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2008 Annual Report
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Foreword

From the CPWF Board Chair

As the CGIAR Challenge Program on Water and Food’s Board first chair, it is my distinct pleasure to present to you the CPWF’s Annual Report for 2008.

This was an active year for a program already known for its inherent dynamism. Through collaborative analysis of the achievements and lessons of the Program’s first phase - which continue in several linkage projects - the CPWF shapes its future by building upon the hard-won experience of its past five years.

Since I was asked to Chair the inaugural CPWF Board in June last year, I’ve had the stimulus of coming to know a highly innovative program that dares to be on the cutting edge of the research-for-development field. The Program is founded upon the conviction that research innovation – developments destined for on-the-ground impact - is best achieved by bringing together key players from diverse research and development institutions.

In my experience of the CGIAR, and of agricultural research in general, I am not aware of other programs that could have achieved such interesting and adoptable results in such a relatively short time.

We believe that the new CPWF Board helps ensure the independence necessary for the experiment to continue. I am pleased to note that the first Board meeting and the Board’s interactions with the CPWF’s committed staff, targeted clear opportunities to further develop the Program’s scientific and operational vigor.

The research achievements, unique character, and future promise of the CPWF took center stage in Addis Ababa at our 2nd International Forum of Water and Food, IFWF2, discussed in this report. Along with other Board and Steering Committee members present, I was amazed by the vital sense of community, the diversity of age, nationality, gender and discipline, and most of all, by the commitment to making a difference in poor rural communities. It was an intense experience into which 240 researchers, policy makers and development specialists were drawn full-time, and whole-heartedly, for a week.

The key to a program that builds on respect for diversity are the staff - including a unified Management Team and hard working Secretariat. Having nurtured the CPWF community from its nascent steps, in September 2008 Program Director Jonathan Woolley announced that he would not seek a second term. He continues with the CPWF until July 2009 to allow a smooth transition to our new Program Director, Alain Vidal.

Working well with change is a hallmark of the CPWF. Recognizing this, the CPWF Board are very pleased that continuity is also a key feature of the Directorial handover. This bodes well for the Program in its second phase.

George Rothschild
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1. Executive Summary

In 2008, the CGIAR Challenge Program for Water and Food (CPWF) was in transition from the first five years of operation to a streamlined and refocused second phase. Beginning in 2009, CPWF research-for-development engages fewer river basins and targets clearly defined 'Basin Development Challenges' within specific geographical areas of each basin.

The CPWF’s priority Basin Development Challenges (BDCs) cover innovative approaches to rainwater management in three African basins - the Nile, Limpopo and Volta. Concurrently they address benefit sharing mechanisms in small basins in the Andean region, develop integrated agriculture and aquaculture in the Ganges delta, and investigate multiple water use from large and small reservoirs in the Mekong basin.

The strategic partnerships of the CPWF are designed to support collegiality, research collaboration and a learning approach to basin development challenges. CPWF partnerships are multi-stakeholder platforms which identify the best forms of collaboration needed to design and implement impact-focused research projects. These unique networks are also valued for their ability to build capacity of local partners and young scientists.

The CPWF’s Second International Forum on Water and Food, IFWF2, consolidated the Program’s research achievements and developments in agricultural water productivity during the CPWF’s first five years, and shared the new knowledge generated. With contributions from experts in research, development and policy, IFWF2 promoted future areas for innovations in research, development, and policy investment.

IFWF2 received plaudits for its effect on people as well as research and development. Participants reported that the Forum’s content in human connections and research-for-development philosophy enabled them to better conceive the great significance of their research and inspired them to invest in it with new energy. The Forum was also a major focus of CPWF communications activities during the year, including the production of event proceedings with over 120 papers and 40 posters from CPWF projects, along with the creation of the CPWF Working Paper series.

The outcomes and initial impacts of four CPWF projects were evaluated in 2008, covering the following areas:

- Coastal resource management for improving livelihoods
- Aerobic rice development for Asia
- Collective action in Andean watersheds, and
- Multiple-use water supply systems.

Research highlights are presented from the basin focal projects that study the connection between water and poverty in ten river basins, as well as from projects covering the following:

- Livestock and water productivity
- Management of small reservoirs
- Payment for environmental services
- Health aspects of peri-urban vegetable farming
- Water security for African farmers in the light of global change, and
- Improving livelihoods of farmers in salt-affected areas.
Major Program governance and management changes took place in 2008. The CPWF Consortium Steering Committee (CSC) resolved in February 2008 that, as part of the Program’s progress, its active governance should be charged to the duties of a Board. The new CPWF Board met first in September 2008 and now holds responsibility for setting the strategic direction of the CPWF and for instituting Program goals. As a result of the establishment of the Board, the CSC has changed functions while maintaining its name and legal status through the CPWF Joint Venture Agreement. It will undertake limited but vital functions that it will exercise in meetings every second year in person, or in ad hoc virtual meetings.

To enhance the practical links between research and development impact, selections were made in September 2008 for a new leadership team that includes Directors for Research and for Innovation & Impact as well as an Associate Director who operates across both arenas.

Capacity building cuts across all Program activities, with over 300 MSc and PhD students - 60% of them based across Africa - taking an active part in contributing to, and learning from, CPWF projects.

The Program continues in sound financial shape.

“Through its innovative operations, and its facilitation of dynamic communities of researchers, development experts, policy makers, producers and consumers, this CGIAR Challenge Program goes beyond research for development as usually practiced.

Yet, paradoxically for a program well-versed in technical and social complexity, the CPWF approach is simple: to effectively address a shared problem, we must first work together. 

2008 CGIAR Annual Report.”
2. Background

2.1 Program objectives and approach

In 2008, the CPWF was in transition from the first five years of operation to the second phase that started in 2009. In its second phase, CPWF research focuses on fewer river basins and on more clearly defined Basin Development Challenges (BDC) in each basin. The process of BDC definition drew on multiple sources of information, including recommendations from the CPWF External Review, advice from the CGIAR Science Council, findings of the Comprehensive Assessment on Water Management in Agriculture, the wisdom of Phase 1 Basin Coordinators, outputs from CPWF Phase 1 projects, advice and counsel from key informants surveyed in mid 2008, and feedback from participants of the Second International Forum on Water and Food. These re-defined BDCs seek to fulfill a modified set of CPWF Phase 2 objectives, designed to be achievable within the 15-year bound timespan of the CPWF, and to be more amenable to measurement. These modified objectives are as follows:

- To use water and food productivity research to generate practical knowledge that will yield tangible development outcomes for the poor;
- To ensure that research in the complementary agriculture and water sectors is better integrated to improve the relevance and adoptability of scientific research, and to focus research solutions in ways that will better achieve developmental impact;
- To foster a more effective and integrated process of collaboration in water and food research among CGIAR Centers, and between Centers and other research partners; and
- To improve the partnerships between the research community and development institutions (including policy-makers and NGOs) over issues of food and water productivity.

The means-to-ends relationships are clear in each of the objectives, while each of them can also be seen as an end in itself. The third objective (research collaboration) is a means of achieving the second (scientific outputs) objective, which in turn is a means of achieving the first (development outcomes). The fourth objective (strategic partnerships) is the key to the success of all the other three.

This changed approach has resulted in a transformation of the research themes with many smaller projects in Phase 1 to fewer more focused projects to address the BDCs in Phase 2. The BDCs are met via development outcomes to which the research seeks to contribute through science outputs. The process of identifying these challenges relies upon strategic partnerships in each basin: e.g. CGIAR Centers contribute through their expertise, NARES provide in-country research and extension support, and NGOs and government organizations contribute outreach and development outcomes. Specifically, these partnerships are designed to:

- Support collegiality, research collaboration, and emphasize a learning approach to addressing development challenges;
- Create multi-stakeholder platforms and identify the most adequate forms of partnership to design and implement the research (through sub-projects);
- Ensure adequate representation of stakeholders (e.g. vulnerable groups, poor, women, policy makers, managers) through stakeholder identification and analysis; and
- Build capacity of local partners and young scientists.

