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REDUCING POVERTY
AND HUNGER
Looking Back and Looking Forward

DECEMBER 2006

Reflections from the Development Community

Full responses from the respondents below are available at www.ifpri.org/pubs/pubs.htm#nl.

For the December issue of *IFPRI Forum*, IFPRI invited some key members of the international development community to comment on the successes and failures in reducing poverty and hunger in the developing world in 2006, as well as on the upcoming opportunities and obstacles of 2007. Here are their responses.

Sartaj Aziz, *Pakistan's former minister of finance, is currently the vice chancellor of the Beaconhouse National University at Lahore.*

2006 successes: There was notable progress in Asia in moving toward the Millennium Development Goal (MDG) of halving hunger and poverty by 2015. Major Asian countries like China (which has already surpassed the MDG target), India, and Pakistan have continued to make significant policy improvements and undertook pro-poor development programs. Brazil also expanded resources for its zero-hunger program.

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How Will Agriculture Adapt to a Shifting Climate?

Global climate change poses particular risks to poor farmers in developing countries, but there are steps that farmers, policymakers, and researchers can take to minimize losses and adapt to climate change.

Climate change, it appears, is now under way. Since 1900 the global mean temperature has increased by 0.7 degree Celsius. The Intergovernmental Panel on Climate Change (IPCC) has concluded that human activities that emit greenhouse gases into the atmosphere are responsible for most of the warming of at least the past 50 years.

Past emissions that are already in the pipeline mean that even if global emissions stopped today, the Earth's temperature would rise by about 0.5 to 1.0 degree Celsius over the next several decades. If global emissions stabilize at today's level, the temperature would increase by 2 to 5 degrees Celsius by the time it reaches equilibrium. And if

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Global Hunger Index

A Focus on Conflict and AIDS

Progress in combating hunger and undernutrition has been lagging for several decades. Part of the problem is that it is difficult to measure even the narrowest aspect of food insecurity—inadequacy of dietary energy intake—on a timely basis. Various composite international indices, such as the United Nations Development Programme’s Human Development Index and the Corruption Perceptions Index released by Transparency International, measure other complex phenomena that cannot be captured adequately by a single indicator, but until recently, a widely propagated “hunger index” did not exist.

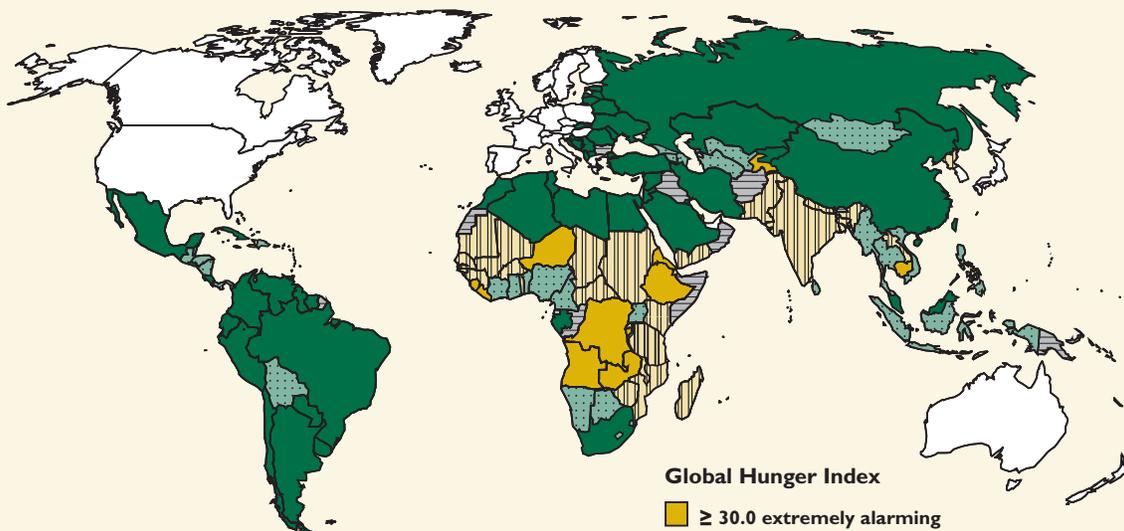
The Global Hunger Index, created by Doris Wiesmann, a postdoctoral fellow at IFPRI, was designed to fill this gap. It includes three equally weighted indicators: the proportion of undernourished people as estimated by the Food and Agriculture Organization of the United Nations (FAO), the prevalence of underweight in children under five as compiled by the World Health Organization (WHO), and the under-five mortality rate as reported by UNICEF. The GHI’s broad conceptual basis allows it to go beyond dietary energy availability to better reflect the multidimensional causes and manifestations of hunger.

Thus far, the GHI has been calculated for 1981, 1992, 1997, and 2003, which is the most recent year for which data are available, and has been used to rank 97 developing countries and 22 countries in transition. Regional trends show that in the past two decades, South and Southeast Asia have achieved some success in reducing hunger due to the Green Revolution and to investments in the social sector and in infrastructure. In contrast, the trends are mixed for Sub-Saharan African countries, where the Green Revolution largely failed, and where wars and AIDS have wreaked havoc on food security in many countries.

