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CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

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Understanding and Containing Global Food Price Inflation

In recent months, dramatic increases in basic cereal prices have aroused intense concern about world agriculture and about the impact of food price inflation on poor consumers in developing countries.

While seeming to burst onto the world scene quite suddenly, the problem has been a long time in the making, as a result of burgeoning demand and slower growth in yields. Since 2000, the price of wheat in the international market has more than tripled, while maize prices have more than doubled over that period. The price of rice, after rising steadily through 2007, then jumped sharply in the first quarter of 2008, up 75% from the previous year. Ongoing trends and new factors have now converged to create this new global food equation, or “perfect storm” as *Science* magazine put it recently.

The cruel reality for poor households

Behind the graphs depicting those trends, a cruel reality is taking shape in millions of desperately poor households. For a family of five living on just US$1 per person per day, a doubling of food prices effectively cuts $1.50 out of their $5 daily budget. That leaves the family no choice but to consume less food and lower the quality of their diet. As nutrition deteriorates and access to services such as health care and education diminishes, the family’s prospects for overcoming hunger and poverty become more remote than ever.

And that isn’t the lot of just an unfortunate few. About 880 million people fall in the category described above, and 2.1 billion, nearly a third of humanity, fair little better, living on less than US$2 a day. According to World Bank President Robert Zoellick, food price inflation could push at least 100 million more people into poverty, wiping out all the gains the poorest billion have made during almost a decade of economic growth.

The CGIAR on high alert

Soaring food prices have put the CGIAR on high alert, and the international research Centers it supports are responding vigorously on several fronts.

In December 2007 at the CGIAR’s 2007 Annual General Meeting in Beijing, the International Food Policy Research Institute (IFPRI) presented a report entitled *The World Food Situation: New Driving Forces and Required Actions*, which examines the factors behind rising prices. It describes how income and population growth, climate change, high energy prices, economic globalization and urbanization have all combined to transform food production, markets and consumption. The IFPRI also report offers a set of policy recommendations designed to stave off the worse consequences of food price inflation for poor consumers.

Particularly urgent is government action to expand “safety net” programs, involving food or income transfers. These must be targeted to the poorest people in both urban and rural areas, with emphasis on protecting the nutrition of young children.

A second recommendation is for developed countries to eliminate subsidies on domestic biofuel production, which have distorted world food markets and acted as a sort of tax on staple foods. According to IFPRI calculations, a moratorium on biofuel production in developed countries through 2008 would ease corn prices by 20 percent and wheat prices by 10 percent. The report also advocates that developed countries eliminate agricultural trade barriers, thus creating a more level playing field for developing-country farmers and giving them stronger incentives to boost production.

Finally, to promote growth in agricultural productivity over the longer term, developing countries should greatly increase their investment in agricultural research and extension, rural infrastructure and market access for poor farmers. In recent years, gains in agricultural productivity have fallen to 1-2 percent per year, well short of the 3-5 percent growth rate needed to keep pace with food demand, which is expected to double by 2030. A key requirement for boosting productivity growth is to invest in research aimed at preserving and making better use of diverse genetic resources for crop and animal improvement.

What agricultural research can do

The International Rice Research Institute (IRRI) has also spoken out strongly, specifically on the rice crisis emerging in Asia, as reflected in numerous high-profile media stories. Closely examining the causes and consequences of the crisis, IRRI has emphasized the need for renewed commitment to the development and dissemination of improved technologies. This, it insists, is the “only viable long-term solution for . . . ensuring that affordable rice is available to poor consumers.”

Though there are no “silver bullets,” many technologies already available could make a difference in boosting supplies of rice and other staples. In some regions, especially of sub-Saharan Africa, the yield potential of improved varieties already in use far exceeds actual performance. To exploit such obvious opportunities for achieving yield gains,, the world community must invest now and over the long term in problem-solving agricultural research. Among the options that should be exploited much more actively are a wide array of higher yielding, stress-resistant varieties of all of the major staples and improved practices for reducing crop losses after harvest. In addition, effective approaches have been developed (such as reduced tillage for South Asia’s rice-wheat system) that permit far more efficient management of agricultural systems.

This is not to say, though, that the basket of options current available is entirely adequate to the tasks at hand. Food price inflation, together with climate change, clearly signal that even more productive and resilient crop varieties must be developed through accelerated study and use of the many thousands of samples of plant genetic resources (including wild plants related to crops) stored in CGIAR and other genebanks. Investment in such research will result in technologies that serve the dual purpose of both abating hunger and helping farmers cope with the impacts of global climate change. Many of the traits required to increase crop productivity in poor rural communities, such as drought and flood tolerance, are also those needed to confront climate change.

Technological innovation, in combination with policy reforms, is a formula that has worked well in the past. According to the *World Development Report 2008*, investment in agricultural research “has paid off handsomely,” delivering an average rate of return of 43 percent in 700 projects evaluated in developing countries. Global public goods developed by the CGIAR Centers, in collaboration with many national partners, have contributed importantly to that success.

In the 1960s and 1970s, the Centers set in motion the Green Revolution, which led to spectacular advances in agricultural production, particularly in South Asia. Those in turn contributed to steadily declining food prices through the end of the 20 th century. Since the early 1990s, the Centers have devised whole new generations of technologies, with the aim of achieving sustainable intensification of crop production, based on prudent management of natural resources, especially soil, water and biodiversity.

Those approaches should have been implemented more vigorously years ago, but it is by no means too late. Perhaps, a major food crisis, combined with the ominous threat of global climate change, will be enough to finally concentrate our minds, efforts and resources on the vital task of achieving sustainable agricultural development.

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Conservation Crossroads

Crop science and global food security stand at an historic crossroads. This may one day be remembered as the time when the world followed the right road, finally ensuring that people could use crop diversity to improve their lives far into the future.

The journey started at the Rio Earth Summit in 1992, which adopted the Convention on Biological Diversity. Ironically, recognition of the importance of biodiversity for the world's future grew in tandem with countries' reluctance to share that biodiversity. Heretofore considered the common heritage of humanity, crop germplasm had been exchanged easily and largely without restriction. The Convention changed all that with its assertion of national sovereignty over biodiversity. Newly aware of the value of their biodiversity, and often unversed regarding the special nature of agricultural biodiversity, some countries began to limit access.

At the same time, the renegotiation of the 1983 International Undertaking on Plant Genetic Resources was getting under way at the Food and Agriculture Organization (FAO) of the United Nations. This was both to bring it in line with the Convention and to address the disposition of collections in the genebanks of the Centers supported by the CGIAR. Although these collections are generally counted among the world's most important, they fell outside of the Convention insofar as the Centers could not sign it. The Centers had, however, signed temporary agreements with FAO in 1994 to place the collections in trust for the world community. The permanent status of the collections would have to be determined in the context of the International Treaty on Plant Genetic Resources for Food and Agriculture, which was to succeed the Undertaking.

After 7 years of difficult negotiations, the new Treaty was adopted in November 2001 and entered into force in June 2004. A central plank is the so-called Multilateral System designed to facilitate parties' access to plant diversity for food and agriculture, while allowing the fair sharing of benefits arising from its use. The Multilateral System covers about 64 crops and forages, including the plants providing 80% of the calories consumed by humans. The Governing Body of the Treaty, composed of the countries that have ratified it, set out the conditions for access and benefit sharing under the Multilateral System in a binding contract: the Standard Material Transfer Agreement (SMTA). New, permanent agreements to replace the 1994 FAO-Center agreements and confirm the in-trust status of the collections held by CGIAR Centers were signed in 2006. Most Centers started using the SMTA on 1 January 2007. By 1 August, the Centers had distributed nearly 98,000 samples of crops in the Multilateral System. The Centers also agreed to distribute the products of their own research under the SMTA, significantly boosting the range of materials available to the Multilateral System.

Meanwhile, in 1996, 150 countries adopted the first Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, which lists 20 agreed priority activities. Significantly, it calls for a rational global system of conservation and use based on the principles of effectiveness, efficiency and transparency. It urged countries to consider the benefits of multilateral cooperation and of sharing roles and responsibilities in the conservation and use of crop diversity.

Another important parallel development was the decision to establish the Global Crop Diversity Trust, a

permanent funding mechanism for *ex situ* conservation. The goal of the Trust is to promote and support the development of a global system for conservation and use and to financially back the operations of key elements of that system. The Trust is essential to funding the Treaty in line with a technical blueprint provided by the Global Plan of Action, in particular its call for a rational global system.