The strategic partnerships and collaborative research generate innovative and immediately useful science outputs. While many researchers adopt participatory approaches to identify what is most helpful in meeting farmers' needs, it is acknowledged that even this is not always enough. The CPWF is one of a growing number of institutions that conceptualizes research, development, extension, and adoption in terms of integrated innovations systems. The CPWF sees successful innovation as a social process in which stakeholders and
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The CPWF sees successful innovation as a social process in which stakeholders and technologies co-evolve.
technologies co-evolve. One tool applied for this purpose by the CPWF is the participatory impact pathways analysis (PIPA), which increases opportunities for interaction among CPWF project partners or basin stakeholders, resulting in a greater diversity of possible innovations. Further interaction determines which innovations are carried forward, which are adjusted and adapted and which are abandoned.

2.2. Research strategy and priorities: Innovation through partnerships and science

As part of the transition from Phase 1 to Phase 2, the CPWF is focusing on six rather than nine river basins. Three of the basins are located in Africa (Limpopo, Nile, and Volta), two in Asia (Ganges and Mekong) and one in Latin America (the Andean system of basins). For each of these basins, Basin Development Challenges (BDC) have been established through an extensive, deliberative process described above.

The initial six BDCs are shown in the box below. The challenges will be designed to reach their first tangible results in late 2013. The estimated budget for each is USD5-8 million for 2009-2013.

| Andes (seven small basins): To improve rural livelihoods, increase water availability, and reduce water-related conflict through benefit-sharing in selected basins |
| Ganges delta (India, Bangladesh): To improve rural livelihoods in the delta through integrated and diversified cropping and aquaculture, and through better use of flood- or salt-affected areas |
| Limpopo: (Mozambique, Zimbabwe, South Africa): To improve rural livelihoods and their resilience through better management of rainwater |
| Mekong: Mekong (Laos, Cambodia, Vietnam): To reduce poverty and foster development through management of water for multiple uses in large and small reservoirs |
| Nile: (especially Ethiopian highlands): To improve rural livelihoods and their resilience through a landscape approach to rainwater management |
| Volta: (Burkina Faso and Ghana): To improve rural livelihoods and their resilience through better management of rainwater, including management of small reservoirs |

Some basins have a clear demand for at least two – often very different – BDCs. Additional BDCs may start later in Phase 2 depending on funding availability. Potential second BDCs are summarized in the box below.

| Ganges: The integrated management of groundwater |
| Mekong: The sustainable management of upland agricultural water |
| Nile: Multiple use of agricultural wastewater in the delta |
| Andes: Strategies for Andean communities to adapt to global change |

Topic Working Groups (TWGs) will be established to take advantage of the opportunities for learning across basin geographic and decision-making scales. For example, research in at least three basins will focus on rainwater management, rainwater harvesting, and small reservoirs. Key scientists from these basins will form a TWG to share experiences on rainwater management, critically appraise each others’ work, engage in cross-basin synthesis research, and receive further mentoring from world-class authorities on rainwater management. By this means, the focus and quality of research in basins can undergo continuous improvement. Similarly, research in several basins will have a strong focus on institutional change, benefit sharing, and multiple-use systems. One or more TWGs will be formed around these topics. One issue shared by all basins is how to use a knowledge of external drivers (population growth, changes in the structure of demand for food, climate change) to shape a research agenda that addresses future as well as present needs, and that takes account of the dynamics of change. A TWG on external drivers of change can assist all basins in doing so. By and large, TWGs are not predetermined – the above are simply examples of TWGs in the process of formation. TWGs can emerge, merge or be eliminated in response to the needs of BDC research teams in basins.
3. Major accomplishments

3.1. Overview

The year 2008 was the last in the first phase of CPWF. Although many phase one projects will not be finalized until 2009, it was thus the year in which many results became clearly visible for the first time. This section reports these results in three main sections. First, the Second International Forum on Water and Food, which acted as a focal event to bring researchers together to share results and plans for the future in the light of the demands of relevance for development impact. Second, the results of a detailed assessment conducted during 2008 of the potential impact of four selected projects. Third, a presentation of examples of results from a sample of CPWF projects and scientific events in which CPWF participated.

3.2. Second International Forum on Water and Food

The CPWF’s Second International Forum on Water and Food, IFWF2 www.ifwf2.org, with a theme of Partnerships for Change, Science for Development was held in Addis Ababa from 9-14 November 2008. More than 240 people participated with representation from each of the CPWF projects.

IFWF2 consolidated the CPWF’s research achievements and developments in agricultural water productivity and shared new knowledge generated during the first five years of CPWF. The Forum promoted future areas for innovations in research, development, and policy investment, with contributions from experts in research, development and policy.

IFWF2 received plaudits for its effect on people as well as research and development. The feedback from those attending was that the Forum content in human connections and research-for-development philosophy enabled them to better see the great importance of their research and to invest new energy to it.

The IFWF2 program also included presentations from selected CPWF projects, and concurrent sessions on science and Basin Development Challenges. The Forum used an innovative interactive style, alternating between more traditional science presentations and provocative plenary discussions that fed into debates on appropriate Basin Development Challenges. A high-level Policy and Practice Panel of eight members accompanied all sessions and provided a challenging opinion paper and verbal summary on ensuring that CPWF results are relevant to development institutions and policy makers, and are used by them. The Forum proceedings include more than 120 papers and 40 posters from each of the CPWF projects. (See Appendix.)

3.3. Measuring impact in Phase 1 research

The outcomes and initial impacts of four CPWF projects were evaluated in 2008. These evaluations sought to verify claims of significant change identified through the most significant change approach (see CPWF Working Paper 031).

The projects and changes selected were:
- Coastal Resource Management for Improving Livelihoods;
- Developing a System of Temperate and Tropical Aerobic Rice (STAR) in Asia;
- Sustaining inclusive Collective Action that Links across Economic and Ecological Scales in Upper Watersheds (SCALES); and

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Participants reported that the IFWF2’s content in human connections and research-for-development philosophy enabled them to better conceive the great significance of their research and inspired them to invest in it with new energy.
Models for Implementing Multiple-Use Water Supply Systems for Enhanced Land and Water Productivity, Rural Livelihoods and Gender Equity (MUS).

Two objectives of the evaluations were to provide evidence of the impact of CPWF projects and understanding of how that impact was achieved. We deliberately chose projects that had achieved early success, in the knowledge that within a three year timespan many projects have not yet had time to provide evidence of the benefits of CPWF research. Moreover, the CPWF seeks to foster innovation as its main mechanism for achieving impact. “With innovation one invariably succeeds via the small number of exceptions ….” (Perrin, p.16, 2002). We wished to learn from these exceptions.

A third objective of the evaluations was for the CPWF to identify evaluation methods best suited to the projects it funded. To this end, four evaluators with differing disciplinary backgrounds and experience were provided with the same evaluation questions for the four evaluations. The specific methods for answering the questions were left to the evaluators and the context of their study. The key findings are summarized below.

3.3 a Coastal Resource Management for Improving Livelihoods

This project produced an improved model of Vietnamese River Systems and Plains (VRSAP) that now contributes to improved operation of sluice gate to meet farmers’ water needs better. It used the model and other data to contribute to the development of the Bac Lieu People’s Committee’s Land Use Policy, which recognizes the benefits of diversification and the role of saline water in farming. It developed and evaluated a successful participatory extension approach that assists farmers and aquaculturalists to select appropriate technologies (and reject others) based on on-farm demonstration and experimentation.

