



THE WORLD FOOD PRIZE



GENDER IN AGRICULTURE



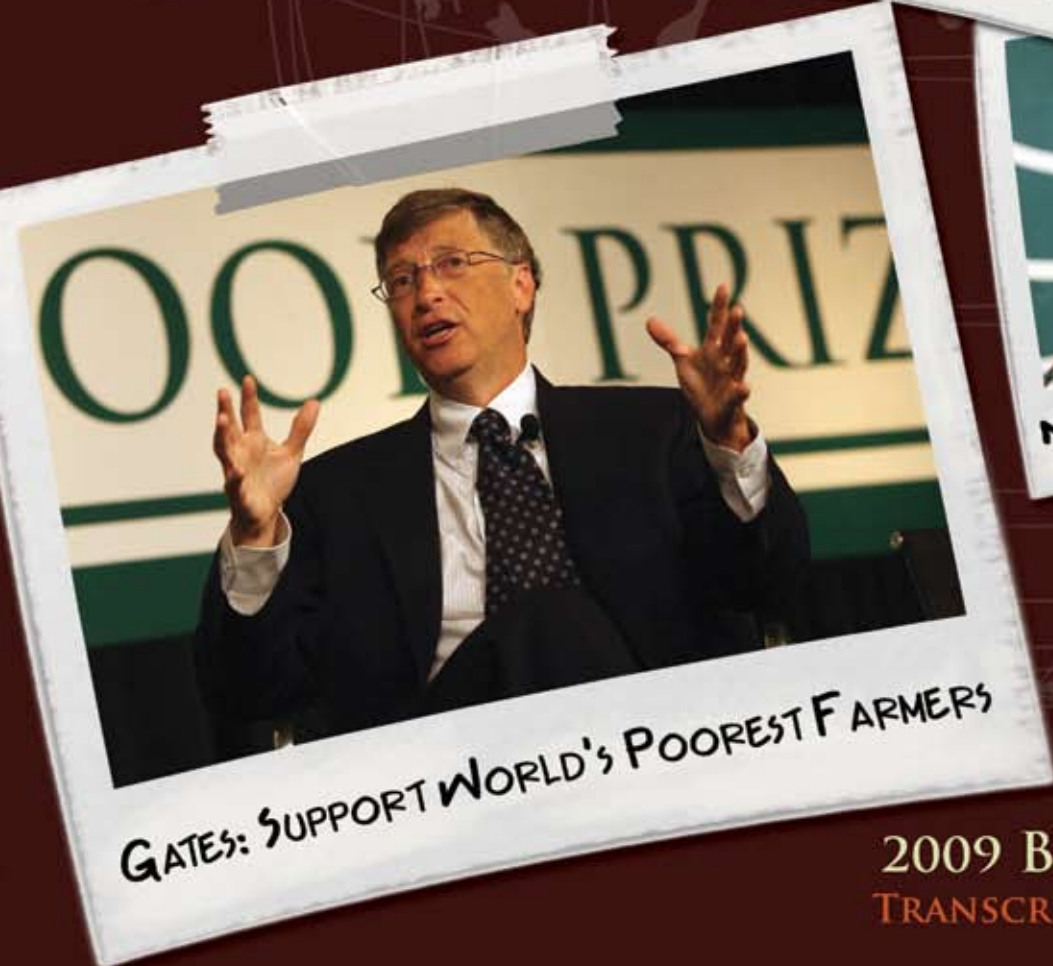
THREATS TO GLOBAL SECURITY



MINISTERIAL ROUNDTABLE



EJETA: AN AFRICAN GREEN REVOLUTION

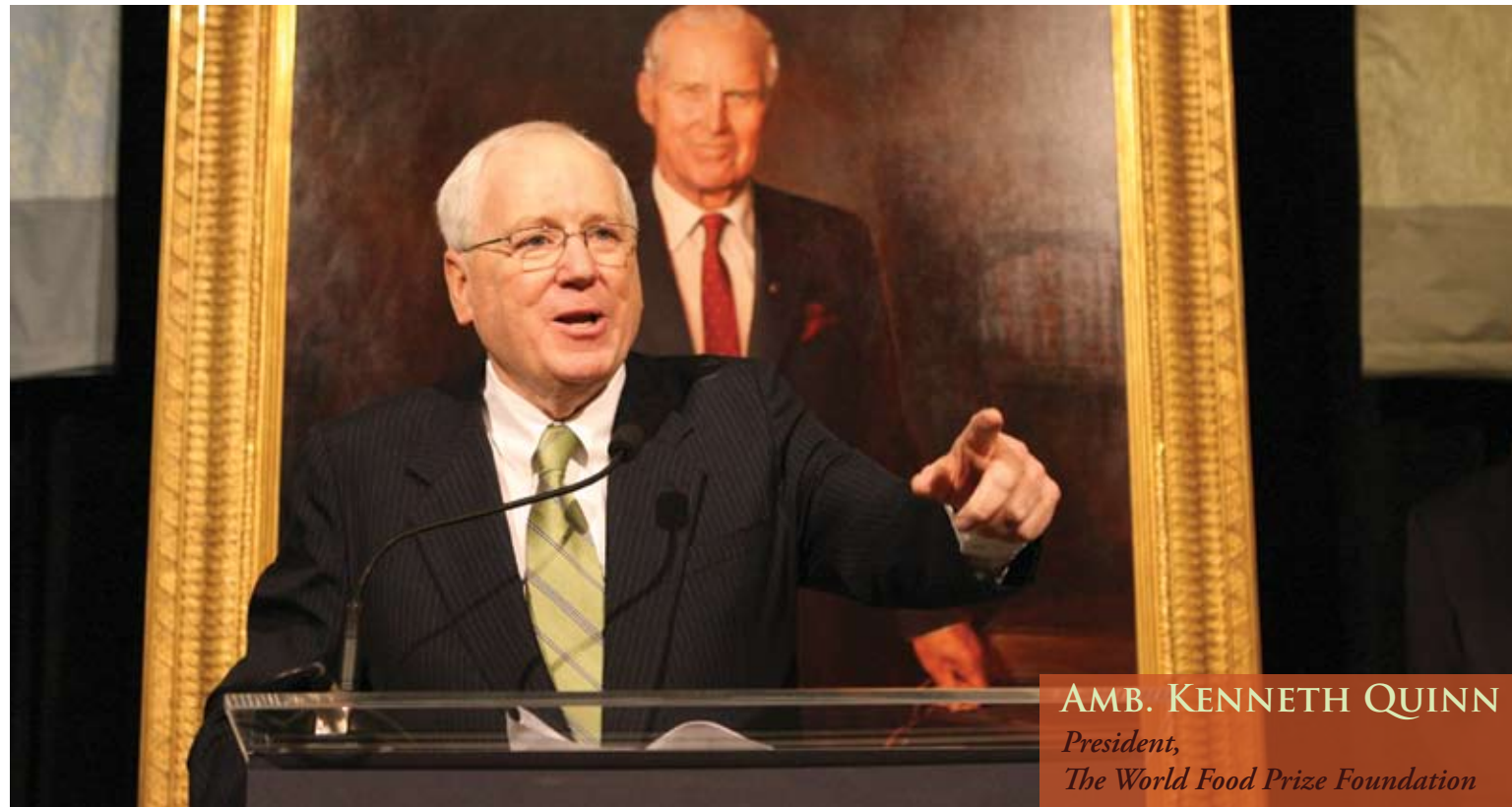


GATES: SUPPORT WORLD'S POOREST FARMERS



NOOYI: INDUSTRY MUST LEAD

2009 BORLAUG DIALOGUE
TRANSCRIPTS & EVENT HIGHLIGHTS



AMB. KENNETH QUINN
President,
The World Food Prize Foundation

President's Welcome

Ten years ago, the World Food Prize International Symposium was a half-day event attracting only about 50 people from outside of Iowa.

Ten years ago, it is safe to say that agriculture was unlikely to be found on the agendas of foreign ministers or the Secretary of State.

Over the last decade, working closely with our founder Dr. Norman Borlaug, my staff and I have strived to build the World Food Prize into one of the most stimulating conferences each year bringing together experts from agriculture, development, education, and government. We have endeavored to pick cutting-edge topics and to address subjects that we believe warranted much greater attention by foreign policy officials, such as: the role of biotechnology in development; the threat of agroterrorism; global water insecurity; and the dual global challenges of obesity and malnutrition.

As a result, each year participation has expanded as has the length of our conference. The "Borlaug Dialogue" is now a three-day event, with people attending from

more than 65 countries. As one senior foundation executive noted: "We meet a more diverse array of people at the World Food Prize in Des Moines than at any other conference we attend anywhere around the world."

This decade-long effort culminated in our 2009 symposium entitled "Food, Agriculture, and National Security in a Globalized World," with close to 1,000 participants.

It was our great honor to welcome Bill Gates and to have him give his first speech ever on agriculture and bringing the Green Revolution to Africa here at the Borlaug Dialogue. We also recognized Dr. Gebisa Ejeta of Ethiopia as our 2009 World Food Prize Laureate.

It was likewise a special privilege to have remarks by Secretary of State Hillary Clinton and to feature Secretary of Agriculture Tom Vilsack along with the ministers of agriculture from Burkina Faso, Canada, Egypt, and the Netherlands.

This book of symposium highlights captures their remarks and comments, as well as those of the CEOs, NGO leaders, journalists, research scientists, educators, intelligence of-

ficers, government officials, and other leaders and thinkers who participated.

It is our great hope that their presentations will help illuminate the challenge our globalized agricultural system may face as countries react to what they perceive as threats to their national security induced by food shortages, price rises, and changes in the climate.

Global agriculture faces numerous challenges in the coming years. It was humbling to have noted economist Jeffrey Sachs declare, "We need a venue to address these challenges. And I would hope that the World Food Prize can be the venue."

Several persons told me that they felt this was our "best conference ever." While I was, of course, pleased, I was so sorry that Norm was not able to be here. I think he might have felt his dream about the World Food Prize being seen as the "Nobel Prize for Food and Agriculture" was coming true.

To honor Norm, I hope you will mark October 13-15 on your calendar and plan to join us for the 2010 World Food Prize and Borlaug Dialogue. ■

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More than 500 community leaders turned out for the third annual Iowa Hunger Summit to take part in panel discussions and attend a “Hunger Luncheon” featuring Vicki Escarra, president and CEO of Feeding America. The event also involved leaders of the Iowa Department of Agriculture, the Community Food Security Coalition, and Doctors Without Borders.

Iowa Hunger Summit

The 2009 Iowa Hunger Summit on October 13 for the third year kicked off the World Food Prize events with a full-day program focused on Iowans’ diverse grassroots efforts to confront hunger both at home and abroad.

More than 500 community leaders and citizens from around the state attended the “Hunger Luncheon” featuring Vicki Escarra, president and CEO of Feeding America, whose keynote remarks focused on the one in eight Americans currently experiencing hunger in their lives.

The luncheon also included First Lady Mari Culver and Bishop Richard Pates, who both reflected on the legacy of Iowans like Norman Borlaug and their dedication that all may have enough to eat. In keeping with the theme, participants enjoyed meals reflecting Iowa-based anti-hunger programs.

Joining this year were attendees of the Community Food Security Coalition’s 13th annual conference, held concurrently in Des Moines. Over the course of the day, Hunger Summit participants heard presentations from leaders and experts on topics including

interfaith and community responses to hunger in Iowa, food security and urban agriculture nationally, Native American perspectives on agriculture and health, and the global epidemic of child malnutrition.

Participants also offered their thoughts and feedback to U.S. Department of Agriculture officials in a listening session on how to achieve President Obama’s goal of eradicating child hunger in the United States by 2015, learned more about hunger and nutrition issues from the many exhibitors with information available, and shared with each other the results and impact of their own work to counteract food insecurity for those in need.

As part of the event, organizers an-



Hunger Luncheon attendees were served meals used by Iowa-based programs in their international or domestic hunger-alleviating work.

nounced that in 2009 Iowans donated at least \$8.72 million, distributed more than 15.6 million pounds of food, and volunteered over 451,000 hours to the fight against hunger – an increase from the 2008 totals.

For more information, or to plan to take part in the 2010 Hunger Summit, please visit www.iowahungersummit.org.



HON. HILLARY RODHAM CLINTON
U.S. Secretary of State

Continuing the Borlaug Legacy

Secretary of State Hillary Rodham Clinton sent the following video message, which was shown at the outset of the 2009 Borlaug Dialogue:

I want to send my congratulations and thanks to you for coming together to discuss an issue that the Obama administration has as a top priority of our foreign policy – global hunger and food security. This year’s meeting occurs against the backdrop of a great loss. The passing of one of the world’s great humanitarians, one of agriculture’s most brilliant pioneers, and the namesake and father of this prize – Norman Borlaug.

Dr. Borlaug always reminded us that the Green Revolution was never won, that there are many whose lives have not yet been improved by agricultural development. Now, we have the opportunity to continue his work, to reach those communities that still

struggle with chronic hunger.

I had the privilege of speaking at the World Food Prize announcement ceremony June. I spoke of Dr. Ejeta’s commitment to strengthening the entire agricultural supply chain, especially in developing nations. Since that time, we have been hard at work, across numerous departments of our government, to shape a comprehensive agriculture-led development plan to tackle global hunger. In doing so, we look to the work of people like Dr. Ejeta and Dr. Borlaug to guide our thinking.

Over the past few weeks I’ve had the privilege to share our plan to tackle chronic hunger. We seek to strengthen agricultural development and nutrition while maintaining our commitment to emergency food aid. Our approach reflects our commitment

to work in support of country-led plans to collaborate and coordinate with other stakeholders, to build partnerships with the private sector, universities, foundations, and NGOs – and to be held accountable for this commitment and our efforts.

In the case of global hunger, actions much speak more loudly than words. We want to work alongside you and partner countries to advance plans for combating hunger and poverty. But first we need your feedback on the strategy we have created.

Please visit www.state.gov and let us know what you think. We cannot let the perfect be the enemy of the good. The time to act is now. So we are eager to begin, and we hope we will see you at the table. Thank you all very much. ■



Patricia Woertz
Chairman, President & CEO,
Archer Daniels Midland Company

Innovation, Investment, Partnership

While millions of people in the world lack sufficient nutrition, rising prosperity has actually allowed millions more to eat more sustainably, to have better diets than ever before, thanks in much part to the advances of agriculture and to agricultural productivity. Today we're looking for agriculture to do even more. Because of the growing population – particularly by the middle of the century – demand for food will double. Energy from traditional sources will be insufficient to meet global demand by that same timeframe. Many people look to agriculture to help fill some of that gap as well. And this is all against a backdrop of somewhat constrained natural resources and growing environmental challenges.

Just as with the Green Revolution, our efforts to meet agricultural challenges of this century begin with innovation. Between 1981 and 2007, world corn production grew 56 percent, while acreage dedicated to that corn production only grew 10 percent. That's like creating 153 million virtual acres of arable land. What's more, in just the last ten years, farmers were able to meet sharp increases in the demand for corn, meat, and

soybeans with just a 4 percent increase in crop area.

At ADM we've looked at productivity gains that might be realized if we could close the gap between productivity in the developed world and in the developing world. We conducted a survey of all land currently in production and asked, "What if all 15 of the top-producing nations or regions were able to achieve somewhere between just 70 and 80 percent of the best yields on records?" Without bringing a single acre of new production into play, we would see an increase of 50 percent in global maize, up to 52 percent in wheat, and as much as 41 percent in rapeseed production.

Innovation on the farm and improved yields alone, though, will [not] be sufficient to meet the global demands. They have to be accompanied by investment. Both industry and government must continue to invest

OPENING SESSION

Patricia Woertz
Chairman, President & CEO,
Archer Daniels Midland Company

Ellen Kullman
CEO,
DuPont

Her Excellency Gerda Verburg
Minister of Agriculture,
The Netherlands

in infrastructure, in research, to ensure that nothing that we already farm goes to waste. 10 percent of the world's grain production, or about 220 million tons, is lost in mishandling or post-harvest operations. Estimates put that percentage even higher for African nations, a little over 17 percent.

The FAO has also pointed out that the world wasted, for example, 48 million tons of rice in 2008 – enough to feed 184 million people, or approximately one-fifth of those who are undernourished. Yet little has been done to address this issue. Fully 95 percent of research dollars directed at agriculture are focused on production, while only 5 percent are focused on this toughie of post-harvest handling and infrastructure.

Protecting the crops we harvest is critical to be able to reach those who need it most and ensure we make the most of the land, water, and energy that we already use. We also need to make investment in critical transportation, processing, and storage infrastructure to ensure that we're able to handle tomorrow's larger crops, to collect and store food crops and collect biomass, and to continue delivering crops from surplus areas to deficit areas in regions in a timely and very cost-efficient manner.

IFPRI noted last year that reducing the number of people worldwide living in poverty by 50 percent would require between \$14-28 billion in agricultural research and infrastructure, par-

“Protecting the crops we harvest is critical to be able to reach those who need it most and ensure we make the most of the land, water, and energy that we already use.”

ticularly in irrigation and rural roads. This week the FAO estimated that the investment required in developing countries to support expansion in agricultural output would amount to about \$83 billion a year, [including] in storage and processing facilities.

While basic infrastructure is generally the responsibility of government, the private sector can play an important role by making investments that help build global markets and create economic opportunity. At ADM we're investing to expand our global storage, transportation, and processing networks. We are completing the largest portfolio of capital investments in our 107-year history – about \$2.5 billion – substantially to increase the capacity to process crops. [And as] we look to tomorrow's larger crop yields, we know those crops will produce more biomass. So we're working to explore ways to sustainably harvest the crop waste for animal feed, biofuel feedstock, or [to] generate steam or electricity.