While no firm agreement defines the boundaries of such a system, significant progress has been made in advancing the sort of collaborative arrangements that may one day lie at its heart. The Trust supports a massive regeneration exercise now getting under way, as well as a comprehensive global information system that will allow genebanks worldwide to be searched for traits to combat new diseases and cope with climate change — a sure stimulus for international cooperation.

Building a rational global system for conserving and using crop diversity remains an uphill battle. How it will function, and how it will be monitored and its impact measured, have yet to be determined. The CGIAR Centers strongly support its development and implementation based on the principles of collaboration and cost effectiveness.

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Interview

David E. Williams, Coordinator of the CGIAR System-wide Genetic Resources Program.

Q: After adoption of the Convention on Biological Diversity (CBD) at the Earth Summit in 1992, as countries began regulating access to plant genetic resources, what overall effect did this have on the use of genetic resources for rural development?

DEW: The tragic irony of the CBD was that it significantly decreased international access to genetic resources and their benefits. Of course, that was hardly the intention. Many developing countries rushed to adopt policies and implement legislation to “protect” their sovereignty over their genetic resources. But they soon found themselves in the uncomfortable position of being unable to adequately conserve and sustainably use their local varieties, while at the same time blocking international efforts to help with these key tasks. As a result, native crop varieties and related wild species have been gradually but permanently lost due to replacement by introduced varieties, deforestation and other changes in land use. Often, this has happened before those unique varieties and wild relatives could be conserved and studied. Such materials are, by their nature, genetically diverse. They are invaluable raw materials for local development of varieties that address the needs of poor farmers and national markets.

Q: In what ways have developing countries progressed toward implementation of the 20 priority activities called for by the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture?

DEW: The priority activities of the Global Plan of Action were adopted by 150 countries more than 10 years ago. They remain the best technical guidelines for national action in conserving and using plant genetic resources. Some developing countries chose to wait for the arrival of external funding before taking action. Many others have undertaken their own activities, while also taking part in internationally funded projects and in regional genetic resources networks. The new International Treaty on Plant Genetic Resources for Food and Agriculture will strengthen countries’ ability to obtain national and international support for activities outlined in the Global Plan of Action. More and more developing countries are becoming parties to the Treaty. They form part of the new multilateral system for exchanging genetic resources and sharing the benefits.

Q: What do you imagine will be the main elements of a new global system for crop diversity conservation and use?

DEW: The new global system will involve a broad spectrum of actors worldwide. So, at this early stage, it’s difficult to predict what the exact structure will be. And obviously, the global system will have to evolve over time as more and more stakeholders are engaged. Yet, some fundamental elements are already in place that will be indispensable for the success of this ambitious initiative. The Global Plan of Action will serve as the technical blueprint. The International Treaty and its multilateral system for equitable exchange of genetic resources provide us with the political framework. And the large in-trust collections, maintained as global public goods in the genebanks of the CGIAR Centers, will provide the infrastructural foundation for global research, conservation and distribution. This will better enable

national organizations to focus their efforts on issues that are priorities for them. Another key element is information. We already have SINGER, the System-wide Information Network for Genetic Resources. It links information on all of the collections held by the CGIAR Centers, offering easy access online through a single entry point. The CGIAR is now updating SINGER's structure and expanding its capacity to include data from other genebanks, including national genebanks. This is being done under the auspices of the SGRP, the System-wide Genetic Resource Programme, and with support from the Global Crop Diversity Trust. The idea is to make SINGER a truly comprehensive global information resource that facilitates the documentation, exchange and management of genetic resources worldwide.

Q: How has the Global Crop Diversity Trust contributed so far to building the new global system?

DEW: The Trust is still in the process of obtaining funds needed to reach its endowment goal. Nonetheless, it has already begun providing grants for strategic activities, with the express purpose of building the global system for plant genetic resources. Aside from the work I already mentioned on global information, the Trust has awarded grants to CGIAR genebanks to help sustain the maintenance of the in-trust collections in perpetuity. Other grants are being awarded to regenerate, duplicate for safety and evaluate unique and endangered germplasm collections, mostly held in small genebanks in developing countries. In supporting those activities, the Trust collaborates closely with the Secretariat of the International Treaty, national organizations, regional networks and with the CGIAR, including both the SGRP and individual Centers.

Q: What role could the SGRP and individual CGIAR Centers play in the new global system?

DEW: The CGIAR Centers must play a central role in the creation and operation of the global system. They are guardians of the in-trust collections and have a mandate to use them for combating hunger and poverty and protecting the environment. The global system will enable the Centers to do that job more effectively by making the complementarity of their efforts with those of other organizations far more explicit. This will also enable the CGIAR to interact more coherently with other global partners, such as the Food and Agriculture Organization of the United Nations, the Secretariat of the International Treaty, the Convention on Biological Diversity and the Global Crop Diversity Trust. Individual Centers will be able to engage more effectively with national and regional partners, providing them with technical and policy assistance, strengthening local technical capacity and involving these partners in collaborative research that addresses their specific needs.

Q: Describe a few of the most important opportunities in developing countries for making more effective use of crop diversity for sustainable rural development.

DEW: In my opinion, the greatest and most frequently overlooked opportunities for developing countries involve making better use of their unique native crops and local crop diversity. In many countries, the notion persists that introduced commercial varieties are somehow automatically superior. As a result, national research organizations frequently neglect traditional crops and the diversity of local varieties, even though these are well adapted to local conditions, fit local culinary traditions and possess other valuable traits, such as resistance to drought, frost, diseases and pests. Because of those traits, local varieties are important for advancing rural development. Moreover, they offer developing countries comparative advantages in agricultural trade. The unique traits of local varieties are often quite exceptional. If studied, developed, produced and marketed to urban and international consumers at premium prices, such value-added varieties could create new sources of income for poor farmers. These local crops and varieties have been patiently developed over centuries by generations of traditional farmers, both women and men. As such, they form an essential part of each nation's unique agricultural patrimony. It is vital that these genetic resources be conserved and used more effectively to enhance agricultural production and diversification, improve human nutrition, strengthen food security and raise developing countries' share of agricultural export markets.

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Stock Options

Livestock are ubiquitous in the developing world. The ”big five” — cattle, sheep, goats, poultry and pigs — are joined by nine other popular farm animals and 26 or so more specialized species. More than half a billion people raise farm animals, either as nomadic herders on pastoral rangelands, as smallholders of mixed farms who raise crops along with livestock, or as peri-urban residents who raise a few animals in their backyards. All of these small-scale livestock enterprises matter to governments of developing countries because livestock accounts for some 30% of their agricultural gross domestic product, a figure expected to rise to 40% by 2030.

The diverse livestock production systems, like most crop production systems, are changing in response to globalization, urbanization, environmental degradation, climate change, and science and technology. But the fastest changes are occurring within the livestock systems themselves as they respond to markets. The developing world’s rising populations and household incomes combine to create soaring demand for milk, meat, eggs and other livestock products.

The rate of change in the livestock sector is so rapid that many local livestock breeds developed by small-scale farmers over millennia no longer have time to evolve adaptations to their new and continuously changing circumstances or the new needs of their owners. Many are simply dying out at unprecedented and accelerating rates. On average, one breed disappears every month, and 20% of the world’s uniquely adapted breeds of domestic animals are at risk of extinction.

Seventy percent of the world’s known livestock genetic diversity now resides on small farms and in remote regions of developing countries. With all the challenges facing developing countries and their 1 billion people who live on less than a dollar a day, the question arises as to what immediate practical and cost-effective steps can be taken to preserve the wealth of livestock genetic diversity.

From a research viewpoint, it is clear that effectively managing the world’s remaining livestock genetic resources requires characterizing the remaining populations to decide which are worth saving and why. Researchers must find ways of broadening the use of those populations deemed useful, and they must conserve the most important livestock genetic diversity for possible future use by poor and rich farmers alike.

From a political viewpoint, new and appropriate institutional and policy frameworks are required, as well as lots of policy discussions, to find ways to strengthen national and international programs that support the conservation of livestock biodiversity.

While the political issues are being discussed at length at national and intergovernmental fora, four practical steps can be taken immediately to ensure that the world’s remaining livestock biodiversity is conserved for future generations:

1. **Establish gene banks.** Freeze the semen, embryos and tissues of local breeds and store them indefinitely to protect indigenous livestock germplasm from extinction and to provide long-term

insurance against catastrophic losses from war, drought, famine and other future shocks.

2. **Keep it on the hoof.** Give local farmers and communities incentive to maintain local livestock breeds by, for example, improving access for poor farmers and herders to markets, perhaps including niche markets, where they can sell their traditional livestock products.
3. **Move it or lose it.** Encourage the safe movement of livestock populations within and between countries, regions and continents to widen the global access to, and the use and conservation of, farm animal genetic resources.
4. **Match breeds with environments.** Optimize livestock production by expertly matching livestock genotypes with farmer ambitions, fast-changing environments, specific natural resources, production systems and socioeconomic circumstances.

