0.0%
3.4 Sustainable Agriculture in Karakalpakstan (ICARDA)	0		25,000		50,000		0		0	
Sub-Total	276,540	10.6%	660,257	21.1%	873,575	20.9%	823,575	20.0%	515,000	13.5%
4. Policy	0		0		0		0		0	
5. Enhancing NARS										
5.1 Program Facilitation Unit for CGIAR	183,000	7.0%	241,466	7.7%	150,000	3.6%	150,000	3.6%	150,000	3.9%
5.2 ICARDA Regional Program for CAC	196,967	7.5%	200,768	6.4%	175,568	4.2%	175,568	4.3%	175,568	4.6%
Sub-Total	379,967	14.5%	442,234	14.2%	325,568	7.8%	325,568	7.9%	325,568	8.5%
Total	2,612,299	100%	3,123,404	100%	4,180,141	100%	4,114,641	100%	3,816,066	100%