Violent conflicts, especially protracted wars, have long-term negative effects on the GHI. “More attention should be given to conflict prevention and resolution as well as to rehabilitation measures in the field of

agriculture, nutrition, and health after peace has been restored,” says Doris Wiesmann.

Wiesmann also found that countries with an HIV prevalence rate greater than 10 percent have a GHI score that is almost 4 percentage points worse than that of countries with lower HIV prevalence rates. She says this can be attributed to concurrent significant differences in the proportion of undernourished and the under-five mortality rate. “The manner in which the AIDS pandemic is confronted is crucial for protecting food security in these countries,” she says. ■



Global Hunger Index

- ≥ 30.0 extremely alarming
- 20.0 – 29.9 alarming
- 10.0 – 19.9 serious
- 1.5 – 9.9 low to moderate hunger
- no data
- excluded from GHI

Sources: FAO 2005, WHO 2006, UNICEF 2005, and Doris Wiesmann's estimates calculated for 2003.

Using Household Expenditure Surveys to Measure Food Insecurity

Reducing food insecurity in the developing world continues to be a major public policy challenge and one that is complicated by lack of information on the location, severity, and causes of food insecurity. Such information is needed to properly target assistance, evaluate whether progress is achieved, and develop appropriate interventions to help those in need. A recent IFPRI research report on food insecurity by Lisa C. Smith, Harold Alderman, and Dede Aduayom (www.ifpri.org/pubs/abstract/rr146.asp) contains new estimates of food insecurity based on food data collected from 12 Sub-Saharan African countries as part of household expenditure surveys (HESs).

HESs offer a rich lens through which to examine food insecurity among and within countries. The surveys used for this report examine a wide variety of socioeconomic characteristics—including region of residence, urban or rural residence, economic status, and female- or male-headed household—that can be of particular interest to policymakers. One consistent pattern that emerged is that urbanites and male-headed households in eastern and southern Africa have a clear advantage when it comes to diet quality.

The report demonstrates the value of HES data for generating estimates of both diet quantity indicators and diet quality indicators. Further, it shows that estimates of food-energy deficiency based on HESs differ substantially for many countries from estimates based on aggregate country food availability rather than directly on data representing peoples' access to food.

The approach used in this report demonstrates that household expenditure surveys are a rich source of data for improving food security measurement. They can improve understanding of benchmarking and measure progress toward the United Nations' Millennium Development Goal of halving the proportion of people suffering from hunger by 2015, and the World Food Summit Goal of cutting the absolute number of undernourished people in half by that time. Though updating the HESs annually is not feasible due to their time-consuming nature, updating them on a five-year basis, at minimum, would help enrich understanding of progress in food security. ■

Income Diversification, Poverty, and Inequality in Vietnam

Since the mid-1990s, Vietnam has sustained high rates of economic growth and has reduced poverty from 58 percent in 1993 to 37 percent in 1998. Despite these gains, Vietnam is among the 30 poorest countries in the world. As a result, the government has embarked upon a series of efforts to reduce rural poverty and raise rural incomes.

Recent efforts have involved income diversification, especially into high-value crops. A recent IFPRI research report by Nicholas Minot, Michael Epprecht, Tran Thi Tram Anh, and Le Quang Trung (www.ifpri.org/pubs/abstract/rr145.asp) has found that farmers in the Northern Uplands—the poorest region of the country—have gradually shifted from rice and cassava cultivation to fruits and tea production. This is due to changes in domestic demand and trade liberalization, facilitated by various programs to promote the adoption of new crops. However, crop diversification accounts for just 6 percent of the crop income growth over 1993-98. Yield increases are the most important source of income growth, particularly among the poor. In contrast, crop diversification accounts for a much larger share of income growth in the commercially oriented

Southeast region. This suggests that in the poorest areas, increasing productivity should take priority over crop diversification.

Because many of Vietnam's antipoverty programs are geographically targeted, improving the targeting of these programs by adopting more precise estimates of poverty at the district and commune level could provide significant benefits. Another IFPRI research report by Nicholas Minot, Bob Baulch, and Michael Epprecht (www.ifpri.org/pubs/abstract/rr148.asp) using "small area estimation" has determined that the poverty rate in Vietnam is greatest in the upland areas of the country—mostly because of low agricultural potential and lack of market access—but that most of the country's poor actually live in the Red River Delta and the Mekong River Delta areas. The study also found that poverty increases with distance to urban centers, but proximity to small district centers is a stronger predictor of poverty rates than is distance to large cities or distance to roads. Thus, rural-urban linkages at the local level matter a great deal for poverty reduction. ■

“There are reasonably good prospects that the developing world, having recognized the importance of agriculture and rural areas in the fight against hunger and poverty, will continue to evolve and implement policies that improve the terms of trade for agriculture and create opportunities for nonfarm employment through microcredit, technical training, and small-scale irrigation projects.”

—Sartaj Aziz

2006 failures: 2005 was a landmark year for a remarkable array of high-level policy initiatives for addressing poverty and hunger, culminating in the G-8 Summit in July 2005. But actual progress in meeting those commitments has been very disappointing in 2006. The biggest disappointment was the deadlock of the World Trade Organization’s Doha Round.