The demonstration site farms averaged approximately US$250/ha/year more than the controls. This approach is now being applied by the Bac Lieu Department of Agriculture and Rural Development (DARD) and the number of sites has increased from eight during the project to 80 new sites per year for each of the last two years. Now, 10,000 farmers visit the sites each year, participate in discussions. Of these 50-70% apply these more appropriate technologies. This approach is based on group processes and the Vietnamese saying “to see once is better than to hear 100 times”.

As a consequence of this research:

- A contribution is being made to poverty reduction in the area and this has been demonstrated in two socio-economic studies;
- More sustainable farming systems are beginning to emerge as evidenced by the annual survey conducted by DARD;
- There has been a reduction in the number of conflicts over water resources as reported by government officials interviewed in the evaluation;
- The Southern Institute for Water Resources Planning has used the improved VRSAP model for the whole of the Ca Mau Peninsular;
- Neighboring provinces are beginning to use the on-farm technologies as evidenced from the queries that the project partners have received; and
- New agribusinesses are beginning to emerge either as a direct result of the project or as a flow-on effect.

In support, the Bac Lieu People’s Committee is encouraging banks to provide credit to farmers who lack collateral but who have adopted the new technologies.

3.3 b Developing a System of Temperate and Tropical Aerobic Rice (STAR) in Asia

The implementation of the STAR project in 2004 enabled acceleration of further understanding and development of aerobic rice systems in China, and the initiation of important research on aerobic rice systems in the Philippines and India. The target was aerobic rice systems for water-scarce irrigated areas. In addition, the

3 Research led by IRRI in partnership with WorldFish, IWMI, Bac Lieu People’s Committee, 8 institutions in Viet Nam and Bangladesh & 2 Bangladeshi NGOs. Success was assured by implementation and promotion of recommendations by Bac Lieu Provincial Government, a key CPWF partner throughout.
4 Research led by International Rice Research Institute (IRRI), China Agricultural University (CAU), Indian Agricultural Research Institute (IARI), National Agriculture and Forestry Research Institute (NAFRI), Lao PDR, National Irrigation Administration Tarlac, Philippines, Philippine Rice Research Institute (PhilRice), Ubon Ratchatani University, Thailand
STAR project enabled initiation of work to identify aerobic rice germplasm suited to favorable rainfed environments in Laos and Thailand. The work was undertaken in collaboration with the International Rice Research Consortium (IRRC), which played a major role in dissemination, and the Consortium for Unfavorable Rice Environments (CURE), which identified and provided drought tolerant germplasm for testing in Philippines, India, Thailand and Laos. Overall, the STAR project allowed the researchers not only to increase the number of partners involved, the countries covered, and the amount and type of research, but also to undertake scaling-up and scaling-out. There were also strong links with the project on Developing and Disseminating Water-Saving Rice Technologies in South Asia, supported by a grant from the Asian Development Bank (ADB). Indeed, the achievements of the research on aerobic rice under the IRRC, CURE and the STAR project were important factors that led to ADB funding a project aimed at identifying and developing potential aerobic varieties for a range of locations across South Asia.

At present, the area in China grown to aerobic rice is estimated at 350,000 ha. However, from 2000, an increasing trend in the aerobic rice growing area is evident and expected to grow further, largely due to increased awareness of the benefits of aerobic rice. Government policies such as subsidizing rice production are also likely to have a favorable influence on the adoption of aerobic rice technology. In the Philippines, India and elsewhere, adoption is still very low because the technology is in the research and development stage, although an extrapolation domain analysis showed that its potential is huge, especially in the Ganges basin. Therefore the assessment of economic benefits was only undertaken for China.

Using the data and information from the project, and from the extrapolation domain analysis (Rubiano and Soto 2008), the project estimates conservatively that by 2015, over 1 million hectares of aerobic rice will be grown in China, saving much water by replacing areas that previously required full irrigation. At least 15% of this area will grow aerobic rice varieties developed by the China Agricultural University.

The cultivation of aerobic rice is economically viable when rice yields are 3.5 t/ha or more. Moreover, if the yield is 4.5 t/ha or more then the gross margin of aerobic rice is higher than for maize and soybean grown in the same area. In addition, in irrigated systems where water is either physically or economically scarce, aerobic rice can be a profitable alternative to lowland rice.

Limiting the returns to China, and applying a 30% attribution figure, the net present value (NPV) of the total benefits attributable to STAR is US$39 million. Given that the research costs for the STAR project were only about US$1.8 million, and even if economic benefits were only ever realized in China, the NPV of the STAR project is estimated to be $37 million over a 30-year time horizon. The corresponding benefit:cost ratio is about 21:1. Hence, even under a series of conservative assumptions, and considering the benefits in China alone, the returns to investment are important.

The CGIAR’s scientific oversight body, the Science Council, gave the aerobic rice work 9.5 out of 10, the highest rating of any IRRI research program in 2008.

3.3 c Sustaining Inclusive Collective Action in Upper Watersheds

Many people living in upper watersheds are not only poor but are also blamed for environmental destruction. The goal of the Sustaining Collective Action Linking Economic and Ecological Scales in Upper Watersheds (SCALES) project was to contribute to alleviating poverty in upper watersheds of the tropics. With an aim of improving collective action for watershed resource management within and across social-spatial scales, the SCALES Project implemented Conversatorios of citizen participation (CAC, for its Spanish acronym) in two watersheds in Colombia, Coello and Fuquene.

The CAC is a legal mechanism, supported by the Colombian constitution, that enables communities to reach agreements with government authorities. The SCALES project adapted and oriented the CAC to address natural resources management issues by bringing together a range of actors. Included were local NGOs, community representatives, politically important actors and scientific experts in research and development. The project supported the CAC process in three phases: (1) awareness raising, (2) preparation and implementation of the CAC, and (3) review and follow-up.

5 Rubiano J. and Soto V. 2008, Extrapolation Domains of Project No 16 “Aerobic Rice System (STAR)”. Internal Report for the IMPACT Module of CPWF.

The evaluation found that the project led to four outcomes:

- Improved community relationships with the local and regional authorities. New knowledge helped clarify citizen rights and the roles and responsibilities of public and private organizations. CAC activities stimulated the commitment of government organizations to address environment-related themes. Thirty agreements were signed.

- Strengthened links between community-based organizations (CBOs), NGOs and public sector agencies (water, agriculture, power, environment and, forest conservation). The CAC provided a platform for CBOs and NGOs to communicate and build support for their development and conservation agendas, establish partnerships with public funds, and obtain additional public-sector funds.

- Improved communication amongst actors in different parts of the watersheds. Problems and experiences from the upper, middle and lower areas of the watershed were shared. Communities advanced agreements to work towards joint problem resolution.

- Changes in community perceptions led to priorities for alternative environment-friendly agricultural production. New activities and practices include organic farming systems, waste management and forest conservation.

### 3.3d Multiple Use Services (MUS)

The evaluation concluded that “the most important achievement of the MUS Project has been its contribution to conceptualizing, legitimizing and raising the profile of MUS both as a topic worthy of detailed scientific study, and as a potentially powerful tool for improving the livelihoods of poor people by providing a higher-level water service than is often the case in rural water supply programs and irrigation projects.” This applies at multiple levels. Globally, there is concrete evidence of growing interest in supporting the implementation of MUS schemes as well as research and advocacy efforts, as witnessed by the high level of interest expressed at the WWF4, by ICID, GWP, Comprehensive Assessment on Water Management in Agriculture, FAO, the organizers of WWF5 in Turkey, and expressions of interest by the World Bank, Bill and Melinda Gates Foundation and IFAD. In addition, an international thematic group has formed of organizations working on the topic (MUS Group; see http://www.musgroup.net). At national level in the participating countries, there is clearer understanding of the concept of MUS; many participants credited the MUS Project with helping with clarification and conceptualization. We have noted from our interviews that in some countries stakeholders have a broader concept of MUS than in others: some restrict it to productive use of (some) domestic water from a single source, while others recognize MUS as including multiple sources, uses, and users.