Advances in several scientific fields promise to give rise to innovations that will improve the conservation and husbandry of animal genetic resources. Breakthroughs in livestock reproductive technologies and functional genomics, as well as in the information fields of bioinformatics and spatial analysis, are now being systematically marshaled for the first time to address this challenge.

Whereas societies and countries tend to differ in their short-term interests regarding livestock production, their long-term interests — such as learning how to cope with unforeseen changes in livestock production systems and their environments — tend to converge. This creates real opportunities for international scientific, environmental and aid agencies to take collective action with developing countries to conserve the world's remaining livestock genetic diversity.

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Calculated Advantage

Compensating farmers for preserving landscapes that are rich in carbon will, in addition to mitigating climate change and deforestation, have a significant impact on reducing poverty. These are the findings of a study by CGIAR scientists, which was released at the Bali climate change conference in December 2007, attracting considerable interest and media coverage.

According to the study, farmers' planting of annual crops at the expense of forests usually generates less than US$5 for each ton of carbon dioxide equivalent released — an amount that is unlikely to lift them out of poverty. At the same time, the European market for carbon credits is currently paying €21 per ton, or about six times more. Yet, in the absence of a suitable mechanism for receiving payment for carbon credits, planting annual crops currently makes more economic sense for farmers.

Brent Swallow, leader of the study and global coordinator of the Alternative to Slash and Burn (ASB) Partnership for the Tropical Forest Margins, said that prevailing policy environments and short-term economics favor cutting trees.

"But if farmers were rewarded for carbon stored in trees and forests, vast areas of forest could be saved and carbon emissions greatly reduced," he added.

The study, which covered sites across Indonesia and the Amazon and Congo basins, draws on a decade of research by the ASB Partnership for the Tropical Forest Margins on the tradeoffs between local development and the environmental consequences of tropical deforestation. Swallow explained that one of the key objectives of ASB is to provide the science and policy formulas needed to inform debate about deforestation and help decision makers to determine how it can be addressed.

"This study demonstrates a method for calculating the opportunity costs of avoiding deforestation," Swallow said. "And the findings provide a starting point for informed national and international negotiations."

The ASB Partnership for the Tropical Forest Margins is a consortium of five CGIAR Centers and the national research organizations of six countries with tropical forests. It supports country-level negotiators in building the case for preserving tropical forests and works toward finding a balance between people and the environment through such land-use systems as agroforestry.

Fahmuddin Agus of the Indonesian Soil Research Institute, an ASB partner, emphasized the need for policymakers and land users to pay special attention to emissions and the economic tradeoffs from deforestation, especially in relation to the peat forests of Indonesia.

"When peat lands are converted to other land uses, large stores of carbon are emitted in the form of carbon dioxide," he said. "The ASB analysis shows that most of these conversions provide very small returns to the farmers. This needs to be considered by policymakers and land users."

The findings of the ASB study have attracted a great deal of attention from key players in the global debate on reducing emissions from deforestation and degradation in developing countries (REDD). The Woods Hole Research Center has agreed to collaborate with ASB in the Congo Basin, and the Prince of Wales Rainforest Project is using ASB results to promote rainforest protection.

In addition to the release of the study, the ASB Partnership produced a series of policy briefs and a short film on the Indonesian perspective that was screened at the Bali conference.

The ASB Partnership is now launching a monthly e-newsletter to provide updates on its work and news about publications and events relating to REDD. The distribution list of 1,200 so far includes policymakers, senior scientists, students and journalists.

Swallow said the ASB Partnership will continue to 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.

The full report and related publications are available at www.asb.cgiar.org. To subscribe to the ASB e-newsletter, send an email to asb@cgiar.org.

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Amazingly Mobile Maize

How did a crop domesticated some 7,000 years ago from a humble Mexican grass called teosinte become the number-one food crop in Africa and Latin America and a major food, feed and industrial crop just about everywhere else?

The story of the spread of maize has been told in books (notably *Maize and Grace: Africa's Encounter with a New World Crop 1500-2000*, by James C. McCann), but there have always been lingering doubts and unanswered questions. If, for example, Christopher Columbus brought maize to Spain in 1493 following his pioneering visit to the Caribbean, as records show, how is it that reliable accounts have the crop being grown in 1539 in the very different climate of Germany? That's only 46 years later, far too soon for tropical maize to change its preferred temperature, humidity and day length. In another case, maize was assumed to have been brought to Nigeria by Portuguese colonists, but the local names for maize in that country derive from Arabic, suggesting that the crop was likely brought by Arabic-speaking traders.

Recent work by the International Maize and Wheat Improvement Center (CIMMYT) and partners sheds new light on maize's global migration. With support from the Generation Challenge Program of the CGIAR, and in collaboration with nine research institutes on four continents, scientists have used DNA markers (molecular signposts for genes of interest) and new approaches to analyze nearly 900 populations of maize and teosinte from around the world.

"What is emerging is a far clearer picture of the crop's global diversity and the pathways that led to it," says Marilyn Warburton, a CIMMYT molecular geneticist and the leader of the effort.

Phase I of the work, funded by the European maize consortium PROMAIS, focused on North America and Europe. The Generation Challenge Program commissioned Phase II, which expanded coverage worldwide and raised the number of maize populations studied to 580. In Phase III, partners are adding another 300 populations of maize and teosinte to plug the geographical gaps. A primary objective is to gather samples of landraces (local varieties developed through centuries of farmer selection) and ensure their conservation in genebanks. The diversity studies apply a method Warburton developed that uses DNA markers on bulk samples of individuals from large, heterogeneous populations like those typical of maize.

Among its findings, the study confirms that northern European maize originates from North American varieties brought to the continent some decades after Columbus returned, not from the tropical genotypes he carried.

"The two main modern divisions of maize arose about 3,000 years ago, as maize arrived in what is now the southwestern US and, at about the same time, on the islands of the Caribbean," says Warburton. "Temperate maize spread further north and east across North America, while tropical maize spread south. The temperate-tropical division remains today. What maintains it are differences in disease susceptibility and photosensitivity — essentially, how day length affects flowering time. The two maize types are now so different from each other that they do not cross well, and their hybrids are not well

adapted anywhere."

The work continues and, in addition to elucidating the epic journey of maize, will help breeders to home in on, and more effectively use, traits like drought tolerance found in the vast gene pool of maize.

For more information, read a longer report entitled *Tracing History's Maize* in Generation's *Partner and Product Highlights 2006* or contact Marilyn Warburton (m.warburton@cgiar.org) .

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Vitamin A Breakthrough

Maize is one of six key staple food crops consumed in developing countries that the HarvestPlus Challenge Program aims to biofortify with micronutrients. Maize is the preferred staple in Africa, in many parts of which consumption is higher even than in Mexico, where the crop originated. Meanwhile, vitamin A deficiency is widely prevalent in Africa, afflicting millions of children with morbidity, blindness and even death. To help combat this, HarvestPlus scientists are breeding varieties of maize biofortified with higher levels of beta-carotene, which the body converts into vitamin A. Now, a major scientific breakthrough has brought HarvestsPlus one step closer to this goal.

Maize is one of the most genetically diverse crops in the world. More than 20,000 accessions are held in the genebanks of Centers supported by the CGIAR. Thanks to this tremendous diversity, lines of maize that have naturally high levels of beta-carotene have been found. Some lines, in fact, exceed the intermediate target levels set by HarvestPlus, and a hybrid of two lines meets the final target level. But additional lines high in beta-carotene must be identified.

maize lines that are rich in carotenoids tend to be more yellow and orange in color. Photo: Robin Allscheid Stevens.

Maize kernels that have higher total carotenoid content tend to be distinctively dark yellow or orange in color, but not all carotenoids are converted to vitamin A in the body. Therefore, varieties with higher levels of the desired beta-carotene cannot be identified by color alone; parent plants and their progeny must be screened specifically for beta-carotene. This process has, until now, been time consuming and expensive, greatly limiting the number of plants that can be processed.

In research partly funded by HarvestPlus and recently published in *Science*, a team led by Ed Buckler, of the United States Department of Agriculture Agricultural Research Service and Cornell University, and Torbert Rocheford, of the University of Illinois, analyzed a genetically diverse panel of almost 300 maize

lines. These lines showed a range in values for the concentration of total carotenoids and beta-carotene. For the first time, they were able to identify a gene and develop genetic markers that are associated with higher levels of beta-carotene in the grain. This method of identifying and selecting breeding lines that are rich in beta-carotene is much simpler and faster than running conventional chemical tests — and up to 1,000 times cheaper.