2007 opportunities: There are reasonably good prospects that the developing world, having recognized the importance of agriculture and rural areas in the fight against hunger and poverty, will continue to evolve and implement policies that improve the terms of trade for agriculture and create opportunities for nonfarm employment through microcredit, technical training, and small-scale irrigation projects.

2007 obstacles: The negative effects of agricultural subsidies provided by developed countries must be kept in check, otherwise the resultant distortions in global commodity markets will not only deny larger access for agricultural exports from developing countries, but also dampen domestic agricultural prices and erode the livelihood of small farmers in these countries.

Andrew Bennett is executive director, Syngenta Foundation for Sustainable Agriculture, Switzerland.

2006 successes: The award of the Nobel Peace Prize to Muhammad Yunus—a fitting recognition for someone who had a vision and made it work for poor people.

2006 failures: The collapse of the Doha Round—this will perpetuate distortions and inhibit market opportunities for developing countries.

2007 opportunities: Political commitment to a realistic action plan on climate change in which all countries will engage, and a reduction in tensions, conflict, and suffering in West Asia, the Middle East, Sudan, and the Horn of Africa.

2007 obstacles: Instability and building commitment and capacity to deliver the outcomes desired.

Margaret Catley-Carlson is chair of the Global Water Partnership

2006 successes: Agricultural productivity per capita went up—a little bit. And World Bank lending for agricultural infrastructure went up—a little bit. The availability of and planting of New Rice for Africa (NERICA) [varieties] went up—a little bit. Treadle pumps spread further in Africa—a little bit.

2006 failures: Even bigger issues than poverty and hunger are emerging. The damage we are doing to our planet will eclipse all other issues. Better resource management—including improvement of those measures that would help poor people—falls to the bottom of consumption-driven national agendas. The September United Nations Summit did little on development issues—and little on the big political items, either!

2007 opportunities: More and more, we know what to do—in terms of agricultural change, roads, roads, roads, roads, water management, soil restoration, crop intensification, credit that works, agricultural inputs. There is so much knowledge—and so many competing agendas.

2007 obstacles: It’s poverty, stupid. From time immemorial, we have wanted to ignore it. But the number of poor grows—even though the percentage of people living in poverty continues to decline (which shows that while we know what to do, it is a question of how much we really want to do). It is horrifying but nevertheless true that as the ravages of climate change make their impact, it will be the poor that suffer first, and probably the most.

Kevin Cleaver is assistant president of the Programme Management Department at the International Fund for Agricultural Development (IFAD).

2006 successes: Progress in China and Vietnam, East Asia more broadly, and some positive signs in parts of Africa such as Ghana and Tanzania.

2006 failures: The donor community: largely talk, less action. No reform of international trade and

subsidy systems affecting agriculture. In many developing countries, limited or no internal action to address hunger and poverty—corruption remains rampant.

2007 opportunities: Adapting the China/East Asia models of poverty reduction to other circumstances and countries—and financing such approaches.

2007 obstacles: Continued lack of commitment by donors and many developing countries to action as opposed to words; lack of consensus on reform of trade and subsidy barriers.

Peter H. Gleick is president of the Pacific Institute in Oakland, California.

2006 successes: Although there were no huge successes in 2006, there were some modest improvements in efforts to address unmet basic human needs for water and water services.

2006 failures: Overall, governments are not living up to their commitments and responsibilities. The United States, for example, has failed to provide the financial and moral commitments it is capable of, and to meet its responsibilities in the area of water and sanitation.

2007 opportunities: To intensify efforts by nongovernmental organizations (NGOs) and governments to meet the Millennium Development Goals.

2007 obstacles: The continued obsession of governments with military power and expenditures remains a major obstacle to reducing economic inequality and increasing the opportunity for meaningful work and satisfying lives.

Jikun Huang is director of and professor at the Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research.

2006 successes: The rapid growth of the economies of China and India. China's real GDP is expected to grow at more than 10 percent during 2006. The employment generated from the strong economic growth and improvements in regional labor markets have continued to raise the income of farmers in the poor regions.

2006 failures: The suspension of the Doha Development Round Negotiations. The least developed and developing countries are the biggest losers because the round was originally supposed to be designed to be pro-poor and to create links that would help farmers in the developing world become more efficient and gain access to emerging world markets for agricultural commodities.

2007 opportunities: Continued strong economic growth in China and India, and the recent emergence of China-Africa cooperation and the willingness of China to join global efforts to facilitate economic development in Africa.

2007 obstacles: The absence of any urgency on the part of

governments in both developed and developing countries to make political and financial commitments to reduce poverty and hunger. More effort should be made to invest in education and rural infrastructure, guarantee access to food and provide clean drinking water and primary health care.

Timothy Lang is professor of Food Policy, Department of Health Management & Food Policy, Institute of Health Sciences, City University, London.

2006 successes: The impact of the climate-change agenda on the continuing realization that the sustainability and food production agendas need to come together.

2006 failures: The foreign policy failures of the rich countries (United States, United Kingdom) in the Middle East, and the failure of the political elite to sort out world trade even on their own terms, let alone in terms of a world sustainable trade agreement.

2007 opportunities: The continued coming together of academics, NGOs, and popular movements to pressure policy change.