If agriculture is going to fulfill the potential that many see, we will also need strong, mutually beneficial partnerships – from farmers to consumers, with governments, communities, civil society as well. In Brazil, we're collaborating with a sustainable farming group, Alância da Terra, [to] help soybean growers improve yields without expanding in any ecologically sensitive areas. In India, we partner in a program that provides guidance to farmers on soil testing, land preparation, seed selection, fertilizer application, and the post-harvest management process. In Côte d'Ivoire, we've developed several initiatives to help cocoa farmers grow higher-quality beans under environmentally and socially responsible conditions.

As we pursue innovation, investment, and partnership, it will help ensure that agriculture can meet the world's growing needs for food, fiber, fuel, and energy in a very sustainable way. We need to address frankly and thoroughly the concerns associated with this [and] also together work on the solutions to those concerns. Any ambition this big, any vision this big, will have issues. But with continued innovation, investment, and partnership, we are confident that agriculture can create viable, sustainable solutions to some of the world's most pressing needs. ■



Ellen Kullman
CEO,
DuPont

Increasing Quantity, Improving Quality

I'd like to start by sharing a quotation: "I am cautiously optimistic. Despite all of today's gloom and doom, we live longer in a better life than all previous generations. But solutions to problems can be synthesized and implemented only by well-informed, clear-thinking minds with positive points of view. You can't hope to win the game of life with negativism." The person speaking was Dr. Norman Borlaug. His words are excellent advice for all of us here today: Be well-informed, think clearly, maintain a positive point of view. He will be missed, but we honor him in a special way if we try to mirror his spirit and outlook as well as continue the work he advanced so exceptionally during his lifetime.

Agricultural output will need to double by 2050 to adequately feed the about 9.3 billion people expected to be alive at that time. This will need to occur as available arable land and resources remain unchanged and, in some areas, decrease. Worldwide, more than one in six people are already starving, roughly the equivalent of the populations of the United States, Indonesia, Brazil, Pakistan, and Bangladesh combined. For those

who are consuming sufficient calories, as many as half of them are considered malnourished, lacking suitable amounts of essential nutrients, vitamins, and minerals to ensure good health.

As the human population grows, more people will grow hungry, and fewer will have access to the nutrients that their bodies need – unless there are innovations that can meet the different needs of different people in different places around the world; that's the key. [It's] so significant [that] about 50 percent of our research dollars at DuPont are dedicated to increasing global food production. But we believe it must be done in a sustainable manner to reduce agriculture's environmental footprint and conserve the very precious resources available to us. When it comes to increasing global food productivity, there is no one-size-fits-all solution. The challenge before us is one of quantity and quality – enough food for all, and all the food nutritious and healthy.

In the next nine years alone, we can increase corn and soybean yields by 40 percent.

Kullman, continued on page 9



H. E. Gerda Verburg

*Minister of Agriculture, The Netherlands
Chair, 17th U.N. Commission for Sustainable Development*

The Critical Challenge of Sustainability

2008 and 2009 have shown very clearly the interdependent character of the world's economy. No country or economic sector was exempted from the worldwide financial and economic crisis. However, we must not forget that the food crisis is still there. This poses a threat not only to the well-being of nearly a billion people, but also to national and international security.

This year's [17th session of the United Nations Commission on Sustainable Development] focused on sustainable agriculture. There was recognition [that] the achievement of the first Millennium Development Goal – of halving the number of people living in poverty – seems further away than ever. At the same time, we use far more of our natural resources than our planet can regenerate; some reports indicate even four times. The competition for land, water, and biodiversity for the production of food,

and biofuels is fiercer than ever.

Against this backdrop, delegates from all over the world agreed that a world that is facing multiple crises, including climate change and looming natural-resource scarcity, urgently needs a transition towards a more sustainable and resource-efficient agriculture. People realized that old solutions do not any longer fit the new challenges of the 21st century – because, if you do what

you did, you get what you got.

Agriculture is no longer seen as a problem in reaching sustainable development; agriculture is now considered an important part of the solution. Agriculture is at the heart of poverty

reduction. In many developing countries, agriculture is the driving force for economic development. It's crucial for the conservation and sustainable use of our natural resources. [And it's] at the heart of the climate-change agenda, especially when we look at mitiga-

tion and adaptation measures.

[This shared vision] builds on the work of Dr. Norman Borlaug and aligns the need for a sustainable and homegrown Green Revolution, especially in Africa. This means a revolution in ideas, in technologies, and in agricultural and trade policies and market access, as well as providing the financial means.

Such a sustainable Green Revolution can happen along a five-track approach: first, increasing our investment in sustainable agriculture; two, creating an enabling environment; three, developing sustainable production and food chains; four, improving market access, especially for developing countries; and five, social safety nets and access to finance, for example, to micro-credit.

From these five areas of actions, one can see the importance of concerted action of governments and other partners in society, especially agribusiness. Globalization is an important driver of regional and inter-continental integration of the agri-food system. International corporations have been increasing their power and leverage. The sustainability of agriculture can no longer be defined by just looking at fields or farms. Agribusiness should be fully involved in agricultural sustainability.

Entrepreneurship in the broad agricultural sector is key to sustainable growth. For stability and wealth in a country, the development of large-scale and small-scale agricultural sector is needed.

Governments also have a role to play. [The Netherlands] invests in improving agricultural production and strengthening the sustainable agricultural value chain – by providing assistance for the establishment of innovation centers and advisory services; or contributing to research into smart solutions, green gene technology, better use of the plant properties that enable them to grow under difficult conditions, etc.; or encouraging more careful use of phosphates, essential building blocks for plants, to counter the impending phosphate shortage.

We also engage in strengthening farmers' organizations, such as marketing cooperatives, to enable them to play a stronger role in the marketplace and to participate in agro-processing or other parts of the value chain. New institutions will also be needed to help farmers better manage their risks,

including weather and climate insurance, affordable also to small farmers.

The opportunities provided by science, research, and technology must be linked up with education and extension to disseminate the results of research and to make it applicable on the ground. Science and technology, education, and extension are the pillars for sustainable agricultural and rural development. This so-called golden triangle is one of the main factors of the success of the Dutch agricultural sector.

In addressing the challenges of the 21st century, there is a strong need to learn from the past. We can avoid mistakes while replicating and scaling up effective practices and making them tailor-made to specific circumstances.

Kullman, continued from page 7

The seed industry must continue to preserve, refine, and utilize the diverse germplasm pools available – along with all the tools of modern plant breeding – to bring to farmers products that drive yield through more efficient and sustainable use of water, nutrients, soil, and land area, as well as through herbicide tolerance and resistance to pest and disease. Agriculture input providers have to continue to develop cutting-edge crop partnership products with increasingly lower use rates and better efficacy.

New [biofuels] technologies and processes are making it possible to get more out of each unit of grain, allowing for the conversion of cellulose to ethanol, [and] creating possibilities to use the entire corn plant to produce

ethanol. By converting nearly all the simple and complex sugars in corn plants into ethanol, we can increase the amount of ethanol per acre while maintaining sustainable agricultural practices. Biofuels such as biobutanol are another example of more efficient grain use. These fuels contain energy content closer to gasoline, so the result is better fuel economy compared to current biofuels.

Globally, the agricultural sector has a significant potential to contribute to mitigation of climate change, to provide adaptation and sustainable-development opportunities, while at the same time improving the lives and incomes of farmers and delivering alternative or diversified livelihoods. Some reports suggest that the sector could be broadly carbon-neutral by 2030 if sustainable-management practices were widely adopted.

The challenge here is to [maintain] a sustained food-production capacity. Actions to increase soil carbon, for example, can increase resilience against climate-induced stresses and increase productivity. [And] we must not lose sight of the serious challenges resulting from higher temperatures or drier or wetter climates. Therefore, investments in

Further efforts are necessary to make sure farmers around the world, both large and small, have access to seed technologies and to the best knowledge that will allow them to increase their productivity. Agriculture advancements will be [critical] in China and other developing countries in Asia, where in many areas farmers still plant open-pollinated varieties by hand. These are markets where population and incomes are growing and driving better diets with more protein.

Not only are we challenged to bring new technologies to these markets, from hybridization to Bt corn, but we need to provide

“Worldwide, more than one in six people are starving. As many as half of those consuming sufficient calories lack suitable amounts of essential nutrients, vitamins, and minerals for good health.”

the right tools and agronomic knowledge. In rural areas of India, we're supporting Access Development Services in

an initiative to make farm inputs and agronomic advice available to thousands of men and women in small farming operations. [Through] six agribusiness resource centers and more than 200 best-practice and product farmer-demonstration sites, we believe we can help increase small-farmer income levels by more than 30 percent. We've helped farmers in Ethiopia shift from open-pollinated

adaptation are key, including, for example, in more drought- and heat-tolerant crops.

But it is not just what happens down on the farm that echoes the climate-change theme. There is a great deal that can be achieved in terms of the distribution, post-harvest, and consumption of the food we eat. Food waste, from the farm and the seas to the supermarket and the kitchen, is an area that has been underexamined in this regard.

There is a great scope for advancing the link between sustainable agriculture and climate change. So let us not miss the opportunity for including agriculture and soil carbon in a new climate-change deal in Copenhagen. Let us find new, innovative financing mechanisms for adaptation and mitigation incentives in the agricultural sector. ■

corn to the benefits of corn hybrids. And in the past 13 years, our customers in Ethiopia have gone from planting no hybrids to planting about 25 percent of their farmland with hybrids; this has quadrupled – quadrupled – their yields.

We also need to look for solutions that increase the nutrition and quality of our foods. We can do this by providing packaging structures made from renewable resources while protecting food from spoilage and contamination; developing high-yielding soybean varieties that produce healthier oils and efficiently working with soy protein to make great-tasting, nutritious soy foods more accessible; and continuing to innovate in food-safety diagnostic technology.

Collective success in meeting [our] goals will be limited if we can't find ways to track our progress and hold ourselves accountable. So that's why we were happy to partner with people like Archer Daniels Midland for the Global Harvest Initiative, [which] kicked off a few weeks ago. The organization recognizes the need to double our agricultural output by 2050 and is spurring the development and sharing of agriculture innovation with those that need it most. But my favorite part is the commitment to set milestones. In business, what gets measured gets done. So by setting milestones and tracking them in this area, we can make a meaningful difference in agricultural productivity. ■



Photo courtesy of Gebisa Ejeta, Purdue University

In Ethiopia, a sorghum plot infested by the parasitic weed *Striga* grows next to *Striga*-resistant varieties developed by 2009 Laureate Gebisa Ejeta.

Global Agricultural Yields: Trends and Threats

Margaret Catley-Carlson: We're going to talk about something absolutely central to global food security. How productive can we be? Norman Borlaug said, "We've only got two choices: we have to grow more on the land we've got, or we have to cut down trees and have further environmental impact." If we don't get a change in yield, we really are not going to be able to answer the question positively about whether we can feed the world.

In the time of the Roman Empire, yield was about 1 ton per hectare. Millions, if not hundreds of millions, of farmers are not much above that level now, while the rest of the world has climbed up to 7-9 tons per hectare.

The Chicago Council on Global Affairs points out that, whereas 1 in 3 people used to be hungry, 1 in 6 people [are currently] hungry. And that's because we've in-

creased yield in so many parts of the world. So we've increased yield – the whole post-war increase in calories per person was very largely about yield increases – and yet we've still got hundreds of millions of farmers at yield levels which are about the same as the Roman Empire achieved without mechanization, without agricultural inputs.

Why do we have two worlds living in one – one world where yields have improved; another world where yields stubbornly refuse to improve? Why is it so difficult to get yields to go up?

William Dar: Let's have Africa as a case. Eight kilograms of nitrogen per hectare per year compared to advanced countries, with 160-200 kilograms of nitrogen per year. That's one of the reasons. Number two, the use of even good seeds – if not improved seeds – is not happening. The use of improved va-

rieties is not at all scaled-up today. Extension services are not as ready as the research community. That value-chain approach has to be institutionalized in many respects.

There are lots of opportunities to increase productivity per unit area. In the current climate, with low-input practices, you only [yield] 1-1.5 tons per hectare. But our long-term trials show that we end up producing 5 tons of food that can feed 20-22 people per year. So that current-climate yield gap has to be handled utilizing sustainable management practices like improved seeds, improved practices, and, of course, the policy environment must be there to support smallholder agriculture.

Now, we are facing a climate crisis. Under climate change with low-input practices, you have this low level of productivity. But if you employ improved practices with climate change, you are going to sig-

nificantly increase the yields. And where you add, on top of the improved practices, adapted varieties that you develop as a result of investments for climate-change adapted varieties, you are now able to significantly increase yields.

Jeffrey Simmons: In 50 years – we're 10 years into that, so 40 years left – we need 100 percent more food. 70 percent needs to come from technology. 20 percent is done with more density and 10 percent is with more land; [those are] FAO numbers.

Technology... is products and it's seeds and it's the new things – but it's also the practices. And I think one of the challenges, when you look at a China or an India, is understanding and having the ability to bring the practices we have in the First World to the Third World. It's technology, and most importantly it's access to that technology.

Seyfu Ketema: Particularly if you talk about East Africa, that's not the case. What you said applies to certain parts of the world. Generally, in Africa, the issue of governance [and] the issue of policy are critical. The kind of governance that allows dynamism, discussion, trying to understand problems, to engage the population in identifying problems and allowing people to come up with solutions. Policy issues are incentive to farmers, attracting investment to agriculture, land tenure, partnership – these are very critical. As you said, Maggie, the Romans had 1 ton [per hectare], and it's still 1 ton [per hectare] in Africa. And you go to the research institutions – you have 4 tons. In the research institutions you have 4 tons. In the farmers' fields, you have 1 ton.

Sasakawa Global 2000 [gave] great support to give access to farmers to seed, improved seed, fertilizer. Farmers were able to produce 2-3 tons average, and the whole country had excess maize production. And what happened? The market price collapsed, and there were about 2 tons of maize [that] farmers were not able to sell for \$2. The irony is, the livestock industry and the chicken industry were crying for feed. We had several industries fighting for foreign currency to import starch, and the farmers were not able to sell their maize. And [in] the general population, there was a shortage of oil. But

there's no market, there's no processing, there is no partnership between the private sector and the farmers.

If we can create the right policy that encourages partnership, gives incentives, market infrastructure, we can make the jump.

Catley-Carlson: So it's not as simple as technology. If you don't have governance, if you don't have policy, if you don't have a functioning internal market – then, even when things go right, they'll go wrong. So what was the blend in China? You greatly increased yield and productivity; how much was technology part of the pie, and how much was better governance and policy part of the pie?

Weibin Yan: You mentioned access. I think awareness to new technology is very important, and the position of the government is even more important, because it decides whether the farmers adopt, or not, new technology. For example, China... should see that 8 percent of the arable land in the world still feeds the 22 percent of the people in the world. [And] 1 out of 5 hungry people is in China. According to the FAO, around 10 percent of [China's] population is hungry. According to our estimation, the hunger problem [is probably] less than that.

Hunger in the 1970s was even more serious. 30 percent of our total population was hungry. People my age have very clear memories about that. [Then] China had a very big breakthrough from hybrid rice. The government pushed, invested a lot of money for extension, the training of new technology, and there was expansion. Nowadays 57 percent of the total rice production area is for hybrid rice, [with] the

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average yield around 7.2 metric tons per hectare. For conventional rice, it is less than 6 – 5.3 or something like that. So new technology played a very important role, but the government position played an even more important role.

Catley-Carlson: Jason, you've been looking at market chains, which take these questions from the very top to the bottom. How would you describe the technology-vis-à-vis-governance issue, in terms of why getting yields up is so difficult?

Jason Clay: We will not have biodiversity [or] ecosystem functions on this planet if agriculture continues to expand into natural habitat as it has done historically. The last 40 years, 0.4% per year; the last 10 years, 0.6% per year. That trend is increasing. We've got to freeze the footprint.

We don't necessarily think that doubling food is going to be enough, because



Catley-Carlson

it really depends on the content of the diet, how much of that food is wasted. It could be as much as tripling food by 2050 that we're going to need.

Genetics has clearly got to be on the table, but not necessarily GM; also look at GE and landraces and hybrids and all kinds of plant breeding. So many crops that are, say, in the top 15 crops of providing calories to the planet, have never been the subject of good breeding programs.

There are a lot of poor practices. Within a country, some producers are 10 times better than others. Globally, some producers are 100 times better than others. We need to close that gap. It will have a bigger environmental impact and a bigger impact in terms of feeding the planet. Then we need to look at technology in the traditional sense – improved irrigation, improved post-harvest handling, etc., etc. That's going to be 40 percent, maybe, of the total that we need.

We've got a lot of underperforming land out there that's been abandoned, land formerly used for crops that's now in pasture and on its way to being severely degraded. We need to bring that back.

“In the time of the Roman Empire, yield was about 1 ton per hectare. Millions, if not hundreds of millions, of farmers are not much above that level now, while the rest of the world has climbed up to 7-9 tons per hectare.”

- Margaret Catley-Carlson



Dar

And we can – we have the technology to do it. We need to set up the investment funds to do it. We need to show and provide the business case for doing it. That'll be maybe 25 percent of the gain that we need.

And then we can look at property rights. Companies that develop seeds and technologies need to be protected, but so do farmers who plant perennials. They need to own the land that they put a tree crop in. They need to own the land that they put a terrace in. If they don't, there's no incentive for them to invest in better practices.

