

# RESEARCH WITHIN REACH



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THE SUSTAINING SUPPORT OF THE MEMBERS OF THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH (CGIAR) MAKES POSSIBLE THE LONG-TERM AND STRATEGIC INVESTMENT IN AGRICULTURE RESEARCH FUNDAMENTAL TO MEETING THE DEMANDS OF A CHANGING WORLD. TODAY, THANKS TO THE COMMITMENT OF OUR 64 MEMBERS, WE HAVE PROMISING RESEARCH WITHIN OUR REACH THAT WILL HELP US TO ADDRESS THE CHALLENGES THE WORLD NOW FACES, NOTABLY MOUNTING PRESSURES ON FOOD PRODUCTION AND DEEPENING CONCERN OVER THE IMPACTS OF CLIMATE CHANGE. THE WORLD'S POOR WILL REAP THE BENEFITS OF OUR MEMBERS' VISION AND INVESTMENT MANY FOLD AS FUTURE FOOD CRISES ARE AVERTED THROUGH CROP YIELD GAINS AND SUSTAINABLE PRODUCTION SYSTEMS THAT CAN WITHSTAND INCREASINGLY ERRATIC WEATHER. TOGETHER, WE CAN BRING TO SCALE RESEARCH SOLUTIONS TO FEED THE WORLD WHILE CONSERVING OUR PRECIOUS NATURAL RESOURCES FOR FUTURE GENERATIONS. THANK YOU FOR YOUR SUPPORT.

# RESEARCH WITHIN REACH

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# CGIAR RESEARCH CONDUCTED IN 2007 AT INTERNATIONAL RESEARCH CENTERS AROUND THE WORLD PROMISES A BETTER TOMORROW



IITA

The insightful research-for-development model of the International Institute of Tropical Agriculture (IITA) proves effective in setting a research course that addresses major development problems in Africa rather than simply contributing to scientific knowledge, say external reviews in 2007. This CGIAR-supported Center and its partners have delivered the bulk (70 percent) of the international research impact in sub-Saharan Africa.



CIFOR

By convening Forest Day at the December 2007 United Nations Framework Convention on Climate Change in Bali, the Center for International Forestry Research (CIFOR) took a leadership role in advancing the global discussion on how best to reduce greenhouse gas emissions from deforestation, from which 20 percent of global emissions arise each year. Attended by 800 people, the Forest Day event helped inform the ongoing negotiations and raise the prominence of forests in the global climate debate.



AFRICA RICE

Rice research in Africa is particularly well served by the partnership approach adopted by the Africa Rice Center. The use of upland and lowland New Rices for Africa varieties helped increase rice production in 2006-2007 by 6 percent to 22 million tons. Technologies developed for irrigated conditions have increased average rice yields in the Senegal River valley from 3-4 tons per hectare in the early 1990s to about 5.5-6 tons per hectare today.



CIMMYT

New African maize withstands the onslaught of one of the most damaging grain storage pests. Using crosses with Cuban maize from the genebank at the International Maize and Wheat Improvement Center (CIMMYT), researchers there and at the Kenya Agricultural Research Institute bred varieties resistant to the larger grain borer, a beetle that can destroy in just 6 months more than a third of farmers' maize stores.



WORLD AGROFORESTRY

World Agroforestry Centre technology, now widely used in southern Africa, greatly enriches depleted soils by using fertilizer trees to fix atmospheric nitrogen. Two-thirds of the farmers who use the technology — currently estimated at some 400,000 — double or even triple their maize production. In long-term farmer trials, the trees provide nearly the same benefit as expensive commercial fertilizers.



IRRI

Revolutions in rice genetics, molecular biology, computing power and communications allow the International Rice Research Institute (IRRI) to develop exciting new technologies, such as drought-tolerant high-yielding rice varieties, to benefit millions of poor rice farmers and consumers. Improved productivity already plays a vital role in guaranteeing global food security as concerns grow over the planet's ability to feed everyone.



CIP

As global temperatures increase, the devastating potato late blight will threaten crops in areas previously immune to attack. In preparation, the International Potato Center (CIP) has developed potato clones selected for broad-spectrum resistance to late blight as well as for desirable agronomic traits. Two such varieties show excellent resistance to late blight and provide yields almost three times that of local varieties.



## BIOVERSITY

More species will remain freely available and subject to the benefit-sharing provisions of the International Treaty on Plant Genetic Resources for Food and Agriculture, thanks to a decision by its governing body to extend the range of crops CGIAR Centers distribute through the Standard Material Transfer Agreement. Representing the Systemwide Genetic Resources Program, Bioversity International advocated this broader policy as being important to countless small farmers.



## IFPRI

An International Food Policy Research Institute (IFPRI) study found that preventing undernutrition in children under 2 years old is more effective than treating children who are already moderately malnourished. Food-assisted nutrition programs usually target undernourished children up to age 5, but World Vision and others responded to the findings by targeting all children under 2 in poor communities in Haiti and elsewhere.



## ILRI

With Manchester and other universities, the International Livestock Research Institute (ILRI) has developed high-density mouse maps of genes, gene networks and sequence polymorphisms involved in resisting a deadly tropical disease of livestock. An unexpected discovery of this research indicates that low levels of cholesterol are associated with early death. This finding may contribute to healthcare in the UK, where clinical trials are now assessing low cholesterol levels as an indicator of which critically ill patients require urgent, life-saving medical attention.



## ICARDA

The drought-tolerant chickpea variety Gokce proved itself by producing high yields under severe drought in 2007 in the Anatolia region of Turkey. Developed at the International Center for Agricultural Research in the Dry Areas (ICARDA), Gokce is now cultivated on over 80 percent of the chickpea-growing area of Central Anatolia. In addition to its drought tolerance, farmers like its large seeds.



## IWMI

Ambitious goals for biofuel production in China and India raise serious concerns because the crops to be used — maize and sugarcane — are water intensive. Worsening water scarcity in both countries makes this prospect untenable and could jeopardize sustainable food production. *Biofuels and Agricultural Water Use: Blue Impacts of Green Energy*, a paper from the International Water Management Institute (IWMI), addressed crucial tradeoffs for consideration when designing biofuel policies.



## CIAT

Work by the International Center for Tropical Agriculture (CIAT) to develop forage technologies for smallholder farmers in Southeast Asia is yielding results. More than 10,000 smallholder farmers have planted forage plots that provide them with a feed resource for animals that is secure and easily accessible. The feed contributes to improved animal productivity and market-oriented livestock production systems such as cattle fattening and raising calves for sale and herbivorous fish.



## ICRISAT

Super-early chickpeas have the potential to avoid terminal drought and frost, while fetching a higher price for early delivery to market. Developed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), one such new chickpea variety can be cultivated in short-season environments, thus expanding the chickpea growing area. Now that super-earliness is within scientists' grasp, efforts are on to improve disease resistance and seed size.



## WORLD FISH

The WorldFish Center helps farmers and fishers adopt aquaculture by providing policymakers with decision-support tools that identify appropriate locations and methods for promoting aquaculture. Readily quantifiable factors — such as temperature, the availability of water and other inputs, terrain and soil conditions, market potential, and human and social capital — are mapped using geographic information systems.



REACHING FOR THE NEW FACE  
OF AGRICULTURE





## 2007: A NEW ERA FOR AGRICULTURE

Farmers around the world invariably recall certain years as having been especially good because of favorable weather and rich harvests or especially bad because of natural disasters and meager returns from backbreaking labor. In the minds of farmers everywhere, 2007 will no doubt be remembered as a year like no other. An alarming shift in the natural and economic forces that shape the lives of rural communities became painfully evident across the globe.

Those changes confront agriculture in developing countries with almost unprecedented challenges but also present unique opportunities for sustainable development. The CGIAR was alert to both and responded in diverse ways.

**Global Climate Change.** One challenge requiring decisive action is global climate change, a theme that dominated development debate and grabbed media headlines throughout the year. Thanks in large part to a steady stream of substantive reports from the International Panel on Climate Change, any remaining skepticism about human responsibility for this phenomenon rapidly melted away. The message is getting through that, unless appropriate actions are taken now, climate change will hit the rural poor with

particular severity, depressing agricultural productivity, diminishing hope for the eventual defeat of hunger and poverty, and thus destroying any chance of achieving the Millennium Development Goals.

Because of the sheer magnitude of climate change, it may represent our best opportunity yet for mobilizing support to achieve sustainable agricultural development. Since the early 1990s, researchers have put forward a variety of innovative approaches for achieving that end, based on combinations of improved crop varieties and better practices for managing soil, water and biodiversity. Clearly, those approaches should have been implemented more vigorously years ago, but it is by no means too late now.

With the aim of bolstering support for such work, we announced a new initiative — with the full support of the CGIAR Membership — at the 13<sup>th</sup> United Nations Conference on Climate Change, held in December in Bali, Indonesia. As explained on page 11 of this report, our aim is to double the resources dedicated to CGIAR research that particularly addresses adapting agriculture to climate change impacts and for mitigating these impacts in the future.

**Global Food Price Crisis.** Another emerging threat to global food security is the recent dramatic rise in prices for staple grains. While seeming to burst onto the world scene quite suddenly in 2007, this problem was, of course, a long time in the making. According to CGIAR food policy experts, the price spike resulted from the convergence of continuing trends, particularly oil price increases, burgeoning demand for food and feed in developing countries, the lagging productivity gains of major staple crops, increased frequency of extreme weather such as droughts and floods, and the growth of the biofuel industry.

This profound shift in the world food equation, following several decades of steadily dropping food prices, created great hardship for poor people throughout the developing world.

The causes and consequences of the emerging food crisis were spelled out clearly in a major report on the world food situation presented at the CGIAR's 2007 Annual General Meeting in early December in Beijing, China. Covered widely by international media, the presentation called for bold policy measures to stave off the worst consequences of soaring food prices for poor consumers and to restore the balance between food supplies and demand over the longer term. Among those measures is renewed support for agriculture focused specifically on problem-solving research, rural infrastructure and markets.

Agricultural research may be a victim of its own success. Long-term price declines from the 1970s to the end of the millennium, while greatly benefiting poor consumers, left policymakers complacent about continued investment in agricultural development. If the emerging world food crisis is giving them a wake-up call, then the World Bank's *World Development Report 2008: Agriculture for Development* provides them with a clear and cogent agenda for action to reverse years of neglect. CGIAR researchers contributed substantially to the development and dissemination of the report. Our economic analyses and achievements in technology development underlie some of its key messages about agriculture's "uniquely powerful" role in poverty

reduction — a role that our research enhances through science-based innovation.

**New Round of Reforms.** In the context of a changing agricultural landscape, the CGIAR initiated an external review of the system and its forward-looking Change Management Initiative, which aims to make CGIAR research an even better investment for confronting major global challenges. In addition, a comprehensive and rigorous independent review of the CGIAR was initiated in 2007.

The Change Management Initiative centers on four main areas of wide concern to CGIAR stakeholders: (1) visioning and development challenges, (2) strategic partnerships, (3) governance of the CGIAR and the Centers it supports and (4) funding mechanisms. Based on a plan approved by our Members at the 2007 Annual General Meeting, the initiative will seek to build a broad consensus around concrete proposals for change developed through a highly democratic and consultative process. Those changes, together with the recommendations of the independent review, represent our best chance for enhancing the CGIAR's performance — this at the precise time that the world needs us to be at our best.

**Research Within Reach.** The theme of the 2007 CGIAR *Annual Report: Research Within Reach* focuses on new research that promises to help respond to the challenges the agriculture sector now confronts — challenges of increasingly erratic weather, scarce resources and expensive inputs. In addition to more resilient and productive crops, and better ways to control pests, the research highlighted in this report includes tools that will enable better delivery of development approaches by targeting local needs through climate and poverty mapping. Together, this research represents new potential for reducing the vulnerability of the poor, improving their nutrition and providing pathways out of poverty.

KATHERINE SIERRA  
CGIAR Chair

REN WANG  
CGIAR Director



## REVIEW AND ASSESS

EXTERNAL PROGRAM AND MANAGEMENT REVIEWS ARE ESSENTIAL FOR THE CREDIBILITY OF THE CGIAR SYSTEM, AND IMPACT ASSESSMENTS ARE VITAL TO ITS RELEVANCE

The year 2007 was a very productive one for the Science Council. Two of its core responsibilities required much attention, as monitoring and evaluation were major tasks. There were external reviews of four Centers (International Potato Center, International Institute of Tropical Agriculture, International Livestock Research Institute and International Water Management Institute) and two Challenge Programs (HarvestPlus and Water and Food), plus the annual review of all Center and Challenge Program medium-term plans. In addition, a second cycle of Challenge Programs was launched in 2007 with a call for pre-proposals on three topics: climate change, agriculture and food security; high-value crops; and combating desertification. That created a tremendous work load especially for the Science Council Secretariat.

The reports were well received by the Executive Council and the Annual General Meeting (AGM), demonstrating how seriously the CGIAR considers the permanent reviewing and monitoring of the activities of the Centers and their partners. The external program and management meta-review organized by the Science Council jointly with the CGIAR Secretariat came to a similar conclusion: External reviews are essential for the credibility of the System.

The second core activity of the Science Council, impact assessment, resulted in various reports that were discussed in the Executive Council and at AGM. The need for quality systems of impact measurement is strongly felt. A major output in 2007 was the publication of a book entitled *International Research on Natural Research Management: Advances in Impact Assessment*. It presents seven case studies detailing the assessment of impacts of some major research projects in natural research management undertaken by the CGIAR and examines some of the major methodological challenges, in addition to deriving lessons learned.

A synthesis report of a meeting held at the headquarters of the World Agroforestry Centre on the theme "Advancing impact assessment of international agricultural research" was published in 2007. The meeting was jointly organized by the impact assessment focal points of the Centers and the Challenge Programs and by the Standing Panel on Impact Assessment (SPIA). SPIA currently has several studies in progress and is embarking on some new initiatives where the Centers are pivotal. A follow-up meeting in 2008 will be hosted by the Brazilian Agricultural Research Corporation (Embrapa).

Progress with the implementation of the CGIAR prioritized competence areas resulted in a series of framework plans developed by the Centers and guided and supported by the Science Council. Implementation shows the impact that the various projects and framework plans of CGIAR Centers have on development goals. As this process continues, the Science Council will continue to make recommendations on how that impact may be increased and what partners and modes of operation are needed to be even more relevant.

The evolution of CGIAR research and its research agenda shows that in this seventh phase of development (see *CGIAR Annual Report 2006* for the description of the evolution of the research agenda) more and more collaboration with partners is needed. The Science Council is instrumental in mobilizing scientists from the North and the South who work in such knowledge centers as universities and in the private sector. It will help to upgrade the research and make it more relevant. The Science Council expects that in 2 years' time many more active partnerships with the private sector and universities will be visibly contributing to the relevance and impact of the CGIAR.

The Science Council sees as its task and mandate contributing to updating the mission of the CGIAR, which may have consequences for its governance. The Science Council expects that the reformulated mission may help to intensify the building of partnerships and strengthen funding for the work of the Centers. Change is needed in the mission in five fields:

1. The mission should be more focused on the role of science and technology toward reaching the Millennium Development Goals in general and specifically goals 1 (eradicating poverty and hunger), 7 (environmental sustainability) and 8 (global partnership for development). As that requires more specifics in the mission, such that the goals are addressed directly, concrete development challenges need to be identified.
2. In their mode of operation, the CGIAR Centers are oriented toward concepts, methodologies

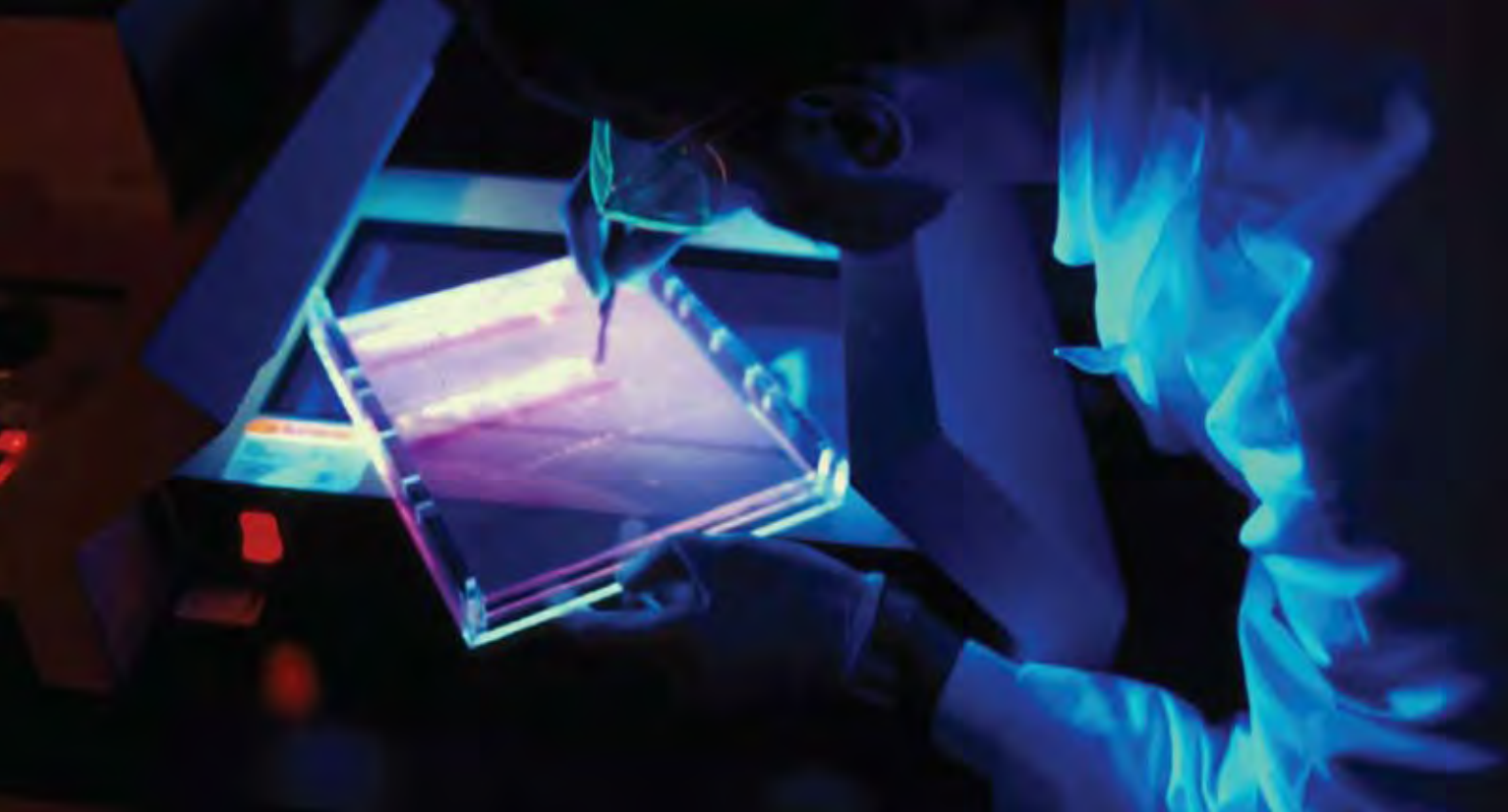
and extended insights, not on ready products such as completed crop varieties. The Centers should work in programs oriented toward specific development challenges.

3. The CGIAR Centers play a role in addressing global challenges and issues by stimulating, coordinating and implementing global research programs. The CGIAR Centers also have a task as regional concentration points with ecoregion-specific expertise and experience not provided by individual national agricultural research systems. This provides the opportunity to help partners fine-tune technological and socioeconomic interventions to the specific regional characteristics and variation.
4. The Centers should continue to aim for excellence in research of all types with a clear orientation toward the ultimate goals and the intention to contribute to substantial impact that is relevant for development. This culture of the CGIAR should remain apparent at all times. We consider that the "contradiction" between upstream research and development is obsolete, as all CGIAR research is oriented toward development in the long run.
5. The Centers function as nodes in a network in line with the development of third-generation universities.<sup>1</sup> That implies that a centralized hierarchical structure is not concurrent with this way of functioning. Scientific leadership and unifying concepts and approaches stimulate coherence within the CGIAR. The Science Council has a major role to play in that continuous struggle for coherence and relevance.

We in the Science Council believe that, by strengthening these five areas, the CGIAR will have a clearer Systemwide vision focusing on priorities that respond to global developmental challenges as well as much stronger collaboration across Centers and improved research partnerships outside the System.

RUDY RABBINGE  
*Science Council Chair*

1. Third-generation universities, which developed after the medieval and Humboldt type, are network universities that serve as focal points for cooperative innovation in which all types of knowledge institutes work together with input from the private sector and ultimate users of knowledge.



## SPEAKING WITH ONE VOICE

CENTERS COME TOGETHER TO EXERCISE JOINT INTELLECTUAL LEADERSHIP OF INTERNATIONAL AGRICULTURAL RESEARCH AND TO DESIGN AND IMPLEMENT NEW COLLECTIVE ACTIVITIES

The Alliance of the CGIAR Centers was created in 2006 to facilitate coherent and systematic collective action among Centers and their partners to more effectively and efficiently fulfill the CGIAR mission. The Alliance is a mechanism by which Centers exercise joint intellectual leadership of international agricultural research for sustainable development, design and launch new programmatic collective activities, implement relevant shared services, and speak with one voice.

A dialogue with CGIAR Members begun in April 2007 led to the Alliance position paper *The Way Forward*, which sketches a collective vision and proposal for a stronger CGIAR System. Another Alliance-commissioned paper, discussed with Members in December 2007, generated a second Alliance position paper identifying the key development challenges for the CGIAR over the coming decade: *pro-poor growth*, to improve the productivity and sustainability of developing country agriculture and food systems; *sustainability, climate and energy*, to improve the management of natural resources and environmental services and thereby strengthen livelihoods and respond to climate change and energy scarcity; and *health*, through improved nutrition and control of infectious and chronic diseases.

The two position papers are Alliance inputs for the 2008 Change Management Initiative.

**Climate Change.** The Alliance and the University of Oxford organized an international scientific workshop to discuss new collaborative avenues on climate change and agriculture. An inventory and analysis of Centers' work on climate change and agriculture, prepared by the Alliance, elucidated five main foci. The first concerns new research methods, including innovative models, scenario analyses and early warning tools for small-scale agriculture. The second deals with assessing how climate change affects vulnerable populations, ecosystems and genetic resources. The third considers options for adapting crops and small-scale agricultural practices to climate change and variability. The fourth concerns mitigation options, including practices to reduce emissions from agriculture and deforestation and to sequester carbon. The fifth offers policy options that support small-scale farmers' adaptation to, and mitigation of, climate change.

Agenda discussions with a scientific community new to the CGIAR, the Earth Systems Science Partnership, culminated in new strategic collaboration by the world's best researchers in agricultural, climate and earth system science that leverages the scientific expertise and stakeholder linkages needed to amplify impact. The resulting innovative and transformative research program addresses food security in light of climate change, variability and uncertainty. Innovations such as plant breeding for drought and heat tolerance, and

better management of pastures and livestock, soil and water, and fisheries and forests, are necessary but not sufficient. Also needed are integrated options based on using appropriate combinations of crops, biodiversity to provide ecosystem services and improved management practices, all enabled by policy and institutional support. This program adds value to the CGIAR Climate Change Initiative by addressing interactions, synergies and tradeoffs affecting agriculture and food security.

**Challenge Programs and Regional Plans.** The Alliance coordinated the preparation, driven by innovative science and partnerships, of three new Challenge Program proposals. It surveyed lessons learned from existing Challenge Programs from Centers' perspective regarding, for example, value addition to ongoing research. These lessons complemented those drawn by the Science Council and Secretariat.