The evaluators further concluded that the change theory embedded in the MUS Project, based on innovations systems theory, has been demonstrated to be effective. This is especially the case for projects seeking changes in policies, institutions and concepts (or mindsets). In fact, the report demonstrates there is considerable evidence that the MUS Project contributed importantly to raising the level of awareness, knowledge, interest and in some cases implementation skills in most of the countries where it was active. These include Colombia, Nepal, South Africa, Thailand, and Zimbabwe. The reasons for this success are related to its emphasis on partnerships and joint learning by diverse stakeholders through “Learning Alliances,” combined with identifying effective “champions of change” in these countries.

A review of the countries where there was most impact, compared to those where the MUS Project had the least impact, suggests two observations. First, in part as a function of the limited funding available and channeled from the global Project partners to local partners, it was only in those countries where there was a good potential to leverage existing matching local resources where the most salient impacts were achieved. These include Colombia, Nepal, South Africa, and Thailand. In Bolivia, and definitely in Zimbabwe, the inadequate level of locally available resources that could be leveraged was a serious constraint.

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3.4 Research highlights

3.4a Livestock and water productivity

Livestock production is a major component of global agriculture. For livestock production to be sustainable, it needs to address environmental concerns such as over-grazing and soil erosion, water pollution, and water depletion, especially in areas where livestock are fed with irrigated grain, and where loss in biodiversity is associated with conversion of wetlands and forests into grazing lands. Evaluation of the performance of livestock production systems in developing countries shows that there are opportunities to develop them sustainably to share their benefits equitably whilst maintaining both profitability and productivity.

One major component of the project explored how technical interventions can, at the basin level, enhance positive impacts and reduce negative impacts of livestock production. Through a comprehensive assessment the project was able to develop an analytical framework on livestock water productivity by studying livestock production systems in Ethiopia, Uganda and Sudan in the Nile basin.

In 2008, this project had a major breakthrough towards improving livelihoods in a specific highly degraded area of the White Nile Basin. Large areas of Uganda's "cattle corridor" lying within the Nile River basin are primarily suited to livestock-based livelihoods, but land and water degradation has reduced agricultural water productivity to almost nil. Overgrazing aggravated by charcoal production led to loss of vegetative cover, high rates of soil erosion and rapid siltation of "valley tanks", a local version of water harvesting that provides animal drinking requirements. Efforts to restore pasture through re-seeding failed consistently because termites destroyed the newly planted pasture grasses especially in the dry season. Investors, government and local farmers had lost hope of rehabilitating the grazing lands and many farmers had abandoned their land due to lost productivity.

Students and the Department Head from Makerere University's Department of Animal Science with support from the CPWF and ILRI took a systems approach to the problem of rehabilitating the land and water resources. They discovered that corralling cattle at night in a degraded area for about two weeks resulted in the deposit of sufficient manure to the degraded land that subsequent re-seeding was successful. It transpired that termites ate the manure, provided there was sufficient, instead of the seedlings. This discovery was the trigger that enabled the team to produce more animal feed while reducing run-off, erosion and siltation of the valley tanks. Integrating livestock, land and water management was essential. By protecting the riparian vegetation, the valley tanks maintained higher water quality, are less susceptible to siltation, and retain greater storage capacity.

During droughts, livestock keepers are forced to migrate with their animals about 20 km to Lake Kyoga, a widening in the Nile River, to get drinking water. This causes a large concentration of livestock, which quickly depletes the feed supplies and puts the animals under nutritional stress and subjects them to high risks of water-related diseases. This results in significant mortality and loss of people's primary asset and thereby aggravates poverty in the area. Ironically, although water is available in the Nile River, it is not accessible to livestock keepers because of these feed shortages and health risks. Making water accessible year round through integrated management of valley tanks and pasture production can overcome this major constraint.

The overall framework of this research and aspects of the results described above are already being adopted by local and regional partners, including:

- The United Nations Development Program Environmental Office, which will sponsor 2 new MSc students;
- The Swedish International development Agency (SIDA), which has provided partial funding for two students to undertake PhD studies. This work will be handled by the "Regional University Forum for Capacity Building in Agriculture" that includes Kenya, Uganda, Tanzania and Mozambique;
- The NGO, Concern, which is taking up the technologies and applying them at another site about 20 km away; and
- The Uganda Ministry of Agriculture, which has provided wire, tools, seed, fertilizer and training to enable the Nakasongola District Veterinary Officer to scale up the technologies.

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3.4 b  Integrated management of small reservoirs

People living in arid areas with highly variable rainfall experience droughts and floods and often have insecure livelihoods. Small multi-purpose reservoirs are a widely-used form of infrastructure to provide reliable water supplies. Reservoirs are often constructed in a series of projects funded by different agencies, at different times, with little or no coordination among the implementing partners. Many small reservoirs function sub-optimally or are falling into disrepair, which indicates that there is room for improvement in their planning, operation, and maintenance. The CPWF Small Reservoirs Project provided major research insights as well as a suite of more than 30 tools to support better planning and management of small reservoirs to improve the livelihoods of small-holder farmers.

In 2005 the project began in the Volta, Limpopo and Sao Francisco basins, with the aim of developing tools to support use of small multi-purpose reservoirs that are properly located, well designed, well maintained and operated to improve the livelihoods of the local residents while at the same time maintaining water related ecosystem services, the long-term sustainability of local water supplies, and adequate downstream flows. To reach this goal, the project assembled a multi-disciplinary team to develop a set of tools based on socio-economic and biophysical research. The team considered the hydrologic, economic, ecological, health, and institutional dimensions of small reservoirs.

Some of these tools are simple and applying them requires nothing more than the desire to try something new, and the drive to ‘get out and do it’. Using others requires facilitation and communication skills. Here, researchers aimed to provide comprehensive accounts of how to apply such techniques, with a focus on the skills required. Other researchers will make additional contributions as part of the on-going process of expanding our knowledge of small reservoirs. www.smallreservoirs.org

Earlier assumptions of evaporation losses from small reservoirs were based on analogy with oases in deserts. The project’s researchers demonstrated that evaporation from small multi-use reservoirs was half of this assumption. Project research also showed that in a savanna setting losses from open water in reservoirs are even smaller than those from cropped areas of a similar size. Water balance measurements, based on combined satellite and field measurements, showed that downstream impact of small reservoirs is minimal. For instance, in the Volta Basin, even quadrupling the number of small reservoirs would result in the consumption of less than one percent of the total available water. These findings and the project’s management tools provide NGOs and governments investing in small reservoirs the scientific information and methods they will require to do it well. The ease of access and localized control of small reservoirs translates into increased water access and use, as well as enhanced benefits for local people.

The first version of the Small Reservoirs Toolkit was produced by the Small Reservoirs Project (the tool kit can be found at www.smallreservoirs.org). There are approximately 30 tools and techniques presented in four topic areas: i) Intervention planning; ii) Storage and hydrology; iii) Ecosystems and health; and iv) Institutions and economics. This tool kit is intended for the use of NGOs, research institutes, universities, donor agencies,

9 Research led by IWMI in partnership with WRI Ghana, University of Zimbabwe, IRD, SEI, Embrapa and TU Delft.
multilateral organizations, and government agencies. These tools are not meant to replace the traditional methods of collecting, storing, and presenting knowledge. However, information in journal articles, dissertations, theses, and other literature is often difficult to find and is seldom written for use by practitioners. The purpose of the tools is to make information more accessible and more useful to practitioners. In the tools, references are made to the original documents and it is expected that where necessary the reader will refer to and make use of the original sources.