Catley-Carlson: So with this as the background – what crops or animals or production methods don't get enough attention that could make quite a bit of difference in yield? What deserves more attention in closing that productivity gap?

Simmons: Biotechnology, without question. But a lot of the current technology we have today is not in markets that it's needed, some of the traditional technology we have. But no question, biotechnology, and genomics, too. A lot of things we're do-



Clay

ing today, looking [to please] the consumer in the First World, will be helpful in the Third World – will take less nutrients, less water, etc. [There are] livestock products [in] the protein platforms that can expand productivity of a dairy cow by as much as 15-20 percent, swine production 8-10 percent.

Clay: By 2050, tilapia or catfish or Pangasius will be head-to-head with poultry. After that they'll surpass poultry as the white meat that we're eating on the planet. That's without any significant investment in genetics today. And they'll do it, because for half the amount of feed you can produce the same amount of protein. So that's going to be the animal that we need to invest in. [Also], tropical trees. The demand for food in the future is in the tropics, and we need permanent sources of food. So I would say things like palm oil; cash crops like coffee, tea, cocoa. Also other crops in the tropics that are basic food crops, so cassava, sorghum, millet, sweet potatoes, cowpeas – those kinds of things, things that have not really benefited yet from genetic engineering, from technology that we have.

Yan: [In southern Hainan], income per capita in 1979 was 411. Last year it was 16,000 – almost 40 times more. But rice prices only increased 60 percent. Wheat and corn prices only increased around 2 times more. So the grain price did not increase quite enough in China.



Ketema



Simmons

In China, there's a very big contradiction. On one side, we would like to keep a low food price, because normal people's income is very low, so food consumption is relatively high in their income. But all the farmers are small farmers – normally, only 0.2 hectares. Even if the yield is very high, production is still very low. Grain price [must increase] to stimulate incentives for production.

Dar: Where are the most vulnerable people? Where are the poorest of the poor? The dry-land areas of the world. Almost 600 million people are there. So you need to enhance development of the very nutritious dry-land crops, and that would include sorghum, millet, chickpea, pigeon pea, and groundnut or peanut. And there are lots of opportunities to increase productivity.

Ketema: Sorghum is a traditional African crop. What's missing there is the processing and marketing of sorghum. The other one missing for attention is millet:

finger millets, pearl millets. These are also traditional African crops, and when we see the effects of droughts on the dry lands, I

“Where are the most vulnerable people? Where are the poorest of the poor? The dry-land areas of the world. Almost 600 million people are there. So you need to enhance development of the very nutritious dry-land crops.”

- William Dar



Yan

think sorghum and millet need to get greater attention. Also there are some dry-land pulses, so that we have the calorie and protein mix. We have to think about what would be the source for the carbohydrates, which would be sorghum and millet, and for the proteins.

Catley-Carlson: Is it a question of not having the improved seed and the improved crop on hand? Or is it a question of the dissemination of improved farming methods?

Ketema: It is complex. These traditional food crops like sorghum and finger millets – for some reason, there was some food habit change for wheat, rice, and maize. When you have the good environment and when international production is good, these things work. But when drought comes, the food habit has been changed. Now you go and even if you put the sorghum and millet in the market, still people go to rice and wheat. So there should be a lot of work to rehabilitate [them]. And that's why processing for sorghum and millet is very important.

Dar: While improved practices and germplasm would be key, we have to appreciate the importance of improving the capacities of the farming communities, the smallholders. Women are doing lots of the work. Capacity can sustain any in-

tervention, and the policy framework should support smallholder agriculture. On top of that we need to restore and conserve our

natural resources. Our land degradation rate today is 1 percent a year, [and] so much of our natural resources have been degraded.

Catley-Carlson: Let me turn the coin over and ask if we're looking sufficiently at the threats even to existing levels of production.

From where I stand, the major threat is obviously water. It takes 1 liter of water to produce 1 calorie of food. We've got a world that is moving on from rice, which takes a metric ton to produce a kilo, to beef, chicken, which take 6-8 metric tons to produce the same kilo. So in addition to the 2 billion more population, we've got a higher level of protein demand. The 1 calorie still takes 1 liter; the more calories people demand, the more water [is] going to be demanded – along with the water it takes to produce T-shirts, automobiles, computer chips, etc. We've got the same amount of water we had since the dinosaurs were on the planet, and we've chosen to live in places that don't necessarily have the water we need to sustain agricultural production.

What do you see as the threats we're not thinking about? We didn't really foresee stem rust a few years ago.

Ketema: Continuously we should expect that there will be new diseases as part of evolution; there will be new rusts, new viruses, and new diseases. I can't predict which one will be next, but definitely the Ug99 that started from Uganda is still a big threat, and there is specific action being taken there.

Natural-resource degradation, soil-fertility degradation [are] very critical. There is soil erosion. The microbial system in the soils is very much degraded. And especially in Africa I would also like to put the threat of malnutrition, disease – HIV/AIDS, malaria – as big threats to yield.

Yan: In China, the constraints come from several aspects. Every year we have 16 million new births, while we have less arable land because of the cities becoming bigger. Another problem is [climate] change. The third challenge is water, especially in the lowest area of China.

Another big issue is the shortage of labor, because most of the farmers are in the mountain area. You cannot do this work

with a machine; you need labor to do it personally. And when more people are going to the cities, the labor cost is going up. There are less and less farmers, and their wage is not so high, so the incentive for them is not high.

Catley-Carlson: Did you ever think you'd hear a country of 1.3 billion saying, "We've got a shortage of labor"? That is quite fascinating.

Simmons: There's something going on in the developed markets that we need to be very careful about. It's the dilemma of choice, and it's going to impact everything that's been talked about here in terms of innovation.

[If] you ask the global consumers an unaided question – "What's important to you?" – or you find out where they're spending money; in any country, 95 percent say, "Access to food, affordability, and nutrition." There is that minority that's very important, a luxury group that say, "I want something different." And that's fine, and we need to give that choice to them. But what is happening is that 5 percent, and that demand for more than just choice – it becomes a cause – is turning food policy into law that's affecting the 95 percent. From 2000 to 2007, [the United Kingdom] went from a net food exporter, a major productive country, to today, when it comes to meat and milk, they're a net food importer. And they're one of the least productive countries.

Choice is important. Don't let choice turn into law, because that takes the innovation away. How that impacts us is, all the companies, from ADM to DuPont to Elanco, look at that. We've got 63 things in our pipeline to help feed the world. We have to be very careful, because when we see those movements, it impacts our investments in technologies that can help the coun-

"We are challenged to come up with innovative ways to increase production, but at the same time maintain sustainability. All these issues – the ecosystem, using different methods in approach of production – are going to be very important as we go along."

- Seyfu Ketema

tries around the world. doing in terms of natural-resource use shows right now that – as a planet, all the people on it – we're living at about 1.3 planets. As of September 25 this year, we started eating our principal – or as a farmer, we started eating our seed.

With 3 billion more people consuming twice as much in general, and maybe more food, and 2.8 times as much income – this is a severe crisis that we're in. There are lots of ways to go about resolving this, but we need to get started. It's urgent. 40 years is not long.

Dar: The perfect storm has happened in many countries: a convergence of climate crisis, biodiversity crisis, desertification, energy crisis, of course the food crisis as a result, and population explosion. This has to be treated in a holistic fashion because these are intersecting; these are interlinking. It's the biggest storm coming.

Catley-Carlson: Give me

an example where the way that women are treated in agriculture has added to the threats that we have in terms of not reaching improved yields.

Dar: In India, women's empowerment is a

major strategy already. Self-help groups are making a big difference in the lives of rural folks in Andhra Pradesh. So we must enhance the capacities of women; they are key to improving agricultural productivity.

Clay: We've got to figure out how to freeze the footprint, both in terms of land but also in terms of input use. We've got to get more from less. The index that we publish on how we're

"Let's not fool ourselves. The next 40 years, we don't have that much time. Probably 70 to 80 percent of what we need we already have – we just need to make sure it's in the right place."

- Jeffrey Simmons

Wherever subsistence crops become cash crops, they suddenly become men's crops. And that's something that we have to watch for, because then productivity declines.

Clay: We need more women at the boardroom tables, because we need that diversity of thought. You know, 80-90 percent of the money spent comes from women, and that is very important. So it's exciting to me seeing global, multinational companies [with] women at the table – that's absolutely critical.

Catley-Carlson: [China] just celebrated the 60th anniversary of a revolution that was supposed to make women and men equal, among its other goals. Does the situation of women in agriculture help or impede moves to more productivity?

Yan: In the past, it was the same as in Africa and some of the South Asian countries. Women in China eat less but do most of the job, especially in south part of China – in Hainan Province, in Guangdong Province, and in Fujian Province. You'll see in the farmlands most all of the people are women. So China has been fighting this situation for 60 years. We try to improve the situation. Nowadays the situation has [seen] some kind

of a change, but still we have a long way to go.

Catley-Carlson: So all of you would agree that if women in agriculture were treated differently, this would remove a significant

threat to agricultural production?

Clay: It sure would help.

Catley-Carlson: Why don't we take on post-harvest losses more seriously? Are there instances where you can tell us good stories about post-harvest losses?

Dar: This is one area where initial gains can be achieved already, by reducing significantly 20-40 percent of post-harvest losses. Take the case of the Philippines. They have the longest drying facility, and that's the national road. Most developing countries would need rural infrastructure to help reduce lots of these post-harvest losses.

Yan: Storage and transportation [are] really important. Nowadays China's situation has changed quite a lot, because 10 years before, according to statistics of the ministry of agriculture, around 25 percent of total grain production had been lost after harvest. That was during the transportation-storage process.

Catley-Carlson: You had a huge campaign to build rural roads in China, and this has made a difference.

Yan: Yes, and also we have another program to help each farmer to build more storage to save the grain.

Clay: One of the things that I think

is the most promising is bringing carbon into agriculture. It's a tremendous opportunity to improve productivity, reduce input use, increase efficiency, etc. Farmers in Brazil with soy, and palm oil in Borneo, have made more money growing soil than they

"In China, another big issue is the shortage of labor because most of the farmers are in the mountain area. You cannot do this work with a machine; you need labor to do it personally."

- Weibin Yan

productive and it produces with half as many inputs. We have a market for carbon. Figuring out how to bring carbon into the equation, and link it to commodities and link it to commodity prices, cuts farmers' costs, but it's also something that farmers can sell. So there's a dual incentive.

Simmons: I just want to say – let's not fool ourselves. The next 40 years, we don't have that much time. Probably 70 to 80 percent of what we need we already have – we just need to make sure it's in the right place. Access to markets and getting the right ideas, technology, [and] practices in the right markets is very important.

Catley-Carlson: When you've got post-harvest losses at 20 to 30 percent, then growing it isn't the whole story.

Dar: We have found [that] we have first to bring in soil- and water-conservation measures. After restoring soil fertility and the availability of water, then you can diversify the production

system. As a result of this, for the last 10 years from a number of community watersheds, we call them, we are up to 500 watersheds benefiting half a million people in five countries in Asia. The level of productivity [has] gone up 3-4 times. The net income has

gone up 2-3 times. All the children in these communities have been sent to school; the homes have been restructured or remodeled. These are very poor areas. In India we have now 350 districts with this up-scaling of the watershed technology.

Usually poverty is the enemy of soil fertility, because when you have to make a decision about whether your dung gets burned, sold, or plowed back into the soil, you've got an agonizing choice. So this is a good story.

Ketema: I'm glad that issue was raised. Some time ago, we were much more concerned about production only – but now we hear not only about production but sustainable production. So we are challenged to come up with innovative ways to increase production, but at the same time maintain the sustainability of agriculture. All these issues – the ecosystem, using different methods in approach of production – are going to be very important as we go along.

Simmons: [But] why can't we act and move quicker? Time is running out. There are 100-200 people involved in key countries that shape food policy, that shape the determination of trade standards and even practices. And it is absolutely critical – especially going from taking developed country technologies and practices and moving them into emerging markets – that those 100-200 people that are influential come to the table.

Clay: By 2050 more people will be living in cities than are alive today. Think about what that means for food. They may produce some nutrition in their city gardens, but they're not going to produce their calories. Bringing carbon into agriculture is one way to bring an environmental externality back into the pricing of a commodity. It's the first. Water is the next carbon; and hopefully, after that, biodiversity. ■



The Norman E. Borlaug Hall of Laureates Dedication Ceremony

Over 400 friends and admirers of the late Dr. Norman Borlaug gathered at the Norman E. Borlaug Hall of Laureates on Wednesday, October 14, 2009, to celebrate the life and work of the 1970 Nobel Peace Prize Laureate, who had died the previous month.

The event marked the official transfer of the century-old former Des Moines Public Library to the World Food Prize Foundation, which has signed a 50-year lease on the building with an option to renew for an additional 50 years. Shortly after the dedication ceremony, construction work began to transform the building into the Norman E. Borlaug Hall of Laureates, an enduring testament to Dr. Borlaug's humanitarian legacy.

"The Hall of Laureates will ensure that the legacy and spirit of Dr. Norman Borlaug will continue to inspire Borlaug-like achievements in the fight against hunger well into the 22nd century," said Ambassador Kenneth Quinn, president of the World Food Prize Foundation.

In addition to Quinn, the event also included remembrances of Dr. Borlaug by Iowa Lieutenant Governor Patty Judge; Bill Borlaug and Jeanie Borlaug Laube, Dr. Borlaug's children; A.S. Clausi, co-founder and former chairman of the World Food Prize; and Miss Iowa 2009 Anne Michael Langguth, who served as a Borlaug-Ruan International Intern in 2004.

As part of the ceremony, the World Food Prize Foundation unveiled an original portrait of Dr. Borlaug by artist Chas Fagan

commissioned for permanent display in the Hall of Laureates.

Once completed, the \$29.8 million restored Hall of Laureates will be open to the public, serving as a museum to recognize great achievements in agriculture; a convocation center at which to hold the Norman E. Borlaug International Symposium, known as the "Borlaug Dialogue;" a home for the World Food Prize Global Youth Institute; an educational facility featuring interactive displays on hunger and food security; and a conference center and community hall available to other groups and organizations for their meetings and events.

The dedication ceremony was followed by a screening of the new Borlaug documentary, *Freedom from Famine*.



AP Images / Karel Prinsloo

Following violent protests in 2008, residents of Nairobi battle over maize distributed by the Kenyan Red Cross.

Poverty, Hunger, and Food Security in Crisis Areas

Per Pinstруп-Andersen: Do empty stomachs – poverty, hunger, food insecurity – really contribute to instability and armed conflict? Intuitively, it seems to me the answer is yes. Together with a very unequal distribution of income, of land, and of other material goods, [they] generate anger, hopelessness, and a sense of unfairness and a lack of social justice. I don't believe there can be any question. This, in turn, provides a fertile ground for grievances and conflict, which can be exploited by individuals and groups with a desire to cause conflict, including national and international terrorism. This is not to say that poor people are terrorists; rather, that existing human misery and perceived unfairness serve as a moral and political foundation for those who wish to promote armed conflict and terrorism.

Frances, have you found strong causal links between poverty and instability? And are the hunger hotspots more likely to be exposed to instability and armed conflict than other regions and countries?

Frances Stewart: There's no question that the worst forms of hunger in the world are also [in] those countries at war. 50 percent of countries in conflict have very serious malnutrition, and a much smaller proportion of countries which are not in conflict. It's not only that war disrupts production – it causes people to flee so they can no longer farm, mines are put in the agricultural areas so that the land can no longer be farmed. But also, food is a weapon of war, deliberately withheld from people; and governments no longer provide food if people are in need.

If we look at any famine throughout the world, we can be pretty sure there is war. You just don't get famines where there isn't war, because in those situations, the international community and governments do something about it. [But they] should do much more about people who are in the middle of war and seeing that they get fed – and, even more important, that disease is controlled, because it is that combination of disease and hunger which causes the mass deaths that we see so often.

Does poverty cause war? The situation is a little bit more complicated, because our work has shown that inequality – in particular inequality between groups – is at the root of so many conflicts. It's not just hunger but unfair hunger; hunger [and] poverty which is unfairly on one

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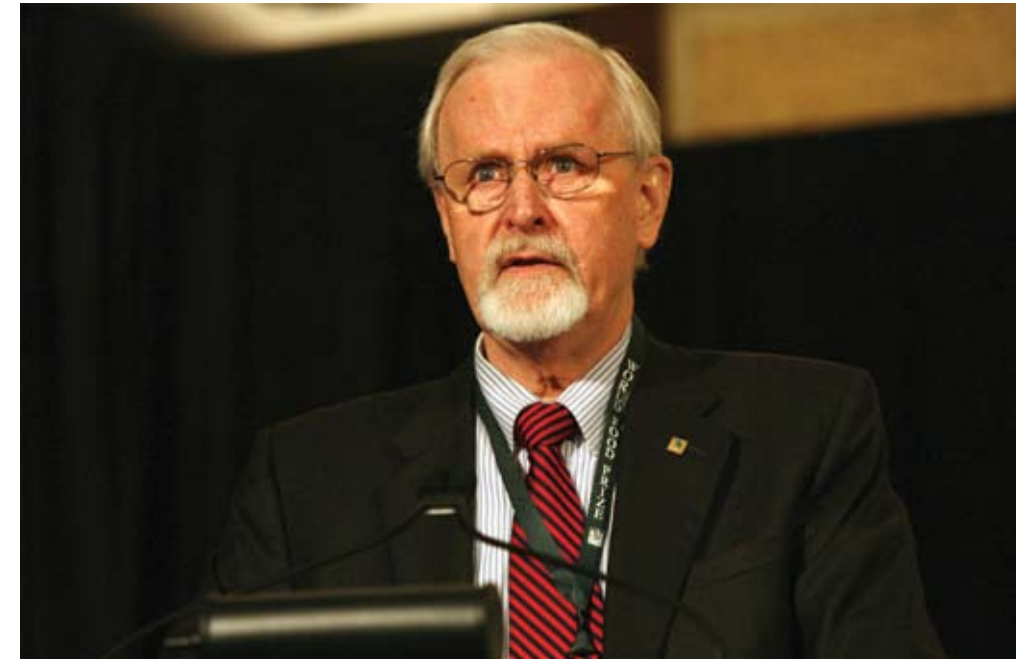
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“Poverty, hunger, and food insecurity generate anger, hopelessness, and a sense of unfairness. I don't believe there can be any question. This, in turn, provides a fertile ground for grievances which can be exploited by individuals and groups with a desire to cause conflict, including national and international terrorism.”