The eastern and southern Africa regional plan for collective action has four flagship projects. The first seeks to link long-term research sites for integrated natural resource management into a single knowledge, research and monitoring platform. The second addressed markets, institutions and policies with a panel discussion on market development at an international conference and is discussing with stakeholders a major conference on agricultural market development and pro-poor growth. The third, on genetics, organized a workshop on "Knowledge, methods and approaches to accelerate the contribution of biotechnology to African agriculture." The fourth, on recovery after crises or conflict, is active in southern Sudan.

The western and central Africa regional plan for collective action has five programs: harmonizing the sustainable use of genetic resources, using genetics and technology for food security, reducing rural poverty through diversification, sustainable resource management for improved productivity, and harnessing the power of the marketplace to help farmers.

The Alliance has strongly linked the two plans with regional agricultural research associations. The Forum for Agricultural Research in Africa has endorsed them as contributing to existing programs, as have sub-regional organizations.

The Africa Rice Center, International Institute for Tropical Agriculture and International Rice Research Institute have drawn up a coordination and management plan for their Sub-Saharan Africa Rice Research Consortium, which will liaise with existing African networks for sustainable access to national research programs.

**Collaboration with FAO.** The Alliance and the Food and Agriculture Organization (FAO) of the United Nations have agreed on a collaborative program with seven thematic priorities: climate change, genetics, policy, ecosystem services, agricultural biodiversity and conservation agriculture, scaling up and promoting appropriate technologies, and capacity building. Initially, the Alliance and FAO coordinated relevant Centers' participation in a regional meeting of Nigeria's National Programme on Food Security. Similar meetings will follow in other countries to mainstream Centers' research outputs in FAO-facilitated national food security programs.

FAO is a partner in the proposed Challenge Program on climate change, and the Alliance is helping to organize for 2008 the FAO High-Level Conference on World Food Security and the Challenges of Climate Change and Bioenergy.

**Plans and Reporting.** Center scientists worked in 2007 under the guidance of their deputy directors general for science on framework plans for 12 of the 20 System priorities. The plans describe the CGIAR's research role in the context of global initiatives and cutting-edge research being conducted elsewhere.

Working with the Science Council, Information and Communication Technologies and Knowledge Management Program, and CGIAR Secretariat, the Alliance developed an online tool for compiling and submitting medium-term plans. By end-2008, it will allow online consultation of plans and searches across Centers to identify all activities they undertake in any one region, for example, or on any specific topic across regions and Centers. This System-level view of Center activities will serve research managers, Center staff, development investors, CGIAR Members, national partners and the Science Council.

JIM GODFREY  
*Alliance Board Chair*

EMILE FRISON  
*Alliance Executive Chair*

## Highlights

New collaboration on climate change leverages scientific expertise and stakeholder linkages to amplify impact

Plans for collective action in Africa forge strong links with regional agricultural research associations

A new collaborative program lays the foundation for expanded Center collaboration with FAO



## RISING TO A GLOBAL CHALLENGE

RESEARCH RELEVANT TO GLOBAL CLIMATE CHANGE WILL BE BETTER FOCUSED AND COORDINATED THROUGH THE NEWLY PROPOSED CLIMATE CHANGE INITIATIVE AND A NEW CHALLENGE PROGRAM

Global climate change poses an ominous threat to food security and rural livelihoods in the developing world. Recent research has made it clear that the widely anticipated increase in extreme weather events (more drought in some areas, more flooding in others and higher temperatures all around), and a likely increase in plant pests and diseases ushered in by these changes, are going to hit poor countries particularly hard. The Intergovernmental Panel on Climate Change concluded that rising temperatures and changing rainfall patterns could cause agricultural production to drop by as much as 50 percent in many African countries and by 30 percent in Central and South Asia.

Aware of the risks ahead, the CGIAR stepped up its engagement with climate change in 2007. Building on the foundation of decades of research targeted to help poor farmers cope with weather variability and improve yields from marginal lands, the CGIAR set in action programs and partnerships that will contribute to solutions to enable agriculture in developing

countries to adapt to climate change and mitigate its expected impacts. With its new Climate Change Initiative and a Challenge Program on climate change under development, the CGIAR is scaling up its efforts to deliver research to meet this global threat.

**Building on Experience and Expertise.** The CGIAR already possesses a wealth of experience and expertise relevant to the anticipated changes in rainfall patterns and rising temperatures. In fact, much of the research highlighted in this annual report represents the seed of future response to intensified climate variability. CGIAR scientists use climate change models to help predict and plan for impacts on staple and cash crops (see pg 25). They breed new and promising varieties of wheat and chickpeas that are more tolerant of drier conditions and more resilient to heat stress (see pg 28 and pg 31). They introduce a gene from submergence-tolerant rice into popular rice varieties to offer protection against the ravages of floods (see pg 35).

The benefits of such research could be far reaching, supporting the well-being and livelihoods of millions of the rural poor. In sub-Saharan Africa alone, new varieties of drought-tolerant maize may help farmers avoid the current loss of 20 million tons of maize each year to excessively dry conditions. In Southeast Asia, flood-tolerant rice can help farmers avoid the \$1 billion in annual losses caused by flooding, a problem that is likely to get worse in the wake of global warming.

Beyond agriculture, the sustainable management of natural resources is fundamental to securing climate change solutions. Climate change will put greater pressure on water resources, as increasingly volatile rainfall patterns force farmers to rely more heavily on irrigation. Recent CGIAR research points to a wide range of technology and policy measures that could improve water productivity in both irrigated and rainfed agricultural systems, including those that incorporate livestock and fisheries (see pg 38). Rising sea temperatures are expected to contribute significantly to coral bleaching and the resulting destruction of vital fish-breeding habitats. CGIAR scientists are monitoring this phenomenon with the aid of an online tool called ReefBase (see pg 45).

As deforestation is a significant driver of climate change, contributing an estimated 20 percent of global greenhouse gas emissions each year, 2007 saw a greater emphasis on opportunities to mitigate climate change effects through new incentives to stop deforestation. The Center for International Forestry Research took a global leadership role in framing the debate around reducing emissions by avoiding deforestation when it convened Forests Day at the December 2007 United Nations Framework Convention on Climate Change in Bali. Furthermore, CGIAR research provides practical assessments of the drivers of deforestation and the opportunity costs of avoided deforestation that promise to help inform policy responses (see pg 37).

**Nurturing New Partnerships for Solutions.** In February 2007, the Alliance of the CGIAR Centers convened a scientific workshop on Climate Change, Agriculture

and Food Security at Oxford University in collaboration with the Earth System Science Partnership (ESSP). This produced a set of priority research questions and knowledge gaps concerning climate change and agriculture for CGIAR and ESSP scientists to address collaboratively. These findings subsequently informed the development of the Challenge Program on climate change, whose concept note was subsequently endorsed by the CGIAR Science Council and Executive Council. The full proposal for Challenge Program on climate change will be finalized in 2008.

At the Bali climate change convention, the CGIAR announced a new Climate Change Initiative that urges the international community to step up its investment in research on crops bred to be ready for climate change and on better natural resource management to meet the coming challenges. Specifically, the initiative calls upon donors to double current investments in such research to an annual sum of US\$140 million.

Speaking at the Bali launch, CGIAR Chair Katherine Sierra catalyzed the initiative in response to the urgent need to scale up the CGIAR's climate-related work: "We plan to take advantage of the strong cadre of experts at our research centers who are poised to rapidly intensify research efforts that already are coming up with many practical solutions — like drought-tolerant wheat, flood-tolerant rice and new approaches to crop and soil management."

Bolstered resources from the initiative will enable CGIAR scientists to identify genetic mechanisms that account for the stress tolerance of naturally hardy food crops like barley, cassava, pearl millet and sorghum. The breeding of such resilient varieties will go hand-in-hand with measures to strengthen the resilience of diverse cropping systems and sound natural resource management. In addition, the initiative will develop tools to assess how climate change will affect specific regions and production systems, as well as the wild relatives of domesticated crops and livestock, allowing scientists to tailor solutions to specific needs.

## Highlights

The CGIAR possesses experience and expertise relevant to anticipated changes in rainfall and temperatures

The Climate Change Initiative calls for doubling investment in crop and resource management innovations

Priority research questions and knowledge gaps shape the proposed Challenge Program on climate change



A photograph of a diverse group of people, likely in a developing region, gathered outdoors. In the foreground, a woman with a black headscarf and a red top smiles as she holds out a large handful of white beans. Behind her, a man in a striped shirt looks on with a serious expression, holding a plastic bag. Other people, including a woman with a patterned headscarf, are visible in the background, some looking towards the camera. The scene is brightly lit, suggesting a sunny day. The text "REACHING FURTHER THROUGH NETWORKS AND PARTNERS" is overlaid in white, bold, sans-serif font across the middle of the image.

**REACHING FURTHER THROUGH  
NETWORKS AND PARTNERS**

THE EUROPEAN INITIATIVE FOR AGRICULTURAL RESEARCH FOR DEVELOPMENT SEES A UNIQUE ROLE FOR A REFORMED, UNIFIED, STREAMLINED AND ACCOUNTABLE CGIAR

Europe plays a dual role in agricultural research for development (ARD). It serves as both a leading provider of research and education for development partners in developing and emerging countries (DEC) and as the major donor to ARD institutions. As the European Union's political commitment to DEC is high, in particular in Africa, it bears a special responsibility regarding ARD.

The European Initiative on International Agricultural Research for Development (EIARD) was created by the European Council of Ministers and the European Parliament in 1997 at the suggestion of the European Commission. EIARD combines all European Union members plus Norway, Switzerland and the European Commission. Countries are represented in EIARD by ARD policymakers from such ministries as foreign affairs, research, agriculture, overseas development, and economic cooperation and development. Representatives are advised by research institutes, universities and agencies for international cooperation. This institutional mix creates a rich medium for discussing common ARD issues from diverse perspectives across Europe.

The purpose of EIARD is to develop coherent European policies on ARD and implement them in a coordinated way. In its decade of existence, EIARD has achieved many policy inputs and institutional and operational impacts, including

- strong support for the emergence of the Global Forum on Agricultural Research;
- valuable contributions to renegotiating the International Undertaking on Plant Genetic Resources and negotiating the subsequent International Treaty on Plant Genetic Resources for Food and Agriculture; and
- raising the awareness of European decision-makers of the essential contributions of ARD to food security and poverty elimination, and thereby maintaining European support for ARD over the years at about half of the worldwide total.

EIARD has provided, since its foundation, continuous support to the CGIAR. Collectively, Europe is the largest source of funding to the CGIAR, contributing about half of its budget, and a key driver of its evolution.

The context of ARD has changed in recent years. After the "lost decades" of the 1980s and 1990s, agricultural development in DEC is firmly back on the agenda.

The major drivers of change include

- the emergence of global challenges such as climate change, animal diseases and pandemics;
- new European policies that recognize the key role of ARD for the common interests of DEC and Europe; and
- the development of South-South partnerships and rapidly growing capacity in such key emerging countries as Brazil, China, India and South Africa.

Change provides opportunities for renewal in ARD. In this context, Europe sees a unique role for the CGIAR to play internationally as a key provider of public goods and facilitator for mobilizing ARD actors from developing and industrialized countries. Europe is thus willing to continue to support the CGIAR but considers that it should pursue reform toward a more unified system that would facilitate CGIAR funding and its relationships with ARD partners. It should also streamline governance and improve its accountability to those that it exists to serve: current and future generations of poor children, women and men.



A woman plants seeds in India, where rapidly expanding capacity in agricultural research, paralleled in Brazil, China and South Africa, is a driver of change.

## Highlights

Europeans provide research and education in agricultural research and collectively are the CGIAR's largest donor

In its first decade, EIARD supported international cooperation regarding issues affecting global agriculture

Europe encourages CGIAR reform toward unity, streamlined governance and improved accountability

## IRAN'S AGRICULTURAL RESEARCH, EXTENSION AND EDUCATION ORGANIZATION PRIORITIZES PARTNERSHIPS THAT MEET THE NEEDS OF FARMERS IN IRAN AND ACROSS THE REGION

Iranian agricultural research institutes date back about 80 years. The Agricultural Research, Extension and Education Organization (AREEO) was founded to oversee and coordinate all agricultural research activities of the Ministry of Jihad-e-Agricultural and is the umbrella institution for all national and provincial research institutes and centers working in field crops, horticulture, natural resources, livestock and fisheries. At present, 23 national institutes, 34 provincial centers and about 315 research stations affiliated with AREEO have a combined staff of about 3,000 scientists with PhD and MS degrees and more than 2,000 research assistants with BS degrees.

Iranian research institutes' collaboration with the International Maize and Wheat Improvement Center (CIMMYT) and the International Rice Research Institute (IRRI) goes back to the mid-1960s, during the Green Revolution. The longstanding partnership with CGIAR Centers has been very fruitful and resulted in outstanding achievements to improve the livelihoods of poor Iranian farmers living in marginal and harsh environments. We are pleased to highlight a few achievements of our collaboration during the past several years.

In 2004, collaboration with the International Center for Agricultural Research in the Dry Areas (ICARDA) and CIMMYT to develop high-yielding wheat varieties able to withstand drought and diseases allowed Iran to achieve self-sufficiency in wheat for the first time in 50 years. The technologies developed for both irrigated and upland conditions are transferable to other countries in the Central and West Asia and North Africa (CWANA) region. AREEO recently established a center of excellence in partnership of ICARDA and CIMMYT to combat yellow rust and Ug99 stem rust, which threaten food security in many countries.

CWANA faces severe water shortages, requiring improved water productivity. One river basin with low water productivity selected by the Challenge Program on Water and Food as representative of arid regions is the Karkheh River basin in western Iran. Through multidisciplinary research and extension activities carried out with the participation of many stakeholders, water productivity has significantly improved. The new technologies — developed through the partnership of several AREEO research institutes, ICARDA,



Iranian and CGIAR scientists work in partnership to develop high-yielding wheat varieties tolerant to drought and yellow rust disease.

International Water Management Institute (IWMI), University of California Davis, farmers, nongovernmental organizations and others in the basin — could benefit many developing countries in arid regions.

Climate change and worsening drought are major challenges facing CWANA. To address them, AREEO's research portfolio integrates research activities on improving crop water-use efficiency; improving water and soil management; combating land degradation and desertification; developing drought-tolerant varieties of major crops; expanding agricultural diversification; and improving farming systems, carbon sequestration, and the conservation of biodiversity and natural resources. The application of new technologies — such as biotechnology, nanotechnology, nuclear energy, and information and communication technology in agricultural development — is also a priority in AREEO's research agenda. These are some of the research areas in which CGIAR Centers and AREEO could pool resources and enhance collaboration.

We are very proud of our partnership with the CGIAR System, particularly with ICARDA, CIMMYT, IRRI, ICRISAT and IWMI, and pleased to share our experiences and know-how with other national agricultural research systems in the region and beyond.

**DR. MOHAMMAD H. ROOZITALAB**  
*AREEO Senior Advisor*

Iranian research collaboration with CGIAR Centers dates back to the early Green Revolution

Collaboration recently helped Iran achieve wheat self-sufficiency for the first time in 50 years

A CGIAR Challenge Program raises water productivity in western Iran's Karkheh Basin

# Highlights



## NETWORKS THAT REALLY WORK

SYSTEMWIDE AND ECOREGIONAL PROGRAMS ENHANCE THE EFFICIENCY AND EFFECTIVENESS OF CENTER RESEARCH, AS THE STORIES OF THREE ESPECIALLY SUCCESSFUL PROGRAMS ILLUSTRATE

In the closing weeks of 2007, the managers and staff of 10 CGIAR genebanks rushed to prepare tons of seed of some 200,000 distinct crop samples for shipment to the arctic settlement of Longyearbyen in Norway's Svalbard Archipelago. Their aim was to get the seed there in plenty of time for the official opening of the Svalbard Global Seed Vault, which was built to provide a safeguard of last resort for the world's agricultural heritage.

Flawless orchestration of the genebanks' preparations was made possible by a cohesive network under the coordination of the CGIAR Systemwide Genetic Resources Programme (SGRP), which is hosted by Bioversity International. The network's virtuoso performance for the Svalbard opening demonstrated concrete results of the CGIAR's longstanding efforts to foster collective action in a key area of research for rural development.

This report outlines several such efforts under way, emphasizing the important lessons and insights they offer, as the CGIAR embarks on a major new endeavor

to strengthen partnerships and make changes aimed at enhancing efficiency and effectiveness in confronting major development challenges.

**Evolving Capacity for Collective Action.** Established in 1994, the SGRP is among the earliest of the CGIAR's Systemwide Programs. Along with Ecoregional Programs, they were created with the aim of enabling the CGIAR Centers to work in a more complementary fashion. The programs focus on major crosscutting themes — such as genetic resources, integrated pest management, livestock, participatory research, and alternatives to slash-and-burn agriculture — or on ecologically distinct regions.

Both types of program have evolved substantially since the 1990s. The SGRP, for example, has broadened the agenda of the Centers' work on conserving germplasm in genebanks to include a wide range of issues in genetic resource management. Meanwhile, the Ecoregional Programs have shifted their research paradigm from a relatively narrow emphasis on the

biophysical aspects of natural resource management to a more integrated approach, with strong emphasis on participatory action research and learning.

**Taking Stock of Shared Experience.** Their many achievements in joint research and capacity building endow the 15 current Systemwide and Ecoregional Programs with a rich body of shared experience. The CGIAR is taking stock of this experience, as it seeks to become a more networked organization, adept at building inclusive and effective partnerships for solving complex problems and achieving large-scale development impact.

#### SYSTEMWIDE PROGRAMS ALLOW QUICK RESPONSE TO RESEARCH OPPORTUNITIES; ECOREGIONAL PROGRAMS CAN DERIVE GLOBAL PUBLIC GOODS FROM SITE-SPECIFIC RESEARCH

To that end, the CGIAR Science Council has recently studied the Systemwide and Ecoregional Programs for their potential to advance the CGIAR's central research priorities. It suggests that in the future such programs can serve three main purposes particularly well. First, they can continue to improve research coordination across CGIAR Centers through support for networks or communities of scientists focusing on common themes or environments. Second, the Ecoregional Programs specifically can do more to derive global public goods from the results of site-specific research on natural resource management conducted across Centers. And finally, Systemwide Programs offer the means to respond quickly to opportunities for exploring new areas of research.

The CGIAR Challenge Programs, launched several years ago, have also shown great promise as collaborative platforms for research (see pages 39-43). But this report focuses on three Systemwide and Ecoregional Programs in particular that the Science Council has singled out as especially effective following thorough evaluation, including a meta-review completed in 2007. Those programs draw on more than a decade of collaborative experience.

**Exemplary Service to Agriculture.** As participants in the SGRP, CGIAR Center genebanks apply cutting-edge

biological and information science — in partnership with national institutes, universities and farmers — to the vital tasks of conserving and using plant genetic resources. “Arguably, this is the Systemwide Program that has evolved the furthest towards becoming a truly integrated whole,” avers the successful nomination of the program for the CGIAR's 2006 Outstanding Partnership Award.

The argument rests on a long list of achievements. Foremost among them is the program's success in ensuring that the CGIAR genebanks meet international technical standards for germplasm conservation.

In connection with that work, the program established consistent policies and procedures for fulfilling the CGIAR genebanks' commitment to hold the germplasm collections in trust for humanity.

Central to that commitment is the Systemwide Information Network for Genetic Resources, which guarantees transparency with respect to the germplasm holdings and their origins and distribution. The product of continuous multidisciplinary work, SGRP's information systems helped inform the lengthy intergovernmental debate that secured wide acceptance of the new International Treaty on Plant Genetic Resources for Agriculture. The treaty underpins an emerging global system for conserving and using plant genetic resources, in which the SGRP's cohesive network will play a central role.

**Innovators in regional collaboration.** That the CGIAR was able to form an effective network for germplasm conservation is hardly surprising, since this activity has a long history in the Centers and continues to be fundamental to their research. But the CGIAR has also come far in building networks for research undertaken more recently on natural resource management.

The Rice-Wheat Consortium for the Indo-Gangetic Plains — created at the same time as the SGRP in 1994

— is a highly innovative model for regional collaboration. Winner of the 2004 King Baudouin Award, the consortium builds on strong ties among five CGIAR Centers, the national agricultural research institutes of four countries (Bangladesh, India, Nepal and Pakistan) and numerous private firms, which together have compiled an impressive record of achievement. The consortium is coordinated alternately by the International Maize and Wheat Improvement Center and the International Rice Research Institute (IRRI).

“NETWORKS ARE A WELL-ESTABLISHED TRADITION IN HUMAN INTERACTION,” WRITES ENRIQUE MENDIZIBAL, THAT “SEEM TO MAKE ANYTHING AND EVERYTHING HAPPEN” — FROM NEWS REPORTING AND AIR TRAVEL TO BANKING AND EVEN GLOBAL TERRORISM. THEY ARE NO LESS IMPORTANT FOR REDUCING POVERTY, HUNGER AND ENVIRONMENTAL DAMAGE.

At the end of 2007, it was estimated that about half a million small-scale farmers plant some 4 million hectares (nearly a third of South Asia’s total rice-wheat area of 13.5 million hectares) using various resource-conserving technologies developed and promoted by the consortium. This includes 1.94 million hectares under zero or reduced tillage. The new technologies offer immediate economic benefits from reduced production costs — made possible by savings in water, fuel and labor — and timely planting, which raises yields.

The consortium’s current coordinator, Jagdish Ladha of IRRI, attributes this impact to various features of an evolving model for collaborative research. One is the cropping systems perspective adopted early on. Another is the consortium’s participatory approach to technology development and dissemination, which broke the hierarchical barriers that had previously kept researchers, extensionists and farmers apart. This gave rise to a more dynamic process of technological innovation, in which all these actors, together with private equipment manufacturers and input suppliers, worked in teams.

Finally, all partners have gained in effectiveness from the consortium’s emphasis on knowledge sharing through traveling seminars and study tours. In these

activities, CGIAR scientists often serve as mentors and facilitators.

**A Program Living Up to Its Name.** The Systemwide Program on Collective Action and Property Rights (CAPRI) further advanced network building in the CGIAR by extending it to research on seemingly arcane issues that nevertheless constitute real forces in people’s lives.

Before CAPRI, individual Centers had one or a few social scientists working in relative isolation on issues of rural institutions. Within a year or so after its establishment in 1996, the program had created a critical mass of such specialists from all CGIAR Centers. Since then, they have succeeded in carving out an important place for their studies in the CGIAR’s research agenda. And they have made this work a truly shared endeavor, involving some 400 partner organizations.

Together, the group has demonstrated convincingly why institutions of collective action and property rights are central to technological and social innovation in rural communities. Study after study explores the profound influence these institutions exert on people’s choices about such matters as technology adoption, the conservation of genetic resources, agro-enterprise development, and the management of watersheds and rangelands. From that research, it is clear that strengthening rural institutions is critical for poverty reduction and sustainable development in rural areas.

CAPRI succeeded in getting researchers to work together, says coordinator Ruth Meinzen-Dick, by using “principles identified in studies of collective action among farmers, pastoralists and forest communities to promote collective action in our own research.”

## Highlights

The Systemwide Genetic Resources Programme (SGRP) informed debate that secured International Treaty acceptance

The SGRP orchestrates CGIAR contributions totaling 200,000 accessions to the Svalbard Global Seed Vault

The Rice-Wheat Consortium broke hierarchical barriers that previously kept researchers, extensionists and farmers apart

Farmers building an irrigation system, for example, take pains to form the “social glue” that is essential for collectively managing a shared resource, she explains. Similarly, CAPRI used its limited seed money first to consolidate the social capital of CGIAR social scientists and only then embarked on a more aggressive effort to raise funds for its collaborative program. Moreover, as the program grew, Meinzen-Dick adhered closely to what she calls the “golden rule of governance”: Run the program for others as you would like them to run it for you.