Some of these tools are simple and applying them requires nothing more than the desire to try something new, and the drive to ‘get out and do it’. Using others requires facilitation and communication skills. Here, researchers aimed to provide comprehensive accounts of how to apply such techniques, with a focus on the skills required of potential facilitators. Some of the tools are more complex, and call for the use of substantial resources. Here, they attempted to provide an introduction and orientation to the topic at hand, as well as an introduction to resources that will be required to use the tools. The toolkit provides entry points and references for a range of ‘Small Reservoirs’ topics and related research. Other researchers will make additional contributions as part of the on-going process of expanding our knowledge of small reservoirs. References and contact persons are listed at the end of each tool.

3.4 c Payment for environmental services

Win-win situations for different users are rare in water management, especially as basins become more stressed. There is thus a need to share water, but even beyond water sharing, to assign water to higher-value uses, and sharing the benefits with those who give up their water to do so. The research challenge faced in this project is to identify practical mechanisms for sharing benefits from water-related ecosystem services. Contrasting strategies were developed in three small basins in the Andes, namely Fuquene in Colombia, Ambato in Ecuador, and Moyabamba in Peru.

The main services provided related to sediment retention and water flow regulation. The research in each basin first determined which parts of the watershed provided services that could then be used to target interventions. For each service-providing unit the opportunity cost of proposed interventions were determined to design the proper economic or financial mechanism to provide incentives for the desired land-use changes. With this information, two main schemes were initiated: a revolving fund in Colombia (in the Fuquene watershed) and an environmental services fund with resources from a water surcharge in Peru (the Moyobamba watershed). In the Ambato watershed, a third approach is presently being initiated. A local trust fund, financed so far by donations from the water and electricity utility companies and from the city council will invest in conservation agriculture by upland farmers. It will also encourage those upland communities to withdraw from use of vulnerable areas needed to maintain flow of quality water to urban areas.

In Fuquene, conservation agriculture was promoted with soft credits. Conservation agriculture was then implemented as a means to provide multiple ecosystem services such as soil water retention, soil carbon retention, and sediment retention. The findings indicated that net incomes of upper and middle catchment farmers implementing conservation tillage schemes were increased as the negative externality was modified positively (a reduction of about 50% in the sediment yield levels). In addition, the value chain analysis demonstrated that when conservation agriculture practices were implemented in the upper and middle-catchment, a marginal increment of 40% and 100% in social benefits could be achieved, respectively.

In addition, conservation tillage in potato-based systems improved soil organic matter and carbon content in disturbed soils of Fuquene. After two years, the soil carbon concentration in the whole profile was 29% higher under conservation tillage than under conventional tillage sites and the carbon stock was higher by 31%. This improvement was attributed to the enhancement of soil physical characteristics related to soil water movement and storage such as bulk density, saturated hydraulic conductivity and mesoporosity. Conservation tillage re-habilitates the carbon and water-related soil characteristics compared to conventional tillage systems. All these characteristics resulted in positive effects on multiple ecosystem services such as carbon accumulation, water flows regulation and sediment retention.

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10 Research led by Condesan, GTZ Andean Systems Project, Danish Institute for International Studies (DIIS), International Center for Tropical Agriculture (CIAT)
3.4 d Safeguarding public health concerns: Peri-urban vegetable farming

The change the CPWF hopes to achieve requires a social process of communication and negotiation across scales. Two linked projects in the Volta basin region highlight how research can directly contribute to more socially equitable and improved development outcomes – in this case influencing local bylaws as well as national policies. The projects were especially novel because they brought hydrologists, agronomists and social scientists together with epidemiologists.

The city of Accra in Ghana has a bylaw on ‘Growing and Sale of Crops’, which states in short that: “No crops shall be watered or irrigated by the effluent of a drain which is fed by water from a street drainage.” However, due to the perishable nature of leafy vegetables and high market demand, in Accra there are about 1000 farmers who specialize in vegetable cultivation on every free plot near any water source, which is in most cases either a highly polluted stream or a drain. Although the city is willing to enforce its bylaws to protect public health, it lacks the means to do so.

The two CPWF research projects recognized this challenge and worked with the Ministry of Food and Agriculture on options to safeguard public health while protecting farmers’ livelihoods. The projects linked with the network of Resource Centers on Urban Agriculture and Food Security (RUAF), which facilitated in Ghana multi-stakeholder fora and policy seminars on Urban Agriculture. The CPWF project seized the opportunity to present its research to a variety of municipal and governmental authorities, outlining the benefits of irrigated urban farming and options on how to minimize health risks without outright banning wastewater use. Among the key findings was that there were many sources of fecal contamination, including the water used to “refresh” vegetables for sale on market stalls and in food preparation at all social levels, and not just in vegetable production with wastewater; even vegetables produced with piped water arrived contaminated at the consumer level. The presentation was so well received that the Ministry made a declaration in favor of urban farming.

The projects benefited from their exposure to Participatory Impact Pathways Analysis, introduced in all its projects by the CPWF. Through impact pathways and network maps, the project team identified a) the Extension Services as key dialogue partner and not only as end-of-project recipient, and b) the ongoing discussion on a national irrigation policy in Ghana as a key policy process with which to link. As a result, the projects produced extension material tailored to the needs of the Extension Service, and brought their arguments on safer wastewater irrigation to the national policy that was launched in 2008 and recognizes the various dimensions of this practice.

In close collaboration with RUAF, the projects also supported the revision of the Accra bylaws with research-based arguments. The outcome in 2008 was a first draft of a new bylaw that considers that, with certain precautions, the re-use of wastewater can be beneficial. These experiences have led to the project researchers being asked to provide input to World Health Organization guidelines for wastewater use in agriculture.

3.4 e Water security under global change

Surprisingly little is known about farmer perceptions of climate change in rural Africa and even less about the barriers to adaptation. To address this knowledge gap, a CPWF project in the Limpopo and Nile basins examined awareness of climate change, along with agricultural adaptation strategies. Innovatively, it worked at four levels of analysis: household, basin, national and regional.

In two large-scale household surveys implemented in parts of South Africa and Ethiopia, it was found that a majority of farmers in the Limpopo (99% in South Africa) and the Nile Basins (88% in Ethiopia) perceived long-term changes in precipitation or temperature. In response to higher temperatures and decreased rainfall, farmers propose different adaptation strategies to reduce the negative impacts of climate change. The strategies range from irrigating more, changing crop varieties or types, shifting planting dates, implementing soil and water conservation measures, to stopping farming as an activity and instead investing in livestock.

Some farmers were found to have already developed different adaptation strategies in response to changes in rainfall and temperature changes. While adoption of new crop varieties or types and planting trees for shade

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11 Research led by University of Copenhagen, Nkrumah University of Science and Technology, The Royal Veterinary and Agricultural University (KVL), University of Copenhagen, International Water Management Institute (IWMI)
12 Research led by IFPRI in partnership with the Universities of Pretoria and Hamburg, EDRI and the Ethiopian Economics Association
Due to the perishable nature of leafy vegetables and high market demand, in Accra there are about 1000 farmers who specialize in vegetable cultivation on every free plot near any water source, which is in most cases either a highly polluted stream or a drain.

Two CPWF research projects recognized this challenge and worked with Ghana’s Ministry of Food and Agriculture on options to safeguard public health while protecting farmers’ livelihoods.
were common strategies to adapt to rising temperatures, soil and water conservation, changing planting dates, water harvesting schemes, and increasing irrigation were the primary adaptation strategies to cope with decreased precipitation.