2007 obstacles: Wars and political instability.

Charlotte McClain-Nhlapo is disability advisor, East Asia Pacific Region/South Asia Region, World Bank, U.S.A.

2006 successes: There are very few “great successes,” but there are pledges that should result in more aid to Africa, and commitments to better and stronger leadership by way of the Africa Peer Review mechanism. There has also been a reduction of poverty in the East Asia region, and in Africa, a few countries' growth registered up to 5 percent.

2006 failures: Growing domestic inequalities as a result of globalization. We need to better recognize that these huge domestic inequalities often result in conflicts, which only further perpetuate poverty and hunger.

2007 opportunities: Developing a comprehensive strategy for food security, investing in people, ensuring clean water for all, addressing the gender dimension, improving governance and resolving conflict, developing national policies that support social cohesion, creating regional cooperation linked to harmonized donor support, and developing stronger partnerships.

2007 obstacles: The lack of access to services, ongoing conflict, and HIV/AIDS. We need better infrastructure, so that food can be easily transported, stored, and distributed, and we need to design effective interventions that empower and facilitate the participation of poor people.

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“Recognition of the importance of investment in agricultural research, of the need for diverting public resources and investments to villages where poor people are concentrated, of the importance of microcredit in reducing poverty (which earned Muhammad Yunus and the Grameen Bank the Nobel Peace Prize), and of the need for research on biotechnology in many developing countries.”

—M. Syeduzzaman

Hans-Joachim Preuss is secretary general of Deutsche Welthungerhilfe, Germany.

2006 successes: That agriculture and rural development are back on the political agenda after the World Bank has decided to dedicate its 2008 World Development Report to the subject.

2006 failures: That the sharp increase in official development assistance is mainly an effect of debt cancellation, and that the amount of “fresh money” to developing countries is still below our expectations.

2007 opportunities: That we—as German NGOs—will use the German European Union presidency together with the G8 summit in Germany to bring African agriculture higher on the political agenda, and that heads of state will commit to contributing higher amounts of their budgets to this sector, removing obstacles for small-farmer development, and acknowledging the importance of civil society when it comes to modernizing the economy.

2007 obstacles: That there will be new outbreaks of violent conflict in Darfur/Sudan, Liberia, Sierra Leone, Rwanda, Democratic Republic of Congo, and Haiti; and that despite all the efforts of the international community, Afghanistan will be lost to warlords and religious fundamentalists.

M. Syeduzzaman is former minister of finance, Bangladesh.

2006 successes: Recognition of the importance of investment in agricultural research, of the need for diverting public resources and investments to villages where poor people are concentrated, of the importance of microcredit in reducing poverty (which earned Muhammad Yunus and the Grameen Bank the Nobel Peace Prize), and of the need for research on biotechnology in many developing countries.

2006 failures: Unprecedented increase in the price of oil which has had, and will continue to have, a severe impact on the cost of production and marketing of cereals, fruits, and vegetables; the failure of multilateral trade negotiations; the failure of many developing countries to remain on track in terms of the MDGs, and the failure of donors to honor their commitments.

2007 opportunities: Reduction of global hostilities, especially in the Middle East and in Africa; government–NGO collaboration in many African countries; and learning lessons from the South Asian experience.

2007 obstacles: Failure to recognize the massive impact that global warming can have on weather, water, and soil fertility and to initiate policies to counter it; failure to initiate action on the protection and replenishment of sea resources; and failure to strengthen population-control programs, to sustain economic policy-reform initiatives, and to promote investment and governance in many developing countries.

Alan Whiteside is director of the Health Economics and HIV/AIDS Research Division (HEARD), University of KwaZulu-Natal, South Africa.

2006 successes/2007 opportunities: 2006 may be the year in which global climate change finally got the attention it deserves. If projections are correct, then it will be a major source of food insecurity in poorer and more vulnerable parts of the world. I hope, therefore, that looking ahead to 2007, there will be serious attention paid to this issue and that we will see global political commitment, a change in attitude and a real desire to make a difference.

2006 failures/2007 obstacles: The failures of 2006 that will carry forward into 2007 also involve global commitments. The lack of new and fairer trade agreements must rank highest here. Without more equitable development, poverty and hunger will continue. Redressing this requires the wealthy to give up something. The biggest obstacle to reducing world poverty and hunger is that we are a selfish species with a narrow view of the world and what benefits us. ■

Obesity and Chronic Diseases: Not Limited to the Affluent

How can food policy address the “double burden” of obesity and chronic diseases in Africa?

Abay Asfaw

THE CHALLENGE

Obesity has become a leading global public health problem. However, very little is known about its incidence, causes, and health effects in developing countries and particularly in Africa. Policymakers, donors, and researchers hesitate to draw attention to obesity in Africa, due to the huge burden of diseases associated with the high prevalence of hunger and malnutrition and acute infections in the continent. Recent studies, however, show that more and more Africans are becoming overweight or obese, and that this trend is not limited to the affluent. In Egypt, 70 percent of women and 48 percent of men are overweight or obese. In Morocco 40 percent of the population was overweight in 2004; in Kenya, 12 percent. Unless urgent measures are taken to reverse the current trend, the “double burden of disease” will hinder poverty reduction and sustainable economic development in many African countries.