To strengthen the capacity of researchers and policymakers, the program relies on substantive international workshops, grants for research, support for introducing novel methods, peer-reviewed research papers and the communication of results through accessible research briefs. Through these activities, CAPRI builds bridges linking researchers and regions, which permit the cross-fertilization of ideas between work on water rights, for example, and that on rangeland management. By thus strengthening social science capacity in a technically oriented CGIAR, the program has succeeded in promoting a kind of innovation in research that parallels the innovation process in farming communities.

**Networking for Life.** It is no accident that the CGIAR’s establishment of Systemwide and Ecoregional Programs coincided approximately with the emergence of the notion of a “networked society,” a phrase coined in 1996 by Manuel Castells, writing about the influence of new information and communications technologies (ICTs) on economic development.

Networks are a well-established tradition in human interaction, writes Enrique Mendizibal, that “seem to make anything and everything happen” — from news reporting and air travel to banking and even global terrorism. They are no less important for reducing poverty, hunger and environmental damage through research and advocacy.

New ICTs vastly extend the reach of networks at the same time that frustration over the inability of traditional approaches to solve complex problems heightens

interest in networking as a means of achieving better results through more holistic approaches that rely on synergy and cooperation. But there are many barriers to the creation of truly effective and sustainable networks that conform to Robert Chambers’ four Ds: diversity, dynamism, democracy and decentralization.

The CGIAR’s Systemwide and Ecoregional Programs have worked hard to reflect those attributes in a valuable and largely successful long-term endeavor. The Consortium for Spatial Information (CSI) offers an example of a more informal, flexible arrangement, as it is a loosely structured network that links all CGIAR specialists in geographic information systems and remote sensing with colleagues applying these tools in other institutions around the world.

Drawing on an impressive body of scientific expertise and practical experience, the CSI network has created valuable collections of biophysical and socioeconomic data on population, poverty, climate, soils, crops, livestock, transportation and biodiversity. Moreover, network members use these data and other products in ingenious ways to pinpoint and monitor change in agricultural systems, while better targeting improved technologies and other measures needed to overcome poverty and environmental degradation, particularly in the face of such challenges as global climate change.

A more recent example is the Bioenergy Platform of the Alliance of the CGIAR Centers, which nine Centers formed at the CGIAR’s 2007 Annual General Meeting in Beijing, China. Within this new framework, the Centers will seek to devise pro-poor approaches to biofuel development through collaborative research on crops and cropping systems as well as on land management and policy formulation. The spontaneous nature of this initiative raises the question of how the CGIAR can better support such efforts to respond quickly to new research opportunities.

“Wherever we see life, we see networks,” writes Fritjof Capra.

But to thrive, networks, like life itself, must be nourished.

The Systemwide Program on Collective Action and Property Rights mirrors how farm communities cohere

Systemwide Programs offer the means to respond quickly to opportunities for new research initiatives

The Alliance’s newly formed Bioenergy Platform will devise pro-poor approaches to biofuel development



## PARTNERS TAKE THE LEAD

THE CGIAR STRENGTHENS COLLABORATION WITH CIVIL SOCIETY ORGANIZATIONS BY FUNDING FOUR SUPERIOR CSO-LED PROJECTS WINNOWNED FROM 151 CONCEPT NOTES SUBMITTED

Civil society organizations (CSOs) — by which is meant the nonprofit sector, including NGOs, farmers' organizations, advocacy groups, universities and advanced research institutions — are key partners of the CGIAR. By engaging with CSOs, the CGIAR gives voice to stakeholders, thereby strengthening mutual understanding and learning, improving research effectiveness and impact for development, and bringing innovative ideas and new perspectives to research challenges. In addition, this relationship recognizes CSOs as exemplary in meeting the needs for public accountability and transparency in global public programs.

The CSO-CGIAR engagement process builds on the extensive network the Centers and Challenge Programs supported by the CGIAR have with as many as a thousand CSOs. By helping ensure the relevance of CGIAR research for development, and by boosting its effectiveness, these partners contribute to accomplishing the shared goals of strengthening food security, reducing poverty and improving natural resource management in the developing world.

With the aim of further strengthening this collaboration, in 2006 the CGIAR developed its Strategic Framework for Engagement Between the CGIAR and CSOs, which offers a series of recommendations designed to give civil society a stronger voice in the CGIAR and foster mutual learning in joint endeavors.

As a start toward implementing its newly focused CSO engagement strategy, the CGIAR organized various events in connection with the CGIAR Annual General Meeting held in Washington, DC, in early December 2006. These events — the Virtual Conversation, Innovation Marketplace and CSO-CGIAR Forum — gave rise to a constructive dialogue among CGIAR stakeholders.

These events culminated in the launch of the CSO-CGIAR Competitive Grants Program with funding of US\$1 million. The program is designed to further strengthen collaboration and knowledge-sharing mechanisms and tools among CGIAR partners. It supports innovative projects involving civil society partners and other stakeholders in agricultural



research for development, promotes partnerships that apply novel approaches for better working together, and creates new avenues by which a growing network of CSO and CGIAR partners can continue to learn from one another by actively sharing knowledge.

**Selection of Projects.** The first call for concept notes for the CSO-CGIAR competitive grants attracted 151 concept notes. An external panel of four members identified 14 outstanding concept notes, whose authors were invited to develop full project proposals. Of these, four were selected to receive funding of \$250,000 each.

The four grant-winning projects were

- **Mobilizing innovation platforms for bringing quality benefits to more people in the post-conflict Central African Great Lakes region**, submitted by Plate-Forme Diobass au Kivu and to be implemented in the Democratic Republic of the Congo and Rwanda in cooperation with the International Center for Tropical Agriculture and six other partners in the Great Lakes region;
- **Scaling up payments for watershed services: Designing regional compensation schemes to safeguard water supplies for downstream agriculture**, submitted by Fundación Natura Bolivia and to be implemented in Bolivia in cooperation with the Center for International Forestry Research and five other partners in Bolivia, India, Kenya and South Africa;
- **Use of native cacao varieties to reduce poverty and conserve globally important biodiversity in northern Ecuador**, submitted by Conservación y Desarrollo in cooperation with Bioersity International and four other partners in Ecuador and the United States; and
- **Linking Thai jasmine rice farmers with markets, using participatory action research for sustainability of rainfed lowland rice-based systems of northeast Thailand**, submitted by the Asian Institute of Technology in cooperation with the International Water Management Institute and two other partners in Thailand.

**Inception workshop.** An inception workshop for the four winning projects took place in Washington, DC, in October 2007. The workshop aimed to set the stage for project implementation and find common ground for the program, explore together the issues surrounding partnerships, and stimulate the sharing of knowledge and experiences among projects for the duration of the program.

The 2-day event offered opportunities for fruitful discussions around each project's focus, partnership networks and issues related to project communication. Participants valued the cross-regional richness of experiences from projects in Africa, Asia and Latin America, and the opportunity to share thoughts with colleagues with similar perspectives.

"We're committed to make this process work," stated one participant at the end, illustrating the bright prospects for more effective CSO-CGIAR engagement.



A boy gathers cacao grown in northern Ecuador.

The CGIAR has partnerships with as many as 1,000 civil society organizations (CSOs)

In 2006, the CGIAR initiated an engagement process to strengthen and expand these partnerships

The CSO-CGIAR Competitive Grants Program funds four CSO-led projects on three continents

Highlights

FELLOWSHIPS FOR YOUNG SCIENTISTS AND POLICYMAKERS BUILD THE PROFESSIONAL CAPACITY AND PERSONAL TIES THAT PROMISE A FUTURE OF INCREASINGLY EFFECTIVE AGRICULTURAL RESEARCH

Through a growing number of fellowship programs, partners of the CGIAR invest in the next generation of international agricultural researchers. These programs are beneficial to both research Centers supported by the CGIAR and individual researchers alike. They provide researchers with opportunities to work in cutting-edge science, establish mentoring relationships that allow young scientists to learn from experienced practitioners, and promote scientific exchanges across borders. Worth far more than their financial cost, such initiatives build strong linkages among scientists across nations and Centers, helping to create a more networked scientific community. The following are a few examples of fellowship programs in the CGIAR.

The Japanese Ministry of Agriculture, Forestry and Fisheries supports two fellowship programs. The Japan-CGIAR Fellowship Program, initiated in 2004, targets the professional development of promising young Japanese professionals who wish to lead international agriculture research partnerships. In 2007, eleven Japanese fellows participated in this program, carrying out research on diverse topics ranging from the screening of rice cultivars for weed competitiveness in West Africa to the analysis of mycotoxin in wheat grain.

The Japan-Africa Capacity-Building Program offers training to young African researchers. Launched in 2006, the program aims to deliver Japanese agricultural research methods and technologies to Africa and to strengthen collaboration between Japan and agricultural research organizations committed to African development. In 2007, the program enabled 21 African scientists to work alongside Japanese researchers and trainers at CGIAR Centers.

The International Fund for Agricultural Research (IFAR) provides young scientists and policymakers from developing countries with training and professional development opportunities in partnership with CGIAR Centers. In keeping with this goal, in 2007 IFAR issued 13 grants of US\$11,000 each to enable young scientists from developing countries to build their skills through fellowships that support research on

key challenges facing world agriculture such as stress resistance in food crops and the effects of land-use change on greenhouse gas emissions. Among these grants are the Wilfried Thalwitz Memorial Scholarship, established by the Thalwitz family in memory of the CGIAR chairman from 1990 to 1991, and the Ravi Tadvalkar Memorial Scholarship, which is awarded to the youngest female scientist among each year's IFAR grant recipients.

New fellowship programs under development will soon offer additional opportunities for scientists. In 2007, France announced plans for an initiative that will help bring young scientists into the CGIAR System while at the same time strengthening collaboration between France and the CGIAR. An initial inventory of how arrangements will be implemented with Centers has been completed, and research priorities for the program are currently being identified.

Together, these investments in scientists, networks and cooperation across institutions and borders establish the right conditions for future scientific excellence.



The Japan-Africa Capacity Building Program enabled 21 African scientists to work alongside Japanese researchers and trainers at CGIAR Centers in 2007.

## Highlights

Japan supports two CGIAR fellowship programs that develop Japanese professionals and African capacity

International Fund for Agriculture Research fellowships train young scientists and policymakers from developing countries

France supports a new fellowship program that will soon strengthen collaboration with the CGIAR

A pair of hands wearing blue nitrile gloves is shown in a laboratory setting. The hands are using silver tweezers to carefully handle a small, green, leafy plant specimen. The background is a solid, vibrant blue. The text "CENTERS SUPPORTED BY THE CGIAR" is overlaid in white, uppercase letters across the center of the image. A vertical green bar is visible on the right side of the image.

CENTERS SUPPORTED BY THE CGIAR



Strengthening biotechnology capacity in Africa will help address constraints to rice farming.



AFRICA RICE CENTER (WARDA)  
HEADQUARTERS: COTONOU, BENIN  
WWW.WARDA.ORG

## Achievements

Resistance to rice yellow mottle virus is bred into popular West African rice varieties

Biotechnology laboratories are set up and put into operation in four African countries

Scientists and laboratory technicians are trained in molecular techniques with wide application

# AFRICA'S DEADLY RICE DISEASE

Impact

As resistant varieties are adopted, a deadly virus will relinquish African lowland rice paddies

The threat posed by the rice yellow mottle virus (RYMV) became evident when severe epidemics broke out in West Africa in the 1990s. Stunned by the devastation it caused, farmers in Africa began calling RYMV, which is unique to Africa, "rice AIDS."

"RYMV has the potential to destroy lowland rice anywhere in Africa, contributing to food scarcity in areas where rice is an important staple food," explains Yacouba Séré, a plant pathologist at the Africa Rice Center (WARDA). "Unfortunately, all rice varieties traditionally grown in these ecologies are susceptible to RYMV."

In Africa, rice cultivation employs more than 20 million farmers and sustains the livelihoods of 100 million people.

### MODERN MOLECULAR BREEDING — MUCH OF IT DONE BY NEWLY TRAINED AFRICAN SCIENTISTS — PROMISES TO STIFLE THE IMPACT OF THE RICE YELLOW MOTTLE VIRUS THAT FARMERS DUBBED 'RICE AIDS'

Working with many national and international partners, Séré has developed a regional strategy to address RYMV. The team has identified a few sources of high resistance and developed RYMV-resistant lines through backcrossing, and African farmers have adopted some of these lines through participatory varietal selection. WARDA scientists are also working in

close partnership with such advanced research institutes as Institut de recherche pour le développement in France to fast-track the process of developing RYMV-resistant varieties using molecular biology.

An important aim of WARDA's work on RYMV is to put molecular tools in the hands of national partners in Africa so that they can adapt the technology to their countries' needs and constraints. As part of this effort, a 3-year project ending in 2007 trained national staff in Burkina Faso, The Gambia, Guinea and Mali to apply marker-assisted selection to achieve the successful transfer of RYMV resistance into popular West African rice varieties previously susceptible to the disease.

Eight scientists from project countries have received intensive hands-on training in the use of molecular techniques in their plant breeding programs. Functional biotechnology laboratories have been established in each of the four countries, and 27 national scientific staff, including women, have been trained to use the laboratory equipment.

To further strengthen biotechnology capacity of Africa, students from Benin, Burkina Faso, Côte d'Ivoire and Niger are doing PhD studies on RYMV under the supervision of WARDA.

Project participants are hopeful that an integrated pest management strategy combining biotechnology with regional knowledge can significantly reduce the impact of this disease.

"This was very challenging work, and we are extremely happy with the result," comments Marie-Noelle Ndjiondjop, the WARDA molecular biologist who leads the project. "The lines carrying the resistant allele will be extensively evaluated by national partners and used in national breeding programs."

The benefits of the project are expected to go far beyond the four project countries to reach all the African countries that grow rice and could eventually turn the tide in the battle against the disease. Ndjiondjop additionally underlined that this is the first time that national programs in the project countries have access to functional biotechnology laboratories and trained national staff who could apply molecular biology techniques to improve many different crops.

Climate change may threaten this Bolivian species of wild groundnut, a potential source of pest and disease resistance.



BIOVERSITY INTERNATIONAL  
HEADQUARTERS: ROME, ITALY  
WWW.BIOVERSITYINTERNATIONAL.ORG



Modeling predicts how climate change will affect areas' suitability for specific crops

A model of shifting agroecological zones focuses plant breeders' priorities in crop improvement

Modeling predicts the impact of climate change on the survival of crop wild relatives

## Achievements

### CHANGE ACROSS THE MAP

Climate change means that farmers and breeders are going to face novel weather patterns. What will that mean for harvests? And will it affect the diversity upon which agricultural adaptation so often depends? Research by Bioversity International with the International Rice Research Institute (IRRI) is beginning to provide answers.

The research team examined the impact of climate change on the world's most important staple and cash crops. The predictions are bleak: By 2055, more than half of the 23 crops studied — including such cereals as wheat, rye and oats — will lose land suitable for their cultivation. These losses will fall disproportionately on sub-Saharan Africa and the Caribbean, poor regions with the least capacity to cope. Europe and North America are predicted to experience the largest gain in suitable land.

The study used the Ecocrop model of the Food and Agriculture Organization of the United Nations to see how changes in weather predicted by two models of climate change would affect suitability for specific crops. Overall, the area suitable for crops will increase: for pearl millet by 31 percent, sunflower 18 percent, common millet 16 percent, chickpea 15 percent and soybean 14 percent.

“The problem is that many of the gains occur in regions where these crops are not important for food security,” observes Andy Jarvis, the Bioversity-based coordinator of the study. “The model predicts an increase of more than 10 percent in the area suitable for pearl millet in Europe and the Caribbean, where hardly anyone eats the crop, but not for Africa, where pearl millet is widely consumed.”

The results of the study support the recent call by the Intergovernmental Panel on Climate Change for investments that will allow countries to adapt to climate change.

**CLIMATE CHANGE IS PREDICTED TO MISALIGN AGRICULTURAL SUITABILITY WITH NEED, WHILE THREATENING THE WILD RELATIVES OF CROPS NEEDED TO BREED CULTIVARS THAT CAN COPE**

“Breeding efforts need to focus on drought- and heat-resistant varieties to help farmers reduce the losses caused by climate change,” says Robert Hijmans, a geographic information system specialist at IRRI. “Such new varieties could allow cultivation to continue in areas that would otherwise become unsuitable for the crop, as well as allowing the crop to be grown in new and previously unsuitable areas.”

The needed traits will likely come from traditional varieties and their wild

Impact

Research supports conserving crop wild relatives in genebanks, on farms and in protected areas

relatives. But another modeling study led by Jarvis in collaboration with colleagues at the International Center for Tropical Agriculture, shows that these genetic resources may themselves be under threat of extinction.

“Models of the impact of climate change on wild groundnut, potato and cowpea found that up to 61 percent of the 51 groundnut species analyzed, and 12 percent of the 108 potato species studied, could become extinct within 50 years,” reports Jarvis, adding that wild cowpea was less affected, with 4 percent of the 48 species studied expected to go extinct.

These results point to the urgent need to collect and conserve the wild relatives of crops in genebanks, on farms and in protected areas. These resources so far account for only a small portion of the material stored in genebanks worldwide. The models could also indicate where to collect first.



Biofortified beans are well on their way to boosting iron in the diets of the poor.



INTERNATIONAL CENTER FOR TROPICAL AGRICULTURE (CIAT)  
HEADQUARTERS: CALI, COLOMBIA  
WWW.CIAT.CGIAR.ORG

## Achievements

Wide differences in iron and zinc content are found in the common bean core collection

Intermediate breeding lines of bean achieve iron levels 30-50 percent above the unimproved average

A broad partnership designs a series of studies to determine public health implications

## FULLER BEANS

Legumes are often called the “poor man’s meat” for their high protein content. They are also rich in minerals, giving them great potential not only to substitute for costly meat but also to provide essential micronutrients, especially iron and zinc. Iron is essential in the human diet to prevent anemia and for the proper functioning of many metabolic processes. Zinc is essential for adequate growth and sexual maturation and for resistance to gastroenteric and respiratory infections, especially in children.

The HarvestPlus Challenge Program and its Latin American partner, the AgroSalud Project, were created to use food-based strategies to help win the war against micronutrient deficiencies. Of the legumes, common bean (*Phaseolus vulgaris* L.) has been most studied by HarvestPlus.

An early evaluation of the common bean core collection at the International Center for Tropical Agriculture (CIAT by its Spanish acronym) revealed wide differences in iron and zinc concentrations by genotype. Some types had almost double the iron content as others and 40 percent more zinc. The possibility of improving mineral content in the most widely grown classes of bean was real but also presented a challenge. The high mineral content appeared to have derived from wide crosses

across species, requiring extra work to restore typical crop characteristics.

**LEGUMES ARE WELL KNOWN FOR COMBINING SOLID NUTRITION WITH AFFORDABILITY, AND BIOFORTIFICATION WITH IRON AND ZINC PROMISES TO ENHANCE THAT REPUTATION**

To improve the mineral content of popular bean classes, breeders must follow a painstaking approach that maximizes mineral content while, as far as possible, simultaneously improving agronomic qualities and retaining the valued traits of the popular classes. This means advancing, step by step, adding 15-20 milligrams of minerals per kilogram of beans in each cycle of crossing and selection.

The first cycle of crosses gave rise to a series of bean lines with intermediate levels of iron 30-50 percent above the unimproved average of 55 milligrams per kilogram. Breeders at the Nicaraguan Institute of Agricultural Technology selected several small red seeded lines, originally from CIAT, that offered not only elevated iron but also excellent combinations of farmer-preferred grain type with environmental stress tolerance. The same lines are also being tested in Honduras, El Salvador and Costa Rica.

CIAT breeders aim to add enough iron to meet at least 30 percent of the recommended daily intake of iron for adult women, taking into account the amount of beans consumed; losses during storage,

cooking and processing; and the extent to which iron is taken up in humans.

Impact

Beans will deliver a third of the recommended daily iron intake for adult women

Rapid progress means that biofortified beans are well on their way to boosting iron in the diets of the poor.

The question remains whether nutritionally augmented varieties will improve public health. A series of studies is planned for the next 2 years to determine the effects on human health of increased iron concentrations in beans, with CIAT working in partnership with nutritionists from HarvestPlus and AgroSalud; colleagues from the United States Department of Agriculture, Penn State, Cornell University and Universidad del Valle in Colombia; and other scientists in Colombia, Mexico and Rwanda.

A PhD student and assistant interview a landowner at the forest margin about farming practices in Scotland Half Moon, Belize.



CENTER FOR INTERNATIONAL FORESTRY  
RESEARCH (CIFOR)  
HEADQUARTERS: BOGOR, INDONESIA  
WWW.CIFOR.CGIAR.ORG



Data is collected from more than 9,000 households in 400 forest villages and communities

Some 300,000 pages of standard questionnaires gathered worldwide fill a uniquely comprehensive database

Highly effective data collection additionally builds the capacity of researchers from the South

## Achievements

## FORESTS FOR PEOPLE

Forests are vitally important for hundreds of millions of people. They provide food, fuel, medicinal plants and numerous other products, generating income and other benefits that are vital, particularly during periods of hardship. We know that forests' survival is crucial to the livelihoods of the forest-dwelling poor. But can forests also help to lift people out of poverty? If they can, what sort of forest products, and what management regimes and policies, do the most to reduce poverty?

Answers to these questions are urgently needed, yet surprisingly little systematic knowledge exists about the relationship between forests and poverty. That is why the Center for International Forestry Research (CIFOR) established the Poverty and Environment Network (PEN) in 2004 as a 7-year research effort. A key strategy of PEN is to use PhD students who are doing long-term fieldwork to gather uniform and high-quality data across the tropics. In return, the students receive guidance from CIFOR scientists and other experts, as well as modest financial help.

"This has proved to be a unique and highly effective way of gathering data," explains PEN coordinator Arild Angelsen. "We're building the most comprehensive database on the subject, and this will

provide essential information for policymakers and forest managers."

As 2007 drew to a close, 38 PEN studies were in progress or completed, with data collected from more than 9,000 households in some 400 villages and communities. Using a prototype questionnaire and collecting quarterly data over a full year, the researchers have investigated a wide range of subjects, from brazil-nut production in Brazil and Bolivia, to the role of bamboo in alleviating poverty in China; from the economic value of tourism in Cameroon to the impact of decentralization in Senegal and Uganda.

A year of transition, 2007 marked a gradual move away from collecting data to analyzing it. In the second phase, researchers will have to make sense of some 300,000 questionnaire pages.

### RESEARCHERS ENLIST A GLOBAL NETWORK OF PHD STUDENTS TO ASSEMBLE A COMPREHENSIVE DATABASE FOR DISCOVERING EXACTLY HOW AND WHY FORESTS MATTER TO THE POOR

According to Angelsen, the research will provide more representative figures about the importance of forests and thereby furnish new insights on such hot policy issues as the relationship between community-based forest management and forest benefits to the poor.

### Impact

New insights emerge on how forest management and policies affect benefits for the poor

Regular meetings of PEN researchers and CIFOR scientists suggest that the project is providing valuable training and support for the students involved, three-quarters of whom come from developing countries.

"PEN allows me to be part of a process that is much bigger than me, and that is a nice feeling when you're a PhD student," explains Angelica Almeyda, who has been conducting fieldwork in Peru, Bolivia and Brazil.

A new tranche of funding received in 2007 has allowed the geographical scope of the PEN project to expand, with PEN researchers now active in 26 developing countries. Notable recent additions are Cambodia, Ghana and Burkina Faso, along with PEN's heightened presence in Malawi and Uganda.



A wheat physiologist looks over drought-tolerant Mexican wheat landraces that contributed to the improved lines.