However, about 40% of farmers in Ethiopia and 60% in South Africa have not changed farming practices in response to climate change that is already taking place. Why are there not more farmers adapting? The results of the survey highlighted several constraints to adaptation in the case study sites: in the Limpopo Basin, lack of credit was the main factor that was cited by 36% of farmers. Other reasons included lack of access to water (8%), lack of information about climate change and appropriate adaptations (5%), lack of market access (3%), and no property rights (1%).

In Ethiopia, farmers cited shortage of land (27%), lack of information and knowledge (23%), and lack of credit/money (21%) as the primary factors preventing them from adapting to long-term changes in temperature and rainfall. These results suggest that although adaptation strategies to climate change need to focus on the provision of improved access to water, and enhanced crop varieties, to be effective, policies must also address market imperfections such as access to information, credit and markets to facilitate adaptation of smallholder subsistence farmers.

To complement this work, climate-change impacts were analyzed combining a global general-equilibrium model with a global partial agriculture-sector-equilibrium model, both of which account for water as a factor in agricultural production. This is the first global economic climate change impact analysis using this type of modeling framework. The results were discussed with national policy makers so as to begin the development of national adaptation strategies. Based on the analysis of two alternative adaptation scenarios—doubling irrigated area on the one hand and achieving conservative crop productivity increases for both irrigated and rainfed areas in Sub-Saharan Africa, on the other hand, the researchers found that both adaptation scenarios enable farmers to achieve higher yields and revenues from crop production. However, when the efficacy of the two scenarios to cope with climate change was measured by changes in regional GDP, it was found that increases in productivity were far more effective. Their benefits greatly exceeded the GDP losses due to climate change (using the Hadley global climate model and B2 scenario); GDP would increase by about US$26 billion compared to the initial reduction in GDP of about US$3 billion. With a projected doubling of irrigated area; the GDP increase did not offset GDP losses due to climate change (GDP increased by only about US$0.1 billion). Even though Sub-Saharan Africa is not a key contributor to global food production or irrigated food production, both scenarios helped lower world food prices, stimulating national and international food markets.

3.4 Improving livelihoods of poor farmers in salt-affected areas

This research project is developing the means for enhancing food security and livelihoods for the millions of rural dwellers dependent on production from the millions of hectares of sodic or salt-affected soils of inland and coastal parts of the Ganges basin. Such farmers are among the poorest in the basin. The project has shown that it is possible to increase land and water productivity greatly on both sodic and salt-affected soils through the incorporation of tolerance into locally-adapted, high-yielding varieties. When tolerant varieties are used on sodic or salt-affected soils, the results are often dramatic, increasing yields several-fold. In the case of rice, such varieties can make the difference between no yield and yields of 2-4 t/ha.

The project has also shown that improvements in productivity are greatest when improved varieties are combined with cost-effective approaches to resource management and land reclamation, cropping system intensification, diversification (to a range of crop and crop-aquaculture systems), and innovative water management practices using scarce fresh water resources for supplementary irrigation. Tolerant varieties are the key entry point to achieving this positive change.

Much previous work on tolerant varieties has been done in rice, particularly by IRRI and partners. Unusually, this project brings together new partners from developed and developing countries so as to take a broader cropping systems approach. Thus, ICRISAT, the International Centre for Biosaline Agriculture (ICBA), the University of California and Indian and Bangladeshi NARES have pooled their promising salt and sodic tolerant lines and varieties of pigeon pea, chickpea, groundnut, sorghum, pearl millet, safflower, barley and triticale. 

13 Research led by International Rice Research Institute (IRRI), International Center for Biosaline Agriculture (ICBA), Bangladesh Rice Research Institute (BRRI), Cuu Long Delta Rice Research Institute (CLRRRI) Vietnam, ICAR - Central Rice Research Institute (CRRI), Narendra Dev University of Agriculture and Technology (NDUAT) India, Rice Research and Training Center (RRTC) Egypt, University of California, Davis (UC Davis)
One specific example of the impact of this project on enhanced water and food security is for farmers in Orissa, India. Farmers here are poor, with small land holdings and food insecurity. The rice they produce is enough only for four to nine months, thus they have to buy during the lean months. Farmers grow traditional varieties that have low yields at 1 ton per ha. During the dry season, farmers grow varieties with yields 2.5 to 3 tons/ha. However during the dry season, these varieties are susceptible to salinity and any increase in salinity level damages the crop severely. The low productivity of summer rice is due to unavailability of suitable rice varieties and lack of technical knowledge about management of the rice crop under this stress situation. Under the project, these severely-stressed rice environments became the laboratory for farmer participatory experiments for saline-tolerant rice varieties and crop diversification.

As a result of the introduction of new varieties, yields increased and additional / expanded dry season rice crop allowed farm households to grow enough rice for the year. Farmers say, “We no longer think about whether we will have enough to eat the next day”.

3.4 g Basin Focal Projects

In order to maintain a whole-basin perspective in CPWF benchmark basins, providing context to individual projects working therein and tying work in basins to global drivers and trends, a series of Basin Focal Projects (BFPs) were initiated. Of these, four began in 2006 (Karkheh, Mekong, São Francisco and Volta basins) and six in 2008 (Andes, Ganges, Limpopo, Niger, Nile, and Yellow River basins).

BFPs aim to explore the complex interrelationships among poverty, livelihoods, water access, water availability, major water uses at the basin level, water productivity in crops, fisheries and livestock, institutional drivers of water management, and opportunities to improve livelihoods through water-related interventions.

As a result of the introduction of new varieties, yields increased and additional / expanded dry season rice crop allowed farm households to grow enough rice for the year.

Farmers say, “We no longer think about whether we will have enough to eat the next day”.

Insights from BFPs began to accumulate in earlier years and accelerated throughout 2008. Some notable examples include analyses of water and poverty, and water productivity related to crop and non-crop food products, which are discussed below.

Water and Poverty Insights

Relationships among water, food and poverty are variable, subtle and complex. The naïve notion that “water scarcity increases poverty” is rarely adequate. It is true that some people are pushed into poverty as a consequence of water scarcity. More often, however, the ability to access, organize or exploit water and land resources seems more influential than total availability of water.

Poverty is increased by inequitable development of land and water resources. Lack of access is more important than total water availability. This remains true even in industrialized economies. For example, some people have been left behind in poverty within the São Francisco, an otherwise prosperous and (relatively) “water-rich”
basin. The loss of existing livelihood support due to inequitable water use is common and often under-reported. It tends to affect the poorest, such as those who rely on fish in the Mekong, or on pastures in the Nile, the Volta, or the Niger, and who are often neglected when development happens.

People are poor when they are unprotected against water-related hazards, such as drought, flood or water-related disease. The ability to cope, or even exploit, the “hazard” is more important than the hazard itself. For example, many people, especially in Cambodia, depend on annual Mekong floods. In contrast, periodic Limpopo floods are life-threatening.

**Water productivity for crop and non-crop food products**

The conversion rate of water into food, for both crop and non-crop (i.e. livestock and fisheries), is generally very low. This is true almost everywhere in rain-fed systems. This is both bad news, because the situation seems widespread, and good, because there is ample scope for improvements that will lead to improvement of the common good.

Crop water productivity appears well below its potential in most basins and there is considerable scope for improvement. Estimates suggest the potential water productivity of wheat is approximately 2 kg/m³, but it is rare to find systems with productivity greater than 0.4 or 0.6 kg/m³ (exceptions occur in parts of the Ganges, Yellow River and Nile delta). This is the case for many other staple foods such as rice, sorghum or millet.