Recent studies conducted by IFPRI provide insights about the root causes of obesity and its association with chronic diseases in some African countries. This understanding will help to develop wide-ranging policy measures related to food production, marketing, pricing, and nutritional education.

FINDINGS

1. Food price policies and rising obesity prevalence in Africa

Government food pricing policies can be one of the drivers of obesity. A study conducted in Egypt shows that the country's food subsidy program reduces the per-calorie costs of energy-dense foods such as bread, oil, and sugar compared to energy-dilute but nutrient-dense foods such as fruits

and vegetables. The study also reveals that mothers' Body Mass Index increases as the price of energy-dense food items decreases and decreases as the price of energy-diluted food items decreases. This suggests that the food subsidy program may aggravate obesity in the country by lowering the direct costs of becoming obese. Therefore, improving the affordability of micronutrient rich foodstuffs may help to improve the diet of the population and consequently help to solve the obesity problem.

2. Overweight and obesity overlap with micronutrient deficiency

Individuals who do not have access to micronutrient-rich food items are more likely to be obese. A study of Egyptian mothers shows that the odds of being overweight or obese are 80 percent higher for micronutrient-deficient mothers. This implies that the overlap between obesity and micronutrient malnutrition may be overlooked since micronutrient-deficiency is usually associated with hunger. This overlap may also create new and serious public health problems since little is known about the potential impact of the interaction between micronutrient-deficiency and diet-related chronic diseases. Thus, there is a need to focus food-related policies toward addressing all forms of malnutrition.

3. Obesity is associated with chronic diseases in Africa

Little is known about the association between obesity and chronic diseases in Africa. An empirical study conducted in Senegal and South Africa examined the association between obesity and four doctor-diagnosed chronic diseases. The results reveal that obese respondents are more likely to face the risks of arthritis,

diabetes, and heart diseases in South Africa and of heart disease and asthma in Senegal than their leaner counterparts. This strong association between obesity and chronic diseases has important implications for policymakers. Failure to address the problem of obesity today may impose additional burdens that the health sector and the economy of African countries may not be able to shoulder in the future. African countries must not learn about the impact of obesity the hard way, through direct experience.

CONCLUSION

Obesity is now a major health problem in Africa, along with HIV/AIDS and other communicable diseases. The problem is complicated by the coexistence of obesity and undernutrition in the same countries, households, and individuals. Under- and overnutrition are “two symptoms at either end of the same continuum.” As such, a holistic approach is needed to address the two problems simultaneously. Addressing obesity demands a multifaceted approach, recognizing the roles of globalization, trade agreements, food production, marketing, pricing, education, physical activity, and other factors. In-depth research is needed in African and other developing countries to identify optimal and multidimensional policies that help to address the problems of under- and over-nutrition simultaneously and curb the current trends toward obesity and chronic diseases before the problems reach an epidemic level. ■

Abay Asfaw (a.asfaw@cgiar.org) is a postdoctoral fellow in the Food Consumption and Nutrition Division at IFPRI.

This commentary is based on the following background papers:

Asfaw, A. 2006. The Effects of Obesity on Doctor-Diagnosed Chronic Diseases in Africa: Empirical Results from Senegal and South Africa. *Journal of Public Health Policy* 27 (3): 250–264.

Asfaw, A. 2006. The Role of Food Price Policy in Determining the Incidence of Obesity: Evidence from Egypt. *Review of Agricultural Economics* 28 (3): 305–312.

Asfaw, A. 2006. Do Government Food Price Policies Affect the Prevalence of Obesity? Empirical Evidence from Egypt. Forthcoming in *World Development* (Winter 2006).

CGIAR Researchers Join Forces with Senegalese Parliamentarians to Promote Agricultural Science for the Benefit of the Poor

In the irrigated rice systems of West Africa, the back-breaking work of threshing and cleaning grain is largely carried out by women. This difficult manual labor not only adversely affects the women's health, but the quality and profitability of the rice as well. To address these problems, the Africa Rice Center (WARDA), in close collaboration with Senegalese partners, developed and adapted a rice thresher that is perfectly suited for the Senegal River Valley conditions.

In order to discuss this and other new technologies, production systems, income-generating crops and products, and development strategies and policies that can improve the livelihoods of the rural poor while protecting the environment, researchers from seven centers supported by the Consultative Group on International Agricultural Research (CGIAR) met with Senegalese parliamentarians in Dakar in October. The event, held as part of the CGIAR Marketing Group's Parliamentarian Campaign, was organized jointly by IFPRI and l'Institut Sénégalais de Recherches Agricoles (ISRA).

CGIAR scientists gathered with Senegalese parliamentarians, researchers, and ministers at the CGIAR-sponsored dialogue, "A Focus on Agriculture and Science for Development."



Left to Right : Papa Abdoulaye Seck (director general of WARDA), Taib Diouf (acting director general of ISRA), and Senegalese parliamentarian Mamadou Diakharé discuss the importance of agricultural research to Senegal's development.