Buckler expects it to significantly accelerate research in maize biofortification, especially by scientists working in basic labs in developing countries. To this end, Buckler and Rocheford are working with CGIAR Centers, including the International Maize and Wheat Improvement Center (CIMMYT) and the International Institute of Tropical Agriculture (IITA), to help train plant breeders in developing countries to use their techniques, which are being made freely available. CIMMYT and IITA are partner organizations leading HarvestPlus efforts to breed biofortified maize.

Breeding for maize with enhanced provitamin A is just one step in the process. Sufficient micronutrients have to be retained during processing and cooking, and subsequently converted in the body into vitamin A. Studies to date have shown that nutrient retention in orange maize after processing and cooking exceeds the initial assumption of 50%. Furthermore, the conversion factor of provitamin A in the grain to vitamin A in the body has also been found to be approximately 7:1, far better than the expected 12:1. Based on these positive results, the next step is to conduct, in a clinical setting, a study of how well maize that is high in provitamin A improves people's vitamin A status.

Finally, consumers, especially those in regions where vitamin A deficiency is endemic, have to be convinced that eating biofortified maize will improve their health. One significant hurdle is that white varieties of maize are generally preferred in many parts of Africa. However, in a study conducted in Mozambique, Rocheford and his colleagues found that orange maize is an acceptable product to many consumers, particularly when offered at a modest price discount, and that those who are most likely to suffer from vitamin A deficiency were the most likely to accept orange maize meal.

These positive findings, in tandem with the recent breakthrough in genetic marker screening that will make it far easier to identify desirable maize varieties, should help HarvestPlus and its national agricultural research partners remain on target to release naturally biofortified provitamin A maize in Africa as early as 2012.

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Help at Hand

Every year, around 30% of the global harvest is lost to pests and diseases. The worst affected are poor farmers in the developing world. A number of measures are available to help limit losses. Pesticides and fungicides are one kind of solution, but they can damage the environment and harm people's health and are often too costly for poor farmers. Modern varieties that resist pests and diseases offer another kind of solution, but planting large areas with genetically uniform resistant varieties provides ideal conditions for new strains of pests and diseases to evolve, threatening to overcome the crops' resistance after only a few seasons. In any case, smallholder farmers are often unable to get hold of the latest modern varieties, and most are too poor to buy them. Furthermore, modern varieties often perform badly in marginal areas, especially with little or no fertilizer or irrigation.

Farmers in the developing world need sustainable solutions that require few inputs and are affordable and environmentally friendly. Devra Jarvis, senior scientist at Bioversity International, believes that sustainable and cost-effective solutions could lie in the diversity of traditional crops and varieties, a resource that smallholder farmers can easily access and use. That is the basis of the 6-year Bioversity project "Conservation and use of crop genetic diversity to control pests and disease in support of sustainable agriculture," funded by the United Nations Environment Programme-Global Environment Facility, and the Swiss Agency for Development and Cooperation, with additional support from the Ford Foundation and the Food and Agriculture Organization (FAO) of the United Nations.

The project will work in China, Ecuador, Morocco and Uganda with the aim of helping poor farmers to make the most of their local crop diversity to control pests and diseases. The approach is to integrate farmers' knowledge, beliefs and practices with advanced analysis of crop, pest and disease interactions. The first phase of the project was formally launched in November 2007 at a meeting of global partners in China.

Key staple crops are the focus in each country: banana, barley, common bean, faba bean, maize and rice. Bioversity will collaborate with a range of national and international partners, including the Users' Perspectives with Agricultural Research and Development of the International Potato Center, FAO, International Food Policy Research Institute, International Rice Research Institute, and several local universities and nongovernmental organizations.

Considerable evidence supports the project's approach to pest and disease management. Studies of advanced agricultural systems show that crop mixtures and rotations can reduce the damage caused by pests and diseases. Research also reveals that many farmers already use the diversity of traditional varieties, and mixtures of modern and traditional varieties, in this way. The benefits of the approach are clear. Not only is it affordable and environmentally sustainable, it also protects the diversity of the local agricultural ecosystem.

According to Jarvis, the project partners will identify systems in which farmers can reduce their vulnerability and losses by planting diverse varieties. A key starting point has been to develop a set of

participatory tools to capture and understand farmers' knowledge and practices of using local crop varieties to manage pests and diseases, thereby finding solutions that suit local needs and environments. This adds a new dimension to work on pest and disease management, which has commonly focused on only three components: host, pathogen and environment.

"The project will ensure that the fourth critical component — the farmer — is also included," says Jarvis.

Participatory diagnostic tools are now available in English, Chinese, French and Spanish, with plans to translate them into Arabic well advanced. Many of the tools build on participatory techniques developed during Bioversity's global project on the *in situ* conservation of agricultural biodiversity.

The next challenge will be to develop guidelines for laboratory and field assessments that build on this knowledge. Trials in farmers' fields will assess the disease and pest resistance of traditional varieties, and trials at experimental stations will allow researchers to follow epidemics over time and observe impacts on yields.

The final goal is to augment farmers' options for fighting pests and diseases in a sustainable way.

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Markets of Biodiversity

Under a tree in a sandy village center on the fringes of the Sahara Desert, women display baskets of millet and handmade wares to prospective customers. After successive years of poor harvests in this harsh environment, farmers who typically rely on themselves or their relatives for seed are obliged to seek it here. They peruse the small amounts of grain women from nearby villages have brought from family granaries. One asks a woman if her grain comes from Tabi, a village nestled in the rocky hills some 20 kilometers away and known for its early-maturing varieties of millet. Answering in the dialect of Dogon, the woman confirms it is a Tabi variety.

Nearly every meal consumed by rural families in drier areas of Mali is based on millet. Although these women most often sell grain for food, their small-scale trade gives other farmers access to vital seeds when both the formal and the informal seed systems fail. Despite the gradual liberalization of the formal seed sector in Mali, no certified seeds are sold yet by traders — either men or women — in local markets. The supply of certified seed continues to be dominated by state institutions and agricultural development and extension services.

“Where formal seed systems for certified seed have limited reach, farmers continue to depend primarily on themselves or their social ties for seed,” says Melinda Smale, a senior research fellow of the International Food Policy Research Institute (IFPRI). “Farmers are very resourceful at finding seed.”

Researchers were surprised to discover that local grain markets can provide a form of seed insurance in case of disaster or drought. Village grain markets become especially active as seed markets just before planting season. They’re also important later for replanting if the rains that watered the first planting were followed by a dry spell, and after successive years of crop failure, when whole communities find themselves short of seed.

Farmers who sell grain that is suitable for seed may be supporting local crop biodiversity by exchanging genetic resources with a particularly valuable trait, such as early maturity. The team also found that women vendors most often use the money they earn by selling millet to purchase ingredients that add important nutrients to the sauces they prepare for the families’ daily millet porridge. The research was conducted by IFPRI, the Institut d’Economie Rurale of Mali and Bioversity International as part of a collaborative project lead by FAO, and builds on the findings of a seed security assessment conducted by Catholic Relief Services (CRS) and partners. Findings of the CRS study raise the possibility that, when grain is sold as seed with recognized, valued attributes, vendors are “trading plant genetic resources”.

Generally, grain markets are not thought to be good sources of seed because the vendor does not know the variety or whether the grain of several varieties has been mixed. In this case, however, farmers in search of seed know that the grain is suitable for planting because it comes directly from the farmer. Farmer-vendors know about the variety and its characteristics. For the customers, knowing the village of origin is also important, as varieties have a very narrow range of adaptation in this agroclimatic zone, often as little as 40 kilometers across.

The major policy challenge in Mali today, says Smale, is how to develop grain markets into markets for seed. One option is to legalize the sale in village markets of the seed of local varieties that are truthfully labeled, but formalizing the trade of women vendors may not meet the desired objectives of enhancing their welfare. Exchanging millet seed for cash carries social stigma in a culture where farmers have managed the selection and planting of millet varieties for millennia, probably since the crop was domesticated. A fundamental step would seem to be supplying vendors, perhaps through farmers' associations, with small packets of certified seed that has been proven to perform well in this environment. Local nongovernmental organizations are experimenting with seed auctions and fairs to encourage more cash-based exchange of seed.

Supporting the development of local seed markets in the right way will ensure that Malian farmers have access to the genetic diversity they need to combat drought and locust attacks.