- Per Pinstруп-Andersen

group rather than another, between different ethnicities, between Tutus and Hutus, or between Catholics and Protestants, or between Christians and Muslims, different divisions all over the world.

Faida Mitifu: My country is a perfect example of all the elements that Frances has just put [forth]. Political instability started not recently – we can go back to 1991-1992, when the country was trying to democratize its system, and the resistance of the former dictatorship. By that time, the country economically was already in a very bad shape.

Land management [was also] a crucial issue, particularly in the eastern part of the country. Traditionally in the Congo, the land belongs to the chief of the former kingdoms. When the state comes in and starts regulating and moving people, that created resentment – in North Kivu, particularly, and then the issue moved to South Kivu. So you add to that political instability, issue[s] with the justice system – you are creating a vacuum, and in a country that is endowed

naturally with lots of resources, that also creates other factors.

One thing that we have to [keep] in mind – you have the internal fault, meaning the history of the country, the years of dictatorship and mismanagement, and the civil war. But you also have external factors. You have multinationals who took advantage of the vacuum that had been created. We had about six countries fighting on Congolese soil, then right now we have the UN presence. That creates a very complex situation. Yes, there is a role that the government ought to play to remediate this situation, but the international community as well – because if you look at all the reforms that the government has been trying, they are being implemented timidly because of other factors that are making them harder to implement.

Tom Arnold: There are circumstances where you are reduced, if you like, as an organization to responding on a purely humanitarian needs-based approach, because

that's what's necessary and basically all you can do. But there are many places where an international NGO doing its humanitarian work can connect into a wider agenda toward some level of political stability, or improvement anyway. There are many places where the international community needs to put more emphasis on conflict prevention and conflict resolution – a lot more. It's within a process like that that NGOs can begin to start being more effective.

A lot of that is low-level, community-level activity – which ultimately can, you know, have wider political implications and positive benefits. We've seen in Ireland, over a 30-year period, that it's not just the big, high-end politics that's necessary for conflict resolution; it's some of the social processes, frequently with women's groups, that become very important.

The other thing which is important and very relevant – we're frequently working in countries that are in conflict and that are emerging from conflict. It can happen that, when the spotlight moves away from a conflict and you're into a transition towards rehabilitation or some extra level of stability, not only does the political attention go away but so does the funding. There is a real issue here for the international community to help countries that have made the first step away from conflict to actually help them out of conflict – putting in place a process [that] is not going to go backwards again.

Stewart: I certainly agree that we neglect post-conflict countries after a bit, but we need to think about the role of the international community a little more critically. Because when countries are not in conflict, in many cases the policies are feeding into later conflict. If we look at Rwanda pre-genocide, the development community was feeding resources into one side and not the other and neglecting what was about to happen. If you look at the general development policies that we adopt, they're just insensitive to these issues.

Even when it comes to relief, the same thing is true. In Sri Lanka, in some cases, agencies are very careful about being fair among the groups, but in other cases they're not. One of the causes of the resumption of the conflict was the way the tsunami re-



“Does poverty cause war? The situation is a little complicated. Inequality is at the root of so many conflicts. It’s not just hunger but unfair hunger; hunger [and] poverty which are unfairly on one group rather than another, between different ethnicities, between different divisions all over the world.”

- Frances Stewart



“We are finding – take the case of Haiti – that poverty contributes to social instability. Food insecurity could bring down any government. People will tolerate the lack of transport or the lack of electricity, but they will not tolerate the lack of food.”

- Chelston Brathwaite

lief was handled. It was not handled so that each “side,” so to speak, could use that relief but was channeled through the government. The result was, in fact, a resumption of conflict. I absolutely agree with what Tom’s been saying, but we do need to realize that many times we’re actually contributing to the problem rather than solving it.

Pinstrup-Andersen: It sounds like there the three of you tend to agree on that, that the international institutions and the behavior of them can be part of the problem. Can they also be part of the solution, or would those of us from outside be better off just staying home?

Arnold: Of course, the international community has to play a key role. And let’s be clear – there have been some positive moves in the area of humanitarian reform: appointment of humanitarian coordinators to get a more coherent approach from the UN; the funding situation has improved; and the whole business of clusters, which get agencies, whether they be governmental or nongovernmental, working together. All of these are steps in the right direction, but

they need to be built upon.

Pinstrup-Andersen: Chelston, as [IICA] prioritize[s] agricultural-development efforts, do you take into account the potential impact on stability, efforts to avoid armed conflict? Do you pick the priorities and the countries and the regions on that basis? Or do you assume that, once you get agricultural development, these other things will fall into place by themselves?

Chelston Brathwaite: In Latin America and the Caribbean, a significant constraint to development is the high levels of poverty and inequality. The Gini index, which is the measure of inequality between the rich and the poor, over the years has not changed substantially in Latin America and the Caribbean. In fact, the Gini index of 0.5, which is high in relation to the rest of the world, is the highest in the world in the countries of Latin America and the Caribbean. It is even higher than in sub-Saharan Africa. Poverty – in areas such as Haiti, Guatemala, in Honduras, in Bolivia, in Paraguay, in Guyana – is significantly higher in some of the rural communities than in sub-Saharan Africa.

We are finding – take the case of Haiti – that poverty contributes to social instability. We saw this last year when we had the food crisis and there were riots on the streets of Haiti because people did not have access to food. Food insecurity can be one of the triggers to political instability. It could bring down any government. People will tolerate the lack of transport or the lack of electricity, but they will not tolerate the lack of food. Therefore, it is critically important that food security be seen as part of national security. Because, at the end of the day, if you do not have that political stability, then development is not going to take place. And governments have a critical role to play in reducing inequality and the potential for conflict.

We have a very peculiar situation in Latin America and the Caribbean where a significant number of countries have taken the democratic route in the last decade – countries like Nicaragua, that used to be ruled by dictators. And what has happened is not necessarily armed conflict but social tension. As you move to democracy and people get the right to vote, that is not enough. People are looking for more, they

are looking to enjoy the benefits of democracy – and many times those benefits are not there. Especially in the context of increased urbanization, where more and more people come to the city expecting the good life, which is not delivered by the new democratic regimes; [this] high level of social tension, consequently, can generate a certain amount of conflict.

Pinstrup-Andersen: But IICA is focused on agricultural development and poverty alleviation in rural areas, and governments are worried about food riots by the urban poor, or the middle class. How do you square that? Do governments in Latin America really care about what’s happening in rural areas, or are they only worried about the urban threat to their legitimacy?

Brathwaite: This is one of our basic concerns. In Latin America and the Caribbean, where 40 percent of the population is in the rural area, many governments are only spending about 6 percent of their national budgets. And we have made the case for increased investment to promote rural prosperity; because many problems in the urban area have their origin in the rural area. People move to the city when there are no opportunities in the rural sector, and with unplanned migration, lack of water, lack of health care, lack of schools, lack of infrastructure, we create more social problems in the city. We could look at this in the context of Venezuela, Mexico, Brazil. There are many countries where increased urbanization is a threat to social peace. When I lived in Mexico City, they told me that there are about 1,000 people that come to Mexico City every day and never go back.

So we promote an emphasis on rural prosperity – not only agricultural development; we talk about agricultural jobs and nonagricultural jobs. We need to focus more; almost 50 percent of the food produced in many of our countries comes from family farms, not from large, commercial farms. Look at countries like Colombia. If you have high unemployment levels, that means you have a potential population for social unrest, for guerilla warfare, and for involvement in drugs. It is very important that we see this as a nexus.

Pinstrup-Andersen: [So] why are governments not understanding this and investing more in rural areas?

Brathwaite: The efforts in Brazil by President Lula, with the Zero Hunger Program, are an excellent example of tremendous progress in reducing rural inequalities and poverty. Chile is an excellent example of significant progress. They have reduced poverty from 40 percent in 1990 to 20 percent today, as a result of enlightened rural policy and a social policy that takes into consideration the small producer and links him to the market.

That’s very important. One of the problems is that the small producers are not linked to the marketplace. They don’t participate in the supermarkets; they do not have fair prices; they do not have the technology to improve the quality of their product; they do not have access to credit and irrigation. So there is a need for rethinking the development model.

Pinstrup-Andersen: Instability in Pakistan is very much in the news these days. What role does poverty, hunger, unequal income distribution play in promoting that kind of instability?

Malik Zahoor Ahmad: Frances said that hunger is not always the problem that creates instability. In Pakistan, the situation is in fact very different from the situations that have come across in the discussion. Hunger, poverty creates instability. No doubt. But it does not necessarily create militancy. And in the Pakistani situation, hunger and poverty did not create militancy. It’s all politics.

Some 15 years ago in Soviet-occupied



“Community-level activity can have wider political implications and benefits. We’ve seen in Ireland, over a 30-year period, that it’s not just high-end politics that’s necessary for conflict resolution; it’s some of the social processes, frequently with women’s groups, that become very important.”

- Tom Arnold

Afghanistan, Pakistani intelligence agencies and CIA joined forces together to push the Soviets out. All of a sudden the Americans left Pakistan in the lurch, decided to leave Afghanistan. But the mujahidin stayed back. They became rebels. Then there were refugees also on Pakistani soil, and the refugees didn’t have money. They were producing children, living in tents, and those kids grew up in terrible poverty – no place, no shelter, no education. And then the only hope there was to pick up the gun and shoot all of us. And I think, in a way, they were justified. Now, in our case, we are back to square one.

I do not blame the international community entirely. They are helpful – but, unfortunately, our experience with international aid has been a dismal failure. Aid comes, and with the aid you receive an army of consultants. So maybe more than 50 percent of the money goes back to the original country of the aid. Then the other 50 percent is gobbled up by the local bureaucracy and the system. And unfortunately, the money does not reach the ordinary man, the farmer. The international community in general, and the concerned country in particular, need to focus sharply to make that



“Our experience with international aid has been a dismal failure. With aid, you receive an army of consultants, so maybe 50 percent of the money goes back to the [donor] country. The other 50 percent is gobbled up by local bureaucracy. And the money does not reach the farmer.”

- Malik Zahoor Ahmad

money reach the ordinary farmer.

It's better that money is spent on education, on health, on agriculture in particular, because in the tribal areas of Afghanistan and Pakistan, we do need to keep people engaged, create more jobs. Then they definitely would enjoy the benefits of prosperity – at least some kind of livelihood where they're able to survive. Then, I'm sure, 80 percent of the people would, instead of picking up the gun, try to live a decent living, make money, and become peaceful citizens of their country.

[The U.S., Pakistan and Afghanistan] have started trilateral talks for mutual economic cooperation. What we are trying to do is, instead of leaving things to the whims and caprices of the politicians and civil servants, we are picking up 50 percent of people from the private sector, the other 50 from the public sector, and we are requesting them to come up and tell us – how can we reach the ordinary man in that country?

Brathwaite: With respect to the costs of international interventions, that a significant amount of the money is spent on consultants and absorbed by the bureaucracy, [you're]

right. But what is more critical to understand is that international money is not going to have the impact that it should unless you have the absorptive capacity in the countries to channel that money to the direct beneficiaries. That is where we are lacking in our development paradigm.

At the national level, development organizations need to do more to help build capacity – not to give money specifically for projects, but to help build national capacity and to convince national governments that they too must put some money in. Because if governments don't put money in and depend on international assistance, what happens as soon as the international assistance finishes? We're back to square one. We've put a lot of money into Haiti without seeing significant progress, because we have not built the institutions and the capacity to absorb and to utilize the money in productive ways.

Mitifu: In the case of Congo in particular, there have been some missed opportunities. When the country was going through the transition process that preceded the election, that was a crucial time to start building capacity at the institutional level but also at the grassroots level. And that was missed. The UN has been present in the Congo since 2000. And the UN spends at least \$1 billion every year. We need to move from the humanitarian aspect and start building capacity, moving towards sustainable development, and helping the country build its own military capable of protecting its people and its borders.

We are witnessing – particularly in the eastern part of the country – [that] the longer the conflict takes place, the more there is a system that escapes from the central government, from the central authority. And the longer NGOs stay, because they have buying power, there is a rise in the cost of living. Whereas the general population has absolutely no power. And this is creating tension, so we might see another problem emerging beyond what exists already.

In Goma, in Bukavu, you have the rural population displaced because of the violence taking place in the rural areas, where agricultural products are supposed to come from. People have abandoned their fields. You have urban areas beyond capacity – they absolutely are very poor, and they have to compete in the market with the UN, with NGOs, and so forth. And they cannot afford anything – the cost of living has gone way too high because of the long presence of the international community.

Stewart: I wanted to comment partly about Pakistan. I had the honor of working with a great Pakistani, Dr. Mahbub ul Haq. [In the 1970s] he was continuously saying that so little was going to social expenditures – so much was going to military expenditure. Land reform was so needed. And this really brings us to the critical issue: It wasn't changed by aid. Huge amounts of aid went in. Nobody changed it. It's the politics of change that is absolutely fundamental. If we look at those countries in Latin America which were successful – they didn't just suddenly appear with good social policies; they had years of political struggle by people themselves, and not by outsiders telling them what to do but by people themselves.

At the very minimum, we can support the conditions in which people themselves will develop a political struggle. I think that means that they have reasonable health, education; if possible, they have jobs. And agricultural development certainly has a large part to play there, but we need to create a situation in which local people can take control of the situation. They should be empowered in the sense that governments should provide them with good services and so on. And then they will seize power themselves. Then they will begin to organize



“The longer conflict takes place, the more there is a system that escapes from the central government. In [Congo] you have population displaced because of the violence in rural areas. People have abandoned their fields. You have urban areas beyond capacity, and the cost of living has gone way too high because of the long presence of the international community. This is creating tension, so we might see another problem emerging beyond what exists already.”

- Faida Mitifu

themselves. I personally believe you have to build up governments, not destroy them.

Arnold: If there's one legacy from the food-price crisis of last year, it is a much broader understanding that there is a connection between food security and political stability. That's [what] we really need to focus on – what are the opportunities that this changed perception of the importance of food security provides?

We have commitments at the level of the G8. It's not clear how they're going to be going into effect. We have a very important commitment in the United States, the food-security initiative; how that's to be put into place is one of the next big challenges. There's a very interesting emerging consensus among international donors and multilateral agencies about the importance of child malnutrition and doing something about it. That's an initiative that needs to be supported.

So how do we capitalize on this opportunity, on the high-level statements that have

been made, and translate them into real action? That has to be translated down to institutional change at country level, down to real communities, down to real improvement in people's lives, new ways of people working together – NGOs, governments, private sector.

Pinstrup-Andersen: I know we have high-level representatives from the U.S. government, from USAID. And I have a question I'd like to address to [Dr.

Franklin Moore]. All this wonderful rhetoric that Tom is mentioning – is this going to be translated into real money and real action? [And] should a lot more international development assistance be focused on avoiding armed conflict and instability and getting rid of the instability that we have?

Franklin Moore (deputy assistant administrator for Africa, US Agency for International Development): In focusing the money, one of the critically important things is governance and the aspect of countries who are able and willing to put some of their own funds into agricultural and rural development. Initially one has to concentrate on those countries who have, from the bottom up, included the private sector, the government, civil society [groups] who are saying, “Here are the changes that need to take place in rural life, and here is what moves us to a more productive life, and here are the institutions that need to be in place.”

I think one clearly starts with stable states. But there are two pieces to that.

There is the productive capacity of the country; there's also the humanitarian relief. The world is looking at a different way of how one makes the transformation from humanitarian relief to development. And that is the same transformation one makes from instable states to stable, moving from a mining of the economy – “Get out whatever you can get out as quick as you can, because it's instable” – to a sustainable use of the elements of the economy.

Brathwaite: With respect to indigenous knowledge – we have established a leadership center for agriculture in our institute to develop leaders, not only at the level of the ministers of agriculture but at the community level, at the level of the NGOs, at the intermediate levels of government. If you can involve those local leaders in the process of project development, then you're going to get local and indigenous knowledge to be a part of the process.

Mitifu: There is a great deal of hope in Africa. Within NEPAD the African leaders have developed this vision on developing agriculture in Africa, CAADP. And it involves everybody – at the political level, the private sector, NGOs, and also at the community level. And I think that's a very good ground for working with the community to develop this capacity. We hope, since it has been endorsed by the G8, that a great deal of this money will go towards community development and how to reinforce this community, which has knowledge, but unfortunately they don't have the capacity.