Both photos this page © 2006 Michele Pietrowski/IFPRI

The goal of the dialogue was to familiarize parliamentarians with cutting-edge research being conducted by CGIAR scientists in collaboration with their Senegalese partners, highlight how these efforts are contributing to Senegal's agricultural and rural growth, and raise awareness about how science can be mobilized to benefit smallholder farmers.

Hearing how the research activities of Senegalese and CGIAR scientists have led to concrete results in terms of reducing poverty and fostering human well-being, the parliamentarians unanimously agreed on the importance of the dialogue, and called for increased support for agricultural

research for the benefit of Senegal's national development.

"By the end of the meeting, all participants understood how vital it is for researchers to inform parliamentarians of the potential benefits of promising research, and for parliamentarians in turn to provide increased funding and favorable policies to support such research," said Dr. Papa Abdoulaye Seck, director general of WARDA.

In addition to IFPRI and WARDA, participating CGIAR centers included the International Center for Tropical Agriculture (CIAT), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Livestock Research Institute (ILRI), the International Water Management Institute (IWMI), and the World Agroforestry Centre. ■

How will Agriculture Adapt to a Shifting Climate? *(continued from page 1)*

emissions continue to grow at current rates, they would cause temperatures to rise by 3 to 10 degrees Celsius, not including climate feedback effects that could further exacerbate climate change in a vicious circle.

Awareness of climate change and its risks has now made it firmly onto the international agenda. Former U.S. vice president Al Gore recently released a documentary, *An Inconvenient Truth*, on the risks of global warming, and in October 2006 Sir Nicholas Stern, a U.K. Treasury official and former World Bank economist, published the "Stern Review on the Economics of Climate Change," a 700-page report arguing that the risks are large and the costs of acting now are relatively small.

"Climate change is rapidly emerging as one of the most serious threats that humanity may ever face," said Kenyan Environment Minister Kivutha Kibwana at the opening of the United Nations Climate Change Conference on November 6. The conference, of which Kibwana was president, brought together representatives of the 166 parties to the Kyoto Protocol for their second meeting.

Because it is linked so closely to natural resources and climate conditions, agriculture will keenly feel the effects of climate change through changes in both temperature and precipitation, and thus the availability of water for growing food. Scientists predict that the interiors of major continents will warm more quickly than the oceans. In addition, current weather extremes are likely to be exacerbated. It is likely that wet areas of the world will get even wetter, and dry areas will get drier. Thus, for example, monsoons in South Asia will intensify, while arid regions of Africa will become drier. Mark Rosegrant, director of IFPRI's Environment and Production Technology Division, points out, "Agriculture is the largest consumer of water globally, and as climate change alters the quantity and reliability of water supplies, it could threaten the welfare of millions of poor farmers."

Clearly, controlling and ultimately reducing greenhouse gas emissions are essential to minimizing the severity of global climate change and its harmful effects. Yet global warming has already begun, and given the levels of past greenhouse gas emissions, it will continue for decades.

According to Bob Watson, the World Bank's chief scientist and advisor for environmentally and socially sustainable development, "The Earth's climate is already changing, and further change is inevitable. Therefore we need to both mitigate climate change and to adapt to climate change. Clearly, the industrialized countries must take the lead in mitigating climate change by reducing greenhouse gas emissions, but large developing countries such as India and China will also have to start to reduce their emissions over the next 20 to 30 years, albeit with differentiated responsibilities. But for many countries, especially in Africa and small countries in Asia and Latin America, the challenge of the day is adaptation to current climate variability and climate change."

Africa to Be Hardest Hit

Of all the world's regions, Africa is likely to be hardest hit by the impacts of global warming. Climate models differ, but according to the U.K.'s Hadley Centre for Climate Change, a leading producer of global climate change estimates, temperature increases in parts of Africa could be double the global average increase. Given Africa's heavy dependence on agriculture—agriculture employs 70 percent of people in Africa—the effects of climate change could put millions of people there at greater risk of poverty and hunger.

Africa is particularly vulnerable to climate change because of its high proportion of low-input, rainfed agriculture, compared with Asia or Latin America, according to Siwa Msangi, an IFPRI researcher. The Food and Agriculture Organization of the United Nations (FAO) reports that rainfed agriculture is used on 95 percent of cropland in Sub-Saharan Africa. "This type of exposure to rainfall variability also extends to livestock, which mostly depend on range and grasslands that are affected by environmental shocks, such as climate change," says Msangi.

In addition, temperatures in Africa are already generally high and rainfall patterns often erratic, and climate change that exacerbates these conditions will thus create even more hardship. Most important, poverty is widespread in Africa, and governments typically face tight budget constraints, making it much harder for individuals and governments to invest in adaptations to climate change.

Moreover, Africa accounts for 30 percent of global land degradation, so farmers are already struggling to grow crops on land that contains inadequate nutrients and has little capacity to retain water. According to a November 2006 report from the United Nations Framework Convention on Climate Change (UNFCCC), climate models show that 80,000 square kilometers of agricultural land in Sub-Saharan Africa that is currently classified as water constrained will experience more rainfall with climate change. On the other hand, a much larger 600,000 square kilometers classified as moderately water constrained will become severely water limited. This will create even more challenges for African farmers, even for subsistence crops like millet, groundnuts, and sorghum.