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Branching Out

As the world's forests rapidly disappear or become increasingly fragmented, conservation efforts have focused on establishing protected areas to conserve these key ecosystems and the diverse array of flora and fauna they support. Vital as protected areas are, conservationists and scientists have recently observed that they are not sufficient in themselves for conserving biodiversity.

In this context, the role of multifunctional landscape mosaics, especially those surrounding protected areas, has come increasingly into focus. These landscapes include everything from agricultural land, agroforests and settlements to the patches of remaining forest that dot the terrain. What shapes these mosaics are the activities of human beings, often in communities driven by the need to sustain their livelihoods in the face of poverty.

Toward developing an integrated strategy to address these complex and often conflicting ecological and social dynamics, 40 scientists from the Center for International Forestry Research (CIFOR), the World Agroforestry Centre (ICRAF) and affiliated organizations converged on the island of Lombok, Indonesia, in early December 2007.

The objective of the 4-day meeting was to finalize the guidelines for the Landscape Mosaics Project, which will research and develop ways to better integrate improved livelihoods and biodiversity conservation into land-use management in five countries: Cameroon, Indonesia, Laos, Madagascar and Tanzania. The Landscape Mosaics Project is the inaugural project of the Joint Biodiversity Platform, which was launched in 2006 by CIFOR and ICRAF in recognition of the role that multifunctional landscape mosaics have in preserving biodiversity, both within and beyond protected areas.

Tree cover in multifunctional landscape mosaics preserves important habitats and can play a crucial role in maintaining connectivity between large reserves, which has been demonstrated to be essential for the survival of many species. Human occupation and use of these landscapes, however, require that conservation efforts consider the social dimensions of the use and conservation of biodiversity, in addition to their biophysical dimensions and dynamics.

The Joint Biodiversity Platform draws on the wealth of experience and expertise at CIFOR and ICRAF. A collaborative approach enables the platform to bring together highly qualified multidisciplinary teams, drawing scientists from the natural and social sciences, as well as experts in geographic information systems and spatial analysis.

"All of us are influenced by our personal as well as our technical background, so we look at problems or research needs from different perspectives," said Jean-Laurent Pfund, CIFOR coordinator of both the platform and the Landscape Mosaics Project, following the Lombok meeting. "Global meetings such as this one generate lively discussions and innovative ideas, largely as a result of these varied perspectives."

Pfund added that the consensus at the Lombok meeting was to focus less on collecting standardized

data for comparative research and place a stronger emphasis on impact-oriented research that explores more participatory ways of compiling information and supporting negotiations.

Four complementary project themes have been identified: biodiversity and livelihoods, landscape patterns, landscape governance, and rewards for biodiversity conservation. An information base addressing these themes will be developed with local communities and relevant government institutions to help them negotiate a common vision for the future that improves communities' well-being as well as their environment.

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Seasoned for Salt

Salt makes its way into the rice paddies of coastal Bangladesh every which way. During the dry season, when the flow of freshwater out to the mouths of the Ganges is weakest, saltwater rides inland on the tide, and saline groundwater rises and spreads laterally across the delta. Salinity is less prevalent during the wet monsoon but can still poison rice crops as it lingers in the soil, percolates into paddies from the brackish ponds of neighboring shrimp farmers and, during drought, rises as in the dry season.

“Nearly 1 million hectares of the Bangladesh coast are affected by varying degrees of salinity,” reports Zeba Islam Seraj, a professor of biochemistry and molecular biology at the University of Dhaka.

Seraj is a co-principal investigator of a project of the Generation Challenge Programme (GCP) that aims to revitalize marginal rice lands by discovering and breeding into popular rice varieties genes for tolerating soils that are saline or deficient in phosphorus. As the focal collaborator in Bangladesh, she is responsible for the molecular evaluation and selection of rice lines bred by the Bangladesh Rice Research Institute with which to insert into popular farmers’ cultivars the gene *Saltol*, short for “salt tolerance.”

Using marker-assisted selection, which allows rapid screening of large numbers of plants, the International Rice Research Institute (IRRI) and its collaborators in the GCP project have mapped *Saltol* — which accounts for 40-65% of the salt tolerance observed — to a small segment of rice chromosome 1. Importantly, *Saltol* and the other identified loci confer salinity tolerance at the seedling stage.

“This is essential in the monsoon season, when salinity tolerance is mainly needed during seedling transplantation and for a few weeks thereafter, until rain has washed the salt from the soil,” explains Abdelbagi Ismail, the IRRI senior plant physiologist who is the principal investigator of the GCP project.

Rice is susceptible to salinity during two periods of its growth cycle. The first is the seedling stage and the second begins a few days before panicle initiation and ends with flowering and pollination. As Ismail explains, salt tolerance at the seedling stage is sufficient for the crop grown in the wet monsoon, known as *aman*, provided there is no drought. This is the traditional season for rice cultivation in Bangladesh, but the spread of tube wells in recent years has allowed farmers to irrigate and grow a second, *boro* (dry) season crop.

As the boro season coincides with high river water salinity, rice grown in this season must tolerate not only moderate salinity during the seedling stage but also much worse salinity during the critical period from panicle initiation to the start of grain filling. As food security and farmers’ well-being in Bangladesh depend increasingly on boro rice, rice varieties that yield well under high salinity stress are needed more urgently than ever.

The GCP project aims to breed *Saltol* into at least one aman variety and one boro variety already

popular with farmers. The goal is to develop improved varieties that are identical to popular farmers' varieties in every way except that they have the *Saltol* gene and so are able to provide a reasonably good yield under conditions of moderate to high salinity in which salt accounts for 0.4-0.5% of the soil.

A sister project led by Ismail under the Challenge Program for Water and Food (CPWF) aims to harness the productivity potential of salt-affected areas of three river basins, including the Ganges. In that project, the partners use the newly developed lines that have the *Saltol* locus and also search for additional sources of salinity tolerance.

"*Saltol* and other genes conferring tolerance at the seedling stage could be sufficient for the wet season," Ismail observes. "However, for the boro season, additional genes for higher tolerance during flowering and pollination are needed.

"The two projects actually work closely together to maximize the benefits," Ismail adds. "The molecular markers for *Saltol* developed through the GCP will help speed the breeding progress of the CPWF project, and the material will be further tested and scaled out through CPWF activities, as well as other networks. Neither of the two projects could achieve this without the other."

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River Run Dry

For the past 11 years, the Great Ruaha River in Tanzania has stopped flowing for extended periods every dry season. Previously, the river was perennial. The recent drying is caused by diversions for irrigation upstream of the Usangu Wetlands, a valuable freshwater ecosystem. Between 1970 and 2004, the irrigated rice area increased from approximately 10,000 hectares to 45,000 hectares.

The drying has brought social conflict between upstream and downstream users. In the dry season, some women and children have to walk up to 20 kilometers every day to find water. There is also harm to Ruaha National Park, which is located downstream of the Usangu Wetlands. The river is a crucial dry season water source for the park, and its drying has had serious ecological impacts. In some years, many hippopotami, fish and freshwater invertebrates die.

Researchers at the International Water Management Institute (IWMI), together with partners from Sokoine University in Tanzania and the University of East Anglia in the United Kingdom, conducted a hydrological study to estimate the environmental flow of the Great Ruaha River required to maintain its basic ecological functions. Results showed a requirement of an average of 635.3 million cubic meters per annum (equivalent to 22% of mean annual runoff) and an absolute minimum dry season flow of 0.5 cubic meters per second through the national park.

The Great Ruaha River is one of the most important waterways in the Rufiji Basin of Tanzania. Water from the river and its tributaries is used for hydropower production and irrigation, making vital contributions to the livelihoods of rural households. The headwaters of the Great Ruaha River drain through the rich alluvial plains of Usangu, which have both permanent swamps and seasonally flooded grasslands. This is a habitat for over 400 bird species and many other animals and plants. The Usangu Wetlands also support agriculture, fisheries, livestock rearing and light industry. In some villages, 95% of households benefit from the wetlands.

Balancing the tradeoffs between economic growth and resource degradation and depletion is a key objective of the Rufiji Basin Water Office. In their study, IWMI and its partners used the desktop reserve model (DRM) to quantify the environmental flow requirements of the river downstream of the wetlands. The model is useful when a rapid appraisal is required but data is limited. Like the building block method developed by South African scientists, it is underpinned by the premise that, under natural conditions, different components of flow play different roles in the ecological functioning of a river. Another model was used to simulate the hydrology of the Usangu Wetlands and estimate the flow into them required to maintain downstream environmental flows.