**CIMMYT**

INTERNATIONAL MAIZE AND WHEAT  
IMPROVEMENT CENTER (CIMMYT)  
HEADQUARTERS: MEXICO CITY, MEXICO  
WWW.CIMMYT.ORG

## Achievements

Wheat crossed with goat grass yields 30 percent more in dry conditions than normal wheat

Low canopy temperature and high chlorophyll during grain filling are associated with heat tolerance

South Asian farmers adopt conservation tillage, saving fuel and water and limiting CO<sub>2</sub> emissions

## TEMPERING TROPICAL WHEAT

Impact

Improved wheat varieties help farmers maintain stable yields under worsening heat and water stress

Wheat, a crop whose origins lie in temperate climates, may suffer serious effects from the changes that leading global climate models predict for developing countries. Studies demonstrate that high wheat yields in tropical areas are strongly associated with low average temperatures, especially nighttime temperatures. Dwindling water supplies for many irrigated wheat zones worldwide will make the situation even more critical, challenging farmers' food security and ability to make a living.

### RESEARCH AIMS TO BREED WHEAT ABLE TO YIELD WELL IN THE HOTTER, DRIER TROPICS OF THE FUTURE AND TO REFINE CROP MANAGEMENT TO REDUCE GREENHOUSE GAS EMISSIONS

Work at the International Maize and Wheat Improvement Center (CIMMYT by its Spanish acronym) has resulted in wheat varieties that are better at using available water to produce grain. Experimental varieties derived from crosses between wheat and goat grass, one of wheat's wild relatives, produced up to 30 percent more grain than their wheat parents, in tests over 2 years under tough dryland conditions. These experimental wheat varieties can help farmers in irrigated areas, where water is growing scarce, as well as poor farmers who grow the crop under rainfed conditions for food, income and livestock fodder. CIMMYT scientists are seeking and testing new

sources of drought tolerance from genebank collections and other wheat or grass species, including wheat landraces brought to Mexico by Spanish colonizers and grown for centuries under dry conditions.

Nearly 2 decades of research on heat tolerance has pointed to key physiological traits associated with higher yields in heat-stressed environments, including low canopy temperatures and high chlorophyll content in leaves during grain filling.

Partly as a result of the development and release of improved, stress-tolerant varieties by CIMMYT and its partners, wheat yields improved 2-3 percent per year in dry and heat-stressed environments in developing countries during 1979-1995, and work in this direction has continued.

CIMMYT has studied and fostered farmers' testing and adoption of various resource-conserving practices — including conservation tillage and keeping a crop residue cover on the soil — to save food production costs and resources, as well as maintain or improve soil quality. Work as part of the Rice-Wheat Consortium for the

Indo-Gangetic Plains has encouraged the adoption of conservation tillage by farmers on nearly 2 million hectares in South Asia when sowing wheat after rice (see pg 16). The practice saves 50 liters or more of diesel per hectare, greatly reduces water use, and limits carbon dioxide emissions.

Fertilizer is another resource whose efficient use can improve crop productivity and reduce greenhouse gas emissions and other damage to the environment. With CIMMYT's help, wheat farmers in irrigated zones of Latin America and South Asia are testing the use of infrared sensors to fine-tune fertilizer application amounts, timing and methods. This saves money for farmers and cuts emissions of nitrous oxide, a gas with some 300 times the greenhouse effects of carbon dioxide. Research to date also supports the hope of using wheat's grassy relatives as a source of genes to inhibit soil nitrification and the associated release of nitrous oxide.



Accessions under slow-growth *in vitro* conservation in the genebank at CIP are guaranteed free of disease.



INTERNATIONAL POTATO CENTER (CIP)  
HEADQUARTERS: LIMA, PERU  
WWW.CIPOTATO.ORG



Potato genebank formalizes workflows and introduces a barcode system to track germplasm movement

A fully integrated quality system becomes a reality covering all aspects of germplasm handling

Genebank achieves accreditation to ISO 17025 quality standard for competence in testing laboratories

## Achievements

## QUALITY YOU CAN COUNT ON

The International Potato Center (CIP) has received International Standards Organization (ISO) accreditation for its germplasm acquisition, management and distribution operations. With the collaboration of David Galsworthy, a quality systems expert from the Central Science Laboratory in the United Kingdom, CIP has successfully implemented a quality system covering the complete process of distributing *in vitro* germplasm.

“CIP is the first CGIAR Center to implement a quality system in a genebank and the first genebank in the world to gain accreditation to ISO 17025,” reports Galsworthy.

### POTATO GENE BANK SETS A GOLD STANDARD FOR GERmplasm MANAGEMENT AS IT BECOMES THE WORLD’S FIRST SUCH FACILITY TO ACQUIRE THE HIGHEST ACCREDITATION FOR COMPETENCE

This means that *in vitro* material distributed from CIP will bear ISO accreditation that it is free from viruses and other pathogens and diseases. In addition to inspiring confidence in CIP’s partners, accreditation is evidence that the biodiversity the Center holds in trust is safely conserved for the future.

“Accreditation is a milestone event for CIP, made possible through the hard work and dedication of CIP staff,” says Pamela Anderson, the director

general of CIP. “This demonstrates how seriously we take our obligations to distribute disease-free germplasm.”

Moving planting material around the world risks spreading pests and diseases. As custodian of the world’s largest collection of potato and sweetpotato germplasm, CIP has always taken seriously its obligations to maintain and distribute this material. In early 2007, CIP’s senior management took the forward-looking decision to formalize and modernize its distribution of clean germplasm into a quality system and obtain third-party verification through accreditation.

Implementing a quality system entails identifying, characterizing and controlling key operational processes and demonstrating their effectiveness through validation and quality control. CIP was keen to use a quality system to demonstrate the highest level of technical expertise. In so doing, the Center chose to model its system on the ISO/IEC 17025 quality standard for the competence of testing laboratories, the most demanding standard for quality systems. The Center sought

### Impact

Confidence that potato breeding materials are clean encourages sharing and facilitates crop improvement

accreditation from the United Kingdom Accreditation Service.

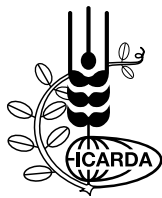
Introducing the quality system built on considerable investments CIP had made over many years, with workflows formalized and a barcode system introduced to track the movement of germplasm. In 2007, the vision of a fully integrated quality system became a reality, with all aspects of acquiring, managing and distributing germplasm brought into the system. The United Kingdom Accreditation Service will continue to monitor the system with annual surveillance visits.

“The genebank is a long-term responsibility for CIP, and we have made a long-term commitment to this process,” says Charles Crissman, CIP deputy director general for research.

By realizing an accredited system supporting healthy germplasm distribution, CIP has set a gold standard for genebank management and provides a model for other genebanks in the CGIAR and the rest of the world. Their emulation would contribute significantly to the speed and trust with which germplasm can be shared for breeding and the delivery of crop varieties that afford developing countries greater food security.



Farmers in Silvas district of Central Anatolia harvest Gokce, the only chickpea variety to yield well in the severe drought of 2007.



INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH  
IN THE DRY AREAS (ICARDA)  
HEADQUARTERS: ALEPPO, SYRIAN ARAB REPUBLIC  
WWW.ICARDA.ORG

## Achievements

Turkey releases drought-tolerant chickpea variety Gokce after successful field trials in the 1990s

Since 2000, Turkish farmers have received 100-150 tons of certified Gokce seed for cultivation

Turkish chickpea yield rises from 861 to 1,071 kilograms per hectare in 6 years

## LAST CROP STANDING

Impact

A sturdy chickpea variety safeguards farmers' livelihoods in temperate dry areas prone to drought

Every year crops worth hundreds of millions of dollars are lost and thousands of farmers are driven toward economic despondency because of drought. Climate change, in particular global warming, is worsening the threat of reduced rainfall and water availability for agriculture in the Mediterranean basin. Drought is becoming a common phenomenon in dry areas outside of the tropics.

Agricultural scientists face the challenge of developing varieties that can withstand drought and save the livelihood of farmers.

At the International Center for Agricultural Research in the Dry Areas (ICARDA), researchers working with scientists from the national agricultural research system of Turkey have successfully developed a new variety of chickpea, Gokce, that can survive drought.

Gokce proved itself by surviving severe drought during 2007 in Turkey and producing an impressive yield in severely adverse weather conditions. Specifically, it survived the acute drought in the Central Anatolia region of Turkey that wreaked havoc for farmers. In most areas where yields for wheat, barley and other cereal crops fell by at least 40 percent or failed entirely, Gokce's yield was a high 1.2 tons per hectare, according to

farmers who grew it. This was reduced by only 20 percent from the 1.5 tons per hectare Gokce would likely have yielded on average without drought.

Gokce not only tolerates drought but also has moderate resistance to *Ascochyta* blight, a disease that attacks chickpea crops.

"Work on developing this variety began in 1984 and 1985 as part of an international yield trial," says R.S. Malhotra, a senior chickpea breeder at ICARDA. "Gokce field trials began in Turkey in 1991."

### A HARDY NEW CHICKPEA VARIETY RAISES THE AVERAGE YIELD FOR THE CROP WHILE DROUGHT IN TURKEY'S CENTRAL ANATOLIA REGION CAUSES OTHER CROPS TO FAIL

It was initially tested at the Central Research Institute's research farm at Haymana, near Ankara. Subsequently, in 1992 and 1993, it was tested in regional yield trials at five contrasting locations: Corum, Haymana, Karaman, Konya and Yozgat. In 1997, the National Variety Registration and Release Committee of Turkey released it for commercial production and, responding to the success of the field trials, the Exporters' Union Seed and Research Company (ITAS by its Turkish acronym), a nonprofit organization set up by agricultural exporters in Turkey, introduced Gokce into the country.

"The results of the field trials were excellent, and we immediately registered the variety," says Ismail Kusmenoglu, general manager of ITAS.

ITAS initiated an integrated technology transfer project in 1997 and planted 1,400 kilograms of foundation seed at Konya, in the Central Anatolia region, in the spring of 1998. The seed was then distributed to growers in 2000. Since then, farmers have received 100-150 tons of certified seed annually for cultivation.

As Gokce cultivation expanded, the average yield of chickpea increased from 861 kilograms per hectare in 2000 to 1,071 kilograms per hectare in 2006. Chickpea is now grown on some 600,000 hectares in Turkey, of which nearly two-thirds is in the Central Anatolia region. In 2007, Gokce was planted on 60-70 percent of Turkey's total area, or some 360,000-420,000 hectares.



INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS (ICRISAT)  
HEADQUARTERS: PATANCHERU, INDIA  
WWW.ICRISAT.ORG



Breeders develop high-yielding chickpea varieties that mature quickly and so avoid late-season stress

Breeding in resistance to *Fusarium* wilt makes early-maturing chickpea varieties more durable

Super-early chickpea proves suitable planted between rice and wheat for cash and soil improvement

## Achievements

## CHICKPEA AS THE EARLY BIRD

Chickpea (*Cicer arietinum*) is grown in more than 50 countries in a wide range of environments and cropping systems. It matures in timeframes ranging from 80 to 180 days depending on the variety and growing conditions. However, in at least two-thirds of chickpea growing areas, the growing season is only 90-120 days. It is therefore important to cultivate early-maturing varieties in these areas to escape end-of-season stress.

Terminal drought and heat are the major environmental stresses that chickpea faces in the semi-arid tropics, where it is grown in rainfed fields. Drought late in the season is also a major constraint in autumn-sown rainfed crops in Mediterranean-type environments, as in Australia. Early maturity is also important for the summer-grown crop in temperate environments, as in Canada, as the crop often encounters end-of-season frost.

Over 60 percent of the global chickpea growing area is in India. In the past 4 decades, the chickpea area has declined by 3.2 million hectares in northern India, where the season is cool and long, and increased by 2.5 million hectares in central and southern India, where the season is warm and short. This further creates demand for early-maturing varieties.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and partners in the Indian national agricultural research system have developed many high-yielding varieties of chickpea that mature early and resist *Fusarium* wilt. The adoption of these varieties allowed an increase in area and productivity in short-season environments in central and southern India and in Myanmar. The first landmark variety was ICCV 2, which flowers in 30 days and matures in 85 days, making it perhaps the world's earliest-maturing variety of kabuli chickpea (also called garbanzo bean). Released for commercial cultivation in India, Myanmar and Sudan, ICCV 2 has spread to many other countries and has been instrumental in extending kabuli chickpea cultivation into such tropical environments as Tanzania and Myanmar, in the latter of which it occupies more than half of the chickpea area.

### BREEDING FOR EARLY MATURITY ALLOWS FARMERS TO HARVEST CHICKPEA BEFORE THE ONSET OF END-OF-SEASON DROUGHT, HEAT OR OTHER STRESS — AND WHEN CROP PRICES ARE HIGH

ICRISAT developed two super-early desi (Bengal gram) varieties, ICCV 96029 and ICCV 96030, that mature in 75-80 days in southern India. Scientists experimented with super-early lines to see if they were suitable

Impact

Early maturity allows chickpea to expand into tropical areas previously unsuitable for the crop

for cultivation in northern India as a vegetable (harvesting the immature green grain), as early delivery to the market fetches a higher price. The experiments showed that super-early chickpeas could be grown as a short-duration cash crop after rice and before wheat. This will provide extra income to farmers, and including a legume in the rice-wheat cropping system will improve soil health. However, these lines (particularly ICCV 96029) need improvement for seed size and resistance to *Fusarium* wilt.

Using different early-flowering genes discovered in ICCV 2, ICC 5810 and ICC 16641, scientists have now developed progenies that are as early as the super-early parent ICCV 96029, have high resistance to *Fusarium* wilt and bear a seed similar in size to that of ICCV 2. Several other lines that mature even a week earlier than ICCV 96029 look very promising.



The preventative approach to fighting undernutrition focuses efforts on younger children, like this girl at a health center on the Central Plateau of Haiti.



INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE (IFPRI)  
HEADQUARTERS: WASHINGTON, DC, UNITED STATES OF AMERICA  
WWW.IFPRI.ORG

## Achievements

Preventative and recuperative approaches to alleviating child nutrition are scientifically compared in Haiti

Prevention proves significantly better than recuperation at preventing child stunting, underweight and wasting

Proof of the power of prevention offers policy guidance to child nutrition programs worldwide

## OUNCE OF PREVENTION

Impact

Research prompts child nutrition programs in Haiti and beyond to adopt more effective approaches

Scientific research now confirms what common sense suggests: Preventing malnutrition is preferable to treating it, especially in children, who can suffer irreparable harm from undernourishment during the first 2 years of life.

However, most food-assisted maternal and child health and nutrition programs focus on children up to 5 years of age and target interventions only after children become underweight. A recent study by the International Food Policy Research Institute (IFPRI) and Cornell University is contributing to changing approaches and program practice in the fight against childhood malnutrition.

The study found that preventing infants and young children from becoming undernourished is much more effective than treating children who are already moderately malnourished. Conducted in Haiti with World Vision Haiti and the Food and Nutrition Technical Assistance Project of the Academy for Educational Development, the study was featured in the leading medical journal, *Lancet*, as part of its focus on maternal and child undernutrition.

The study compared the impact on childhood nutrition of two World Vision programs, both providing food assistance and interventions on health and nutrition. The first approach was recuperative, providing 9 months of

food, health and nutrition assistance to children 6 months to 5 years of age once they became underweight. The second approach was preventative, targeting all children from 6 months of age with similar food, health and nutrition services until they reached the age of 2 years, regardless of whether or not they were underweight. The preventive model also offered assistance and benefits to children from 2 to 5 years of age who were severely underweight. Both approaches targeted pregnant women and breastfeeding mothers. A strategy of communication and behavior change was an important component of both programs.

### STUDY FINDS THAT FIGHTING CHILD MALNUTRITION IS MORE EFFECTIVE BEFORE THE CONDITION TAKES HOLD, PROMPTING AID AGENCIES TO FOCUS INTERVENTIONS ON CHILDREN UNDER 2 YEARS OF AGE

After 3 years, all indicators of malnutrition were lower among poor communities participating in preventative programs than recuperative ones: child stunting by 4 percentage points, underweight by 6 and wasting by 4. These differences are substantial and provide empirical evidence that preventing infants and young children from becoming undernourished is much more effective than treating children who are already moderately malnourished.

If nutrition programs wait until children have become malnourished, their benefits are significantly diminished. In light of these findings, World Vision Haiti and other NGOs operating similar programs in Haiti have changed their approach. They now target their food assistance and programs for maternal and child health and nutrition to all children under 2 years of age in poor communities in Haiti. They have started to adopt this approach in some of their other country programs, such as in Afghanistan and Ethiopia.

Although this research was conducted in rural Haiti, the findings are relevant to other poor communities around the world, as children's patterns of growth and development are remarkably similar no matter where they live. The study reinforces the need to address malnutrition in the first 2 years of life and provides concrete evidence that preventive programs can have a high impact in combating child undernutrition.



INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE (IITA)  
HEADQUARTERS: IBADAN, NIGERIA  
WWW.IITA.ORG

High-yielding cassava varieties that resist cassava brown streak disease are developed and quickly disseminated

Cassava improvement raises protein content to 28 percent, or 14 times that of local varieties

Partnerships are established to biofortify cassava without changing crop management or consumption practices.

## Achievements

## ROOT OF SUCCESS

Over 240 million people in sub-Saharan Africa depend on cassava for food and income. Cassava is a cheap but rich source of calories, protein and vitamins A and B. Producers sell the crop as fresh roots or as value-added products such as starch or roasted cassava granules, some of which are exported to Europe and America.

The International Institute of Tropical Agriculture (IITA) is at the forefront of cassava research for development in Africa to help turn cassava into the “root” of successful development. Highlights in 2007 include the development and release of new varieties with national and international partners to reduce producer and consumer risk and improve productivity and income.

### IMPROVED CASSAVA VARIETIES THAT RESIST DISEASE, FACILITATE ADDED VALUE AND FIGHT HIDDEN HUNGER CAN HELP LAY THE FOUNDATION FOR AFRICAN DEVELOPMENT

Cassava brown-streak disease poses a major threat to cassava production across the continent, and urgent action is needed to further develop and disseminate resistant varieties. IITA collaborated with the Kizimbani Research Station in Zanzibar to develop four new cultivars that resist the disease. These sturdy varieties also have good cooking quality and high yield, averaging 20 tons per hectare of fresh roots.

Zanzibar’s Ministry of Agriculture accelerated the release of the new varieties in March 2007 in response to strong producer demand. This was the crown on 4 years of intensive farmer participatory breeding trials. Farmers and small-scale entrepreneurs like the members of the Mitakawani Cassava Processing Site, a cottage industry that adds value to cassava roots, celebrated the release of the new cultivars.

For example, Mama Juma is much better off thanks to IITA’s activities in Tanzania. The new cultivars have allowed the small-scale farmer to produce more cassava roots and facilitated her diversification into making flour. The flour sells for US\$6 per 80 kilogram bag, or double the price she would receive for the roots alone.

“The flour we make from them tastes better,” she says. “We’re happy because the new hybrids not only give us abundant and steady harvests but also supply our small-scale enterprises with cassava that has good processing qualities.”

The Alliance for a Green Revolution in Africa has granted funds for a 3-year multiplication project to expedite the

### Impact

Healthier, more prosperous African communities are better positioned to achieve successful development

dissemination of the resistant hybrids. More needs to be done, though, to prevent the spread of this disease, especially to West Africa, where it would devastate production.

Aside from addressing issues of production and incomes, IITA works with partners to use cassava to mitigate hidden hunger in Africa. Varieties commonly grown in the region contain little protein, only about 2 percent of the plant’s dry weight. In partnership with International Center for Tropical Agriculture, IITA developed cassava varieties that provide up to 14 times more protein (28 percent) than do local varieties.

IITA also works with the HarvestPlus Challenge Program to produce biofortified cassava with enhanced content of protein, beta-carotene and other nutrients. Biofortified cassava promises to significantly address hidden hunger in Africa. Farmers will be able to realize the nutritional benefits without changing their eating habits or crop management practices.



Participatory disease surveillance and response helps contain bird flu among free-range poultry in Indonesia.

# ILRI

INTERNATIONAL LIVESTOCK RESEARCH  
INSTITUTE (ILRI)  
HEADQUARTERS: NAIROBI, KENYA;  
ADDIS ABABA, ETHIOPIA  
WWW.ILRI.ORG

## Achievements

Some 1,300 Indonesian veterinary officials educate villagers in the fight against bird flu

Villagers in over 160 districts of Indonesia actively help veterinarians track bird flu outbreaks

Comprehensive disease surveillance provides investigators with a deeper understanding of bird flu epidemiology

## EYES WIDE OPEN

Critical to controlling infectious disease is simple surveillance to tell control agents where an outbreak is occurring. Surveillance also helps scientists better understand how emerging diseases spread. This information is particularly vital for battling bird flu and other new diseases. To contain outbreaks, policymakers and disease-control agents need to act quickly, and both depend on high-quality information about how the disease is transmitted and where it is likely to spread.

a great deal of time and money, but neither rich nor poor countries have time to spare. It is feared, for example, that the deadly H5N1 strain of bird flu will mutate, allowing it to spread easily from person to person and threaten the lives of millions. The most effective way to prevent this and other human pandemics is to stop the virus in animals. But animal disease control in the homesteads of hundreds of millions of rural villagers across Asia and Africa is not a simple task. Fortunately, rural populations are rising to the task.

### Impact

Participatory disease surveillance helps control bird flu, reducing the risk of a human pandemic

Begun late in 2005 as a pilot project, PDSR is now used in more than 160 districts throughout the country, with 1,300 Indonesian veterinary officials in the field working part time for the program. This work has provided the first reliable picture of Indonesia's bird flu burden and, in the process, provided investigators with a deeper understanding of the disease and its transmission.

"The active involvement of local communities in our work vastly improved our information on, as well as understanding of, this deadly infectious disease," says Christine Jost of the International Livestock Research Institute, which is evaluating control alternatives in close collaboration with the PDSR program. "Participatory disease surveillance and response can make a difference in public and veterinary health by allowing us to engage our greatest resources in developing countries — the people — in disease-control programs in which they have the greatest stake."

### EPIDEMIOLOGY 'FROM THE GROUND UP' ENGAGES LOCAL PEOPLE — OFTEN POOR COMMUNITIES' GREATEST ASSET — FOR MORE COMPREHENSIVE AND EFFECTIVE DISEASE SURVEILLANCE

Decades of neglect to disease surveillance in the developing world has left many poor countries bereft of even the most basic surveillance tools and systems, putting them at risk of catastrophic livestock and human losses. Fully 70 percent of all infectious diseases are zoonotic, meaning they are transmitted between animals and people. Yet hundreds of millions of poor people live with their farm animals, often eating and sleeping next to chickens, pigs, goats or sheep that can pass their pathogens on to their human keepers.

Rebuilding standard systems of disease surveillance in poor countries will take

In Indonesia, where bird flu has established a hold on free-range backyard chickens, a bright spot in the country's war on bird flu is something called participatory disease surveillance and response (PDSR). The program, run by the Food and Agriculture Organization in conjunction with the Indonesian Ministry of Agriculture, is characterized as "epidemiology from the ground up." Instead of passively waiting to hear about flu outbreaks in poultry, government veterinarians fan out across the countryside, educating and enlisting villagers in the fight against bird flu and effectively reinforcing the country's thinly stretched defenses.

After 11 days of total submergence, the rice on the left with the *Sub1* gene thrives in comparison with the experimental control plants on the right.



# IRRI

INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI)  
HEADQUARTERS: LOS BAÑOS, PHILIPPINES  
WWW.IRRI.ORG

Partners identify the gene region largely responsible for submergence tolerance in rice

Marker-assisted selection facilitates transferring the targeted gene region alone into popular rice varieties

Improved varieties are almost identical to the originals except for their higher yield following submergence

## Achievements

## LIFELINE FOR RICE

Rice is a semiaquatic plant that thrives in the wettest agricultural environments. However, most rice varieties die if they remain completely underwater for more than 4 days. A few varieties — such as the traditional Indian variety FR13A — can tolerate 2 to 3 weeks of submergence and rapidly recover when the water subsides.