Water use accounting indicates that grassland systems dominate water use globally. In African basins, this importance is even more pronounced. Grassland systems in the Limpopo, Nile and Volta process by far the largest volume of water passing through the basins (52%, 45%, and 80%), yet little is known about how such systems support rural livelihoods, even in the Nile, where the vast majority of people depend on livestock for an important part of their livelihood. More recent analysis of livestock water productivity indicates that these systems are relatively efficient and valuable converters of water into livelihood support.

Runoff in relatively dry basins is typically less than 15% of rainfall received. By contrast, in the Mekong, a relatively wet basin, annual runoff is almost 40% of total water balance. This delivers an estimated average of 440 km³ of water to the system, which supports an aquatic environment over much of the basin on which most (estimated at 65%) of the population depend. Precise estimation of the livelihood support is extremely difficult, with the consequence that, even in this basin, the contribution of fish seems seriously under-estimated. Analysis from the Mekong BFP suggests that the value of fish consumption is greater than livestock in all riparian countries and in Cambodia, possibly as great as the value of crops.

It is clear that we need to broaden our analysis of water productivity to take into account different components of the agricultural system (i.e. including fish and livestock). Work is proceeding on this aspect in 2009.

### 3.4 h Participation in research events

**XIII World Water Congress**

The Basin Focal Project held a special session, titled the **Challenge Program on Water and Food: Water, agriculture and poverty alleviation in basins** on 2 September 2008. In this session, ten papers presented data and analysis on various aspects of the complex linkages between water, food and poverty from the ten Phase 1 basins, including the Andes system of basins, Ganges, Karkheh, Limpopo, Mekong, Nile, Niger, Sao Francisco, Volta and Yellow River basins. Starting with a general overview of the CGIAR Challenge Program on Water and Food, papers proceeded to explain details of agricultural water use, water flows within basins, poverty analysis, hydro-economic modeling, and specific problems of crop, livestock, and fisheries management. The sessions were attended by over 90 people and chaired by Prof Asit Biswas, Executive Director of the Third World Center in Mexico. They were published in a special issue of Water International in the March 2009 issue.

In addition, the host of the Congress, the International Water Resources Association announced the selection of the CPWF paper, “The Challenges of Inclusive Cross-Scale Collective Action in Watersheds”, by Brent Swallow, Nancy Johnson, Ruth Meinzen-Dick, and Anna Knox, as the best paper published in Water International in 2006. This paper presents a conceptual framework for integrated water, food and institutions within a basin, **based on the workshop** held during the CPWF Baseline Conference in 2003.

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Workshops on Rainwater Management, Global Drivers and Processes of Change and MUS

Three workshops were held in 2008 with the primary goal of sharing and learning across projects and associated research teams.

The first workshop of note was on *Increasing Water Productivity of Rainfed Cropping Systems* held in Tamale, Ghana, 22-25 September 2008. A total of 26 papers were presented, all based on CPWF research, with participants from 18 countries and 7 basins. The workshop succeeded to meet both of its major objectives. The first objective was to provide insights to participants on how to go about monitoring the fate of water and water productivity – by learning from each others’ experience, and from recognized experts. The second objective was to compile, review, and synthesize findings from Phase 1 projects in relation to:

- In-field water harvesting and conservation, impacts of soil and residue management on land and water productivity and components of the water balance for rainfed crops in Africa; interactions with fertility management;
- Assessing potential for supplementary irrigation systems for rainfed cropping systems, and optimizing their design;
- Application of crop models to study these systems; and
- Potential for input/output markets and microfinance for the rural poor, such as warrentage, to lead to adoption of improved technologies.

Twenty of the papers will be published in July 2009. All papers have been peer-reviewed.

The second workshop focused on the topic of *Global Drivers and Processes of Change* and was held in Washington, D.C. on October 9-10, 2008. The workshop reviewed recent events and challenges in the six focal basins of the CPWF (Andean system of basins, Indus-Ganges, Limpopo, Mekong, Nile, Volta) and present modeling results of the global drivers of, and threats to food and water security in each basin. The workshop was also aimed at refining the research agenda related to global drivers and processes of change for the second phase of the CPWF.

The third major meeting was the MUS Symposium held just before IFWF2 in Addis Ababa. The symposium was organized by the MUS (Multiple Use Services) Group, www.musgroup.net, which acts as a think-tank in the field of multiple uses of water, as well as a platform for dissemination of information and experiences, and for advocacy. This group was formed through the project leader of the CPWF MUS project and her collaborators. The Symposium was also supported by RiPPLE (Research-inspired Policy and Practice Learning in Ethiopia and the Nile Region), a research consortium that provides evidence-based learning to support water and sanitation implementation programs in Ethiopia and the Nile region.

The Symposium succeeded in providing a platform for sharing and consolidating experiences and lessons learned on different aspects of providing multiple-use water services, including technologies, financial models, institutional arrangements, support mechanisms, and impacts. Discussions focused on implications for taking the MUS approach forward, in different areas such as implementation, research, capacity development, and policy.

The symposium produced the following outputs:

- Symposium proceedings;
- Policy brief. The main recommendations of the symposium will be published in the form of a policy brief, to be shared at other global events, including the Fifth World Water Forum; and
- A growing network of individuals and organizations. It is expected that participants can use this event to grow their network with other organizations working in this field.

Progress in the context of the MUS project is elaborated in the section above.
Water use accounting indicates that grassland systems dominate water use globally. Recent analysis of livestock water productivity indicates that these systems are relatively efficient and valuable converters of water into livelihood support.
4. Governance and management changes

4.1. New Board

The CPWF Consortium Steering Committee resolved in February 2008 that, as part of the Program’s progress, its active governance should be charged to the duties of a Board. As such, the new CPWF Board now has responsibility for setting the strategic direction of the CPWF and for instituting Program goals.

The Board is composed of five independent members, not drawn from CPWF Consortium institutions, one of whom acts as the Chair. One member was nominated by the CGIAR Alliance, and another by the ‘non-CGIAR (i.e. the NGOs, NARES and ARIs) Consortium members. Two ex officio members are the International Water Management Institute, the lead member of the Consortium and the CPWF Program Director.

The founding members of the Board are Professor George Rothschild (Chair and Emeritus Professor of International Development at the University of Greenwich); Doctor Barbara Schreiner (independent consultant and former Deputy Director General, Department of Water Affairs and Forestry, South Africa), Doctor Cyrus Ndiritu (independent consultant and former Executive Director of the Kenya Agricultural Research Institute) and Professor Walter Falcon15 (Farnsworth Professor of International Agricultural Policy, Stanford University). Representative members are Professor Alex McCalla (University of California) and Professor Joachim von Braun (Director General IFPRI). Ex officio members are Dr Colin Chartres (Director General IWMI) and Dr Jonathan Woolley (Director CPWF). Dr Don Blackmore (independent consultant and former Chief Executive of the Murray-Darling Basin Commission) was named to assume Board duties in January 2009.

The CPWF Board held its inaugural meeting in September 2008.

4.2. New role for the Consortium Steering Committee (CSC)

As a result of the establishment of the Board, the CSC has changed functions while maintaining its name and legal status through the CPWF Joint Venture Agreement. It will undertake limited but vital functions that it will exercise in meetings every second year in person, or in ad hoc virtual meetings. A strong link is maintained with the Board, as the Chair of the CSC attends all meetings of the Board enabling a two-way flow of information and advice. Amongst its responsibilities, the CSC selected the inaugural Board and provides strategic advice to the members. It retains the right to revise the Joint Venture Agreement, including the contractual rights and obligation of the signatories, and can admit new members to the Consortium. The CSC met in February 2008, and it is expected that the next meeting will be held in conjunction with the Third International Forum on Water and Food to be held in 2010.