Allocating water to maintain the river would require tradeoffs between the environment and other users. Maintaining the dry season minimum flow requires that current water abstractions be reduced by 60%. However, irrigated rice is the main source of income for 30,000 poor rural households. It is also important for national food security, as up to a quarter of Tanzania's rice is grown in the catchment. Reducing abstractions would therefore have serious social and economic repercussions.

Alternative options, including tradeoffs between different environmental needs, should be considered.

For example, active water management to reduce evaporation in the wetlands would improve flows to the national park. Better water management on farms would reduce wastage. Currently, many villages rely on irrigation canals for their domestic water supply, requiring that diversions be maintained throughout the dry season. Since much of the diverted water is lost through seepage and evaporation, significant water savings may be possible from alternative options for domestic supply, such as groundwater. This would reduce the need for surface water withdrawals.

The maintenance of aquatic ecosystems is a prerequisite for sustainable development. In an environment of worsening water scarcity, decisions regarding the allocation of water must consider environmental implications. However, estimating water requirements for wetlands in water-stressed catchments where peoples' livelihoods dependent on water abstraction is a task far from trivial. It is important to consider not only environmental requirements, but also the economic and social implications. In such situations, understanding flow regimes and hydrological functioning is essential for informed decision making.

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Cold Feat

Researchers at the International Center for Agricultural Research in the Dry Areas (ICARDA) in Aleppo, Syria, have developed cold-tolerant chickpea that can be grown in winter. This development will almost double the yield of the crop, which is traditionally sown in the spring.

As the Mediterranean environment experiences rain mainly during the winter months, planting chickpea during this period allows for very efficient water use, as compared with the spring crop, which grows on moisture conserved in the soil. The problem, however, is that the winter-sown crop is exposed to low temperatures and the risk of frost.

Scientists at ICARDA have developed a reliable screening technique for cold tolerance evaluations in areas of low to medium altitude in the countries of Central and West Asia and North Africa.

"Though people in the region experienced excessively severe cold conditions this winter, the chickpea scientists at ICARDA are happy that the cold spell has helped to screen chickpea breeding materials that can resist such extreme temperatures," comments Maarten van Ginkel, ICARDA's deputy director general for research.

R.S. Malhotra, ICARDA's senior chickpea breeder, says that severe cold would likely kill most of the traditionally spring-grown cultivars in the region if they were planted in winter. Meanwhile, the newly developed winter chickpea cultivars have survived and look very promising.

To assess their cold tolerance, the winter chickpea lines were planted on 1 October 2007. By 15 January, the crop had experienced 33 days of sub-freezing temperatures and a minimum temperature of –12 degrees Celsius.

Imtiaz Muhammad, a chickpea breeder and geneticist at ICARDA, reports that the lines exhibiting cold tolerance are derived from otherwise superior chickpea lines crossed with highly cold-tolerant lines of the wild ancestral species, *Cicer reticulatum*.

The cold-tolerant lines developed at ICARDA are being shared with national agriculture research systems in the countries of Central and West Asia and North Africa to test their adaptation to various conditions and their yield.

A large number of lines with some cold tolerance and resistance to *ascochyta* blight, developed at ICARDA, have already been noted to exhibit adaptation in parts of the region and have recently been released for general cultivation and winter sowing. The new materials will further strengthen cold tolerance, allowing for even wider adaptation and adoption. Winter chickpea is already becoming popular with the farmers in the region, some of whom have reported very high yields of as much as 3 tons per hectare.

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What's Bad for Yam...

Research by the International Institute of Tropical Agriculture (IITA) has confirmed that a major phytoparasitic nematode previously known to only infect yam (*Dioscorea* spp.) has the potential to attack and destroy Irish potato. The pest, *Scutellonema bradys*, or simply “yam nematode,” causes severe crop losses, suboptimal yields and the deterioration of yam tubers while in storage.

Yam is a preferred staple tuber crop in West Africa. Annual production in sub-Saharan Africa is about 45 million tons, which is 95% of the world’s total production. In West Africa, some 11 million tons of yams are lost annually because of damage in storage initiated by *S. bradys*. With West African yam exports rising, there is a heightened risk of *S. bradys* spreading to potato-producing countries in southern Africa, where potato production already suffers from other pests and diseases.

The discovery has important implications for trade between the two regions of Africa. The uncontrolled spread of this nematode is especially worrying for small-scale farmers in southern Africa, where potato is the most important commodity crop and about 50,000 hectares are planted to it.

Like other nematode species, *S. bradys* transmits viruses when it feeds on tubers, making them more prone to fungal and bacterial attacks that cause, for example, dry rot and wet rot. Yam nematodes reproduce and build up large populations in stored tubers, causing severe damage. The largest population recorded was 6,200 nematodes per gram of tuber.

The first recorded instance of the nematode attacking potato was in the key Nigerian potato-growing area of Jos. The sample potato specimens showed cracking of the cortex, a symptom associated with an *S. bradys* attack. To confirm the discovery, IITA conducted yam nematode inoculation tests on local potato tubers sourced from Ibadan, Nigeria.

Potato tubers potted in sterile soil were inoculated with about 5,000 *S. bradys* obtained from infected yam 2 weeks after being transplanted from sprouting beds. Plants inoculated with the yam nematode produced tubers with substantial cracking of the cortex and evident tuber rot.

Other symptoms observed that are typical of yam nematode infestation included a scaly appearance, surface and deep tissue cracks and distortions, and sub-surface rotting. Morphological tests of the mature nematodes recovered from the soil, roots and tubers of the inoculated plants were confirmed to be *S. bradys*.

IITA scientists urge further research to better understand the pathology of this nematode so that appropriate plant-quarantine measures can be formulated to stem its advance and prevent potentially severe crop losses.

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An Update on Reform

In recent years, policy makers and the general public have awakened to the threats posed by two major developments on the world scene – global climate change and sharp increases in the price of staple grains – which place agriculture at center stage. Those trends are putting tremendous strain on agriculture's productive capacity, and they have particularly worrisome consequences for poor consumers and producers of food.

Against that background, CGIAR leadership decided in 2007 to embark on major reforms through a forward-looking facilitated Change Management Initiative.

Types of change envisioned

The CGIAR's work is highly relevant to the challenges posed by climate change and higher priced food, and the Centers it supports have much to offer developing countries as they struggle to cope with these problems. Even so, changes are urgently needed on several fronts to ensure that renewed collaborative efforts in the CGIAR are as effective as possible. Here are some of the needs that CGIAR stakeholders consistently single out:

- A research agenda that focuses more sharply on major global development challenges
- Better defined research mandates, around which Centers can more easily organize collaborative research
- Streamlined and effective governance arrangements, with clear accountability for performance and results
- Greater openness to partnerships that include the full range of institutions whose contributions are needed to achieve large-scale impact
- Better coordination on the part of investors, together with adequate and stable levels of financial support
- More transparent and efficient procedures for collective decision making and action

Organizing change management

The Change Management Initiative centers on four main areas of concern to CGIAR stakeholders:

1. visioning and development challenges,
2. strategic partnerships,
3. governance at the Center and CGIAR levels and
4. funding mechanisms.

In early 2008, a change steering team was formed to provide guidance for the work of four working groups, each of which corresponds to one of the areas listed above. The groups met for the first time at a workshop held in February, where they established targets and work plans for the year. In the coming months, the groups will engage in analysis and discussions (both virtually and in face-to-face

workshops), with the aim of developing concrete recommendations for change.

In early April, the visioning working group held a retreat at Addis Ababa to explore options for a revised CGIAR vision. The event featured an inclusive consultation with a broad cross section of stakeholders (representing CGIAR Centers, national partner institutions and others). Discussions in plenary and working groups centered on three main development goals – poverty reduction, hunger eradication and environmental protection – and on the CGIAR's research capacities for addressing these. Using the framework that emerged from those discussions, the working group will prepare a document that covers the CGIAR's vision and mission and offer a set of strategic objectives leading to measurable outcomes that respond to major development challenges.

An approach to institutional change

The CGIAR is a large, diverse, informal and decentralized organization, whose stakeholders share a common commitment to agricultural research for development but differ on important details about the institutional structures and arrangements that are most appropriate for carrying it out. That is why the CGIAR leadership team has opted for a change initiative that, far from being imposed by the few on the many, will be managed in a more democratic and consultative fashion to capture the best ideas from a wide cross-section of stakeholders. Melding those ideas into a coherent blueprint for change will be a complex process requiring professional facilitation.

The change process is being facilitated by the Trium Group (a consulting firm that specializes in organizational change), with assistance from the CGIAR Director and Secretariat. Two important aims of the facilitation will be to foster a more collective mindset, emphasizing the synergies of the CGIAR instead of its individual components, and to build trust between Members, Centers and partners. Both qualities are essential for reaching consensus on the changes to be implemented.