Stewart: [This] is an opportunity. We've had many opportunities. And I think this refers to the comment – should we address our policies towards fragile, pre-fragile societies? It's clear that we should address our policies to all countries. And if we look at Pakistan, it was not fragile in the 1970s, but we should then have been having just policies, fair policies, and so on. So I would like to end saying that we should definitely address all countries and try to have equitable development. ■



BILL GATES

Co-Chair,
The Bill & Melinda Gates Foundation

Supporting the World's Poorest Farmers

When we started our foundation, we agreed that the principle driving our priorities should be that all lives have equal value, that every person deserves a chance to live a healthy and productive life. Our search for the greatest leverage brought us to those people who live on less than a dollar a day. They face huge difficulties. How can they get some traction so that their daily struggle leads to a better life?

A key answer is in the work they do. Three-quarters of the world's poorest people get their food and income by farming small plots of land. So if we can make those smallholder farmers more productive and have more profit, we can have a dramatic impact on hunger and poverty.

Helping the poorest smallholder farmers grow more crops and get them to market is the world's single-most powerful lever for reducing hunger and poverty.

The food crisis has forced hunger higher on the world's agenda. But the global effort to help small farmers is endangered by an ideological wedge that threatens to split the movement in two.



Gates stated that agriculture in poor areas is "the world's single-most powerful lever for reducing hunger and poverty."

Bill & Melinda Gates Foundation / Prashant Panjari

"The next Green Revolution has to be greener than the first. It must be guided by smallholder farmers, adapted to local circumstances, and sustainable for the economy and the environment."

On one side is a technological approach that increases productivity. On the other side is an environmental approach that promotes sustainability. Productivity or sustainability – they say you have to choose. I believe it's a false choice, and it's dangerous for the field. It will block important advances. It breeds hostility among people who need to work together. And it makes it hard to launch a comprehensive program to help poor farmers. We need both productivity and sustainability, and I believe we can have both.

Many environmental voices have rightly highlighted the excesses of the original Green Revolution. They warn against the problems of too much irrigation or fertilizer. They caution against the consolidation of farms that could crowd out smallholders.

These are important points, and they underscore the crucial fact that the next Green Revolution has to be greener than the first. It must be guided by smallholder farmers, adapted to local circumstances, and sustainable for the economy and the environment.

The environment benefits from higher productivity. When productivity is too low, people start farming on grazing land, cutting down forests, using any new acreage they can to grow food. When productivity is high, people can farm on less land.

Some people insist on an ideal vision of the environment – divorced from people and their circumstances. They have tried to restrict the potential use of biotechnology in sub-Saharan Africa without regard to how much hunger and poverty might be reduced by it, or what the farmers themselves might want. Some voices are instantly hostile to any emphasis on productivity. They act as if there is no emergency – even though in the poorest, hungriest places on Earth, population is growing faster than productivity, and the climate is changing.

We need to take full advantage of these emerging technologies to develop healthy new crop varieties – and we need to make the seeds available to the small farmers who

need them.

I hope that the debate over productivity will not slow the distribution of these seeds. I also hope the debate does not obscure a critical lesson from the past: Developing more productive seeds is just one element of an overall strategy.

We take that lesson very seriously. That's why the foundation's investments are guided by two principles. We focus on small farmers, and we make investments across the value chain. We try to see our investments through the eyes of small farmers – will they lead to better yield, better soil, a better living, a better income?

In this global movement, it's crucial that everyone play a role – but Africa must lead. In 2004, African heads of state met in Maputo and pledged 10 percent of their national budgets to agriculture. Countries from Ethiopia to Malawi to Ghana are showing the way.

Ghana has met the 10 percent pledge, and its success demonstrates why others should as well. Ghana's agriculture sector is growing at a steady rate of over 5 percent. GDP is rising; national poverty rates are dropping; rural poverty rates are dropping even more. Ghana is now the first sub-Saharan country to reach the Millennium Development Goal of cutting hunger and poverty in half.

The Alliance for a Green Revolution in Africa, led by Kofi Annan, is pushing for these kinds of advances across the continent. Unfortunately, most African countries have not yet met the 10 percent pledge. Is there any reason not to find 10 percent of your budget for the highest-leverage approach to the biggest problem the poor face?

Rich countries have also pledged investment in agriculture. The G20 made a \$22 billion pledge to help the poorest farmers increase their productivity. It's a great thing that donor nations are focusing on this.

We also need foundations, universities, the UN, the World Bank, scientists, farmer groups, and others to intensify support. Research companies can apply the technology



they've developed to the needs of the small farmer. The crops are different; fertilizers need to adapt to the soils; the seed packages need to be 1 kilogram, not 50. Some of these products need to be royalty-free, or many customers won't be able to afford them.

Food companies can provide markets for small farmers by turning to them as suppliers. A number of corporate partners are making impressive contributions, and we need others to join them.

There is no reason for so many farmers to be so hungry and so poor. Poor farmers are not a problem to be solved; they are the solution – the best answer for a world that is fighting hunger and poverty, and trying to feed a growing population.

If farmers can get what they need to feed their families and sell their surplus, hundreds of millions of the world's poorest people can build themselves a better life.

It will take passion and focus and a sustained sense of urgency. It will take a willingness to put aside old divisions and come together behind this cause. We have the ability to build these tools. We know what needs to be done. We can be the generation that sees Dr. [Norman] Borlaug's dream fulfilled – a world free of hunger.

Q&A: Bill Gates and Gebisa Ejeta

Following Bill Gates's keynote address, he was joined by 2009 World Food Prize Laureate Gebisa Ejeta for a wide-ranging discussion on how to implement agricultural development, specifically in Africa.

Gebisa Ejeta: You've earned in the minds of many Africans the power to bring people, particularly African leaders, to the table for earnest commitment and dedication to bring their resources and their policy decisions for the cause of agriculture and development. You have eloquently described the need for people to get together and do this. Would you and Melinda be willing to engage with leaders of Africa in this kind of dialogue?

Bill Gates: It's certainly our goal to do that. And it'll take several different forms. There's a lot of research that needs to be funded that's not country-specific, like the great work that you did that is more crop-specific. Not just our foundation, but all the rich-world governments, World Bank – we need to provide more support to those horizontal activities.

We also need to help build capacity – the number of PhDs, the people trained in agricultural science – and make sure that those people by and large are going into these national agricultural planning. As that capacity is built up, we have to show that we're simply backing the national plan.

The ideal is to see almost competition between governments, in order that their program is a leading program. If you can build up the standard of excellence, and learn from each other, then you can get a very positive dynamic going. Certainly we've seen that in India, where you have states competing with each other to try and be the place that the latest things get done. And we can see the very beginning of that in Africa.

Ejeta: You also called for people with different opinions to come together around a shared vision of agricultural development. What would it take to get that achieved?

Gates: This will be most concrete as people actually see the progress in the new science. People have to know that the benefit

of the new technology is quite substantial; it's significant productivity differences that can make the difference between starving or having a reasonable amount of food.

The different projects that are going on – the sweet potato, the drought-resistant maize – in the next two or three years, there will be seeds that are adapted to African conditions available to use. And then you look at the experience if you have good scientific review, if you register things in a careful way. [Then] countries can make the sovereign decision to say, "Okay, we're taking a very modest risk here, based on what's been done." Then it moves forward and you have the success stories.

We need more benefit. We need to pick the big problems and solve those, using these tools; that's what's underway now. I am an optimist about technology. There's a constant dialogue: are we mapping the technology to the particular needs of the smallholder? [Are we] solving the right problem?

We're willing to try out different things. The way milk is pasteurized; there might be a better way to do that. Vaccines for animals – a lot of animal diseases devastate smallholders that invest in their animals, and it's a key part of their income. If you can improve the health of those animals, that can have an incredible payback. There are ways of gathering water, which will be more important over time.

We have a pretty high threshold to meet. We're trying to get smallholders to have twice as much output at a time when the climate is going to make that more difficult. In Africa, getting inputs in is harder; you don't have the roads [or] the number of people with expertise. So I'm often cautioned not to think that what happened in the Green Revolution will be nearly as easily achieved. And yet we have to conquer those things.

We have the book out called *Millions Fed*, which can take the success stories and get people to understand. If you bring these

up in terms of the acronyms and the different agencies, it's not as clear-cut as if you tell the success stories. In health, we did a book like this called *Millions Saved* about new vaccines or skilled birth attendants, and that really galvanized things. So we brought that same lesson of – bring more people to the party through the good news, the success story.

Ejeta: These problems are getting complex. This holistic approach is really necessary: an integrated approach, as you indicated, bringing people together. [With] Kofi Annan, you can knock on anybody's door and get attention from Africa leaders.

Gates: That's the great thing about the leadership at AGRA and having Kofi involved. They're in Africa, they know the leaders. As things are being done well, they can make sure the right praise and reinforcement is there. If agricultural budgets are still pretty disappointing, they can in a very constructive, appropriate way push for those things to be done well. We get the leverage as we've been able to back great people and show them what can be done.

Ejeta: One of the weakest institutions in Africa is the private sector. While Kofi Annan can affirm the value of public institutions and the commitment of government to development, you have the credibility to speak about the power of the private sector in catalyzing that kind of activity in Africa.

Gates: If the private sector is unleashed, it can do amazing things. Government policies have to enable that to happen. It's both the local private sector, and then it's other private sectors actors coming into Africa, making investments as well. We're starting to see the beginnings of that with a lot of responsible companies. ■



An Afghan security guard protects the field of a local farmer.

AP Images / Adam Butler

Intelligence and Security Perspectives on Agriculture

Mathew Burrows: Resource issues – food is obviously one of the biggest ones – are now rising up to the top of the national priorities. And that has been a function of events, the 2008 food crisis; but also about trying to cast our analytic vision out 15-20 years, in order to begin to think about those problems [and] so that we can begin to tackle those problems early on. Our hope is when we identify these problems, that policymakers will turn their attention and take action now.

Raymond Gilpin: These days when we think about food security, we are dazzled by the numbers. We think about trillions in terms of budget deficits, many billions in terms of bailouts, and billions in terms of world poverty and hunger. That desensitizes us to the human-security dimension of global hunger.

There are many things that we could

learn from the recent and ongoing food crisis. [One] is the impact of the crisis on households. The second is, how do governments and non-governmental organizations respond to the crisis? And to what extent have these responses sown the seeds for future conflict?

We don't really take time to understand how higher food prices ratcheted up domestic spending, particularly among the poor, and led not just to income poverty in rural areas, but asset poverty. The asset poverty made it impossible for most of the households to remain in the rural areas and led to mass migration out of the breadbaskets of most countries. This not only accentuated poverty but also made it a lot more difficult for these countries to have prospects for being able to feed themselves in the outer years. [And] displacement of population in itself constitutes a human-security challenge.

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Last year [saw] a number of riots; in many countries people lost their lives. But it was relatively easy for most governments to quell these riots, because they blamed it



Burrows



Gilpin



McGinn

on a global phenomenon: rising commodity prices. This will be a lot more difficult when the seeds of the bad policy responses that some countries adopted come back to roost. Then it will become a real national problem and will have a lot more tension – and more likely there will be violence associated with competition for these resources, and which will take political coloring. And for those reasons, the household implications of the food crisis are important.

Some governments adopted postures that were protectionist, which cut global supplies and caused prices to spike. Others had domestic responses that are costly, like subsidies and tax and income policies that would probably in outer years become significant fiscal burdens. From a nongovernmental response, a number of commercial investors turned their attention to large-scale food [and] agricultural production, which lent itself to “land grabbing.” This could result in a lot of smallholders being dispossessed, crowded out of the markets, and displaced. That is another seed of conflict and violence.

Our focus should be on ways to be a lot more conflict-sensitive in our approaches to global hunger, such that in responding to events we don't create more problems for the outer years than we have right now.

Burrows: You pointed out governments taking ill-advised moves; how do we prevent that? Country by country, trying to educate leaders on the longer-term consequences of these measures? Or is there some broader global policy move that we should be taking? We talk about the food crisis in '08, [but] from our analysis we see that happening [again], because of some longer-term trends that are going to continue to put pressure on prices. It's not as if this is going to be a one-off event; to try to prevent that in the future is a very important goal.

Gilpin: I absolutely agree. This is an ongoing crisis; it is not a one-off. Addressing it requires a coordinated and comprehensive approach. The problems of global hunger are very complex. They're linked to political, social, technological and economic issues.

Knee-jerk fiscal responses might grant you a very, very temporary reprieve. But if

we don't have an initiative that starts laying the foundation for sustainable increases in productivity, improving market access, improving affordability, and making sure that the infrastructure to connect production to market is available and functioning – we're going to see the kind of problems that I mentioned.

In the globalized trading environment, there's a very strong role for the international community. This is a unique opportunity where we could hold the G8 to account. L'Aquila is a very bold step; the \$20-22 billion that has been pledged is important. But we need to ask – How much of that is new money? When is it going to be disbursed? Where will it be targeted? How effective will it be? And how could we, as private citizens, measure that progress?

Dennis McGinn: The trends and indicators and warnings [are] quite clear – something [is] happening significant to our climate. Not only is climate change happening but, increasingly, the evidence is that the economic activity of mankind is contributing significantly.

The effects of climate change – prolonged drought; too much water in the form of torrential rains or typhoons, hurricanes; disease factors; loss of shelter; loss of food production capability; perhaps significant rising sea level; certainly rising temperatures, not only of the air and land but of water as well, the Earth's ocean – [are] going to act as a threat multiplier on instability in critical regions of the world.

If you take a look around the world today as we know it, there exist longstanding fault lines. Fault lines, tension along political, ethnic, religious, economic lines that exist and in some cases have ongoing conflict. If you take the effects of climate change, you can anticipate that the intensity of these fault lines, the duration, the frequency, are all going to increase. It will place pressure on social structures and governments that will cause, in many cases, fragile governments to become failed governments. Into this vacuum of power will rush people with extreme ideas about what the solutions should be. And you have a recipe for internal and external mischief in the form of, for example, terrorism.

So these are daunting challenges. They constitute scenarios. One would be the effect of not enough water in critical regions of the world. The Middle East [has] about 6 percent of the world's population, 2 percent of potable water. There are mechanisms in place now that allow a fairly decent inter-government management of this critical water supply. But if you add the effects of drought, in some cases overlaying on significant political factors and religious factors, you have a recipe for some very, very significant instability in an area that is known for strife and conflict.

Bangladesh has been ravaged over the years by typhoons coming from the Bay of Bengal. These have the effect of inundating coastal croplands and fisheries with surges from the typhoons and have knocked out at least one growing season's worth of food supply. In 1991, right after the first Gulf War, the U.S. military conduct[ed] a massive operation called “Sea Angel” to feed and provide water and essential medical attention to tens of thousands, perhaps hundreds of thousands, of people devastated by one of these typhoons.

If you project into the future, because of climate change and global warming, you can imagine that the typhoons would be greater. There could be an effect of sea-level rise; I don't worry as much about that in the near term as I do temperature of the oceans. Increased temperature of the ocean equals much more intense and much more frequent storms. And in the case of Bangladesh, these storms could wipe out not just one growing season's worth of food supply but several years' [worth]. Recognizing that with millions of people affected over a period of months, perhaps years, there's going to be tremendous pressure for mass migration, probably to the northwest towards India. And the lines of tension that exist there today would be greatly exacerbated. The scale of human suffering, the scale of potential for greater instability, would be enormous.

Also in South Asia, in the Hindu Kush, we are seeing a retreat of glaciers, as we are in every continent of the world – in North America, including Alaska; in the Andes in South America; in Europe in the Alps. The Himalayas and their glaciers act as a huge water reservoir, capturing a lot of the

water that falls in that part of the world and storing it, so that you don't have torrential floods rushing down four key rivers – the Ganges, the Indus, the Yellow and Yangtze. And, a temperatures increase and the glacier snow and ice melt, they provide a relatively reliable source of critical water for agriculture in all of those nations.

With predictions of climate change and shrinkage of the Himalayan glaciers, you can get a scenario in which the water in the rivers becomes seasonal. Imagine what this will do to the ability to produce reliable crops, to use water for all of the human needs of tens of millions of people in that critical area of the world – which, like many areas of the world, has a history of existing tensions.

“We talk about the food crisis in '08, [but] from our analysis we see that happening [again], because of some longer-term trends that are going to continue to put pressure on prices. It's not as if this is going to be a one-off event; to try to prevent that in the future is a very important goal.”

- Mathew Burrows

The energy aspect of this has two dimensions. One is that our use of energy, primarily based on fossil fuel across the globe, and growing demand will create more greenhouse gases and accelerate and magnify the effects of climate change. On the other hand, if we continue to rely exclusively on non-sustainable, fossil-fuel-based sources of energy, we will have greatly increased competition, which will eventually lead to conflict over these critical and dwindling supplies.

The opportunity lies in the fact that global climate change is affecting the commons of our Earth, and we have a common enemy. A common enemy tends to bring people together, bring nations together. And we have the opportunity to cooperate [to] prevent, mitigate, and adapt to the effects of climate change – which will create relationships and processes by which we can address other challenges that, perhaps, haven't had those relationships and those policies.

Burrows: All of us were in agreement that food, the food crisis, other resource issues are now center-stage in national-security thinking. How is that beginning to change the military in their actions and their thinking?

McGinn: The Naval Energy Forum in Washington was convened to look at what the energy challenges and energy opportunities were for the Department of the Navy in a climate-change, carbon-constrained world. They took the approach that you can't look at just one aspect, energy security, without considering climate change and its effects on international stability.

In August, the commandant of the Marine Corps held an energy summit – first ever in Washington. The focus was, how can we lighten the expeditionary load for our marines and soldiers in places like Afghanistan, so that we don't have to be as reliant on the long and vulnerable fuel convoys that we paid such a dear price for in real money terms but more importantly, in lives and wounded soldiers, sailors, airmen, and marines?