This is an important trait for the vast rainfed lowland areas of Asia subject to flooding, where crop losses are estimated at US\$1 billion annually. Compounding the problem, submergence often hits areas where poverty is high.

Submergence-tolerant but low-yielding rice varieties have been known for a long time, and submergence tolerance has been a breeding focus at the International Rice Research Institute (IRRI) since the early 1970s, but few farmers liked the resulting varieties.

### RICE FARMERS' FAVORITE CULTIVARS NOW YIELD WELL IN THE WAKE OF PREVIOUSLY CATASTROPHIC FLOODING THANKS TO THE MODERN, MARKER-ASSISTED BREEDING

Now, molecular breeding is turning a new leaf in breeding for submergence tolerance. Work on the genetics of submergence tolerance began in the early 1990s at the University of California at Davis, where scientists discovered a gene from FR13A that is responsible for its strong tolerance of submergence.

“Using molecular markers to map a region of DNA responsible for most of the tolerance, Kenong Xu and I identified the *Sub1* gene,” recalls David Mackill, now a researcher at IRRI, adding that the gene belongs to a class of genes known as ethylene-responsive transcription factors.

Parallel to the gene-hunting work, IRRI researchers started using marker-assisted selection to insert *Sub1* (short for “submergence”) into widely grown varieties. Using the molecular technique, breeders can selectively transfer a small chromosome fragment containing a beneficial gene or genes, while leaving the rest of the genes untouched. Furthermore, the process can be completed in 2 to 3 years and does not require the extensive field nurseries and yield tests normally used in rice breeding.

As reported in the scientific journal *Nature*, (see pg 46) the IRRI team first developed a submergence-tolerant version of the popular variety Swarna, which is grown on some 6 million hectares in India and Bangladesh. Swarna-*Sub1* has the chromosome segment containing the *Sub1* gene,

Impact

Popular rice varieties acquire submergence tolerance to protect farmers' food security and livelihood

while the genes in all other chromosomal regions are those of Swarna. This ensures that the submergence-tolerance trait is added without changing other desirable properties of the recipient variety, such as high yield, acceptable taste and good regional adaptation.

The IRRI group has so far produced submergence-tolerant versions of six widely grown rice varieties: Swarna, Samba Mahsuri and CR1009 from India; IR64 from IRRI; Thadokkham 1 from Laos; and BR11 from Bangladesh.

“Each is grown widely in its respective country,” Mackill points out. “These new varieties have the same quality and agronomic characteristics as the originals except for submergence tolerance.”

Experiments at IRRI showed that the *Sub1*-enhanced version of Swarna achieves the same yield as regular Swarna under normal shallow-water conditions: about 5 tons per hectare. When subjected, though, to 12 days of submergence about 4 weeks after planting, followed by a return to shallow conditions, Swarna-*Sub1* more than doubled the yield of Swarna: 3.5 tons per hectare versus 1.6 tons.



Wetlands are crucial for poor rural communities that depend on them for food, water and livelihoods, but many are disappearing.



INTERNATIONAL WATER MANAGEMENT  
INSTITUTE (IWMI)  
HEADQUARTERS: BATTARAMULLA, SRI LANKA  
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## Achievements

The comprehensive assessment identifies eight recommendations for action regarding water management in agriculture

The comprehensive assessment engenders new thinking on key global challenges regarding water and food

Key individual outputs emerging from the assessment catalyze discussion between researchers and policymakers

## ASSESSING THE SOURCE

Impact

Comprehensive assessment messages influence global research, development and investment initiatives

The CGIAR Comprehensive Assessment of Water Management in Agriculture, a 5-year study led by the International Water Management Institute (IWMI), formally concluded in 2007. This Systemwide initiative provided a mechanism for sharing knowledge and engendering new thinking on key global challenges regarding water and food.

The assessment's overarching research question was this: Is there enough land, water and human capacity to produce food for a growing population over the next 50 years, or will we run out of water?

### THE COMPREHENSIVE ASSESSMENT OF WATER MANAGEMENT IN AGRICULTURE INFORMS CONTINUING RESEARCH AND DEBATE ON HOW BEST TO CONSERVE AND USE THIS VITAL RESOURCE

And this was the assessment's answer: It is possible to produce enough food but probable that current food production and environmental trends, if continued, will bring crises in many parts of the world. Only if we act to improve water use in agriculture will we meet the acute freshwater challenges facing humankind over the coming 50 years.

The assessment engaged stakeholders from around the world to establish a common understanding of the issues at hand and a consensus on practical, achievable options. Eight

recommendations for action emerged:

1. Change the way we think about water and agriculture.
2. Fight poverty by improving access to agricultural water and its use.
3. Manage agriculture to enhance ecosystem services.
4. Improve water productivity.
5. Upgrade rainfed systems — a little water can go a long way.
6. Adapt yesterday's irrigation to tomorrow's needs.
7. Reform the reform process, targeting state institutions.
8. Deal with tradeoffs and make difficult choices.

Assessment messages influence key global research, development and investment initiatives. The research agenda of the CGIAR's Challenge Program on Water and Food builds on assessment results and addresses the key knowledge gaps identified. The assessment also informs the agriculture investment strategies and discussions of such major initiatives as the Bill & Melinda Gates Foundation and the World Economic Forum.

Emerging from the assessment is an important foundation for integrated water resources management

(IWRM). The assessment's capstone book, *Water for Food, Water for Life*, has been proposed as a principal textbook by such prestigious universities as Imperial College, with which IWMI is designing a specific IWRM module as part of a distance-learning Master of Science course.

The assessment received widespread media attention. Findings were highlighted in global and regional news reports by the BBC, Reuters, CNN, Agence France Presse, and Deutsche Welle, as well as in the *Economist*, *Financial Times*, *Guardian*, *New York Times*, *Canberra Times* and *Hindustan Times*, to name a few outlets.

In addition, key individual outputs emerging from the assessment, such as the global water scarcity map and the water impacts of biofuel policies, have featured in a range of print media and catalyze discussion among researchers and policymakers.



Carbon credits can change the equation on land use at the forest margin, favoring preservation at sites like this in southern Cameroon.



World Agroforestry Centre  
TRANSFORMING LIVES AND LANDSCAPES

WORLD AGROFORESTRY CENTRE  
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Scientists estimate what farmers of deforested land earn per ton of carbon dioxide equivalent released

Evaluating forests against crops in carbon terms helps build the case for preserving forests

The global debate on reducing emissions from deforestation is informed and enlivened

## Achievements

## CALCULATED ADVANTAGE

In a new study released during the December 2007 United Nations Framework Convention on Climate Change in Bali, CGIAR scientists report that compensating farmers for preserving carbon-rich landscapes would not only mitigate climate change and deforestation but can also alleviate poverty.

The study, which covered sites across Indonesia and in the Amazon and Congo basins, notes that it currently makes economic sense for farmers to plant annual crops or have plantations at the expense of forests. However, converting forests to fields usually generates less than US\$5 for each ton of carbon dioxide equivalent released — an amount unlikely to help lift farmers out of poverty. In contrast, European buyers of carbon credits were paying €21 per ton in December 2007, or about six times more.

“If farmers were adequately rewarded for carbon stored in trees and forests, vast areas of forest could be saved and carbon emissions greatly reduced,” says Brent Swallow, the leader of the study and global coordinator of the Alternative to Slash and Burn (ASB) Partnership for the Tropical Forest Margins. “At the moment, however, the short-term economics and policy environments favor cutting trees.”

Led by the World Agroforestry Centre, ASB is a CGIAR Systemwide initiative that brings together five CGIAR institutes and national research organizations in six countries with tropical forests.

A key ASB objective is to provide the science and policy formulas needed to inform the debate and help decision makers determine how deforestation is addressed. Swallow notes, for example, that the partnership has put together a method for calculating the opportunity costs of avoided deforestation. The method combines new approaches for depicting regional patterns of land use with research conducted by ASB partners for more than a decade on the tradeoffs between local development and the environmental consequences of tropical deforestation. ASB seeks to strike a balance between people and the environment through land-use systems such as agroforestry.

### PAYING CARBON CREDITS TO FARMERS AT THE FOREST MARGIN COULD MAKE PROTECTING TREES MORE PROFITABLE THAN CUTTING THEM DOWN TO GROW ANNUAL CROPS OR PLANTATIONS

ASB research provides a starting point for informed national and international negotiations and helps negotiators build the case for preserving tropical forests.

### Impact

Research shows that measures to limit deforestation and mitigate climate change can alleviate poverty

“Policymakers and land users need to pay special attention to emissions and the economic tradeoffs from deforestation, especially in the peat forests of Indonesia,” stresses Fahmuddin Agus of the Indonesian Soil Research Institute, a key ASB partner. “When peat lands are converted to other uses, large stores of carbon are emitted in the form of CO<sub>2</sub>. The ASB analysis shows that most of these conversions provide very small returns to farmers.”

In addition to generating media interest, the release of the report at the Bali meeting attracted the attention of key players in the global debate on reducing emissions from deforestation and degradation in developing countries (REDD). The Woods Hole Research Center, for example, has agreed to collaborate with ASB in the Congo Basin, and the Prince of Wales Rainforest Project uses ASB results to promote rainforest protection.

Swallow adds that ASB will build on the results of the study by sharing methods, finalizing results at other sites and clarifying policy options for negotiators working on REDD policies.



Freshwater fish farmers in Chingale, Malawi, improve their income by providing “rich food for poor people.”



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## Achievements

A decision-support toolkit integrates quantitative and qualitative knowledge for identifying recommendation domains for aquaculture

Comprehensive modeling of the duration of water availability allows risk assessment for pond aquaculture

Bayesian belief network modeling captures “soft” factors influencing farmers’ perceptions on target aquaculture technologies

## POOLING RESOURCES

Impact

The capacity of national stakeholders to strategically assess aquaculture potential and limitations is enhanced

Fish farming has expanded rapidly in recent decades, now providing almost half of all fish consumed globally. While aquaculture cannot fully replace capture fisheries, it can relieve pressure on them, as well as facilitate equitable economic development locally, regionally and nationally by generating entrepreneurial and labor opportunities in hatcheries, feed supply, production, processing, transport and sales.

Low-input freshwater aquaculture is particularly effective at alleviating poverty. It efficiently uses crop and kitchen wastes to improve food availability, variety and quality for poor farmers, including those weakened by HIV. Freshwater aquaculture raises farmers’ awareness of water-management opportunities and buoys their farms’ productivity under drought. Heightened production of low-cost freshwater fish makes this healthy and nutritious “rich food for poor people” more plentiful in rural areas and more affordable in urban markets, improving maternal health and child development.

Research has bolstered the potential of aquaculture in recent decades, but adoption has been patchy. In Asia, ill-conceived aquaculture placement has sometimes degraded the environment and so disenfranchised the poorest of the rural poor, who live by harvesting natural aquatic resources. In sub-Saharan Africa, tremendous

potential for sustainable aquaculture remains untapped, even as fish supplies and per capita consumption decline. Just 5 percent of the area suitable for aquaculture in Africa could produce more than twice as much additional fish as is currently traded there — or enough, at prevailing consumption rates, to meet demand for a growing population until 2020.

A 3-year research project led by the WorldFish Center is poised to give agricultural policymakers, planners, managers and extension workers the decision-support tools they need to help farmers and fishers adopt aquaculture where appropriate and practice the methods optimal for their locations. Scientists piloted the project in four African and Asian countries to test the applicability and utility of the tools at different levels of aquaculture development. These range from the early integration of homestead fishponds in Cameroon to intensive commercial production in China. Malawi and Bangladesh represent intermediate stages.

### INTEGRATED MAPPING OF THE FACTORS THAT MAKE OR BREAK AQUACULTURE WILL RENDER THE WORLD’S MOST DYNAMIC FOOD SOURCE MORE ECONOMICALLY, ENVIRONMENTALLY AND SOCIALLY SUSTAINABLE

The project systematically identified the factors that influence the likelihood that aquaculture will prove successful. For specific areas, readily quantifiable factors — such as temperature, the

availability of water and other inputs such as seed and feed, terrain and soil conditions, market potential, and human and social capital — are mapped using geographic information system (GIS) technology. The layered, integrative GIS model thus developed matches requirements with available resources to determine both the potential and the limitations of target areas. The GIS model is complemented with Bayesian belief network modeling that addresses such qualitative factors as how positively or negatively farmers will likely view the target technology.

Together, the models constitute a decision-support toolkit for stakeholders to help focus aquaculture development in the most promising locations. In less ideal areas, analysis identifies local constraints to successful adoption and how best to overcome them. The tools can also explore scenarios under evolving conditions: How will patterns of suitability alter if new road construction improves market access? How, if climate change affects rainfall and the reliability of water supply?



# CHALLENGE PROGRAMS





Genetic diversity is made more accessible to crop breeders by identifying reference samples of preferred material.

## GENERATION CHALLENGE PROGRAMME

### Achievements

Genetic diversity analysis is completed for almost all 22 mandate crops of the CGIAR

Genes and their alleles are associated with favorable traits and tagged with molecular markers

The Genotyping Support Service makes modern molecular breeding tools more available to national systems

## GENETIC ASSETS APPRAISED

Impact

Crop-breeding programs receive detailed information on genetic sources of drought tolerance

In 2007, the Generation Challenge Programme (GCP) completed 4 years of molecular analysis of genetic diversity for almost all 22 mandate crops of the CGIAR.

Plant breeders use genetic variation to develop crops that are better adapted to their growing environments. For this reason, samples of crops and their wild relatives are gathered and conserved in genebanks. But conserving plant biodiversity is one thing. Making it available to plant breeders is another.

Second, the composite sample is surveyed with molecular markers to reveal germplasm diversity. This is an enormous task, with the responsibility for each crop shared among GCP consortium members. Distributing the workload requires that the markers used be standardized, so that simple, high-throughput analyses can be done in multiple laboratories without compromising the uniformity of the resulting data. This work is coordinated for each crop by the CGIAR Center with the mandate for it.

Phenotyping for drought — the focus of GCP work — poses its own particular challenges. In response, the GCP convened in January 2008 an experts' workshop for interdisciplinary consultations to overcome the challenges of drought phenotyping.

To bridge the technology gap between cash-strapped national agricultural research systems in developing countries and their better equipped and financed counterparts, GCP runs the Genotyping Support Service. The service links national germplasm collections requiring genotyping services with cost-efficient providers, facilitates access to data and support for building local capacity, and includes training for the proper interpretation of genotype and phenotype data.

### PROVIDING CROP BREEDERS WITH GOOD GENETIC MATERIALS REQUIRES WINNOWING THE VAST DIVERSITY CONSERVED IN GENE BANKS INTO SMALL, REPRESENTATIVE REFERENCE SAMPLES

Reference samples make crop biodiversity more accessible to breeders. These samples are manageable sets of preferred genetic material selected for advanced characterization and possible promotion to breeding programs.

Identifying reference samples is a two-step process. First, a representative sample of accessions from various genebanks and *in situ* collections around the world is assembled on the basis of crop passport information (the basic descriptor of a plant, including its location, maturity class, height and genotype) and pedigree. The resulting composite sample, or core collection, represents the range of diversity of each crop species and its wild relatives.

The crop reference samples thus identified represent as far as possible the genetic diversity of the crop. Reference samples are phenotyped (the plants grown in the field and their characteristics tracked) and undergo in-depth genotyping (genome characterization using molecular markers) to locate functional markers, thereby associating genes with traits. Through marker-assisted breeding, the genes thus tagged are available for conferring traits of interest to improved crop varieties. Having the samples in the CGIAR Centers facilitates their rapid and reliable distribution and release to breeding programs.

To ensure that GCP research products are readily adopted by national agricultural research systems that serve the GCP's ultimate stakeholders — poor farmers in drought-prone environments — it focuses on developing and validating simple markers for traits to improve crop productivity under drought. The resulting superior crop varieties will help poor farm households improve their food and nutritional security and their income, as well as hedge against climate change, which is expected to make droughts more prolonged and severe.

Orange-hued maize rich in beta-carotene may provide health benefits more readily than previously believed.



## HARVESTPLUS CHALLENGE PROGRAM

Maize rich in beta-carotene is prepared for feeding trials to determine nutrient conversion ratios

Mongolian gerbils are selected for feeding trials because they metabolize beta-carotene similarly to humans

Gerbils are found to convert beta-carotene into retinol four times more efficiently than expected

## Achievements

### FAVORABLE CONVERSION

For biofortified foods to have a measurable impact on human health and achieve the goal of the HarvestPlus Challenge Program, plant breeders must achieve target levels of nutrient content. The higher the target, often measured in micrograms of nutrient per gram of crop, the longer breeding can take. And the longer breeding takes, the more potential consumers may suffer the consequences of micronutrient malnutrition.

A key determinant for setting the target for HarvestPlus breeders is the bioconversion ratio — the poorly understood efficiency with which the human body absorbs nutrients in foods and converts them into compounds essential for human health. Recent research on bioconversion ratios by HarvestPlus scientists suggests a better conversion ratio for maize rich in beta-carotene than expected.

Plants contain several provitamin A carotenoids including alpha-carotene, beta-carotene and beta-cryptoxanthin — all precursors of vitamin A. When the human body ingests foods containing beta-carotene, like carrots or orange sweetpotato, it converts this form of provitamin A into retinol, the animal form of vitamin A.

The amount of retinol the body can manufacture depends in large part on

how much beta-carotene is in the diet and the bioconversion ratio from beta-carotene to retinol. The lower the ratio, the less beta-carotene is required to produce a given amount of retinol — or to meet the HarvestPlus goal. If the conversion ratio is better than previously thought, HarvestPlus can lower the target it originally gave to breeders of provitamin A maize for beta-carotene content. The lower the target, the sooner breeders will reach it, and the sooner public health agencies will have provitamin A maize as an additional nutrition intervention to fight vitamin A deficiency.

#### A MOVING TARGET IS USUALLY ELUSIVE, BUT NEW EVIDENCE SUGGESTS THAT THE TARGET FOR BREEDING PROVITAMIN A INTO MAIZE MAY BE LOWER AND EASIER TO HIT THAN THOUGHT

Across a range of plant foods high in provitamin A, beta-carotene is thought to convert to retinol at a ratio of 12:1. This figure is an average, as beta-carotene from some fruits and vegetables converts more efficiently than from others. How, though, do staple foods compare?

In a recent study published in the *Journal of Nutrition*, HarvestPlus scientists Julie Howe and Sherry Tanumihardjo, of the University of Wisconsin's Department of Nutritional Sciences, tested this conversion ratio of HarvestPlus maize rich in beta-carotene by using Mongolian gerbils.

#### Impact

Discovery of efficient nutrient conversion may accelerate the release of biofortified vitamin A maize

“Unlike mice or rats, Mongolian gerbils absorb and metabolize beta-carotene similarly to humans,” explains Tanumihardjo. “By feeding gerbils maize with known levels of beta-carotene and comparing them with those who received vitamin A supplements, and with those given white maize — which contains no beta-carotene — we could measure the impact on nutritional status and determine the conversion ratio.”

“Our research indicated a conversion ratio of 2.8 micrograms of beta-carotene to 1 microgram of retinol,” reports Howe.

A conversion ratio lower than 3:1 is much better than 12:1, but now HarvestPlus must pursue a similar analysis in humans (preliminary results indicate a likely human conversion ratio of 7:1). Meanwhile, HarvestPlus plant breeders will continue to work toward established targets based on a conversion ratio of 12:1, knowing that when the human study is completed, a nutritionally efficacious beta-carotene-rich maize may prove to be considerably closer than previously thought.



Addressing fundamental issues of research delivery sets the stage for improving farm productivity in Africa.

## SUB-SAHARAN AFRICA CHALLENGE PROGRAM

### Achievements

Conventional methods of transferring agricultural technology are recognized as insufficient in Africa

The research and development approach integrated agricultural research for development (IAR4D) is conceptualized

An experimental methodology for empirically proving the effectiveness of IAR4D is developed and elaborated

## FROM ANECDOTES TO PROOF

Impact

With proof of concept, IAR4D will deliver speedier and larger benefits than conventional methods

By focusing on fundamental issues of how agricultural research in sub-Saharan Africa is organized and conducted, the sub-Saharan Africa Challenge Programme (SSA-CP) works to improve the delivery of results in this part of the world. The Forum for Agricultural Research in Africa proposed the theme of improving delivery in recognition of the need to make the process of agricultural research and development (ARD) more effective.

SSA-CP aims to generate knowledge on how agricultural research in SSA can be better organized and conducted to hasten the delivery and use of research outputs with substantial impact on rural livelihoods. To this end, SSA-CP conceptualized an ARD approach called integrated agricultural research for development (IAR4D), which promises to deliver speedier and larger benefits than does linear technology transfer from researcher to extension specialist to farmer.

IAR4D situates research appropriately within the broader agricultural system in a way that makes its collective knowledge readily available to all actors and stakeholders: scientists, agricultural extension and development agents, private sector input dealers, agro-processors, credit providers, shippers, marketers, educators, policymakers and consumers. It

facilitates the generation of relevant new knowledge and allows its application to deliver benefits to stakeholders, particularly poor farmers and pastoralists. It fosters interaction and learning through actors' organization into dynamic coalitions called "innovation platforms." Instead of introducing outside innovations into the system, it establishes institutional momentum that internally generates innovations affecting technology, markets, institutions and policy.

IAR4D has attracted tremendous interest among those who recognize it as particularly suitable for SSA's diversity and dynamism. It has highlighted the demand for interventions to improve ARD processes.

### THE FOUNDATION IS LAID FOR TESTING AN INNOVATIVE APPROACH THAT PROMISES TO SUBSTANTIALLY ENHANCE THE IMPACT OF AGRICULTURAL RESEARCH FOR DEVELOPMENT IN AFRICA

This interest and demand is not, however, supported by empirical evidence of IAR4D's effectiveness, which is largely anecdotal. A major objective of the SSA-CP is therefore to provide empirical proof of IAR4D's effectiveness and impact pathway. Proof-of-concept research is essential for mobilizing investment to support the scaling up of IAR4D and will generate knowledge on best practices for implementing IAR4D in different contexts.

In 2007, the SSA-CP focused on laying the foundation for experimentally proving the IAR4D concept. This principally entailed developing and elaborating an experimental methodology that draws upon emerging techniques of evaluation and impact assessment and on tools for tracking and attributing behavioral changes to specific interventions.

The main challenges facing the SSA-CP early in 2007 were to formulate a proof-of-concept methodology acceptable to the CGIAR Science Council and secure sufficient funds to initiate field research. These challenges were addressed later in the year, which delayed commencement of the experimental work.

The SSA-CP's IAR4D foundation-laying achievements in 2007 have enormous significance for the subsequent generation of knowledge necessary for improving the impact of agricultural research.

Communities adapt to changes in the balance between fresh and saline water by using new cropping systems and aqua polyculture.



## CHALLENGE PROGRAM ON WATER AND FOOD

Integrated management of a dual saline-freshwater environment meets diverse water users' needs

Research guides land-use zoning and sluice gate operation to control water quality and quantity

New aqua polyculture cropping systems increase farmers' income per hectare from US\$300 to \$2,000

## Achievements

### PROSPERITY RIDES THE TIDE

Processes of global change, ranging from climate change to trade policy reform, will likely have enormous consequences for agriculture, ecosystems and rural livelihoods, often through how they affect the availability and quality of water. With work in nine major river basins in Africa, Asia and Latin America, the Challenge Program on Water and Food (CPWF) responds at a variety of scales — from field to farm to basin — to the challenge of growing more food with less water, in the face of global change.