Farmers Must Adapt

Farmers in developing countries will clearly need to adapt to a climate that is changing and will change further. Farming practices will have to change in many regions. In the face of drier, hotter weather, farmers may need to switch the crops they grow. For example, farmers in some areas of Africa may switch from maize to sorghum, which requires less water. Or they may switch to more drought-resistant or heat-resistant varieties of the crops they already grow.

Before adaptation can be implemented at the farm level, farmers need to perceive a need to change. According to surveys conducted by IFPRI and its partners in Sub-Saharan Africa, 90 percent of farmers in South Africa's Limpopo basin have noticed increased temperatures

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and reduced precipitation levels over the past 20 years, while in the highlands of Ethiopia's Nile River basin, 53 percent have perceived increased temperatures and 61 percent noticed declining precipitation. Yet fewer than half of the farmers who perceived long-term changes in climate actually implemented adaptation measures. Farmers cited insufficient access to credit as the most important obstacle to adaptation in South Africa, and lack of access to information on climate as well as options for adaptation in the Ethiopian highlands. According to Claudia Ringler, an IFPRI research fellow, successful adaptation will require not only new crop technologies and increased investments in water security in rural areas, but also policy actions to give small-scale subsistence farmers better access to information, credit, and markets.

Work is already underway on developing heat- and drought-resistant varieties of staple crops. A project in Southern Africa, for instance,

involving the International Maize and Wheat Improvement Center (CIMMYT) and partners in the region has released drought-tolerant maize varieties that yield 34 percent more than farmers' existing varieties in Malawi, South Africa, Tanzania, and Zimbabwe. According to Rodomiro Ortiz, director of resource mobilization at CIMMYT, farmers can benefit by changing not only what they grow, but how they grow it. CIMMYT scientists are working on developing wheat varieties that are well suited to zero-tillage farming, as well as heat-tolerant, for farmers in the Indo-Gangetic Plain of India. By drastically reducing farmers' manipulation of the soil, zero-tillage farming helps conserve water and nutrients for crops and, as an added benefit, reduces the amount of carbon dioxide released from the soil into the atmosphere, where it contributes to climate change. The Indo-Gangetic Plain is currently a highly productive, irrigated agricultural area, but climate models show that by 2050 as much as half of the region may be reclassified from a high-potential area to a heat-stressed area with a short growing season.

Regional cropping patterns will need to adjust to changing climates. A 2006 Texas A&M University study reached this conclusion when looking at the implications of climate change for food security in Mali. Currently, farmers in the region of Sikasso in relatively cool, wet southern Mali grow mainly maize and cotton, whereas farmers in Segou in hotter, drier northern Mali grow mainly sorghum and millet. As the climate of Sikasso becomes more like that of Segou, the farmers of Sikasso could benefit by growing the crops of Segou, the study found. As Segou becomes still hotter and drier, however, "its farmers may be left with few options," says Tanveer Butt, leader of the study. "The north will become more like the Sahara Desert."

So what are farmers to do if, despite their efforts to adapt, a drought or heat wave decimates their crops? One solution currently being tried in some areas is weather-indexed crop insurance. Insurance will not help farmers who confront permanent climate shifts that reduce the viability of agriculture, but it may be relevant for those who face more volatile weather events. Weather-indexed insurance pays out to farmers based not on their yield losses, but on specific, local weather-related benchmarks. But establishing effective crop insurance programs raises some challenges. Peter Hazell, formerly director of IFPRI's Development Strategy and Governance Division, cautions, "Insurance can be expensive and may not be affordable by the poor people who need it most. The cost is also likely to increase as the probability of more severe weather events increases. Simple forms of regionally indexed weather insurance may be most cost-effective but need government help getting launched. There may also be a case for subsidizing the insurance for the most vulnerable as an alternative to direct disaster assistance."

Food systems may also need to adapt to bear some of the burdens that poor households cannot bear themselves, adds Msangi. “We may need to revisit the design and governance of food distribution systems to stabilize food availability and to compensate for shocks that markets may not be able to absorb, especially where market-level imperfections and liquidity constraints exist,” he says.

Trees Are One Answer

Agroforestry—that is, the cultivation of trees together with crops—can help farmers cope with several of the adverse consequences of climate change. The World Agroforestry Centre (ICRAF) has assessed the potential for agroforestry to help adapt to climate change. Researchers have found that planting trees between crops and in the boundaries around crops can help prevent soil erosion, restore soil fertility, and provide shade for other crops. The practice of improved fallow also holds great promise. By planting certain fast-growing shrubs on fallow land, farmers reduce soil loss and improve soil structure in ways that allow it to retain much more water: “Optimizing the use of increasingly scarce rainwater through agroforestry practices such as improved fallow could be one effective way of improving the adaptive capacity of systems to climate change,” says Louis Verchot, principal scientist at ICRAF.