Participation and consultation

If the change initiative were left in the hands of just a few leaders, it would stand little chance of success, primarily because the changes recommended would lack "buy in" from the many individuals who could contribute to and be affected by them. For that reason, each working group is composed of a mixture of CGIAR Members, Center staff and partner representatives (members of the change steering team and working groups are listed in a special Change section of the CGIAR Web site). Each group also includes one or two external consultants, who are expected to bring new ideas to the discussion, while leading analysis and report writing.

In addition, the groups will consult widely with CGIAR stakeholders through interviews and online surveys. No one who wants to have a voice in the change process will lack opportunities to be heard. Moreover, all the minutes of group meetings will be available on the CGIAR Web site.

Reform time frame

An Independent Review of the CGIAR is taking place simultaneously with the Change Management Initiative. Its final report, to be available by the end of July 2008, will provide important input for the formulation of proposed changes.

Each working group is expected to complete its recommendations in time for them to be considered at the mid-October 2008 meeting of the CGIAR Executive Council. Implementation of recommendations, once approved at the CGIAR's 2008 Annual General Meeting, to be held at Maputo, Mozambique, should get under way in 2009.

Resources for change

A change management facility has been established to channel financial support to the Change Management Initiative as well as the Independent Review, which is also taking place in 2008. We acknowledge the generous financial support of Canada, Germany, the Syngenta Foundation, the UK, the USA and the World Bank. Their contributions indicate the seriousness with which CGIAR Members approach this initiative.

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Progress with the Independent Review

An Independent Review of the CGIAR is under way that parallels the Change Management Initiative covered by another article in this issue of *eNews*. To better link the two efforts, the review chair serves as one of two external advisors to the steering team of the change initiative.

Encompassing mainly the period from the beginning of reforms in 2002 through 2007, the review seeks to determine, from an independent perspective, how well the CGIAR is "positioned to address emerging food security challenges" and to offer recommendations for change that will enhance its effectiveness.

The review takes place against the background of dramatic increases in the cost of food and growing concern about the impact of global climate change on developing country agriculture. Those trends underscore the urgent need for improved agricultural technologies to help achieve sustainable increases in food production and shield agriculture against climate change impacts. Yet, paradoxically, CGIAR funding continues to be volatile. The findings of the Independent Review should help donors make better decisions about investing in the CGIAR to address continuing challenges to world food security.

Focus and methods

The Independent Review is focusing on three main topics:

- Governance, partnership, management and alignment
- Scientific work
- External partnerships

The review panel is gathering information by various means, including a stakeholder survey and interviews with staff of CGIAR Centers and partner organizations. For the latter purpose, more than a half dozen meetings and visits to nine Centers are being organized. The panel is also carrying out meta-reviews and commissioning studies of key issues.

Activities under way

On governance, the panel's main output so far consists of a paper that reviews past proposals for governance reform in the CGIAR. The paper derives from this review several governance scenarios for the future. In connection with its examination of governance, the panel is also analyzing financial controls and risk management practices to determine whether these are adequate to ensure financial stability across the Centers. Preliminary findings suggest that the prevailing practices are not yet fully adapted to the CGIAR's current financial realities.

To assess the effectiveness and impact of CGIAR research, the review panel is conducting a meta-evaluation, which relies largely on studies already completed. The evaluation seeks to determine the CGIAR's degree of success in improving the well-being of rural people through agricultural research. Among the questions being posed are the following: Are the research priorities of the CGIAR properly

focused on the needs of the rural poor? How have funds been allocated among priorities and among specific elements of these? How have Centers learned from their experience, adjusting research to confront new challenges, such as land degradation, water scarcity and climate change?

As part of its impact evaluation, the panel is considering gender issues, relying on evaluations already carried out as well as survey results. Preliminary analysis of those results suggests that respondents consider the integration of gender and diversity issues into CGIAR employment and research to be highly important for effectiveness.

The review panel is also carrying out a meta-evaluation of the CGIAR's four Challenge Programs. It examines the extent to which the programs are heightening the CGIAR's relevance and impact, contributing to greater cohesion among Centers, strengthening partnerships and mobilizing long-term funding. Based on its findings, the panel will assess the potential of Challenge Programs as a model for a more program-based approach to project development and funding in the CGIAR.

Through a desk review of reports from External Program and Management Reviews, medium-term plans and other documents, the review panel is assessing the quality and effectiveness of CGIAR partnerships. The analysis seeks to determine whether partnerships properly exploit the comparative advantages of those involved, meet their expectations and contribute effectively to shared objectives. A second study commissioned by the panel focuses specifically on the quality of CGIAR partnerships with non-government organizations.

Next Steps

The Independent Review Panel will gather in mid-May during the upcoming meeting of the CGIAR's Executive Council (ExCo) in Ottawa, Canada. The next key milestone will be the circulation for comment on July 31 of a draft of the full panel's report. Then, during September, the panel will organize a "stakeholder response" workshop in conjunction with a retreat to be held by the steering committee and working groups of the Change Management Initiative. The purpose of the workshop will be to test preliminary reactions to the review panel's findings on a wide range of issues.

Afterwards, the panel's final report will be circulated in advance of the October ExCo meeting. It will also be presented at the CGIAR's 2008 Annual General Meeting to be held in Maputo, Mozambique.

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Ninth Meeting of the CGIAR Science Council

Recent external reviews and research planning were the central focus of the ninth meeting of the CGIAR Science Council, which was held in late March at the headquarters of the World Agroforestry Centre in Nairobi, Kenya. In addition to plenary discussions and sessions of the Science Council's various standing panels, the meeting's agenda featured invited presentations on important research-for-development issues in sub-Saharan Africa and on projects under way at the World Agroforestry Centre and the International Livestock Research Centre (ILRI), also headquartered in Nairobi.

Following is a summary of key outcomes of the discussions.

With respect to the recent external review of the Generation Challenge Program (GCP), the review panel noted that "the program's most important achievement has been the creation of well-characterized reference collections for a number of crops, which will eventually total 21. The panel believes those collections will be extremely relevant to research in the years to come, upon completion of the GCP." The program's steering committee and management agreed with all of the review panel's recommendations, including the establishment of a more independent governance body. The program is already acting on this latter recommendation through the establishment of an executive board composed of seven members from organizations that do not belong to the GCP consortium. The Water and Food Challenge Program is acting similarly to establish a more independent governing body in its second phase.

The CGIAR Center Alliance reported that 12 "framework" plans (designed for implementation of CGIAR research priorities) had been elaborated as of January 2008. It was suggested that the "heartland" framework plans (e.g., 1A, 2A, 3A, 4A and 5C) be pursued at this stage, as they are likely to remain part of the CGIAR's core business under the most probable scenarios. The Science Council agreed to await the outcomes of the deliberations of the four working groups involved in the CGIAR Facilitated Change Management Initiative and then join in discussions with the Alliance on the best means to move this planning forward, with the aim of making funding recommendations to the CGIAR Executive Council later this year. With further refinement, plans for key priorities should serve to inform the Change Management Initiative.

Progress was made with a process to streamline the development, submission and evaluation of Medium-Term Plans (MTPs). The Science Council reaffirmed its intention to shift its assessment from MTPs more toward Center strategic plans, in keeping with the council's function as a source of advice on strategic scientific issues.

Preparations are under way for the External Program and Management Reviews of the International Rice Research Institute (IRRI) and International Crop Research Institute for the Semi-Arid Tropics (ICRISAT).

The Science Council decided not to endorse development of performance measurement indicators for Challenge Programs, because rigorous monitoring procedures are already in place to reliably inform donors and the programs themselves.

The panels on mobilizing science and on priorities and strategies will undertake jointly a series of strategic studies to examine how research can best address current and emerging development challenges (particularly those signaled by the *World Development Report 2008*) through advanced scientific and technological innovations.

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Riding a Wave of Interest in Agriculture

Somewhat to the surprise of many CGIAR communicators, the mass media worldwide have devoted major attention to agriculture over the last year or so. This is largely a result of widespread concern about rising food prices, the expected impacts of global climate change on farming and the connections between both these issues and the biofuels boom. Increased coverage has also been stimulated by positive developments such as the creation of the Svalbard Global Seed Vault.

This article is the first in a series of updates on media coverage of CGIAR-supported research. By making “Media Spotlight” a regular feature of *CGIAR e-News*, we hope to give readers a sense of the widening scope of that coverage, while raising awareness of CGIAR initiatives being undertaken to generate further rounds of reporting.