#### WHEN CLIMATE CHANGE AND MARKET EVOLUTION AND REFORM ALTER DYNAMIC COASTAL ECOSYSTEMS, INTEGRATED NATURAL RESOURCE MANAGEMENT CAN GUIDE FARMERS' ADAPTATION

In its project Coastal Resource Management for Improving Livelihoods, led by the International Rice Research Institute with the participation of the WorldFish Center, the International Water Management Institute and 12 Vietnamese and Bangladeshi institutes, CPWF used a multidisciplinary scientific approach across multiple stakeholders and scales to reveal new cultivation technologies and decision-support tools with great potential for scaling out to basins in other regions.

First implemented in Bac Lieu Province in the Mekong Delta of Vietnam, the project recognized that, as water flows vary, the balance between fresh and

saline water environments changes. Farmers had already responded to this (and market developments) with brackish water shrimp production, but it was vulnerable to disease. By introducing new cropping systems to allow for aqua polyculture raising shrimp, crab and fish in addition to growing rice, the project helped communities adapt to saltwater incursions and saw farmers increase production and income per hectare from US\$300 to \$2,000. New short-duration rice varieties provided much of the flexibility in cropping systems.

Researchers modeled various hydraulic and salinity regimes for proposed production systems to analyze different scenarios of water management. This helped the project demonstrate how the integrated management of a dual saline-freshwater environment can meet the needs of diverse water users without harming the environment. Taken up by farmers, water-management agencies and policymakers, the results of the model prompted institutional changes in the zoning of rice and shrimp, and refined sluice gate operation to control water quality and quantity.

Specially adapted crop varieties and new cropping systems and decision-

Impact

Integrated resource management and crop innovation contribute to double-digit economic growth despite saltwater incursion

support tools combined to increase food production and incomes, diversify employment opportunities, reduce risks and provide a sound scientific basis for resource planning.

“With integrated resource management, the project has significantly contributed to a provincial average economic growth rate of 16 percent per year during the last few years,” reported Pham Hoang Be, vice governor of Bac Lieu.

Having achieved success at the provincial level in the Mekong Basin, project results and methods are being extrapolated to a very different system in the Ganges Basin. Additionally, two international scientific conferences hosted by the project further disseminated its models and methods. The project's findings have broad implications for coastal systems and have inspired additional research questions about delta ecosystems in the Mekong, Ganges and Nile basins for the next phase of the CPWF.

Global change causes not only increasingly variable stream flows in deltas but also rising sea levels that will exacerbate the invasion of saltwater and reduce the land available on deltas for agriculture and aquaculture.

A close-up photograph of several glass petri dishes containing green plant samples, likely for a biology or agriculture experiment. The dishes are arranged in a grid, and the focus is on the central one. The text "REACHING NEW HEIGHTS" is overlaid in white, bold, sans-serif font. A dark brown rectangular block is visible on the left side of the image.

**REACHING NEW HEIGHTS**



IMPROVED CROP VARIETIES, A SOPHISTICATED KNOWLEDGE TOOL AND ACCELERATED GERMPLASM SCREENING HELP COUNTER NATURAL DISASTERS, EPIDEMICS AND MALNUTRITION

The CGIAR Science Awards bring international recognition to research that illustrates particularly well how science can help poor farmers and consumers in the face of growing concern about higher prices for basic cereals and the devastating impacts of climate change in developing countries. The 2007 awards were presented at the CGIAR's Annual General Meeting in Beijing, China, in a ceremony held at the Great Hall of the People.

"International agricultural research has shown again and again how science-based innovations can help combat hunger, poverty and environmental degradation in the developing world," said CGIAR Chair Katherine Sierra. "Today, we're recognizing a group of CGIAR scientists who are profoundly committed to this goal and have shown extraordinary persistence and creativity in contributing to it."

**Darshan S. Brar**, a plant breeder at the International Rice Research Institute (IRRI), received the **Outstanding Scientist Award** for his success in transferring genes for valuable traits from wild species related to rice into the cultivated crop, using an approach referred to as "wide crossing." To overcome reproductive barriers between species, Brar and his team have resorted to a variety of tools — including tissue culture and molecular markers — for creating cross-species breeding lines. Seven of these lines have been released to farmers as commercial varieties, including one (AS966) that is now sown on 100,000 hectares of moderately acid soils in Vietnam.



**Natalia Palacios**, a microbiologist at the International Maize and Wheat Improvement Center, was named **Promising Young Scientist** for her extraordinary contributions to research aiming to combat malnutrition, especially in Africa, by increasing the content of micronutrients such as zinc and iron in staple crops. Rapid progress in this work depends in part on the availability of cheap but reliable methods for quickly diagnosing key nutritional traits, thus permitting efficient, large-scale screening of grain samples. One of Palacios's innovations made it possible to handle more than twice as many samples per day as before, doubling the number of maize varieties undergoing improvement for content of provitamin A.



A team of marine biologists and information technology experts at the WorldFish Center were named **Outstanding Scientific Support Team** for developing **ReefBase**, the most sophisticated and comprehensive information-management system available on the world's coral reefs. The team keeps this valuable resource continuously up to date, with 25,000 publications, 4,000 photographs, contact details for 3,500 coral reef experts and other information gathered from 120 countries. ReefBase proved critical after the Indian Ocean tsunami of 26 December 2004, helping scientists and relief workers assess the damage to coral reefs and to the coastal communities whose livelihoods depend on them.



Published in *Nature* in August 2006, the **Outstanding Scientific Article**, with ten co-authors including four from **IRRI**, documents the successful use of the *Sub1A* gene to confer flooding tolerance on rice (see pg 35). The gene was introduced into the variety Swarna, which is grown on about 6 million hectares in India and Bangladesh. When completely submerged for 12 to 18 days, Swarna-*Sub1*, the tolerant version of the variety, yields two to three times more grain than the original Swarna. The *Sub1A* genetic sequence has also proved useful in searching rice germplasm collections for further flood-tolerance genes.



The **Outstanding Partnership Award** recognized the **Latin American and Caribbean Consortium to Support Cassava Research and Development (CLAYUCA)** for its especially inclusive and novel approach to collaboration. Set up by the International Center for Tropical Agriculture in 1999, CLAYUCA is an alliance of 33 public and private organizations in 13 countries. They jointly plan and finance research for the development of cassava (*yuca* in Spanish), a starchy root crop that provides food and increasingly serves as a source of animal feed and industrial raw material in tropical America. The consortium has greatly expanded members' access to technologies for improving cassava production and processing.



The **Joint Wheat Quality Team** of the Shandong Academy of Agricultural Science and the Chinese Academy of Agricultural Science received the **Regional Award for Outstanding Agricultural Technology**, Asia-Pacific Region, in recognition of critical contributions to the development of three high-quality wheat cultivars. The cumulative economic returns from these varieties for Chinese farmers are estimated at US\$411 million. The newest variety — Jimai 20 — was sown on 1.3 million hectares in Shandong and three other provinces in 2006. It is the only Chinese wheat cultivar showing resistance to a new African strain of the wheat stem rust pathogen and could therefore serve as a parent in an international campaign to develop resistant varieties.

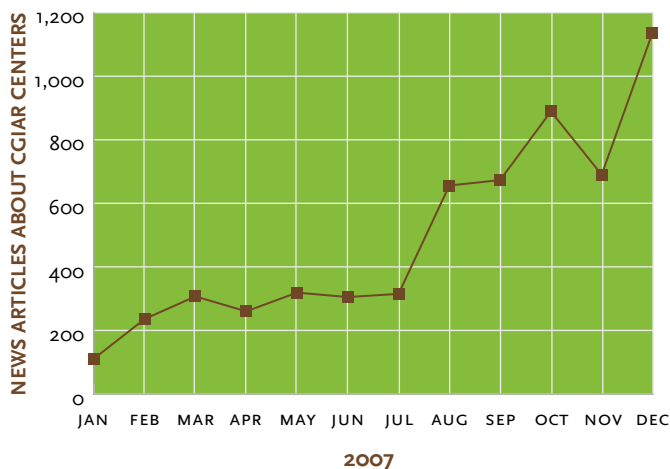


COVERAGE OF CGIAR RESEARCH IN TOP MEDIA OUTLETS BALLOONED IN 2007 AS GLOBAL DEVELOPMENTS POINTED TO THE CGIAR MISSION AND THE SYSTEM IMPROVED COORDINATION IN GETTING THE NEWS OUT

Rising food and energy prices, growing concern over climate change, and a renewed interest in agriculture for development drew media interest in 2007 to CGIAR research on these topics. In the course of the year, coverage of the CGIAR Centers climbed by tenfold, from 111 news articles in January to 1,136 in December. This growth in media coverage demonstrates the CGIAR's increasing relevance to today's urgent issues. It also represents a window of opportunity for the CGIAR to influence public opinion.

This growing media coverage is not simply a response to current events and global trends but also reflects the strategic promotion of the right research at the right time and growing collaboration between communicators and researchers throughout the CGIAR System. Throughout 2007, several stories were promoted collaboratively among CGIAR Centers and the Secretariat Communications Unit. These joint efforts yielded more results than would have been accomplished through individual efforts alone, demonstrating that a collective voice has the ability to project itself further than many separate voices. The creation of an integrated CGIAR Communications Unit (see pg 51) will serve to strengthen the delivery of CGIAR messages, especially in regional and global arenas.

Coverage of CGIAR Centers rose tenfold in 2007.



#### NEWS HIGHLIGHTS

The following are the key CGIAR stories promoted to the media in 2007.

- *How climate change threatens wild relatives of key crops and puts genetic resources vital for resisting drought and pests at risk*, based on a study by Bioversity International and the International Center for Tropical Agriculture, was released for International Biodiversity Day, which focused on climate change. International media coverage included the *Financial Times*, *Die Welt* (Germany) and *Scientific American*.
- *New low-cost technology counters deadly aflatoxin, increases agricultural export* — which is about the detection and elimination of aflatoxin, a naturally occurring and potentially deadly contaminate of several crops, featuring research by the International Crops Research Institute for the Semi-Arid Tropics, International Maize and Wheat Improvement Center, and International Institute of Tropical Agriculture — received coverage in the *Hindu*, *Daily Times* (Malawi), *Kenya Times* and *Guardian* (Nigeria).
- *China and India's planned biofuel boost could worsen water scarcity, compete with food production*, based on a study by the International Water Management Institute on biofuels and their implications for agricultural water use, received international coverage in the BBC World Service program *Science in Action*, Agence France Presse, Reuters, *China Daily*, *Economic Times* (India) and *Hindustan Times*.
- *'Livestock Meltdown' Is Occurring*, a story on the conservation of animal genetic resources by the International Livestock Research Institute, prompted major coverage, in print by *Financial Times*, *Le Monde*, *China Post* and *Hindustan Times* and on the air by Australian Broadcasting Corporation Radio, BBC World Service and Voice of America.
- *Rising food prices threaten world's poor people*, promoted in conjunction with the CGIAR Annual General Meeting 2007 and based on *Overview of the World Food Situation* by the International Food Policy Research Institute, resulted in articles in such influential publications as the *Frankfurter Allgemeine Zeitung* (Germany), *Guardian*, *Le Monde* (France), *Wall Street Journal Europe* and many others. The findings were also featured in the *Economist* in its 8 December briefing report on world food prices.



**STRONG OUTCOMES AND GOVERNANCE**

CENTERS CONTINUE TO ACHIEVE AND DEMONSTRATE SIGNIFICANT RESEARCH OUTCOMES, AS THE CGIAR STRIVES SYSTEMWIDE TO IMPROVE GOVERNANCE

The Performance Measurement System of the CGIAR entered its fourth year in 2007. The system measures Centers in terms of their results and potential to perform. It also reaches out to stakeholders, including CGIAR Members and partners of Centers, to understand their perceptions about the performance of the CGIAR and individual Centers (Table 1). The system is continuously refined in the light of experience and feedback from stakeholders, Centers, Members and the Science Council.

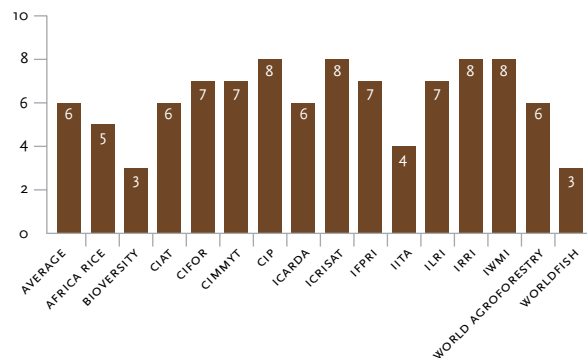
**Research Outcomes.** Centers reported their five most significant research outcomes in 2007 that resulted from Center outputs' adoption and use by, or influence on, partners, stakeholders and clients. The Science Council assessed and scored Center-reported outcomes in terms of their linkage to Center outputs, their significance and their potential for replication (Figure 1). Some of the outcomes are highlighted in chapters of this report on individual Centers.

**Culture of Impact Assessment.** Centers' commitment to documenting their impact and to building a culture of impact assessment is measured as part of the Performance Measurement System. The Science Council assessed Centers' reports using three criteria: (1) ex-post impact assessment studies and the advancement of methods for conducting them, (2) building a culture of impact assessment at the Center and (3) communication and dissemination and capacity enhancement. Figure 2 shows the results of the Science Council's assessment.

**TABLE 1  
PERFORMANCE MEASUREMENT INDICATORS**

RESULTS	POTENTIAL TO PERFORM	STAKEHOLDERS PERCEPTION
Outputs	Quality and Relevance of Current Research	Surveyed every 3 years
Outcomes	Institutional Health	
Impacts	Financial Health	

**FIGURE 1  
SCIENCE COUNCIL ASSESSMENT OF OUTCOMES  
(0=LOWEST, 10=HIGHEST)**



**Quality and Relevance of Current Research.** Centers reported the number of peer-reviewed publications in journals listed in Thomson Scientific/ISI and other reputable journals. Publication indicators reflect the scientific productivity and publishing quality of the Centers as providers of research that meets international peer standards. Figure 3 shows that on average CGIAR scientists published one article per scientist in journals listed in the Thomson Scientific database. When including other refereed journals and publications the average number of externally peer-reviewed articles per scientist doubles to 2.3 in 2007.

On average 45 percent of all articles published in 2007 in refereed journals or in the proceedings of conferences and workshops had partners from developing countries listed among the authors or editors.

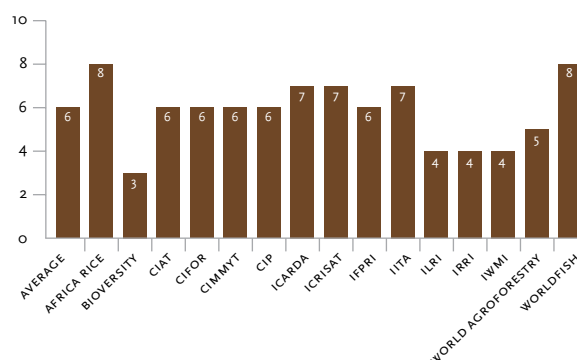
**Institutional Health.** Institutional health is assessed by measures of Center governance, culture of learning and change, and diversity. The following provides some insight on each of the three components. Good governance is a critical component of Center performance. It entails adequate composition and structure of Center boards, effective board practices, full board engagement with Center's strategic business, and transparency and accountability. The following demonstrates some of critical good governance practices at Centers:

- CGIAR Center boards have strengthened their financial oversight by increasing the number of board members with professional qualifications in financial management. Eleven Centers have one board member or more with professional qualifications in financial management.
- Nine Centers have in place a board-approved whistle-blowing policy. In line with good practice, a whistle-blowing policy ensures that a confidential channel of communications is open to staff to report the misconduct of a third party and that a mechanism exists that guarantees that the reporting staff member will be protected from retaliation.
- Six Centers publish the minutes of their boards' meetings on their institutional website. Some Centers have started to make their general compensation structure publicly available.

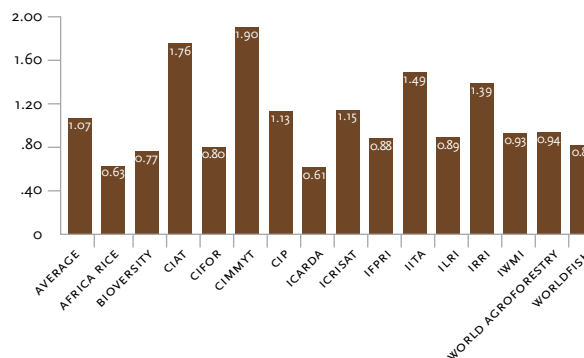
Center boards reported the two most important actions undertaken by them in 2007 with the aim of improving board oversight of programs or finances, as well as any major initiative to improve Center governance. The reports were assessed by an external panel of three governance experts, who then scored them in terms of the importance of the action for improving board performance and the anticipated impact. Figure 4 shows that, overall, Center boards received high scores from experts, meaning that in the past year Center boards undertook significant actions to fulfill their oversight responsibilities.

Centers' culture of learning and change is critical to their continued research excellence. This includes, among other activities, conducting regular staff surveys; encouraging staff development and offering leadership-

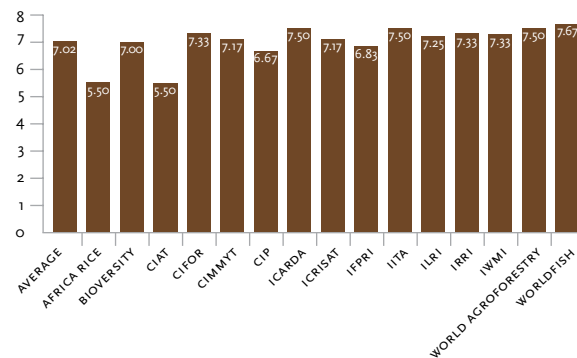
**FIGURE 2**  
COMMITMENT TO DOCUMENTING IMPACTS  
AND BUILDING IMPACT ASSESSMENT CULTURE  
(0=LOWEST, 10=HIGHEST)



**FIGURE 3**  
NUMBER OF PEER-REVIEWED PUBLICATIONS PER  
SCIENTIST THAT ARE PUBLISHED IN JOURNALS  
LISTED IN THOMSON SCIENTIFIC/ISI



**FIGURE 4**  
BOARD STATEMENTS  
(0=LOWEST, 8=HIGHEST)



development programs for current and prospective staff in managerial positions; commissioning regular external reviews of the research program and Center management and governance, including effective follow up; and engaging in new partnerships. The CGIAR Performance Measurement System monitors all of these good practices for promoting the culture of learning and change in the research Centers it supports.

Leveraging rich staff diversity is also vital to the CGIAR's research and management excellence. The Performance Measurement System therefore tracks measures of diversity in terms of the nationality of internationally recruited staff (IRS) and their gender (Table 2). Approximately a quarter of the management positions are occupied by women, and the nationalities that are most prevalent among IRS are Germany, India, Japan, Nigeria, United Kingdom and United States.

**Financial Health.** Financial health is measured in terms of (1) short-term solvency (liquidity), (2) long-term financial stability (adequacy of reserves), (3) efficiency of operations (indirect cost ratio), (4) cash management on restricted operations and (5) audit opinion (Table 3).

**TABLE 2**  
DIVERSITY MEASURES IN THE CGIAR PERFORMANCE MEASUREMENT SYSTEM IN 2007

CENTER	% OF MANAGEMENT POSITIONS OCCUPIED BY WOMEN	MOST PREVALENT NATIONALITY	% OF IRS OF THE MOST PREVALENT NATIONALITY
Africa Rice	20	Japan	12
Bioversity	20	United Kingdom	11
CIAT	33	USA	17
CIFOR	40	USA	22
CIMMYT	22	USA	9
CIP	50	Peru/Germany	15
ICARDA	17	Syria	11
ICRISAT	8	India	17
IFPRI	29	USA	23
IITA	29	Nigeria	13
ILRI	25	United Kingdom	14
IRRI	17	USA	16
IWMI	25	India	17
World Agroforestry	25	USA	14
WorldFish	11	United Kingdom	24

**TABLE 3**  
FINANCIAL HEALTH

CENTER	LIQUIDITY (TARGET: 90-120 DAYS)	ADEQUACY OF RESERVES (TARGET: 75-90 DAYS)	INDIRECT COST RATIO	CASH MANAGEMENT ON RESTRICTED OPERATIONS	AUDIT OPINION*
Africa Rice	114	114	33%	2.58	unqualified
Bioversity	123	82	19%	0.55	unqualified
CIAT	50	39	20%	0.70	unqualified
CIFOR	219	182	20%	0.23	unqualified
CIMMYT	142	91	19%	0.24	unqualified
CIP	104	92	13%	0.19	unqualified
ICARDA	200	149	22%	0.58	unqualified
ICRISAT	206	148	23%	0.14	unqualified
IFPRI	94	81	16%	0.41	unqualified
IITA	175	175	21%	0.07	unqualified
ILRI	144	130	17%	0.18	unqualified
IRRI	309	309	20%	0.21	unqualified
IWMI	114	77	26%	0.18	unqualified
World Agroforestry	178	128	22%	0.75	unqualified
WorldFish	172	158	20%	0.59	unqualified

\* Unqualified means "clean" opinion

## ADJUSTMENTS IN SYSTEM OFFICE STRUCTURE AND GOVERNANCE PROMISE IMPROVED CLARITY, TRANSPARENCY AND INTERNAL COHESION AND A STRONGER SYSTEMWIDE PERSPECTIVE

An external review of the System Office (SO) of the CGIAR in 2006 identified a number of weaknesses in its governance structures. The CGIAR Secretariat subsequently developed a think piece on the governance of the individual units and of the SO as a whole. This responded to an urgent request from many SO units to meet the need for more internal discussions about streamlining the governance and structure of individual SO units and also of the SO as a whole.

The think piece formed the basis for discussion at the System Office Workshop in Rome, Italy, on 14 October 2007. The objectives of the workshop were to discuss improving the effectiveness of SO governance and identify collaborative activities and services for 2008. The workshop discussed various governance models that would further these objectives in day-to-day activities.

Following the conclusion of the workshop, the SO Steering Committee endorsed the principles of effective governance and emphasized the importance of clarity, transparency, internal cohesion and a Systemwide perspective.

To that end, the SO Steering Committee concluded that the number of System Office units should be reduced from nine units to five. These are the

1. Alliance of the CGIAR Centers Office,
2. Central Advisory Service for Intellectual Property,
3. CGIAR Secretariat,
4. Chief Information Officer and Information and Communication Technologies and Knowledge Management and
5. Internal Audit Unit.

These units should be under a five-member oversight board composed of the CGIAR director, Science Council chair and three members from the Alliance, including at least one from the Alliance Executive and the Alliance Board chair, who should also serve as chair of the SO Oversight Board.

The SO Steering Committee recognized that programmatic oversight of the individual units should vary according to the needs of the unit. Each unit except the CGIAR Secretariat and Alliance Office should have a program advisory committee.