At the very top level, the Department of Defense and the Central Intelligence Agency are very, very credible, conservative organizations that are addressing climate change and the potential solutions to deal with this in the context of energy security as well.

As the U.S. military changes its focus and reliance on fossil fuel – and this will take decades, but it is already starting – and we start relying on sustainable energy not just in bases and stations and installations here in the United States but in areas in which we operate, we are going to create an opportunity to bring electricity, in the form of renewable energy, in places where there isn't any or there isn't much. As the operations conclude, working with nongovernmental organizations, the governments of the nations in which the military would operate in cooperation, we'd be able to leave behind a footprint of electricity that would improve

the preservation of medicine, the preservation of food, and, most importantly, would allow the production of water either from wells or the production and purification of existing water. And [where] you have water, you have agriculture. It can literally make a huge contribution – just, in the military sense, working in a civic way – to addressing some of the problems of poverty and starvation that we see around the world.

Burrows: Sometimes in the intelligence community, if you're going on an elevator, a fairly fast-speed elevator up, you have about 30 seconds to tell the President something – what would it be on the food crisis? What steps does the government really need to focus on?

Gilpin: Two things – productivity and market access. The admiral mentioned climate change as a “common enemy.” I think that it's a misnomer because I don't think we've thought deeply enough about how or whether or not climate change is a common enemy. For the farmer in Southeast Asia who has to feed his or her family, cutting down trees to plant food is a survival issue, but then is a climate-change issue. For a small producer in a village in Africa, wanting to generate some electricity for his or her crop, his or her farm, to do some processing, running a polluting generator is a survival issue, not necessarily a climate-change issue.

While we focus on the negative impacts of climate change, it's also important to contextualize it in a manner that provides alternatives for people. So when we remove the polluting technology, we should make it a lot more affordable and easier for less-polluting technology to be available at the farm-gate level. Ditto deforestation and other aspects of global warming. Quite often – because we usually think of these things in aggregated terms – we lose sense of what's happening at the household and the personal level.

Last year, I spent a while in the Democratic Republic of Congo, doing a survey of 1,000 small businesses in the northeast

and the south. And it's amazing to see how adaptable they have become in very trying circumstances. The same could be said for food farmers worldwide: Granted the opportunity, granted access to technology and the possibility of free and fair trade in the global environment, they're able to rise to the challenge.

So my two points to the President would be, one, let's have sustained and targeted engagement; and secondly, let's make sure that the trade aspect is corrected. Because there's a lot that we could do at the global level to make it easier for countries to trade. We generally think about assistance being dropped in, but if we are able to empower a lot of the communities and individuals, they would be able to feed themselves. I don't think it's so much about “millions fed,” but it's about millions being able to feed themselves. That's what we really want to do.

McGinn: In terms of climate change representing a common enemy, Mother Nature doesn't care about politics, doesn't care about public-private partnerships. Mother Nature is going to do what Mother Nature is going to do. It is up to us that care more about

“I would start with the U.S. Congress and say, “Pass legislation that puts a price on carbon.” Let's get on with it. It will accelerate the transformation to a new energy economy, with all of the benefits that accrue, with a tremendous ability to at least mitigate the effects of climate change that are already underway.”

- Dennis McGinn

what Mother Nature does and how we can create an environment in which sustainability is the organizing principle – not just at the supra-government level but, as Dr. Gilpin says, right down to the individual farmer, or individual in a large urban setting.

We need to use large organizations and rich governments to help provide the tools to do that. But we need to break this paradigm that we've been living with since 1854 in this country, when oil was discov-

ered in Pennsylvania, that the only way that you can get economic growth and improve your quality of life is through using fossil fuel. We cannot sustain that. We can move to a higher quality of life, eradication of hunger and poverty, using a different approach that focuses on that key word, sustainability: sustainable energy production, sustainable farming.

If we were to go back to the end of the Cold War, Eastern Europe and the Warsaw Pact countries wanted to have a world-class telecommunications capability. They could have done what had been done in Western Europe, the United States, and other places in the developed world and simply strung lots of telephone poles and copper wire just the way that we did. But they didn't, because there were better technological tools available, called “wireless.” They achieved in a very, very short period of time a world-class ability to communicate with all the productivity and quality of life that accrued from that. The same thing can be done by providing the right kind of technology for sustainable energy and all of the benefits that accrue from having affordable, sustainable, clean, renewable energy.

Burrows: This is a quite critical issue. Whether climate change is a challenge or opportunity, I am not as sanguine on getting technology in place as fast as we need it. That will be one problem. The other is that tendency – particularly on issues like food, water, and other vital resource issues – to put up a protection of barriers, in an effort to get through the short term, even though that oftentimes undermines your position over the longer run. So we could face a world of competition over resources, a very ugly one, and we have to realize that in order to avoid it.

McGinn: I would start with the U.S. Congress and say, “Pass legislation that puts a price on carbon.” Let's get on with it. It will accelerate the transformation to a new energy economy, with all of the benefits that accrue, with a tremendous ability to at least



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mitigate the effects of climate change that are already underway.

Let's be a true international leader and partner at the same time. We need to lead as the world's largest economy and the world's largest user of fossil fuel. But we need to lead with the sense that it must be a cooperative effort. As important as Copenhagen is, we've got to set a much, much better and positive framework across key national lines – especially the world's largest greenhouse-gas producers with the largest economies.

Gilpin: Being a true international partner is difficult because foreign assistance is a political instrument in itself. We should recognize our shared interest and our shared humanity, because climate change is going to have implications for both rich and poor

countries. But it's going to cost the poorer countries who are the largest polluters a lot more to come up to speed than the richer countries. There should be some accommodation for the poorer and more fragile countries to have assistance to increase the uptake of cleaner technology, and to be able to make the transition away from the most harmful paths.

Burrows: Transfer of technology to poor and developing states will be key. This is something that in the developed world is going to be hard for us to get over, in part because this means changing IPR and other issues to allow this effect of transfer.

McGinn: DARPA – the Defense Advanced Research Projects Agency – developed the

Internet and developed global positioning system. Think about what those two inventions have done to transform the way we operate as individuals, as businesses, as nations. For any sustainable-energy or energy-efficiency technologies that are developed by any part of the government – DOE or Defense or other parts – we need to get that type of impact. But we need to do it not in many, many decades, as it took the Internet or GPS, but much, much more quickly, and remove the barriers to doing that. Because it is in all of our interest to have these types of tools in hands of people where it will do the most good. ■



JEFFREY SACHS

Director,
The Earth Institute, Columbia University

Food at the Center of Global Crisis

We are at a graver challenge on food than we've been at for many decades. The challenge is even more complicated now than at the start of the Green Revolution. The food sector, the single-largest sector of the world economy, is at the heart of multiple intersecting crises.

We're not winning the battle against global hunger, that's for sure. Even less are we winning the battle against global malnourishment. FAO has just estimated that we've breached 1 billion chronically hungry people. We have another 2 billion people suffering significant, continuous micronutrient deficiencies. We have at least 1 billion people suffering from obesity. That adds up to more than 4 billion people out of 6.8 billion who are severely malnourished.

We're in the middle of an acute food crisis with food prices that remain very high, especially in poor countries. Underpinning this is the now much higher price of oil and

other energy sources. There's every indication that those energy prices are going to remain high into the future. That pervades the food-production system from fertilizers to energy inputs for farming and, of course, the processing and distribution.

We have a world of climate shocks that clearly is not simply a run of bad luck. The droughts in India this year pushed up pulse and sugar prices to highs that have percolated throughout the international system. Droughts in grain production in recent years have done the same. We face an absolutely unsolved challenge of water. And the food sector is by far the leading consumer of freshwater around the world.

The food industry is the number-one sector of greenhouse-gas emissions in the world. Around 18 percent of greenhouse-gas emissions come from clearing rain forest and other forest for pastureland and cropland. Roughly another 12-15 percent reflect

the carbon dioxide of fossil-fuel use in food production, the methane from our rice paddies and livestock, and the nitrous oxides that come from nitrogen-based fertilizers, which we absolutely need to feed the planet but are a major independent source of greenhouse-gas forcings. One-third, roughly, of all greenhouse-gas emissions [come] from the food sector.

Food is the number-one driver of habitat loss for other species. The food industry is the source of the nitrogen and phosphorous loading that we know in the Gulf of Mexico as "the dead zone." Now science has shown about 130 significant hypoxic zones in estuaries on virtually every populated river system around the world. The food industry stands at the center of fisheries depletion, mangrove destruction, wetlands drainage, invasive species.

It's not an accident; it's the most important function of economic activity in the

world – feeding ourselves. But its effects are at the center of the global challenge. And I'd say that the food sector has lost the public's confidence in food safety, in the healthfulness of the food that we eat, in the environmental impacts of food.

Wrongly, I believe, [the public] has lost confidence in GMOs. People think sometimes that organic food could feed the world, which it manifestly could not. But on the other hand, there has been no solution to the damages that come from having to use 100 million tons plus of fertilizer. And there is a campaign for local foods that is widespread. Again, totally understandable, deeply misguided – there's no way that the planet can feed itself with local foods. But this is an objective sense of how far the industry is from public confidence right now that's needed.

The food industry [needs] to address directly and head-on that the food sector is the leading anthropogenic driver of climate change. There needs to be massive spending on adaptation for places hard hit by climate change. [We need to] seriously move to agro-ecology on many fronts – how water is used, how tillage systems are changed – to address these other anthropogenic drivers.

The conversion of our corn into ethanol makes no sense from a greenhouse-gas direction, an economic direction, an ecological direction. To compete with the world food system, when there are no discernible gains in any event on the environment side, does not make sense.

We're going to have to address dietary issues, which underpin many of these crises. A kilogram of beef requires up to 16 kilograms of grain input. The water, fertilizer, [and] land use to produce that means that 40 percent of our grain production now is for animal feed. And nutritionists tell us,



“The food industry is the number-one sector of greenhouse-gas emissions in the world... One-third, roughly, of all greenhouse-gas emissions [come] from the food sector.”

persuasively, that our beef consumption is so high that it is highly deleterious to our human health.

We're a globally urban society. We need access to safe and healthy foods, which we don't have. We need healthy fast foods. And we need to control the vast amount of waste of our food supply, because we're throwing away 40 or 50 percent of the food that comes into the cities.

“We cannot go on the way we're going. And we need the food industry to say it first and foremost, because we cannot do this without the food industry's leadership.”

We need a strategy for nutrition for early childhood development. We're losing children all over the world, including in the United States, because if brain development is not supported from ages 0 to 3, you never recoup that. And that's a lifelong cost.

We need a population policy, like Norm Borlaug said back in 1971. World population is continuing to rise by 80 million people per year. Africa is on a trajectory, of rising from 800 million now in the sub-Saharan region to 1.8 billion by 2050. I don't have a clue

– I don't think anybody has – as to how 1.8 billion people in sub-Saharan Africa could be gainfully employed and healthy in 2050. We are on an absolutely unsustainable population path.

We cannot go on the way we're going. And we need the food industry to say it first and foremost, because we cannot do this without the food industry's leadership. I've worked with a lot of industries over

the past 25 years. I'm a believer in globalization. I am a booster of capitalism. But I also believe that when an industry doesn't take these problems face-on, it leads to disaster. This is a powerful lobby. And this industry could lobby its way just to [General Motors]'s success. You can be so powerful that you lobby your way to bankruptcy. And this industry is powerful enough to do that.

So I want to close by appealing to the industry to understand and take on the fact that the sector is at the core of the unsustainability right now. But it's a sector that we depend on every hour of every day to stay alive, and that the planet now depends on to get these choices right. ■

INDRA NOOYICEO and Chair,
PepsiCo

Closing the Nutrition Gap

How do we make sure agriculture is organized to serve the nutrition needs of the world? The agricultural community tends to focus on the quantity of food produced and the price it fetches in the marketplace. But to those who are most concerned with nutrition focus on the quality of the food and who it is getting to.

The absence of overlapping incentives results in a problem encapsulated in two terrible facts. One: every day, a billion people the world over go hungry – more than anytime in history – and the situation is getting worse. That’s why we need to ensure that nutritious food gets to the people that need it. The second problem: More than half the food produced today is lost, wasted, or discarded, and that’s why, as a system, we need to become more efficient.

The great agricultural pioneer Norman Borlaug – the patron saint of this gathering – showed us in his remarkable career

how to feed the world. Norman Borlaug is someone that anyone from India has to be grateful to. I grew up in India in the ’60s and the ’70s, and I remember in Madras going to the store with a ration card, waiting in line for rice and wheat. When you did get the rice and wheat, they were terrible quality. The rice was full of stones, and the wheat was just full of junk. And all of a sudden, end of the ’70s, life improved. The rice quality became better; the wheat quality got a lot better. So I was a beneficiary of the Green Revolution.

But let me note another great scientific pioneer, the sage of nutrition, David Morley. If Norman Borlaug showed us how to feed the world, David Morley showed us what to feed the world. His work, starting in Nigeria back in the 1940s, has made us understand the need to monitor growth and good food intake from a very young age. I do not know if they ever met – Norman

Borlaug and David Morley – but it would have been a fascinating conversation. Between them, they provide the answer to the problem that we confront today. By using both Norman Borlaug and David Morley’s insights, global agriculture and global nutrition can be fully synced up.

What causes this damaging division? First, agricultural incentives are not well aligned. There is, for example, an economic incentive to produce meat and dairy for the richer countries, rather than cereals for the poorer people. Second, too much food is lost through inefficiency. And, third, people go hungry because we do not have the right alignment between supply and demand.

The consequences of this misalignment can be terrible. The most obvious and distressing is massive undernutrition. Over 1 billion people worldwide are undernourished – more than 15 percent of the world’s population. Iron, vitamin A,

zinc, micronutrient deficiencies all affect billions of people, damage the brains of babies, and increase the risk of many diseases. And in many countries we face a rising tide of obesity, which leads to diabetes and heart diseases. Chronic diseases are now the dominant causes of death everywhere in the world except in sub-Saharan Africa. And we know that adults are far less likely to contract chronic diseases if they have a healthy nutritional start as a baby and their mothers have better nutrition in pregnancy. So clearly the harmony between agriculture and nutrition is a long way distant.

Farmers, particularly smallholders, cannot invest in technology and innovation or improve their distribution network without capital. Rural households in developing countries are still largely reliant on informal credit, such as money lenders and pawn brokers. Microfinance and community lending are so important for these people, but governments, NGOs, and other agents cannot develop these without at least some investment and backing of large financial firms.

If the finance is in place, the contribution of the private sector, especially consumer-products companies like ours, could be immense. We must share our core farming expertise. In the course of building business, we build a great store of knowledge on things like nutrition science, irrigation techniques, and the development of resilient crop strains. There is no reason why this knowledge cannot be shared with small-scale farmers. Two-thirds of the 3 billion rural people in the world live off farming less than two hectares each. And these farmers are the least able to get hold of agricultural advancements – but they also have the greatest capacity to turn the sector around.

When PepsiCo launched its business in India in the 1980s, we began with agriculture. We worked directly with thousands of farmers and transferred techniques and best practices to improve the yields of tomatoes, chili, and rice. We also introduced new varieties that tripled the yield of these crops. At the same time we introduced criti-

cal food-processing technology. This meant fewer fruits and vegetables would rot on their way to the market. We’ve also worked with local scientists in India to implement drip irrigation to cut back the usage of water in paddy fields.

In China we helped local potato farmers develop thriving crops in the middle of the desert. Water-saving irrigation, crop-rotating methods were all shared along with regular training on modern, environmentally friendly technologies. Production is at 39 tons per hectare, more than double the average in all of China. And we benefit because we buy the output from these farms at competitive prices.

Private-sector companies can [also] leverage our distribution expertise. Lots of companies have highly developed supply chains, and these can be used to distribute food to places where it’s needed the most. In India, South Africa, Nigeria, Mexico,

“We must share our core farming expertise. In the course of building business, we build a great store of knowledge on things like nutrition science, irrigation techniques, and the development of resilient crop strains. There is no reason why this knowledge cannot be shared with small-scale farmers.”

China, as examples, we service between 100,000 and 1 million urban and rural outlets, depending on which country. And we reach all of these outlets once, twice, three times a week. How can we and other companies utilize this precious resource to help address the undernutrition issues that are so rampant?

We have another great resource, which is highly qualified and capable people. We have seconded our retirees with expertise in distribution to the World Food Program to transfer our best practices on distribution-supply chain to help improve the efficiency of distribution of food aid. We have business initiatives with UNICEF and Valid, who are working in Nigeria in addressing undernutrition.

All of these programs form part of a commitment I made with 17 other compa-

nies, to show how we can use our core business capabilities to address the Millennium Development Goals. Knowledge transfer, understanding of consumers and nudging them to make the right food choices, and distribution and reach: that is the holy trinity of the private sector, and this is what we can offer to agriculture and nutrition.

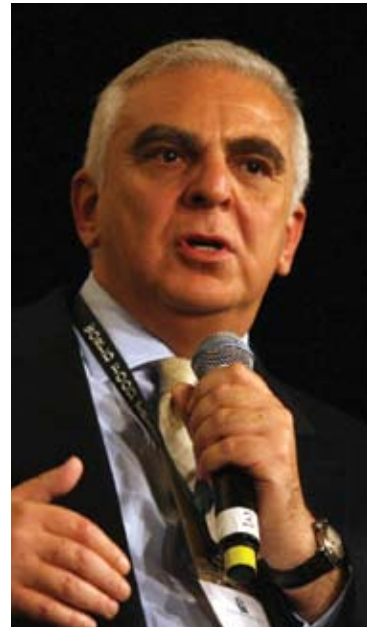
But a word of caution is in order. Even if we did 100 percent of what we can do, would that solve the problem? I don’t think so. It wouldn’t really solve the problem at all, because the time has come for concerted action. As we’re dealing with a global problem, organizations such as the United Nations, the WHO, the FAO, and other large NGOs all need to play a coordinating role.