Agroforestry also has the benefit of contributing to climate change mitigation, because trees and shrubs tend to sequester more carbon than other crops. The IPCC reports that agroforestry has the potential to sequester nearly 600 million metric tons of carbon a year by 2040, compared with about 120 million metric tons for cropland. Given that deforestation and agriculture together account for 32 percent of greenhouse gas emissions, some argue that farmers in developing countries, who are so at risk from climate change, should be able to improve their livelihoods by participating in carbon emissions trading as part of the Kyoto Protocol’s Clean Development Mechanism. Odin Knudsen, joint chief executive officer of the company IDEACarbon and formerly senior manager of the Carbon Finance Unit of the World Bank, says that carbon payments to farmers could encourage them to change their farming practices in ways that benefit the globe while also helping to enhance their incomes. But to achieve these goals, the Clean Development Mechanism would need to change in several respects, says Knudsen. Agricultural land use change and forest preservation should be included as eligible activities, procedures for gaining payments for afforestation and reforestation should be simplified, and limits to payments in these categories should be removed. Then farmers’ cooperatives, or even rural banks, could



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arrange for certifying the group’s carbon sequestration, applying for carbon payments, and distributing funds back to farmers. “In the past, agriculture’s task was mainly to increase production,” says Knudsen. “It needs to switch to a new value proposition. Farmers will need to ask themselves, ‘How do I get more value from this crop—not just as food or fiber, but as a carbon asset?’”

Delivering Better Weather Forecasts

It would be easier for farmers to adapt to climate change if they knew what the weather was going to be like on their farms during the growing season. Africa in particular is in need of much better climate and weather information. The continent has about 1,150 world weather watch stations. That is one per 26,000 square kilometers—or eight times lower than the minimum density recommended by the World Meteorological Organization.

“Meteorological departments in Africa are often more aligned toward the aviation industry or the military than to development priorities in agriculture and other climate-sensitive sectors,” says James W. Hansen, a research scientist at Columbia University’s International Research Institute for Climate and Society. “In most African countries, realigning meteorological departments toward agriculture and development will require major shifts in policy and substantial investment in human capacity and in data.”

Improving climate information is only half the battle—the other half is ensuring that farmers get the information in ways they can use

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to make farming decisions. “We understand why poor farmers in developing countries often find little use for currently available operational climate information products,” says Hansen.

Part of the problem, he says, is that weather information is not provided on a narrow enough spatial and time scale, and little information is given to help farmers understand what weather forecasts might mean for their own particular plots. And it is often not made clear to farmers how certain or uncertain forecasts are. “Climate forecasts reduce but don’t eliminate uncertainty,” Hansen explains. “If risk-averse farmers are going to climate forecasts effectively, farmers must understand this uncertainty in a way that is consistent with how they understand and manage uncertainty in the absence of forecasts.”

Projects in India and Zimbabwe have brought farmers together with climate and agricultural scientists over several seasons to help climate prediction better match farmers’ needs, according to Hansen. This close interaction improved the farmers’ use of climate information in making decisions like what varieties to plant and when, and increased use of climate information was in turn associated with better harvests.

Scaling up these kinds of highly interactive projects will be a challenge, says Hansen, but it can be done through extension or farm advisory services. “It shows that farmers can make good use of climate information if it is local, timely, relevant, and transparent, and if they hear it from people they already go to for advice,” he says.

Not Just a Future Problem

The world community, through the UNFCCC, has established two funds to help poor countries adapt to climate change, and a third, the Adaptation Fund, is being established. Yet funding for the two existing funds is meager—just US\$43 million in 2005–06. And the Adaptation Fund is expected to receive only 2 percent of all funds invested in the Clean Development Mechanism. “Much more money is needed to fund adaptation,” says Knudsen.

Funding will need to go to researching crop varieties that are resistant to drought, heat, and floods, that sequester more carbon, and that make better biofuels. Moreover, other sectors besides agriculture will need funds to adapt as well. According to a report entitled “Africa: Up in Smoke 2” produced by a consortium of development organizations known as the Working Group on Climate Change and Development, the overall cost of adapting to projected climate change is likely to be between US\$10 billion and US\$40 billion a year. And the longer the world delays, the more the costs of adapting will increase.

A new model of development is needed, the report says, to give greater urgency to coping with climate change. For every policy and project, the key question should be, “Are you increasing or decreasing people’s vulnerability to the climate?”

What will it take to get developing-country governments and international organizations to start factoring climate change into their decisions? Clearer information on options may help. IFPRI is expanding an existing model of water and food projections to account for the impacts of climate change on both water and food security at a much more detailed scale than existing models. Understanding these impacts, says Mark Rosegrant, will help clarify the specific adaptations that both policymakers and farmers must make.

The challenge is making climate adaptation in poor countries a higher priority. James Hansen argues that the countries that are most vulnerable to future climate change tend to be most overwhelmed by immediate development concerns. “Understandably, poorer countries are unlikely to place a high priority on problems projected to occur 30–50 years down the road—problems imposed by relatively wealthy countries,” he says. “We hope to gain the attention of policymakers with a different approach: Climate variability is a current development problem. It is one of several crucial challenges that already impede progress in agriculture, particularly in the vast marginal rainfed farming regions of Africa and South Asia, where the majority of the Earth’s poor and food-insecure reside.”

This means that addressing the difficulties that farmers in many areas already face—not only low and erratic rainfall and hot temperatures, but also inadequate infrastructure, lack of access to markets and credit, and other challenges—will contribute to current agricultural development and food security while building resilience to future climate change. ■

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PUBLISHED BY

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