Seizing the opportunity

Following years of relative media neglect, particularly in the international arena, the sudden swell of interest in agriculture represents a valuable opportunity for international agricultural research, one that is unprecedented in recent years. By stepping up media outreach, the CGIAR can heighten its profile, reaffirm the relevance of its work to new challenges and draw merited attention to important outcomes of its collaborative research.

Communications specialists in the CGIAR Centers and Secretariat have worked hard in recent months to seize the opportunity of heightened media interest. The coverage generated, with valuable help from private sector partners, builds on the strong momentum created by a series of news story promotions during 2007. Those stories followed major reporting on the CGIAR’s message about agriculture and global climate change at the 2006 Annual General Meeting in Washington, DC.

Collective and individual efforts in media outreach have paid off handsomely, giving rise to extensive coverage of CGIAR-related research, positioning our organization among major media as a valuable resource and identifying our scientists as key spokespersons on high-profile issues.

On occasion, the coverage has even opened up new funding windows for Centers. But the more modest and realistic aim of media outreach is to create new excitement about the CGIAR and a growing sense of its relevance and value among investors and other stakeholders. Those gains, in turn, should create a more favorable atmosphere for building research partnerships, fostering policy debate and raising funds.

AGM07 in Beijing

As in 2006, this AGM provided an important occasion for media outreach, a task in which the CGIAR Secretariat and Center colleagues worked closely with two firms, Across China and Burness Communications.

The centerpiece of this initiative was a report on the world food situation, presented by the International Food Policy Research Institute (IFPRI). A news release prepared by IFPRI was widely promoted with international media outlets, of which more than 15 registered to attend AGM07. This resulted in substantive articles carried by influential publications around the world, including *Frankfurter Allgemeine Zeitung*, *The Guardian*, *Le Monde*, *Wall Street Journal Europe* and *Süddeutsche Zeitung*.

In addition, a "briefing report" on world food prices in *The Economist* included IFPRI findings, and a *Washington Post* editorial on December 12 used them in calling on governments to examine carefully the potential impacts of biofuel subsidies on global food prices. Numerous wire service stories in more than seven languages resulted in online pick-up by top media outlets, such as CNN Online, *New York Times* Online, TIME.com and *International Herald Tribune* Online.

Media outreach at AGM07 also dealt with the CGIAR Science Awards and with the announcement of a Bill & Melinda Gates Foundation grant for the CGIAR's African Women in Agricultural Research and Development Program. The latter was heavily covered by major African newspapers, including *Business Daily*, *East African* and *The Standard* in Kenya; *Daily Independent* and *This Day* in Nigeria; and *Daily Monitor* and *New Vision* in Uganda.

The AGM07 in general was massively covered by Chinese media. In fact, the CGIAR Director was recently informed that AGM07 was determined to be the most widely reported agricultural event in the Chinese media for the entire year.

Climate Change Conference in Bali

Also in December, the thirteenth Conference of the Parties (COP-13) to the UN Framework Convention on Climate Change (UNFCCC) in Bali presented another opportunity for the CGIAR to step into the limelight with the promotion of *"Do Trees Grow on Money?"* a report by the Center for International Forestry Research (CIFOR) released in conjunction with Forest Day at the COP. CIFOR's timely report on the hot topic of deforestation's contribution to climate change and the potential for avoided deforestation to form part of the solution for mitigation in the post-2012 climate agreement became a high profile news story. The communications unit at CIFOR, Burness Communications, and the CGIAR Secretariat communications staff joined forces for an international promotion that received coverage in *International Herald Tribute*, *Financial Times*, *El Pais* in Spain, *Le Figaro* in France, *Jakarta Post* in Indonesia, and *Tagesspeigel* in Germany, just to name a few. Several wires such as Reuters, Associated Press (AP), and Agence France Press (AFP) and on-line news sources also carried the story.

CGIAR ships seed to Svalbard

Immediately after AGM07 and COP13, CGIAR communicators began preparing for a major collective effort to publicize the smoothly coordinated shipment of tons of seed of some 200,000 crop samples from 10 CGIAR genebanks to the Svalbard Global Seed Vault. The facility was built by the Norwegian government to serve as a safeguard of last resort for the genetic heritage of world agriculture; operating costs are being covered by the Global Crop Diversity Trust, based at Bioversity International.

Since the official opening of the Vault in late February was expected to generate huge coverage, a news release on CGIAR Center seed shipments – putting the focus on the living contents of the vault – was developed and promoted a month in advance. Burness Communications prepared and promoted the story, with the active participation of the CGIAR Secretariat and several Centers, especially the International Center for Tropical Agriculture (CIAT), International Maize and Wheat Improvement Center (CIMMYT), International Potato Center (CIP) and International Institute of Tropical Agriculture (IITA). About 10 wire services wrote stories, and dozens of reports appeared in broadcast, print and online media. Because the release was heavily promoted with the Mexico City press pool and with other media in Latin America, coverage in that region was especially intense.

Maintaining the momentum

In the months since the Svalbard story promotion, the work of the CGIAR Centers has continued to occupy the media spotlight. For example, a Gates Foundation grant to the International Rice Research Institute (IRRI) for the development of “climate-hardy rice” caught the attention of several wire services as well as the *Wall Street Journal* and *Nature*. IRRI has also been quite active in bringing attention to the consequences of serious rice shortages in Asia through articles in *The Economist* and other major media. IFPRI has likewise continued to figure importantly in news stories about food price inflactioin.

In mid-April, CGIAR communicators held their second workshop on news story development at the Addis Ababa campus of the International Livestock Research Institute (ILRI). The group of about 25 communicators, representing 10 Centers, identified and developed a new set of story ideas for promotion with the media during the rest of 2008. The story development workshops are proving to be a highly effective mechanism for maintaining the momentum of CGIAR media coverage and for building the capacity of CGIAR communicators to advance this important task.

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Estimating our Reach

In recent months, media coverage of the work of the CGIAR Centers has reached new highs, with current monthly media hits averaging about 1,200, a four-fold increase from a year ago. What does this mean in terms of our stories reach and impact? To get a better understanding of our reach, an audience analysis was conducted by Burness Communications, a public relations firm based in Washington. Burness assessed coverage received in relation to a story promoted collaboratively by the International Livestock Research Institute (ILRI) and the CGIAR Secretariat communications team on the conservation of animal genetic resources. The promotion coincided with the FAO organized Interlaken Workshop on Animal Genetic Resources in September 2007. The total audience reached derived from this analysis was 49,554,844 people, of which 5,697,702 were reached by printed publications and 43,857,142 by broadcast radio.

Those numbers are based on the circulation numbers of every daily and weekly newspaper and magazine in which the story appeared in print (see Table 1). For newspapers and magazines, all circulation numbers were obtained from Cision MediaSource, unless otherwise indicated. The radio broadcast reach estimate is based on the daily audiences of most of the top radio stations on which the story was broadcast (see Table 2), however, information was not available for all stations.

Table 1: Circulation for print coverage

PRINT NEWSPAPER OR MAGAZINE	CIRCULATION
The Australian	133,000
Australian Farm Journal	5,162
Berliner Zeitung (Germany)	261,693
Business Daily (Kenya)	16,000
China Post	300,000
Courier Mail (Australia)	221,049
Die Presse (Austria)	120,503
East African (Kenya)	35,000
East African Standard (Kenya)	60,000
Le Figaro (France)	332,818
Financial Times (UK)	426,830
Frankfurter Allgemeine Zeitung (Germany)	527,252

The Guardian (Tanzania)	25,000
The Herald (Zimbabwe)	80,000
Hindustan Times (India)	1,066,000
The Mercury (Australia)	49,586
Le Monde (France)	350,039
The Monitor (Uganda)	27,000
Nature	67,437
The Nation (Thailand)	58,000
Nederlands Dagblad (Netherlands)	33,200
New Scientist	178,854
New Vision (Uganda)	35,186
Estado de Sao Paolo (Brazil)	345,000
Sueddeutsche Zeitung (Germany)	703,575
Tages Anzeiger (Switzerland)	234,518
The Tide (Nigeria)	5,000
	TOTAL PRINT NEWSPAPER OR MAGAZINE CIRCULATION = 5,697,702

Source: Burness Communications

Table 2: Audience estimate for radio coverage

RADIO STATION	DAILY AUDIENCE
ABC Radio (Australia)	142,857
BBC World Service	26,142,857
Radio France Internationale—English to Africa	1,142,857
Voice of America Radio	16,428,571
	TOTAL TOP RADIO STATION AUDIENCE = 43,857,142

Source: Burness Communications