But all of us need to ask ourselves now whether our work is making enough of a difference, at a pace that begins to curb the root of the problem. Let’s not forget something – problems in the modern world today cannot be contained within national boundaries. We need global solutions; we need them fast. And unfortunately, progress today is glacial.

So, what if we take the conversation that’s taking place here and put it on a more formal footing? What if we created a commission

of all the interested parties to look ahead to 2020 or 2030? The commission’s task will be simple to state but difficult to do: How do we align agriculture and nutrition to address the world’s nutritional needs? And in doing so, how do we use the R&D expertise and knowledge and supply-chain capability of private industry to bridge the farm-to-family divide? This is the biggest issue of the 21st century.

We have come a long way, but time is short and the need is great. We all demand food – it is a basic human need. United by commitment, underpinned by science, operating with a sense of community, we have to make a difference. It was this task to which Norman Borlaug and David Morley devoted their distinguished careers. It’s up to us now to pick up where they left off and complete their work. ■



PARTICIPANTS

The Honorable Tom Vilsack
Secretary of Agriculture,
United States (Host)

His Excellency Amin Abaza
Minister of Agriculture and Land Reclamation,
Egypt

His Excellency Gerry Ritz
Minister of Agriculture and Agri-Food,
Canada

Carlos Vazquez
Minister-Counselor for Agriculture,
Embassy of Mexico, Washington

Tom Vilsack: In the past, our development assistance has been primarily in the form of the food that we grow. But it is [this administration's] feeling that we must go beyond the traditional notion of food assistance. So we have begun work on a global food security initiative, with a number of other nations, to come up with a cohesive approach that focuses on understanding and appreciating that whatever we do must emanate from the countries we are helping.

It starts with the countries telling us how we can be of help. It goes beyond simply increasing the productivity of lands in other

The Secretary's Roundtable: Cooperation in Food & Agriculture

nations, making food available. It also involves making food accessible to those who need it. So we equally have to be concerned about transportation, marketing, regulatory systems – ways in which we can make sure that the food that is available actually gets to consumers. And it is also important for help and assistance to be focused on the proper utilization of that food so that the highest nutritional value is attained.

USDA will focus specifically on research opportunities in which we can help developing nations address some critical questions. We will focus on capacity building, using our resources – the extension system [and] land-grant university system we have – so that we can train the trainers and lead the leaders within each individual country. And we will also provide technical assistance in a very significant way through the use of fellowships, scholarships, opportunities for individuals from countries to come to the United States and for people from the United States to go to various countries.

Our focus will obviously be on the areas of greatest need. The tremendous challenges in sub-Saharan Africa [are] certainly a good place to start, but [we] will not necessarily be restricted to that part of the world. Challenges exist literally in all parts of the world.

As good as [Dr. Borlaug's work] was while he was alive, his best is yet to come, for he understood the need to instill in the young people of all countries a love and appreciation for science, an understanding that science is one of the significant ways we can make a difference in reducing the billion people who live in this world today who are not sure where the next meal comes from.

Gerry Ritz: This is our chance – as political leaders, as NGOs, as general people – that we can reaffirm our commitment to carry forward in the spirit and the energy of that great work. All of us in agriculture – whether it's in the field or in the political realm or the nongovernmental delivery systems and so on – once again we're confronted with major global food problems and challenges. But these problems create opportunities.

You get a different perspective of some of these challenges when you become the minister of agriculture from a large agricultural country, like Canada. Over the recent decades, our producers in Canada have been steadily increasing the production and quality of the food products in the world. Farmers have been doing their job, yet continue to face obstacles that make it harder to deliver food to the places where it's needed most.

In an ideal world, producers would have the opportunity to reinvest in their operations as they get fair prices for their products. This drives innovation, increases production, [and brings] more product to the global markets. We saw a reversal of that in 2008, where some countries reacted in a protectionist way that actually exacerbated some of the problems. Farmers faced trade barriers that kept food from getting to the people who needed it.

In Canada, 50-85 percent of any given commodity is traded. 32 million people just cannot consume everything that we grow, so we do have a tremendous need for export. And that has led to Canada becoming one of the largest agricultural exporters in the world. At the same time, we're the sixth largest importer of agricultural goods. Food should go where it's needed. We're happy to ship our wheat, pork, and beef to a country where there's great demand, but at the same time, we rely on other countries around the world to serve us with vegetables and fruits and so on.

And the problem that we face is inefficiencies throughout the system, and it only takes one to roadblock a complete, free, and unfettered flow of product. So it begins with fair prices, it follows with market access, quality controls, and so on. But the biggest thing that my farmers tell me they face is the lack of stability and continuity in regulations.

There are more regulations on food than there are on oil and gas. There are more regulations on food than there are on fertilizer. There are more regulations on food than there are on the production of an automobile. Foodstuffs really are hamstrung, and that becomes part of our long-term challenge. Predictions from experts suggest we'll have to double our global food production to feed the rising global population. I don't disagree. And at the same time, we really have no significant amount of new cropland that we can bring into production.

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- Gerry Ritz

We're actually losing productive land with urban sprawl and different situations.

When you deliver food to someone, you want to know what the consumer wants. But you also have to put farmers first so that they can produce that food. And we have worked hard to put producers at the core of all of our policies and programs to meet this growing challenge. And we all know that building a strong agricultural sector takes hard work.

My grandfather went homesteading in 1917, I believe it was, and he kept a journal. He had discussions about the weather, input costs, not getting enough for his product – sounds a lot like today. And that's al-

most 100 years ago. Very little has changed, other than our capacity to produce. The Green Revolution highlighted that producers will step up when they're allowed to, but we have to give them the right support at the government level.

And I am firmly convinced that biotechnology remains the key – sound science. We all know that biotechnology crops can produce more. They can deliver us drought resistance, chemical resistance, plague and pestilence and bug resistance. And there are new facilities out there – less fertilizer, less chemical – and what that does is give you better groundcover overall and yet more production.

We also throw the environment into this mix, and we don't want to see farmers punished by that. And that has led to the rise in biofuel production. There's this argument out there that somehow you cannot produce enough to feed both a food and a fuel line. Absolutely, we can. We're now raising corn with production of 300 bushels an acre, where we didn't used to get anywhere near 200. That's got to go somewhere, and to keep those farmers doing what they're doing, they have to have market access. In Canada, we're starting off with a 5 percent blend, which can be ratcheted up, but that 5 percent takes less than 5 percent of our production capability. The weather is a bigger factor in any given year than that ethanol production is. What biofuels do is give farmers a different warehouse to deliver to. It gets more people bidding on their product – that's a good thing. We can offset that in many ways.

Amin Abaza: When we speak about the average landholding in Iowa, it's 200 acres. The richest guy in [Egypt] doesn't have 20 acres. Size differs from one place to another, problems differ from one place to another. In 1980, we were producing 20 percent of our wheat consumption, so every five loaves that we ate every day, one was produced by local wheat and four were imported. And in 1980 we were at 40 million people. Today we are 80 million people, and we produce 56 percent of our needs, so 2.5 loaves out of 5, even more. This is thanks to [Dr. Borlaug], thanks to science and technology that we believe are the way to the future.



U.S. Secretary of Agriculture Tom Vilsack

We have been planting for more than 4,000 years – but at that time we were less than 2 million people. Now, with the same land and the same water resources, we are 80 million people. This is a challenge for the future. And not only 80 million but growing at 1.5 million every year. We should speak about climate change. We should speak about those countries that are most vulnerable to what is going to happen in the future. I hope that we start to think and act as one and not as different groups where those who have the capacity and those who have the production and those who have the food would turn their backs on those who need their help and who need their experience and who need their knowledge.

Secretary Vilsack has promised that we will see again cooperation as it was before, to help the countries that are in deficit to help themselves. This would only come from science and technology. It can also come through biotechnology. Until now we are toying with the idea; we're trying to understand more. We're trying to do more. We're trying to know that the risks are worth taking.

Egypt is the size of France and Germany combined, but we are living on a plot of land that is not bigger than Denmark. Imagine Denmark with 80 million people. We really

have serious challenges in the future. We will be one of the countries that are most affected by climate change. I don't think that one country can do much without the help of the international community. We have a saying in my country that you cannot clap with one hand. And I think that we need to clap, and we need to clap fast, because we are running out of time.

Carlos Vazquez: Three out of four people living in poverty in developing countries live in rural areas. And most of them depend on agriculture for their livelihoods. Even with all these difficulties attendant to agriculture, it's key for sustainable development and poverty reduction. But if agriculture is to be an engine of growth in developing countries, we must recognize the important role of small- and medium-scale farming, as well as the need to foster the shift to a higher value-added agriculture and livestock and moving valuable non-farm economic activities to rural areas – moving and providing assistance to help more people out of agriculture but with a higher level of human capital.

So how do we move into action, knowing that the past is complicated by climate change, and global financial crisis, and a recession? Of course, the answer must involve coordinated, responsible action by govern-

ments and interested organizations, as well as the private sector. This is especially true for at least two key inputs – collaboration in science, and funding.

We must work together and intensify our efforts to realize the potential of science – and particularly biotechnology – for reducing poverty, protecting the environment, and providing food security. It is simply not possible for an individual country, or even a region, to deal with the issues and obstacles that we must resolve if the world is to benefit from a second, sustainable revolution. Cooperation is needed to better create an interface with the traditional extension services to reach our special producers. We need better transfer of knowledge in a simple way [so] that our producers can be able to immediately implement. And additionally, no country can go it alone on biosafety considerations, consumer acceptance, and the proprietary nature of these technologies. We need to assure the private sector that they will have a very important role to play in the near future.

But to accomplish this, where will the money come from? The financial crisis and the global recession complicate the problem. International lending institutions like the World Bank, the Inter-American Development Bank, and other regional banks can offer some support, but we must work together to bring the needed financial, human, and institutional resources together. Everybody has to participate.

In addition to financing, current conditions make it more important than ever that we create a more open and fair trading system. Today's trading system is impaired by the over-use of subsidies that create many economic distortions. In my country, farmers complain, and with good reason, that they are forced to compete with the treasuries of wealthy companies when it comes to production. Furthermore, the scarce resources that a developing country like Mexico needs are being allocated to grain subsidies instead of providing better education, better health, and other public works like rural roads and infrastructure that maintain the long-term sustainability of work in the rural areas.

The world, especially the developing world, will benefit from completion of the

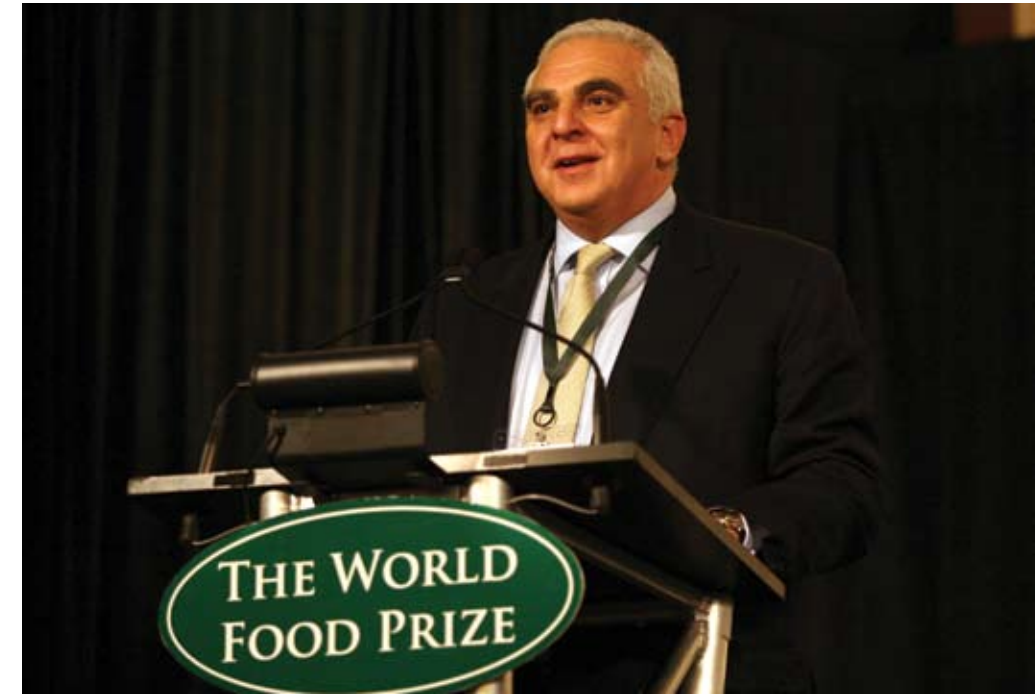
Doha round. Moreover, it's important that countries dismantle protectionist measures that affect agriculture and resist the urge to create new ones. We have many examples; one is the dairy sector. The [EU] and the U.S. significantly subsidize the dairy industry and their exports. These kinds of distortions deprive many developing countries of the benefit of investment and better jobs in the rural communities. It's particularly damaging to a better allocation of global resources that could be targeted to reduce hunger in the world. This is also one of the factors that push migration.

Vilsack: You mentioned concern about regulation. You also talked briefly about trade – how do you explain to your farmers that, by breaking down trade barriers and providing assistance to developing nations so that they become more productive, in the end it also will benefit them?

Ritz: It's a multifaceted approach, and you have to tell them that, as everybody grows and expands, it drives economies in the developing world that creates the economic opportunity for them to buy more product. We've seen China. As they've come of age globally, it's created a whole middle class there that never existed before. We're also seeing India with that situation. What that does is create opportunities for our exports to go in and deliver to that growing demand for different – I won't say better, but different – foodstuffs.

Vilsack: I think those of us representing developed nations would appreciate hearing what you think developing nations' expectations are of us relative to climate change.

Abaza: We are going to be affected by climate change, but who are the major causes of climate change? What are the reasons for this change that's happening to us and is af-



Egyptian Minister of Agriculture Amin Abaza

fecting us and our livelihood? The conventional wisdom is that the major polluters are the developed countries and that the major losers are the developing countries. So we need to convince the people that we are get-

“The world, especially the developing world, will benefit from completion of the Doha round. Moreover, it's important that countries dismantle protectionist measures that affect agriculture and resist the urge to create new ones. These kinds of distortions deprive many developing countries of the benefit of investment and better jobs in the rural communities. It's particularly damaging to a better allocation of global resources that could be targeted to reduce hunger in the world.”

- Carlos Vazquez

ting help from the developed countries and that we are getting technologies, the know-how, even the markets for our farmers or our producers in developing countries, and that by this help they are mitigating the effects of climate change and helping us to over-

come, or at least minimize, the losses that we are incurring due to this process that is happening and that is inevitable.

Vilsack: I appreciate the comments about Doha; obviously that's an area of intense interest to many of us. I sense a willingness on the part of many of the developed countries to take a look at the subsidy issues. Tell me a little bit about your view, in terms of the willingness of developing nations to open up markets as an offset to a reduction in subsidies. What are the challenges politically if markets are opened?

Vazquez: Certainly, Mexico has been willing to open. We are probably one of the countries that has more trade agreements with many parts of the world.

The other thing is, we need a transition of resources, or some level of support domestically to achieve better allocation of resources, because we will have winners and losers in many activities because of trade. So we need to prepare our government to allow them all the necessary resources to better facilitate these transitions and allocations between sectors. It's not only one sector; it's a whole package – industrial, banking, services, whatever – that we need to take a comprehensive look at trade and



Canadian Minister of Agriculture Gerry Ritz

the benefit of trade.

Vilsack: All three of you mentioned Dr. Borlaug's work in biotechnology. What advice do you have for countries like the United States, that have embraced biotechnology, in terms of how best to educate and acquaint farmers within other nations, and consumers within other nations, with the benefits of biotechnology?

Ritz: Whether you're talking the Doha round or whatever – there are always countries who will use non-tariff trade barriers. This idea that somehow genetic modification, which is the extension of biotechnology, is somehow voodoo science or Franken-foods and all those ridiculous arguments – it's ridiculous in the extreme. In Canada's case, as we become more vehement in doing bilateral negotiations, free-trade agreements, memorandums of understanding with other countries, we include our science and technology services. That seems to

be the hook that brings countries to us on free-trade deals.

Abaza: We have a slightly different problem. Our major trading partner is Europe, due to geography. And most of the time, between the prosperous and rich countries, they tend to close their eyes on certain issues, like importing genetically modified soybeans to Europe. But if a country like ours would introduce biotechnology and would

“Especially when we speak about transforming corn into ethanol, this might put a lot of stress on food-importing countries and on people who do not produce enough food, so that it will cause these commodities to be much more expensive – these countries might be unable to afford them in the future.”

- H.E. Amin Abaza

then export some of its products to Europe, then this would be a big problem. Even if it was non-genetically modified products,

they would say, “Well, the field next to it is genetically modified, and who knows what a jumping gene will do?”

There has to be a worldwide agreement, at least a minimum agreement, on the subject. I believe that the consumer has the right to know if [food] is genetically modified or not. But we should not spread terror and fear without a scientific base for that.