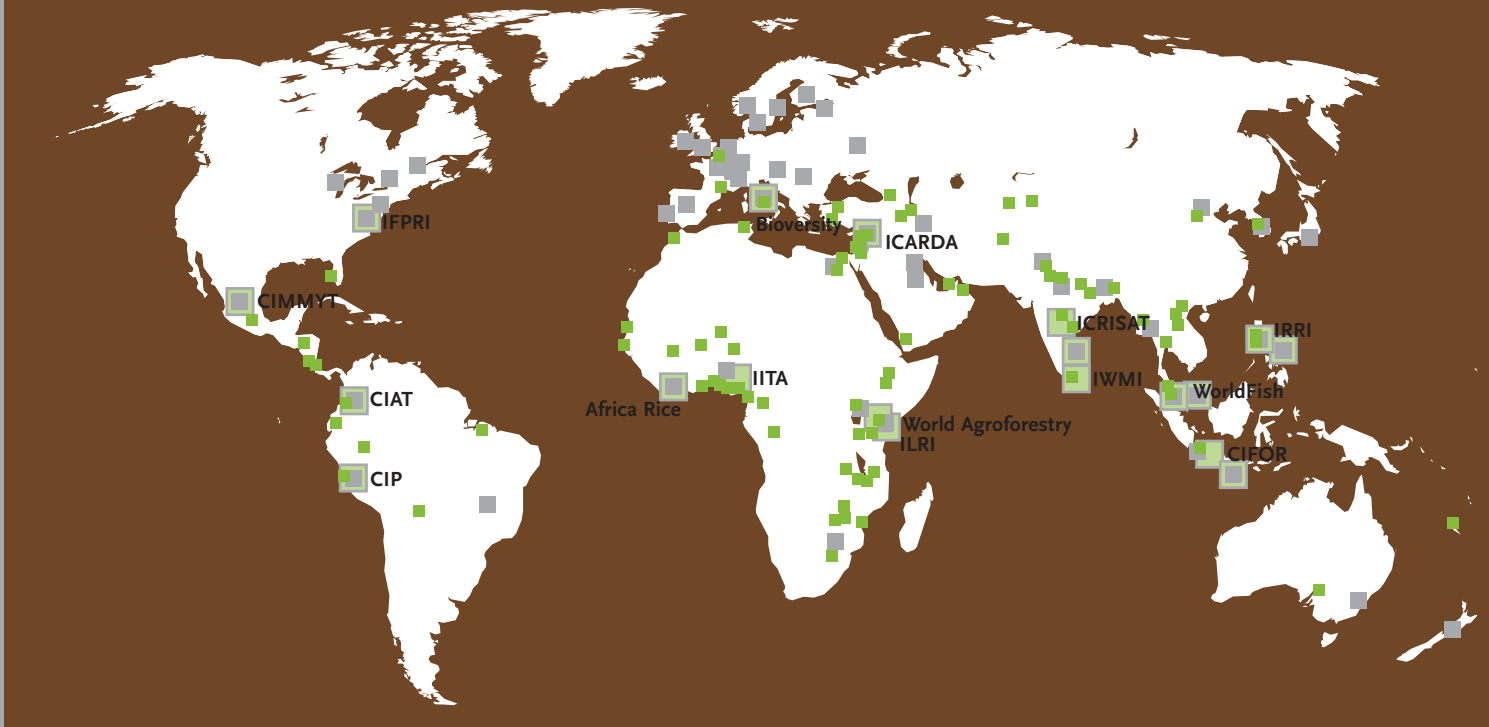
Operational supervision would be conducted by the CGIAR director and the director general of the Center that hosts the particular unit.

The SO Steering Committee determined that the four other units would be handled as follows:

- The **Science Council Secretariat** would not be included in the SO, to ensure the independence of the Science Council.
- The **Gender and Diversity Program** would be transformed into a CGIAR Systemwide Program in anticipation of the Science Council review of Systemwide and Ecoregional Programs. This would empower the work of Gender and Diversity to achieve a higher profile in the global community and enable donors to play a requisite role in governance.
- The **Strategic Advisory Service on Human Resources** will be effectively absorbed by the CGIAR Secretariat, as the SO Steering Committee requested the CGIAR Secretariat to acquire the necessary expertise to provide human resource support to System components — Centers, Challenge Programs, and Systemwide and Ecoregional Programs — from a System perspective, in collaboration with Centers' human resource management.
- The **Media Unit** would be integrated with the Information and Corporate Communications team in the CGIAR Secretariat in recognition of the importance of coherent communications across the System. Centers have committed themselves to contribute to funding activities in the communications work program.



*Passiflora auriculata* Kunth is pollinated by a honey bee in the Colombian Andes.



■ REGIONAL OFFICES ■ MEMBERS ■ CENTERS

CGIAR-SUPPORTED CENTERS

Africa Rice Center (WARDA)  
[www.warda.org](http://www.warda.org)

Bioversity International  
[www.bioversityinternational.org](http://www.bioversityinternational.org)

International Center for Tropical Agriculture (CIAT)  
[www.ciat.cgiar.org](http://www.ciat.cgiar.org)

Center for International Forestry Research (CIFOR)  
[www.cifor.cgiar.org](http://www.cifor.cgiar.org)

International Maize and Wheat Improvement Center (CIMMYT)  
[www.cimmyt.org](http://www.cimmyt.org)

International Potato Center (CIP)  
[www.cipotato.org](http://www.cipotato.org)

International Center for Agricultural Research in the Dry Areas (ICARDA)  
[www.icarda.org](http://www.icarda.org)

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)  
[www.icrisat.org](http://www.icrisat.org)

International Food Policy Research Institute (IFPRI)  
[www.ifpri.org](http://www.ifpri.org)

International Institute of Tropical Agriculture (IITA)  
[www.iita.org](http://www.iita.org)

International Livestock Research Institute (ILRI)  
[www.ilri.org](http://www.ilri.org)

International Rice Research Institute (IRRI)  
[www.irri.org](http://www.irri.org)

International Water Management Institute (IWMI)  
[www.iwmi.cgiar.org](http://www.iwmi.cgiar.org)

World Agroforestry Centre  
[www.worldagroforestrycentre.org](http://www.worldagroforestrycentre.org)

WorldFish Center  
[www.worldfishcenter.org](http://www.worldfishcenter.org)



A photograph of a woman in a purple top and patterned headwrap, smiling and holding a bundle of rice in a field. The background shows a vast green field under a cloudy sky.

EXECUTIVE SUMMARY  
2007 FINANCIALS

## A COLLABORATIVE EFFORT OF IRRI AND THE CGIAR SECRETARIAT

THE 2007 FINANCIAL RESULTS REPORTED HERE ARE BASED ON AUDITED FINANCIAL STATEMENTS OF THE 15 CENTERS AND 4 CHALLENGE PROGRAMS SUPPORTED BY THE CGIAR. THE AGGREGATION, ANALYSES AND REPORTS, INCLUDING THIS SUMMARY, WERE PRODUCED THROUGH A JOINT EFFORT OF A TEAM FROM THE INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI), COMPRISING NORMAN A. MACDONALD, MELBA M. AQUINO AND RODELITA D. PANERGALIN, AND THE CGIAR SECRETARIAT.

Members of the CGIAR support the CGIAR Centers and programs of their choice. The 2007 financial outcome<sup>1</sup> discussed here is an aggregation of the audited financial statements of the 15 Centers and the 4 Challenge Programs supported by the CGIAR. The full 2007 Financial Report is available on the accompanying CD and at the CGIAR website at [www.cgiar.org](http://www.cgiar.org).

### Overview

Total System<sup>2</sup> revenues in 2007 were \$520 million, an increase of \$72 million (16%, or 14% in real terms) from \$448 million in 2006. The improvement in revenue was driven by increases in both contributions from Members and non-members and in Center-earned income.

Contributions increased by \$69 million (16%, or 14% in real terms) to \$495 million. Of this increase, \$52 million was volume and \$17 million was foreign exchange gains on contributions not denominated in US dollars. Center-earned income increased by \$3 million (14%) to \$25 million.

Expenditure in 2007 was \$506 million, an increase of \$48 million (10%) over 2006. The net result was a surplus of \$14 million, which was added to reserves.

In comparison with the financing plan approved at the 2006 Annual General Meeting (AGM06), the actual total revenues of \$520 million are 7% higher, and the \$14 million in net surplus compares with a planned deficit of \$28 million, for an improvement over projections of \$42 million.

### Background

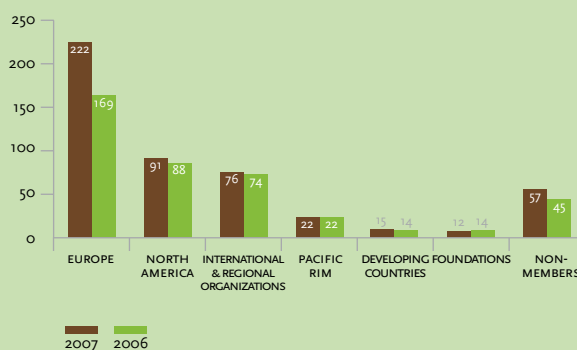
The review and aggregation of the financial statements was done in accordance with fiduciary management and reporting standards approved by the CGIAR to guide the Centers. Additional information on financial compliance is contained in Box 1.

### BOX 1 COMPLIANCE WITH FIDUCIARY GUIDELINES (FGs)

To ensure transparency and consistency in financial practices and the presentation of financial information, the 15 Centers supported by the CGIAR are required to follow financial guidelines issued by the CGIAR Secretariat. Developed with input from Center finance personnel and external experts, these guidelines aim to bring the CGIAR's fiduciary practices into conformity with relevant international standards. The most recent update (FG6) was on procurement of goods, works and services. The update of the guideline on indirect cost allocation (FG5) was recently launched.

As part of the annual review of substantive financial performance, and in keeping with practice established in 2004, a peer group of Centers' finance and internal audit professionals reviewed the Centers' externally audited 2007 financial statements to assess their compliance with CGIAR accounting policies and reporting guidelines, as well as to validate the analysis underpinning the CGIAR financial report.

FIGURE 1  
CGIAR CONTRIBUTIONS (\$ MILLION)



### Overall Financial Outcome

A summary of the CGIAR program outcome for 2007, compared with the approved and the actual outcome for 2006, is shown in Table 1. Highlights of the System's 2007 financial performance are shown in Table 4 on page 58 with comparative information for the previous 4 years.

<sup>1</sup> The outcome is reported in United States dollars.

<sup>2</sup> The CGIAR System comprises the 15 Centers supported by the CGIAR, System Offices and Challenge Programs.

**TABLE 1  
SUMMARY OF 2007 CGIAR-APPROVED PROGRAM VERSUS ACTUAL OUTCOME (\$ MILLION)**

	Actual 2007 Outcome	2007 Plan Approved at AGMo6	Actual 2006 Outcome
<b>Expenditure</b>			
Centers <sup>1</sup>	458	452	418
Challenge Programs			
Centers	31	27	29
Partners	17	34	11
<b>Total expenditure</b>	<b>506</b>	<b>513</b>	<b>458</b>
<b>Revenue</b>			
Funding			
Centers <sup>2</sup>	447	414	386
Challenge Programs			
Centers	31	27	29
Partners	17	29	11
<b>Subtotal funding</b>	<b>495</b>	<b>470</b>	<b>426</b>
Earned income	25	15	22
<b>Total revenue</b>	<b>520</b>	<b>485</b>	<b>448</b>
<b>Carried forward for future use/(Financed from reserves)</b>	<b>14</b>	<b>(28)</b>	<b>(10)</b>

<sup>1</sup> Includes System Office and CGIAR committees

<sup>2</sup> Includes System Office, CGIAR committees and unallocated Member funds

### Contributions to Centers and Programs

Of the total contributions of \$495 million, 36% was unrestricted, a decrease of 6 percentage points from 42% in 2006. Correspondingly, restricted contributions increased in 2007 to 64% from 58% in 2006. Table 5 on page 59 shows contributions to the CGIAR by source and type.

As shown in Figure 1, the increase in 2007 contributions came mainly from two Member groups: Contributions from Europe increased by \$53 million (31%), and those from non-members increased by \$12 million (27%). The increase from Europe was a special one-time additional allocation from the European Commission (EC), which brought its total contribution to \$62.4 million. The increase in contributions from non-members came mainly from the Bill & Melinda Gates Foundation, which increased its contributions by \$15.3 million.

About 17 Members made contributions in their national currencies. As these currencies strengthened against the United States dollar in 2007, translation of the contributions into US dollars resulted in an additional \$17 million. Offsetting these gains were approximately \$14 million in expenditure arising from diminished purchasing power as the US dollar weakened against other currencies of expenditure. The movement of the US dollar against selected currencies of contribution and expenditure during 2007 is shown in Table 2 on page 56.

Contributions from 15 Members accounted for 74% of funding for the research agenda in 2007. The EC, contributing \$62.4 million, ranked as the largest contributor in 2007, followed by the United States of America with \$59.5 million and the World Bank with \$50.0 million. India was the highest contributor among developing countries at \$6.7 million. The top contributors among all Members and those among developing countries in 2007 and 2006 are shown in Table 3 on page 56.

### Resource Allocation

Total CGIAR expenditure in 2007 increased by 10% to \$506 million. The following paragraphs summarize, at the System level, resource allocation by object of expenditure and by CGIAR developing region.

**Expenditure by Object.** The significant change is the share of personnel costs decreasing by 3%, with a corresponding increase in the share of the costs of supplies and services (3%), as shown in Figure 2 on page 57.

**Expenditure by Region.** Allocation of expenditure by region shows stability in 2007 and 2006, and confirms the CGIAR's focus on sub-Saharan Africa (SSA), which was allocated almost half of the System's resources.

### Center Perspectives

The contribution increase noted at the System level is the aggregate of a range of outcomes at individual

**TABLE 2  
MOVEMENT OF USD VERSUS OTHER MAJOR CURRENCIES**

**Contribution Currencies**

Currency	Currency Unit in USD		Movement*
	2006	2007	
YEN	119.00	112.35	-6%
GBP	0.52	0.50	-3%
CAD	1.09	1.08	-1%
NOK	6.23	5.42	-13%
SEK	6.85	6.40	-7%
CHF	1.22	1.13	-8%

**Expenditure Basket**

Currency	Currency Unit in USD		Movement*
	2006	2007	
EUR	0.76	0.68	-11%
COP	2,225.44	1,987.81	-11%
INR	44.25	39.42	-11%
NGN	128.27	117.97	-8%
KES	69.40	62.68	-10%
PHP	49.13	41.40	-16%

\* negative movement denotes depreciation of the USD vs the national currency  
 CAD = Canadian dollar, CHF = Swiss franc, COP = Colombian peso, EUR = euro,  
 GBP = United Kingdom pound, KES = Kenyan shilling, INR = Indian rupee,  
 NGN = Nigerian naira, NOK = Norwegian kroner, PHP = Philippines peso,  
 SEK = Swedish kroner, USD = United States dollar, YEN = Japanese yen.

**TABLE 3  
TOP MEMBER CONTRIBUTIONS (\$ MILLION)**

	2007		2006
<b>Industrialized Countries and Multilateral Organizations</b>			
European Commission	62.4	United States of America	60.7
United States of America	59.5	World Bank	50.0
World Bank	50.0	United Kingdom	44.1
United Kingdom	44.6	Canada	26.9
Canada	31.1	Netherlands	20.1
<b>Developing Countries</b>			
India	6.7	India	4.1
China	1.2	Nigeria	2.5
Kenya	0.8	Mexico	1.1
Pakistan	0.7	Turkey	1.0
Colombia	0.7	Kenya	0.9

Centers. Total contributions for 13 Centers increased in 2007 compared with 2006. IITA maintained its level of contributions in 2007 compared with 2006, and contributions to Africa Rice decreased by 8%.

Financial results (contributions plus Center-earned income, less expenditure) showed that eleven Centers (compared with five in 2006) ended the year with a surplus. As a percentage of total revenues, ICRISAT had a surplus of 11%; CIFOR, ICARDA and World Agroforestry had surpluses between 6% and 10%; and the remaining seven Centers had surpluses of 5% or less. Four Centers (CIAT, ILRI, IRRI and WorldFish) incurred deficits, all of which, except for CIAT's, were planned. IRRI's deficit was 8% of total revenues, WorldFish's was 6%, and ILRI's and CIAT's were each 4%. Figure 4 illustrates the financial results by Center.

Table 6 on page 60 provides the 2007 financial results by Center and for the System as a whole, including results for those portions of Challenge Programs implemented by partners to the CGIAR, and compares these with 2006. Table 7 on page 61 provides an overview of the System's finances (expenditure allocation and financing). Table 8 on page 62 summarizes the System's overall financial position for the 2003-2007 period.

**Summary of Challenge Programs**

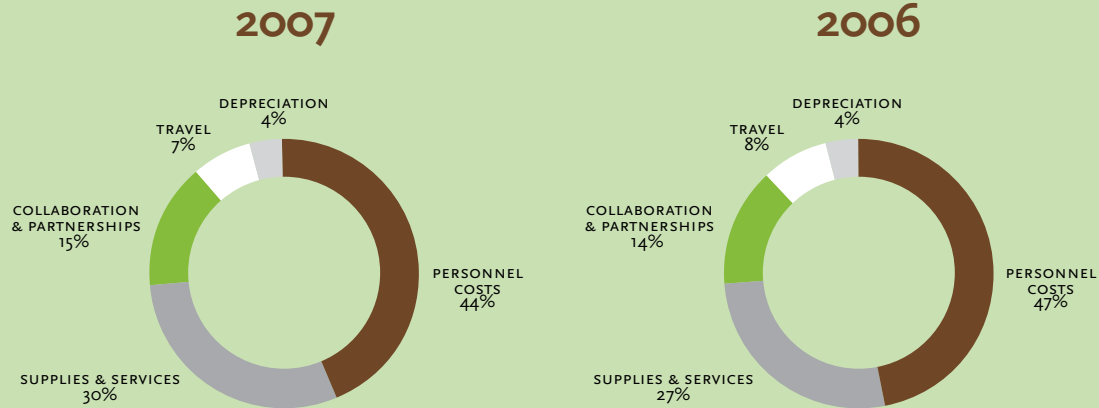
During the year, \$68 million was available for Challenge Programs, compared with \$34 million in 2006, for an increase of \$34 million (100%). The largest increase was for the Generation Challenge Programme, which received a special one-time additional allocation from the EC. In addition, the Bill & Melinda Gates Foundation made \$14 million available to HarvestPlus in 2007. Expenditure of \$48 million, compared with \$40 million in 2006, resulted in the addition of \$20 million to the cumulative balance of Challenge Program funds. Table 9 on page 63 summarizes Challenge Program funds and expenditure.

**Progress Report on Action Plans Following 2006 Financial Report**

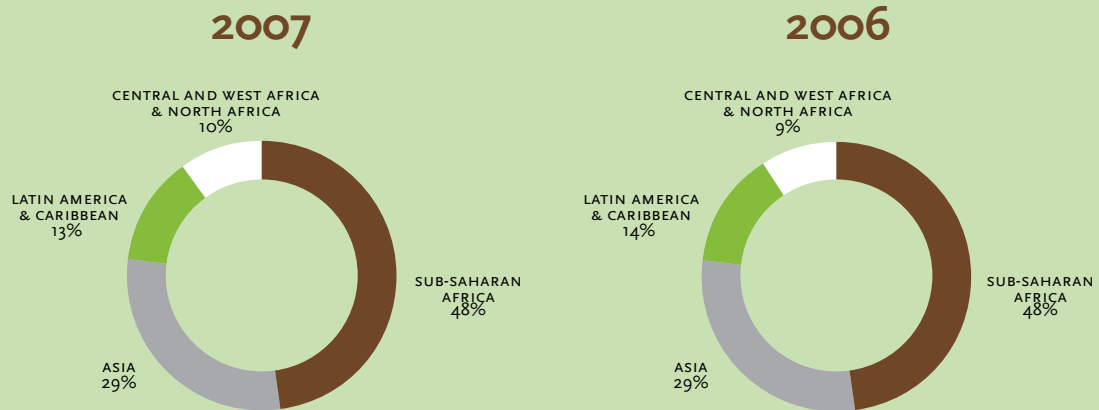
Following the review of 2006 financial indicators, the Executive Council requested five Centers to submit action plans to address deficiencies in liquidity and reserves indicators. CIAT had been cited for low liquidity relative to the CGIAR recommended benchmark of 90-120 days of operating expenditure. Bioversity, CIAT and IWMI had been cited for low reserves relative to the CGIAR recommended benchmark of 75-90 days of operating expenditure.

In 2007, Bioversity and IWMI achieved the recommended benchmark for reserves, while CIAT remained below the recommended benchmarks for both indicators.

**FIGURE 2**  
EXPENDITURE BY OBJECT



**FIGURE 3**  
EXPENDITURE BY REGION



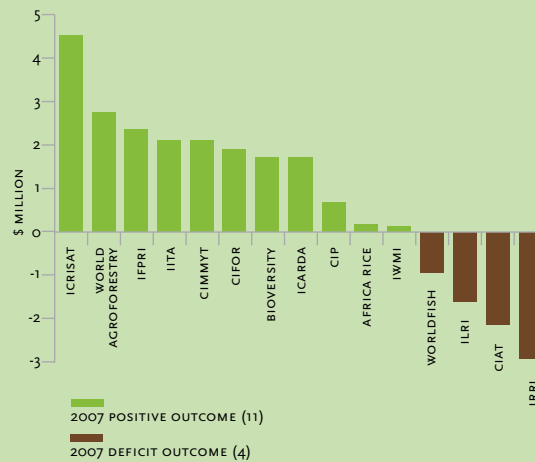
IRRI and WorldFish drew down their reserves in 2007, as recommended by the Executive Council.

**Conclusion**

Overall, the 2007 financial results showed an improvement in performance in various dimensions compared with 2006. On the downside, the continued decline of unrestricted contributions confirms the need for continued vigilance regarding financial health at both the Center and System levels.

The favorable external environment in 2007 that included volume increases and exchange gains allowed Centers to improve their financial health. However, Centers continue to carefully assess their financial strategies, including for resource mobilization, project cost recovery and reserves management.

**FIGURE 4**  
FINANCIAL RESULTS BY CENTER



**TABLE 4**  
**CGIAR PROGRAM AND RESOURCE HIGHLIGHTS**

<b>Actual</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
<b>Revenues (\$ million)</b>					
Agenda funding (of which unrestricted)	381 44%	437 45%	450 43%	426 42%	495 36%
Earned income	17	16	10	22	25
<b>Total</b>	<b>398</b>	<b>453</b>	<b>460</b>	<b>448</b>	<b>520</b>
<b>Agenda funding (\$million)</b>					
<b>Members</b>					
Europe	161	181	197	169	222
North America	76	87	91	88	91
Pacific Rim	25	26	24	22	22
Developing countries	12	17	15	14	15
Foundations	12	13	14	14	12
International and regional organizations	70	73	72	74	76
<b>Subtotal</b>	<b>356</b>	<b>397</b>	<b>413</b>	<b>381</b>	<b>438</b>
<b>Non-members</b>	<b>25</b>	<b>40</b>	<b>37</b>	<b>45</b>	<b>57</b>
<b>Total</b>	<b>381</b>	<b>437</b>	<b>450</b>	<b>426</b>	<b>495</b>
<b>Top three contributors</b>					
	USA World Bank EC	USA World Bank United Kingdom	USA World Bank United Kingdom	USA World Bank United Kingdom	EC USA World Bank
<b>Staffing (number)</b>					
Internationally recruited	1,065	1,063	1,100	1,115	1,096
Nationally recruited	6,837	6,728	6,774	7,039	6,986
<b>Total</b>	<b>7,902</b>	<b>7,791</b>	<b>7,874</b>	<b>8,154</b>	<b>8,082</b>
<b>Object of expenditure</b>					
Personnel costs	46%	45%	45%	47%	44%
Supplies & services	31%	29%	27%	27%	30%
Collaboration & partnerships	12%	14%	16%	14%	15%
Travel	7%	8%	8%	8%	7%
Depreciation	4%	4%	4%	4%	4%
<b>Total Expenditure (\$ million)</b>	<b>395</b>	<b>425</b>	<b>452</b>	<b>458</b>	<b>506</b>
<b>Expenditure by region</b>					
Sub-Saharan Africa	45%	47%	46%	48%	48%
Asia	32%	32%	30%	29%	29%
Latin America & the Caribbean	14%	12%	14%	14%	13%
Central and West Asia & North Africa	9%	9%	10%	9%	10%
<b>Result of operations [surplus/(deficit) in \$ million]</b>	<b>3</b>	<b>28</b>	<b>8</b>	<b>(10)</b>	<b>14</b>
<b>Center financial information (\$ million)</b>					
Unrestricted net assets excluding fixed assets	127	156	158	145	159
<b>Liquidity indicators</b>					
Working capital (days expenditure) <sup>1</sup>	151	164	155	149	161
Current ratio	1.8	1.9	1.9	1.8	1.7
<b>Adequacy of reserve indicator</b>					
Net assets excl. fixed assets expenditure in days	124	145	137	124	127
<b>Fixed asset indicators</b>					
Capital expenditure (\$ million)	9.7	15.5	15.8	16.8	18.7
Capital expenditure/depreciation	63%	90%	101%	107%	110%
<b>Efficiency of operations indicator</b>					
Indirect cost ratio		24%	21%	20%	20%
<b>Cash management on restricted operations</b>					
Restricted accounts receivable ratio <sup>2</sup>		0.55	0.80	0.46	0.32

<sup>1</sup> 2004 and 2005 restated to exclude investment in nonmarketable government of India bonds held by ICRISAT.