4.3. New members of the leadership team

Always searching to enhance the practical links between research and development impact, selections were made in September 2008 for a new leadership team that includes Directors for Research and for Innovation & Impact. This structure replaces the coordination of theme leaders and basin coordinators that operated during Phase 1. The new Directors who took up positions in February 2009 are Dr. Larry Harrington (Research Director), Dr. Boru Douthwaite (Innovation & Impact Director) and Dr. Sophie Nguyen Khoa (Associate Director). In November 2008, the Program Director announced his decision not to seek a new term and the search process for a new Program Director was initiated by the Board.

15 Prof Falcon resigned from the CPWF Board for health reasons in January 2009.
CPWF Board:

*Standing:* Dr. Jim Hill (CSC Chair), Dr. Colin Chartres, Dr. Jonathan Woolley, Prof. Alex Mc Calla, Dr. Don Blackmore.

*Seated:* Dr. Cyrus Ndiritu, Prof. George Rothschild (Board Chair) and Ms. Barbara Schreiner.

*Absent:* Prof. Joachim von Braun and Prof. Walter Falcon.
5. Progress on other activities

5.1. Communications and public awareness

In 2008 the CPWF redoubled its efforts to strengthen its communications and knowledge management (KM) provision in response to recommendations by the External Review. One of the major tasks of 2008 was to define the scope and priorities of this work in a way that more directly contributes to the Program’s objective.

An attempt to find a suitable Communications Coordinator through international competition in August was not successful; although all the short-listed candidates had strengths, none fitted the full range of skills needed for effective communications within the CPWF niche. In the interim, KM consultants with CPWF experience worked with management to identify program needs and structure targeted action plans.

The KM consultants also provided extensive and successful communication planning and service provision for the CPWF Second International Forum on Water and Food, including the production of several key publications. The web-based portal www.ifwf2.org for the Second International Forum on Water and Food brought the Forum to life both physical and virtual participants. The portal was used as an interactive meeting space to share the presentations and papers for the five-day event, as well as be used as a resource tool for the media. It is now being used to share the unique event’s outputs with a wider audience.

The CPWF launched a CPWF Working Paper series in 2008, including papers examining the mitigation of extreme events caused by climate change in the Blue Nile in Ethiopia, and stories from projects reporting the most significant changes (MSC) brought about by their research, both technically and through partnerships. These MSC stories have encouraged learning both within and across project teams, through reflection on what aspects of the overall project contributed most to potential and real development outcomes.

5.2. Capacity building – integration and innovation

The CPWF has taken an innovative approach to capacity building, by embedding it into each of its projects through the engagement of more than 300 students from 24 countries, and national partners. Over 60% of the students live in Africa, and cover water research from the spectrum of biophysical to social sciences.

In one project alone, the small reservoirs project, originally 4 PhD students were planned, but ultimately the project supported 20 BSc, 30 MSc and 9 PhDs, almost all from developing countries of the three project basins. Interestingly, much of this growth was triggered through prospective students discovering the ground-breaking work of the project through internet searches. Similarly, the multiple-use services project originaly projected no student involvement, but by its final year had 37 MSc and 2 PhD students engaged in the research.

The goal and focus of capacity building, beyond the specific research topics of students, is to increase the ability of scientists and policy makers to carry out integrated research on water and food across scales. For example, the workshop described above on water productivity explicitly focused on training field-scale agricultural researchers to consider implications for water at field scale and at higher levels. Similarly, the Second CPWF Forum brought together diverse partners in basin discussions that considered the full range of scales, from local to global. This is a key component of CPWF’s contribution to capacity building in the water and food arenas.
The CPWF takes an innovative approach to capacity building, by embedding it into each of its projects through the engagement of more than 300 students from 24 countries, and national partners.

Over 60% of the students live in Africa, and cover water research from the spectrum of biophysical to social sciences.
6. Finance

The CPWF continued in a healthy financial position during 2008. The CPWF enjoys a broad donor base that tends to be concentrated in Europe. The general funding situation is quite favourable, with income and expenditure in balance. CPWF donors in 2008 were the UK Department for International Development, the World Bank, the European Commission, the Governments of the Netherlands, Switzerland, New Zealand, France, and the International Fund for Agricultural Development (IFAD). The contribution from the Government of New Zealand recognised the CPWF as a way to contribute widely into the CGIAR rather than to a single center.

Please see Table 1 for the 2002-2008 budget figures. Note, however, that the 2008 audit is yet to be finalised so the expenditures remain estimates.

Prospects for obtaining sufficient funding for CPWF plans in Phase 2 are favourable, with funding likely at least at the level of Phase 1.
### Table 1: Annual Income and Expenditure 2002-2008

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<tr>
<th></th>
<th>2002</th>
<th>2003</th>
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<th>2005</th>
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<th>2007</th>
<th>2008</th>
<th>Totals</th>
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#### EXPENDITURE (actual to 2007 - estimate 2008)

**Program governance and management**

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<td>200</td>
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**Research**

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**Total expenditures**

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<tr>
<td>Surplus (Deficit)</td>
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<td>6,352</td>
<td>(557)</td>
<td>(3,114)</td>
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<td>8,573</td>
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<td>Balance carried forward</td>
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<td>7,130</td>
<td>8,573</td>
<td>3,459</td>
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<td><strong>2005</strong></td>
<td><strong>2006</strong></td>
<td><strong>2007</strong></td>
<td><strong>2008</strong></td>
<td><strong>2008 totals</strong></td>
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<tr>
<td><strong>Additional CPWF budget from other sources</strong></td>
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<td>Germany directly received by IFPRI (proc 59)</td>
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<td>499</td>
<td>564</td>
<td>96</td>
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<tr>
<td>IPS Scholarships for developing country scientists working with CPWF</td>
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**NOTES TO BUDGET**

1. 2008 contributions from IFAD (432) and EC (1,950) received in 2009.
2. The balance carried forward at the end of 2008, together with outstanding 2008 contributions, represents commitments of USD$6,282 to on-going projects from the first and second competitive call and Basin Focal Projects.
Appendix - Peer-reviewed publication list 2008

IFWF2 Proceedings
120 papers and 40 posters:


Basin


Modeling the hydrology of the Burití Vermelho sub-catchment area of the São Francisco River basin.


Modeling the hydrology of the São Francisco River basin: A demonstration model.

Masih, I., Ahmad, M.D., Turrul, H., Uhlenbrook, S., Karimi, P., 2008. Understanding hydrologic variability for better surface water allocations in Karkheh basin, Iran.


**Theme**


**Projects**

**PN 2: Improving Water Productivity of Cereals and Food Legumes in the Atbara River Basin of Eritrea**


**PN 5: Rainwater and Nutrient Use Efficiency**


**PN 7: Development of Technologies to Harness the Productivity Potential of Salt-Affected Areas of the Indo-Gangetic, Mekong and Karkheh River Basins**


**PN 8: Improving on-farm agricultural water productivity in the Karkheh river basin**


**PN 19: Improved water and land management in the Ethiopian highlands and its impact on downstream stakeholders dependent on the Blue Nile (Upstream–downstream impacts in Nile)**


**PN 20: Sustaining Inclusive Collective Action that Links Across Economic and Ecological Scale in Upper Watersheds (SCALES)**


**PN 25: Companion Modeling and Water Dynamics**


**PN 28: Multiple Water Use MUS (multiple use systems)**


**PN 34: Improved fisheries productivity and management in tropical reservoirs**


**PN 38: Safer Peri-Urban Vegetable Production**


**PN 40: Integrating Governance and Modeling**


**PN 42: Groundwater Governance in IGB and YRB**


**PN 46: Small Multi-Purpose Reservoir Ensemble Planning**


**PN 47: African Models of Transboundary Governance**


**PN 48: Strategic Analysis of River Linking**


**PN 50: Enhancing Multi-Scale Mekong Water Governance**


**PN 57: Basin Focal Project Karkheh**