<sup>2</sup> 2004 and 2005 restated to reflect refinement of formula (accounts receivables stated net of allowance for doubtful accounts).

**TABLE 5**  
**CGIAR FUNDING BY MEMBER, 2007 (\$ MILLION)**

	Unrestricted	Restricted	Total
<b>Europe</b>			
Austria		2.9	2.9
Belgium	3.5	4.6	8.1
Denmark	2.1	0.3	2.4
European Commission		62.4	62.4
Finland	2.1	0.7	2.8
France	1.3	2.9	4.2
Germany	5.6	10.2	15.8
Ireland	5.9	2.3	8.2
Israel	0.5		0.5
Italy	4.2	2.4	6.6
Luxembourg		0.8	0.8
Netherlands	6.1	7.8	13.9
Norway	13.3	1.2	14.5
Portugal	0.8		0.8
Spain	0.2	2.0	2.2
Sweden	8.4	5.2	13.6
Switzerland	7.8	9.9	17.7
United Kingdom	23.3	21.3	44.6
<b>Subtotal</b>	<b>85.1</b>	<b>136.9</b>	<b>222.0</b>
<b>North America</b>			
Canada	12.7	18.4	31.1
United States of America	19.9	39.6	59.5
<b>Subtotal</b>	<b>32.6</b>	<b>58.0</b>	<b>90.6</b>
<b>Pacific Rim</b>			
Australia	3.8	5.8	9.6
Japan	1.7	7.3	9.0
Korea, Republic of	0.5	1.4	1.9
New Zealand	0.7	0.7	1.4
<b>Subtotal</b>	<b>6.7</b>	<b>15.2</b>	<b>21.9</b>
<b>Developing countries</b>			
Bangladesh	0.1		0.1
Brazil		0.2	0.2
China	1.2	0.01	1.2
Colombia		0.7	0.7
Egypt, Arab Republic of		0.1	0.1
India	1.0	5.7	6.7
Indonesia	0.1		0.1
Iran, Islamic Republic of	0.1	0.3	0.4
Kenya		0.8	0.8
Malaysia	0.01	0.2	0.2
Mexico		0.7	0.7
Morocco	0.5		0.5
Nigeria	0.08	0.05	0.1
Pakistan		0.7	0.7
Peru		0.3	0.3
Philippines	0.2	0.2	0.4
South Africa	0.04	0.38	0.4
Syria, Arab Republic of	0.5	0.2	0.7
Thailand	0.1		0.1
Turkey		0.4	0.4
Uganda		0.3	0.3
<b>Subtotal</b>	<b>3.9</b>	<b>11.2</b>	<b>15.1</b>
<b>Total Member Countries</b>	<b>128.3</b>	<b>221.3</b>	<b>349.6</b>
<b>Foundations</b>			
Ford Foundation		0.8	0.8
IDRC		4.6	4.6
Kellogg Foundation		0.6	0.6
Rockefeller Foundation		5.0	5.0
Syngenta Foundation		0.6	0.6
<b>Subtotal</b>		<b>11.6</b>	<b>11.6</b>
<b>International and regional organizations</b>			
ADB		3.7	3.7
AfDB		0.02	0.02
Arab Fund		1.3	1.3
FAO	0.8	2.1	2.9
Gulf Cooperation Council		0.6	0.6
IDB		1.1	1.1
IFAD		8.6	8.6
OPEC Fund		0.5	0.5
UNDP		0.8	0.8
UNEP		6.7	6.7
World Bank	50.0		50.0
<b>Subtotal</b>	<b>50.8</b>	<b>25.4</b>	<b>76.2</b>
<b>Total Organizations</b>	<b>179.1</b>	<b>258.3</b>	<b>437.4</b>
Non-members	0.1	57.3	57.4
<b>Grand Total</b>	<b>179</b>	<b>316</b>	<b>495</b>

**TABLE 6**  
**FINANCIAL RESULTS BY CENTER (\$ MILLION)**

Center	2007					2006				
	Agenda funding	Earned income	Total revenue	Expenditure	Result	Agenda funding	Earned income	Total revenue	Expenditure	Result
Africa Rice	10.2	0.2	10.4	10.3	0.2	11.1	0.4	11.5	11.2	0.3
Bioversity	39.0	0.3	39.3	37.6	1.7	31.2	0.9	32.2	34.6	(2.4)
CIAT	45.1	1.7	46.8	48.9	(2.1)	36.5	1.4	37.9	41.8	(3.9)
CIFOR	18.2	0.6	18.8	16.9	1.9	15.7	0.5	16.2	16.5	(0.3)
CIMMYT	43.3	2.6	45.9	43.9	2.1	36.0	1.8	37.8	37.4	0.4
CIP	26.0	0.8	26.8	26.1	0.6	22.3	0.6	22.9	22.9	0.0
ICARDA	27.7	1.1	28.8	27.1	1.7	24.4	1.6	26.0	27.0	(1.0)
ICRISAT	37.4	4.9	42.3	37.8	4.5	32.3	2.9	35.2	34.0	1.2
IFPRI	46.4	1.7	48.1	45.7	2.4	37.2	0.9	38.1	39.1	(1.0)
IITA	45.1	1.7	46.8	44.7	2.1	45.1	1.4	46.5	44.4	2.1
ILRI	35.2	3.8	39.0	40.6	(1.6)	26.7	3.9	30.6	34.8	(4.2)
IRRI	32.5	2.3	34.8	37.7	(2.9)	27.7	3.9	31.6	33.3	(1.7)
IWMI	23.5	0.6	24.1	24.0	0.1	20.0	0.5	20.5	20.6	(0.1)
World Agroforestry	31.5	1.6	33.1	30.4	2.7	29.9	1.2	31.1	31.9	(0.8)
WorldFish	15.1	1.2	16.4	17.3	(0.9)	14.8	0.4	15.2	15.5	(0.3)
<b>Subtotal</b>	<b>476.2</b>	<b>25.1</b>	<b>501.4</b>	<b>489.0</b>	<b>12.4</b>	<b>410.9</b>	<b>22.3</b>	<b>433.3</b>	<b>445.0</b>	<b>(11.7)</b>
System level										
System Office and committees	12.3		12.3	12.3		9.3		9.3	9.3	
Advance	(2.0)		(2.0)	(2.0)		(1.9)		(1.9)	(1.9)	
Unallocated Member funding	1.7 <sup>2</sup>		1.7 <sup>2</sup>		1.7 <sup>2</sup>	0.7 <sup>1</sup>		0.7 <sup>1</sup>		0.7 <sup>1</sup>
Additional Challenge Program funds										
Subtotal	12.0		12.0	10.3	1.7	9.6		9.6	7.4	2.2
Less inter-Center activities <sup>3</sup>	(10.2)		(10.2)	(10.2)		(5.6)		(5.6)	(5.6)	
<b>Subtotal System level</b>	<b>1.8</b>		<b>1.8</b>	<b>0.1</b>	<b>1.7</b>	<b>4.0</b>		<b>4.0</b>	<b>1.8</b>	<b>2.2</b>
<b>Total</b>	<b>478.0</b>	<b>25.1</b>	<b>503.2</b>	<b>489.0</b>	<b>14.1</b>	<b>414.9</b>	<b>22.3</b>	<b>437.3</b>	<b>446.9</b>	<b>(9.5)</b>
Plus Challenge Program partners <sup>4</sup>	16.5		16.5	16.5		11.3		11.3	11.3	
<b>Total CGIAR Program</b>	<b>495</b>	<b>25</b>	<b>520</b>	<b>506</b>	<b>14</b>	<b>426</b>	<b>22</b>	<b>448</b>	<b>458</b>	<b>(10)</b>

<sup>1</sup> From Italy, Brazil and Morocco.

<sup>2</sup> From Morocco, Israel, Portugal and China.

<sup>3</sup> Inter-Center activities netted out at the System, not Center, level to maintain the integrity of Center accounts.

<sup>4</sup> Challenge Program components implemented by partners to the CGIAR.



**TABLE 7**  
**CENTER FINANCES, 2007 (\$ MILLION)**

Center	Expenditure allocation						Financing											
	Personnel	Supplies & services	Collaboration & partnerships	Travel	Depreciation	Total	Member funding										Reserves	
							Europe	North America	Pacific rim	Developing countries	Foundations	Intl & regnl organizations	Non-members	Inter-Center activities	Total funding	Earned income	Addition/ (Draw)	
Africa Rice	5.5	2.8	0.8	0.6	0.6	10.3	3.8	1.5	1.6	0.4	0.3	2.1	0.5		10.3	0.2	0.2	
Bioversity	19.5	9.2	6.5	1.9	0.5	37.6	23.8	1.6	1.0	0.7	0.3	9.1	1.7	0.8	39.1	0.3	1.7	
CIAT	18.8	17.6	7.5	3.5	1.5	48.9	17.8	9.8	1.0	0.9	2.7	6.9	5.2	0.8	45.1	1.7	(2.1)	
CIFOR	8.2	2.6	4.8	1.0	0.3	16.9	11.1	1.7	0.9	0.1	1.1	1.8	1.4	0.1	18.2	0.6	1.9	
CIMMYT	19.6	12.7	7.6	2.2	1.8	43.8	13.4	8.0	3.4	1.6	1.8	5.6	9.3	0.2	43.3	2.6	2.1	
CIP	10.6	8.6	3.9	2.0	1.0	26.1	11.2	4.6	0.9	0.6	0.8	2.7	3.4	1.8	26.0	0.8	0.6	
ICARDA	11.1	9.5	2.3	2.8	1.4	27.1	10.6	4.2	1.4	2.4	0.4	7.2	0.6	0.9	27.7	1.1	1.7	
ICRISAT	18.6	12.2	2.1	3.2	1.7	37.8	13.6	6.2	1.3	3.8	0.9	6.1	4.3	1.2	37.4	4.9	4.5	
IFPRI	19.5	8.0	13.9	3.6	0.7	45.7	20.0	10.4	0.9	0.3	0.5	5.2	7.4	1.7	46.4	1.7	2.4	
IITA	19.4	14.1	7.2	2.7	1.3	44.7	15.8	17.5	0.4	0.4	0.7	4.1	5.7	0.5	45.1	1.7	2.1	
ILRI	17.8	14.8	4.0	2.4	1.7	40.6	16.9	10.1	0.6	0.5	0.3	2.9	2.9	1.0	35.2	3.8	(1.6)	
IRRI	15.5	12.1	4.9	2.9	2.3	37.7	13.6	4.7	5.6	1.2	0.7	5.0	1.7	0.0	32.5	2.3	(2.9)	
IWMI	11.8	7.9	1.6	1.8	0.8	24.0	16.1	2.1	1.0	0.6	0.1	2.2	0.7	0.7	23.5	0.6	0.1	
World Agroforestry	12.5	9.0	4.2	3.6	1.0	30.4	14.0	5.4	0.5	0.2	1.1	3.8	6.0	0.5	31.5	1.6	2.6	
WorldFish	8.5	4.1	2.5	1.8	0.4	17.3	8.2	2.0	1.3	0.3		2.5	0.8	0.0	15.1	1.2	(0.9)	
<b>Subtotal</b>	<b>216.9</b>	<b>145.0</b>	<b>74.0</b>	<b>36.0</b>	<b>17.0</b>	<b>488.9</b>	<b>209.9</b>	<b>89.8</b>	<b>21.8</b>	<b>14.0</b>	<b>11.7</b>	<b>67.2</b>	<b>51.6</b>	<b>10.2</b>	<b>476.2</b>	<b>25.1</b>	<b>12.4</b>	
<b>System level</b>																		
System Office and Committees						12.3	1.2	0.1				11.0			12.3			
Advance						(2.0)						(2.0)			(2.0)			
Unallocated Member funding <sup>1</sup>							0.7			1.0					1.7		1.7	
<b>Subtotal</b>						<b>10.3</b>	<b>1.9</b>	<b>0.1</b>		<b>1.0</b>		<b>9.0</b>			<b>12.0</b>		<b>2</b>	
Less inter-Center activities						(10.2)									(10.2)			
<b>Subtotal System level</b>		<b>0.1</b>				<b>0.1</b>	<b>1.9</b>	<b>0.1</b>		<b>1.0</b>		<b>9.0</b>			<b>1.8</b>		<b>2</b>	
<b>Total</b>	<b>216.9</b>	<b>145.1</b>	<b>74.0</b>	<b>36.0</b>	<b>17.0</b>	<b>489.2</b>	<b>211.8</b>	<b>89.9</b>	<b>21.8</b>	<b>15.0</b>	<b>11.7</b>	<b>76.2</b>	<b>51.6</b>		<b>478.0</b>	<b>25.1</b>	<b>14.1</b>	
Plus Challenge Program partners <sup>2</sup>	7.3	4.9	2.5	1.2	0.6	16.5	10.1	0.6			0.1	0.1	5.7		16.6			
<b>Total CGIAR Program</b>	<b>224</b>	<b>150</b>	<b>77</b>	<b>37</b>	<b>18</b>	<b>506</b>	<b>222</b>	<b>91</b>	<b>22</b>	<b>15</b>	<b>12</b>	<b>76</b>	<b>57</b>		<b>495</b>	<b>25</b>	<b>14</b>	

<sup>1</sup> From Morocco, Israel, Portugal and China.

<sup>2</sup> Challenge Program components implemented by partners to the CGIAR.

**TABLE 8**  
**CGIAR SYSTEM FINANCIAL POSITION (\$ THOUSANDS)**

	2003	2004	2005	2006	2007
<b>Assets</b>					
<b>Current assets</b>					
Cash and cash equivalents	201,662	237,047	221,853	255,899	329,054
Accounts receivable					
Members	87,768	69,717	83,907	56,363	65,101
Employees	2,797	3,594	4,105	4,726	3,727
Others	14,527	17,147	22,280	20,952	26,689
Inventories	4,165	4,540	4,593	6,001	5,539
Pre-paid expenses	3,262	2,994	3,401	3,140	4,063
Other current assets	4,567	16,924	6,580	943	1,812
<b>Total current assets</b>	<b>318,748</b>	<b>351,963</b>	<b>346,719</b>	<b>348,024</b>	<b>435,985</b>
<b>Noncurrent assets</b>					
Net property, plant and equipment	79,585	78,433	77,869	78,277	76,177
Investments	37,838	34,985	46,642	41,020	52,819
Others assets		3,012	1,223	7,076	6,748
<b>Total noncurrent assets</b>	<b>117,423</b>	<b>116,430</b>	<b>125,734</b>	<b>126,373</b>	<b>135,744</b>
<b>Total assets</b>	<b>436,171</b>	<b>468,393</b>	<b>472,453</b>	<b>474,397</b>	<b>571,729</b>
<b>Liabilities and net assets</b>					
<b>Current liabilities</b>					
Accounts payable					
Members	110,925	115,904	119,497	112,065	172,599
Employees	13,805	12,435	14,514	19,024	19,727
Others	47,181	49,216	44,430	49,254	63,378
Accruals and provisions	28,925	24,294	24,086	25,938	30,563
<b>Total current liabilities</b>	<b>200,836</b>	<b>201,849</b>	<b>202,527</b>	<b>206,281</b>	<b>286,267</b>
<b>Long-term liabilities</b>	<b>25,876</b>	<b>30,486</b>	<b>31,897</b>	<b>42,383</b>	<b>48,016</b>
<b>Total liabilities</b>	<b>226,712</b>	<b>232,335</b>	<b>234,424</b>	<b>248,664</b>	<b>334,283</b>
<b>Net assets</b>					
<b>Unrestricted</b>					
Unrestricted net assets excl. fixed assets	126,820	155,539	157,966	145,088	158,867
Fixed assets	79,585	78,433	77,869	78,277	76,177
<b>Unrestricted net assets</b>	<b>206,405</b>	<b>233,972</b>	<b>235,835</b>	<b>223,365</b>	<b>235,044</b>
<b>Restricted</b>	<b>3,054</b>	<b>2,086</b>	<b>2,194</b>	<b>2,368</b>	<b>2,402</b>
<b>Total net assets</b>	<b>209,459</b>	<b>236,058</b>	<b>238,029</b>	<b>225,733</b>	<b>237,446</b>
<b>Total liabilities and net assets</b>	<b>436,171</b>	<b>468,393</b>	<b>472,453</b>	<b>474,397</b>	<b>571,729</b>

**TABLE 9**  
**SUMMARY OF CHALLENGE PROGRAMS, 2007 (\$ MILLIONS)**

<b>Funds Available</b>	<b>HarvestPlus</b>		<b>Water &amp; Food</b>		<b>Generation</b>		<b>SSA</b>		<b>Total</b>	
ADB	0.2								0.2	
Bill & Melinda Gates Foundation	14.4				3.5				17.9	
European Commission			3.9		12.1		2.6		18.6	
Italy							0.6		0.6	
IFAD			0.3						0.3	
Netherlands			1.8						1.8	
Norway			0.3						0.3	
Pioneer					0.02				0.02	
Rockefeller Foundation					0.3				0.3	
Sweden	0.1		0.1		0.1				0.3	
Switzerland			1.2		0.4				1.6	
Syngenta Foundation					0.03				0.03	
United Kingdom	1.0		7.5		5.1		4.1		17.6	
USA	1.9								1.9	
World Bank	2.0		2.0		2.0		0.5		6.5	
<b>Total</b>	<b>19.6</b>		<b>17.1</b>		<b>23.5</b>		<b>7.8</b>		<b>68.0</b>	

<b>Expenditure</b>	<b>HarvestPlus</b>		<b>Water &amp; Food</b>		<b>Generation</b>		<b>SSA</b>		<b>Total</b>	
	Center	Others	Center	Others	Center	Others	Center	Others	Center	Others
Bioversity	0.1				0.7		0.3		1.1	
CIAT	1.6		1.1		0.8		0.1		3.6	
CIMMYT	1.1		0.5		3.9				5.5	
CIP	0.6		0.1		0.7				1.4	
ICARDA	0.1		0.6		0.3				1.0	
ICRISAT	0.3		0.5		0.7				1.5	
IFPRI	3.3		0.3						3.6	
IITA	0.7				0.3		0.9		1.9	
ILRI			0.2						0.2	
IRRI	0.8		3.1		1.5				5.4	
IWMI			4.9						4.9	
World Agroforestry			0.05						0.05	
WorldFish			1.1						1.1	
<b>Subtotal</b>	<b>8.6</b>	<b>5.5</b>	<b>12.4</b>	<b>2.4</b>	<b>8.9</b>	<b>7.1</b>	<b>1.3</b>	<b>1.5</b>	<b>31.2</b>	<b>16.5</b>
<b>Total</b>	<b>14.1</b>		<b>14.8</b>		<b>16.0</b>		<b>2.8</b>		<b>47.7</b>	
<b>2007 Balance</b>	<b>5.5</b>		<b>2.3</b>		<b>7.5</b>		<b>5.0</b>		<b>20.3</b>	
<b>2006 Cumulative balance</b>	<b>11.1</b>		<b>2.1</b>		<b>9.2</b>		<b>2.9</b>		<b>25.3</b>	
<b>Cumulative balance</b>	<b>16.6</b>		<b>4.4</b>		<b>16.7</b>		<b>7.9</b>		<b>45.6</b>	

A man wearing a blue cap and a dark jacket is walking through a doorway, carrying a large bundle of leafy green vegetables. The scene is set in a rustic, traditional building with wooden walls and a thatched roof. The doorway is framed by dark wood, and the interior is dimly lit, contrasting with the bright outdoor light. A large woven basket sits on the ground to the left of the man. The background shows a lush, green landscape with trees and a distant mountain range. The text "WHO'S WHO" is overlaid in white, bold, sans-serif font across the middle of the image.

WHO'S WHO

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AB	Alliance Board (board chairs of Centers supported by the CGIAR)	GCP	Generation Challenge Programme of the CGIAR
ADB	Asian Development Bank	GIS	geographic information system
AE	Alliance Executive (directors general of Centers supported by the CGIAR)	GRPC	Genetic Resources Policy Committee of the CGIAR
AfDB	African Development Bank	HIV	Human immunodeficiency virus
AGM	Annual General Meeting of the CGIAR	IAR4D	integrated agricultural research for development
AIDS	acquired immunodeficiency syndrome	ICAR	Indian Council of Agricultural Research
ARC	Agricultural Research Center, Egypt	ICARDA	International Center for Agricultural Research in the Dry Areas, Syria
ARD	Agricultural research and development	ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, India
AREEO	Agricultural Research, Extension and Education Organization, Islamic Republic of Iran	ICT-KM	information and communication technologies and knowledge management
ASB	Alternative to Slash and Burn Partnership for the Tropical Forest Margins	IDB	Inter-American Development Bank
BBC	British Broadcasting Network	IDRC	International Development Research Centre
CAPRI	Systemwide Program on Collective Action and Property Rights of the CGIAR	IFAD	International Fund for Agricultural Development
CGIAR	Consultative Group on International Agricultural Research	IFAR	International Fund for Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical International (International Center for Tropical Agriculture), Colombia	IFPRI	International Food Policy Research Institute, United States
CIFOR	Center for International Forestry Research, Indonesia	IITA	International Institute of Tropical Agriculture, Nigeria
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo (International Maize and Wheat Improvement Center), Mexico	ILRI	International Livestock Research Institute, Kenya and Ethiopia
CIP	Centro Internacional de la Papa (International Potato Center), Peru	INRA	Institut national de la recherche agronomique (National Agricultural Research Institute), Morocco
CLAYUCA	Latin American and Caribbean Consortium to Support Cassava Research and Development	IRS	internationally recruited staff
CNN	Cable News Network	IRRI	International Rice Research Institute, Philippines
CPWF	Challenge Program on Water and Food of the CGIAR	ISO	International Standards Organization
CSI	Consortium for Spatial Information of the CGIAR	ITAS	Exporters' Union Seed and Research Company, Turkey
CSO	civil society organization	IWMI	International Water Management Institute, Sri Lanka
CWANA	Central and West Asia and North Africa	IWRM	international water resources management
DAC	Development Assistance Committee of OECD	NGO	nongovernmental organization
DANIDA	Danish International Development Agency	OPEC	Organization of Petroleum Exporting Countries
DEC	developing and emerging countries	PDSR	participatory disease surveillance and response
DNA	deoxyribonucleic acid	PEN	Poverty and Environment Network of CIFOR
EC	European Commission	REDD	reducing emissions from deforestation and degradation in developing countries
EIARD	European Initiative on International Agricultural Research for Development	RYMV	rice yellow mottle virus
Embrapa	Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Corporation)	SGRP	Systemwide Genetic Resources Programme of the CGIAR
ESSP	Earth System Science Partnership	SO	System Office of the CGIAR
ExCo	Executive Council of the CGIAR	SPIA	Standing Panel on Impact Assessment of the CGIAR
FAO	Food and Agriculture Organization	SPME	Standing Panel on Monitoring and Evaluation of the Science Council of the CGIAR
FARA	Forum for Agricultural Research in Africa	SSA-CP	Sub-Saharan Africa Challenge Program of the CGIAR
FG	fiduciary guideline	UK	United Kingdom
		UNDP	United Nations Development Programme
		UNEP	United Nations Environment Programme
		US, USA	United States of America
		WARDA	Africa Rice Center

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