Vazquez: It is a huge challenge. Consumers are very concerned about the biosafety of this new technology. It has been around for years, but we need to be able to communicate, especially – for example, in my country we are corn-based consumers, and in Asia it's rice-based consumers – that also, let's say, the wheat varieties of the GMOs are being accepted by the rest of the consumers. There is skepticism of the use of the different grains. We need, and especially the companies need, to make a better effort to explain why the development of technology was faster in one area than in another. There is a lot of skepticism in why wheat is lagging behind. And then certainly we need to have a broader global protocol on this matter. That's the only way to achieve it.

Vilsack: With reference to Doha, we understand the world's concern about the framework and structure that we have in place that provides support to our farmers. And there is a willingness on the part of the American delegation to consider reductions. But there has to be a corresponding willingness on the part of the developing world to open up its markets. Because, as Minister Ritz suggested, it only works if, as economies improve, consumers in those economies have choice – and that choice isn't just choice within the country, it's choice around the globe. If we could see a significant effort on the part of many [developing] nations to express in specific detail precisely how those markets are going to be open, we could see progress on Doha.

Ritz: All of us are charged with protecting and backstopping producers in our countries. There's a tremendous amount of work that continues outside of Doha. The problem with Doha is that everybody has their own pet project, and we have it as well. We all spend the first five minutes of our 20-



Mexican Minister-Counselor for Agriculture Carlos Vazquez

minute speeches chastising everybody else for having these bookmarks, and then we spend the next 15 minutes outlining what we want to protect. And that's legitimate – it's the politics of the situation.

I point to the crisis in the dairy sectors in a lot of the countries around the world. In Canada, our dairy is doing just fine. But they've managed the supply, the amount that they put out, and they don't look to export; they simply do domestic. And there are rules and regulations in place to backstop that. With the fulfillment of the Doha round, we would lose that. So I'm a little bit apprehensive to go that far that fast. But we'll get there, no doubt about it.

[Biofuels] is an industry in its infancy. In [Canada], we're large agriculture, but we're also very large oil and gas. When we start to talk about the impact of fossil fuels, we're looking for alternatives. And ethanol and biodiesel certainly look good at this point. We are also investing in the long term in biomass. We've got methane recapture; we've got the biomass

system coming on, but no one has gotten to the extent where commercially it's viable at this point yet. We've got several pilot projects running. We are re-rendering a lot of livestock trim and making biodiesel. Those opportunities are there. But nothing would say that it's viable anymore than the oil and gas sector was when it first started up.

Vilsack: From the perspective of American agriculture – corn-based ethanol was a good

“We suffered in this country a loss of farm families. We're down over 1 million farmers from 1961 to 2009. So I look at biofuels as a way in which we can diversify agriculture, add value to commodities and make them into ingredients, and create the opportunity for that mid-sized operation to have a shot at success.”

- Hon. Tom Vilsack

way to start the conversation, but it is incumbent upon us to continue it in a variety of different ways. Cellulosic ethanol is

one of them. I was at a facility not long ago where I saw dry manure from a dairy operation being converted into ethanol, and a byproduct of that was biochar, which many believe has tremendous opportunities as a fertilizer and as a sequesterer of carbon.

Here is the human aspect of this. [Last year] there were 108,000 new farming operations started in America [with] sales less than \$10,000. These are very small operations – most likely fruit/vegetable operations, selling to farmers' markets and community-supported agriculture – but it's 108,000 families that made the decision to continue a farming tradition and to help repopulate our rural communities. On the production agriculture side – that is to say farms with \$500,000 or more in sales – 41,000 more operators in that category in the last five years. Where we lost ground was in the middle. Between those with \$10,000 sales and \$500,000 sales, we lost 80,000 farmers. We suffered in this country a loss of farm families.

We're down over 1 million farmers from 1961 to 2009. We are farming 200 million fewer acres, yet are 2-3 times more productive. So I look at biofuels as a way in which we can diversify agriculture, add value to commodities and make them into ingredients, and create the opportunity for that mid-sized operation to have a shot at success.

Abaza: Being a net food importer, we are very worried about transforming food into fuel. I understand that fossil fuel is a non-renewable resource, that we have to look into other ways to produce energy in the future. But that there are other kinds of renewable energy that could be explored more.

We come back to the question of subsidies: is this industry capable of surviving without these huge amounts of subsidies or not? Especially when we speak about transforming corn into ethanol. We will reach the second and third generation [of] transferring biomass into fuel, and we have to pass by the first generation to reach the second and third. But this might also put a lot of stress on the food-importing countries and on the people who do not produce enough food, so that it will cause these commodities to be much more expensive – these countries might be unable to afford them in the future. ■



World Food Program / Tom Haskell

A World Food Program staffer works with farmers in Kankan, Guinea.

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Will a Food-Secure World Require New Global Institutions?

Gordon Conway: We've had two decades of neglect of agriculture, accompanied by a myth that says, "Africa, South Asia don't need agriculture; they need industrial development." They say they should be like Vietnam, for example – forgetting that, before Vietnam became a highly prosperous, emerging nation, it went through an agricultural revolution. Now that neglect is beginning to change.

Mark Cackler: Clearly, all of us, including the World Bank, have been part of the problem for the past generation. We talk about the food-price crisis and how 1 billion people are going hungry tonight. Before food prices went up, 830 million people were hungry, but it wasn't considered a crisis.

And although it is true that the World Bank, IFAD, other agencies, have been putting more resources into agriculture recently, it is absolutely essential that we don't make the same mistake we did 30 years ago. Back in the '70s, Bob McNamara, working

with many other partners, put agriculture on the map at the World Bank and helped get it on the agenda for other institutions. CGIAR came into its own. And we forgot that in the '80s and then '90s – not because the problems were solved; again, there were 830 million people going to bed hungry every night – but we neglected it.

In my own institution, agricultural lending is up 50 percent. We have a new action plan to have it go up even further. But no institution can do it by itself, no single country. We all have to work as partners in this. Do we need new institutions? Well, no institution is indispensable. We certainly need new institutional arrangements. I think we are making progress under the UN high-level task force. But we have to not to let our emphasis on these partnerships, on smallholder productivity, on feeding the world, disappear when it disappears from the headlines.

Conway: Why do you think you dropped the ball? Wasn't it partly a belief that the pri-

vate sector would deal with food and that was it? Or am I being too simplistic?

Cackler: That was one of the reasons. Agriculture is a fundamental private-sector activity; the largest group of private-sector actors in the world are farmers. There was a long period of low and stable food prices, and some of those were caused by subsidy policies in countries like [the United States] and Europe. And the World Bank and IFAD only lend when countries want to borrow. When you had a trading regime that artificially suppressed prices for so long, that naturally caused developing countries not to want to invest in agriculture. We talk about institutional arrangements; we also should be talking about policy arrangements. How rich countries respond is very important.

Another part was almost a prejudice against agriculture [as] old-fashioned, and the desire to move into high tech. This myth of Vietnam – I'm glad you brought it up; Vietnam only has done what it did because

it developed its agriculture. 75 percent of the world's poor are rural; most are engaged in agriculture. Agriculture is the way out of poverty for most people in the world, and we cannot forget that.

Kanayo Nwanze: [As] a result of the 1970s crisis, IFAD was created, essentially, to address a particular sector of smallholder farmers, pastoralists, and livestock keepers. IFAD was created to resolve the problem that emanated from the droughts and the famines of the '70s.

Agriculture for the developing world is fundamental for economic growth. You're right – there [is] a shift from agriculture into industries and things like that. But surpluses in agricultural production are essential for a vibrant agro-industrial sector. Europe of the 18th century went through the whole process. China today is a clear example of what can happen: investment in rural development, the whole value chain, linking farmers to markets.

I take particular resentment when people say what we need is commercial agriculture. Yes, we need commercial agriculture, but we need to transform smallholder farmers into commercial farmers. We do not need to transform their farms to big farms. Farming is a business, and every farmer, whether growing half a hectare or 200 hectares, want[s] to make a profit. They must be linked to markets. And it's not as simple as some advocate – give them new seeds and fertilizers and that's all. What happens when prices go down?

The issue here is not whether we need new institutions. We need reformed institutions. My institution was challenged about 5-6 years ago: Either you deliver, or you close. My predecessor took that challenge as an opportunity and began a major reform process. [IFAD] is going through a major change, has reformed itself, is reforming itself, and is delivering on results. We do not have to create new institutions. We need new modes of engagement, new configurations, increased focus.

Conway: What was the key of the reform?

Nwanze: It had to be a results-based program of work; we had to deliver on the ba-

sis of results. Number two, we had to move from a Rome-based institution to a field-based institution, to use existing institutions and to partner with existing institutions – the FAO, the World Bank, UNDP – but have people in the field to be able to dialogue with governments and rural communities, to be able to establish policy dialogue, and reorientate our programs in such a way that they respond to the needs of rural populations.

Farmers all over the world, not just in Africa, are mostly women. We have 500 million smallholder families worldwide. That's about 2 billion people whose lives depend on them. They feed 80 percent of the population of the developing world, and 70 percent of these are women. We have to be more sensitive to the way we develop our policies and our technologies.

Louise Fresco: The issue of institutions is a 20th-century answer to a 21st-century problem. In no way should we spend a lot of time right now to try and reform what is there; it's so complex from a jurisdiction-mandate point of view. I'm more interested in how we can work together in a different mode of operation, irrespective of institutions, to have ad hoc coalitions of the NGOs, the private sector, and the governments.

It's appropriate here to pay tribute to a fantastic institutional program that the United States mounted in the 1970s and 1980s, whereby lots of graduates from developing countries, Europe, and elsewhere in the world had a chance to do their PhDs in U.S. universities. I personally know hundreds if not 1,000 people who have done their studies in the United States, have gone back to their countries to become policymakers or scientists, and that has created a tremendous body of knowledge – people who knew the same thing and created the basis for collaboration worldwide. That program has faded out, but it's an example of how institutions can create things that will work.

The other [example] is, alliances that are far more flexible. If anybody had still a doubt about the private sector, we've seen

"The World Bank and IFAD only lend when countries want to borrow. When you had a trading regime that artificially suppressed prices for so long, that naturally caused developing countries not to want to invest in agriculture. We talk about institutional arrangements; we also should be talking about policy arrangements. How rich countries respond is very important."

- Mark Cackler

today how close they are to public-sector interests and how close they are to understanding the concerns in society. So why not create a flexible mechanism to work together? I see so many things we can do right up from the basis, from research to policy, from helping farmers to discussing the Doha round. Let's create these flexible arrangements, rather than spending a lot of time on UN reform, which, frankly, will not happen until we get the Security Council issues out of the way – and that will not happen overnight.

Conway: Richard, you've been heavily involved in reform of various UN organizations. You've been around and about the United Nations. Do you agree?

Richard Williamson: Reform is like an evergreen; it's perennial, and it will never be achieved, especially in the UN system. At the same time, I've had the opportunity to work with certain organizations that have moved from not-so-effective to quite effective. Over 20 years ago, we certainly did not look at WFP as among the most effective instruments. The institution reformed itself, because of members, because of leadership, because of the commitment of WFP people on the ground. In my most recent assignment to Sudan, there are a million-plus people being kept alive every single day because of WFP. And despite the diplomatic and political inability to make much progress there, the 16,000 humanitarian work-



Conway



Conway



Nwanze



Fresco



Williamson

ers in Darfur, every single day risking their lives, [are] extraordinary. Some of these organizations have become much more effective than they were before and are making a huge difference.

And while we must address agricultural development, there is a humanitarian need in acute situations.

Southern Sudan suffered the longest civil war in Africa. Two million people perished, 4.5 million people were displaced, with little recognition from the international community. A comprehensive peace agreement was made and signed in January of '05, leading to a referendum in 2011. I have great concern about whether it will be successful – because the south is not viable today. This is an area the size of Texas with less than 2.5 kilometers of paved road. Rich in minerals, rich in agricultural land – but no way to get the food to markets.

I waged a battle with USAID to get them to shift more of their assistance to infrastructure, because unless they have bridges and roads, they will not be able to become economically viable. Kosovo be-

came independent recently [and] won't be economically viable in the lifetime of my great-grandchildren. Southern Sudan will be not only precarious but similarly unable to be economically viable unless we do some more large projects.

I know the World Bank have committed more money, as have the Africa Development Bank. It is important that we help agricultural development, but part of that is creating an infrastructure – and some international institutions are the only ones that can help.

Conway: You mentioned the World Food Program. What they're now doing in this Purchase for Progress Program, is, instead of buying grain from Western markets, buying it locally from regional markets in Africa and elsewhere. That seems to me like a new policy; where a traditional body that's been working along a certain way has come up with a new, innovative way of going about it.

Williamson: I have a freedom that Secretary Vilsack didn't have, so I can be more candid. Of course, we need to help local pur-

chases. It shouldn't be just the transfer from developed countries. Politically, that's very difficult for donor countries, including [the United States]. The World Food Program, however, creates at least some political buffer to be able to do that. If we can purchase on local markets, it's going to help generate more economic viability, more agricultural growth. And there are international institutions like the WFP moving in that direction – it's to be encouraged.

Conway: Let's start moving towards this notion of ad hoc coalition. These commitments that came out of the G20, \$22 billion or thereabouts – how do you handle that money? There's a big argument where it should go. The World Bank is a possible place. But is that kind of money too difficult to handle? How would you make it productive?

Cackler: It's certainly not too difficult to handle. In terms of what's really likely to be on the table, it's simply not that much. We're thinking the money that we re-channel multilaterally – not just at the World

Bank but through IFAD and regional development banks and others – is more like \$2 billion over the next three years. We would hope it would be much more. It could be more if other countries adopted a more multilateral approach than a bilateral approach. But \$2 billion over three years simply isn't that much.

IFPRI has calculated that \$14 billion in incremental funds for agricultural development, including supporting infrastructure, is needed to meet the MDG of reducing poverty in half by 2015. That is a conservative figure. Their high end is \$28 billion. So another \$700 million per year is not that much. Now, you don't want to discourage the donors by saying, "Really, this isn't that much." It's great that at L'Aquila, at Pittsburgh, and at Istanbul, the donors have put agricultural development on the agenda. But at the same time that we praise them, we should also keep in mind that it's actually not that much compared to the need.

Now, do we know how the money could be spent? Yes, we do. How should the money be channeled? Well, we would be biased for a multilateral approach. In terms of absorptive capacity, getting the money out effectively – we have a very good experience just in the last two years with the response to the food-price crisis. We have disbursed large sums of money that have benefited large numbers of people, not just on an emergency basis but also contributing to long-term agricultural development.

Nwanze: There are several mechanisms by which these funds can be disbursed. We are fairly comfortable with the World Bank hosting these funds. But we have experiences with the European Commission the last 18 months. We were disbursing about €1 billion to about 22 or 30 countries, and [this] was done very effectively with the World Bank and other institutions, not only the UN institutions.

I agree with Louise about trying to reform the United Nations, but at the same

time institutions can transform and reform themselves. The WFP experience of Purchase for Progress is a clear example of what IFAD has been saying for the last 30 years: we need to create incentives for viable, competitive local markets. When farmers have access to markets to sell their produce, they will produce.

African countries, in particular, must put their house together. It's a leadership issue. The Chinese success story is one of clear leadership and direction, an investment in rural development. Expecting to leap-frog

"The private sector is making real progress in developing input markets through the agro-dealers in Africa and output markets through small, private companies that buy the grain. But there's a big problem over infrastructure. Access to markets is not just about having a market – you've got to get there. And that means roads and railways."

- Gordon Conway

into the 21st century without going through the development part is not going to work. The onus is on African leaders to give the leadership and to be convinced about investing in their own countries before they expect the international community to bail them out. I'm not convinced that putting billions of dollars into the hands of poor countries is going to solve the situation.

Africa is not poor, but Africans have made themselves poor. We grow the coffee that drives a \$70 billion global business. We earn only \$6 billion – it's a pittance. We provide the diamonds, gold, and copper that feed the industries of the Western world and Asia. What do we get for it? A pittance. We drive the chocolate business, how many billions of dollars. What do we get for it? We train thousands of Africans, and then we make it difficult for them to come back home, and they stay in the West and help you grow. The change has to begin from home.

Fresco: I always get a bit sad when we talk only about money when it comes to the agriculture sector. A majority of things do not happen just because there's money there, but because there is competence and political will. China is a good example of a country that did not receive development assistance; I remember India not wanting to receive development assistance anymore.

What are the bottlenecks in these food-poor countries where investment can make a difference? Chocolate is a very good example. All the cocoa is exported and then is reimported as chocolate into Africa. We need to invest some money into getting processing facilities at a good, export-quality level, both for internal consumption and for export, in those countries. Some money is needed to kick-start an industry, but the industry should not be subsidized. It should be in the hands of Africans, in this case, who actually make a business out of it.

I'm very worried about just creating a fund, whether it's \$22 billion or something else, that is not well-governed and well-monitored. It just goes wrong, it just feeds into everybody's worries about handing over large sums of money. That's not what agricultural development is about. Agricultural development is about putting a small amount, a reasonably small amount, of money in the key sectors and pouring some time where it needs to be done.

As somebody who's lived and worked next to WFP all those 10 years in Rome – why was WFP so successful? Because they were very good at creating alliances with the private sector on logistics and other sectors. Because they went beyond emergency aid. We at FAO thought they were actually encroaching very much on FAO's territory – and rightly so. Because emergency aid should not be different from development, it's a continuum. As long as we keep these separate institutions doing their same things, we have a problem. The way around that is not to create new institutions but to bank on those that are successful, such as WFP.

Use the money wisely, specifically with the private sector, and bank on those institutions that can actually handle it, such as IFAD or WFP. If we do that, and we get a government that monitors how the L'Aquila funds are being used, we'll make a big step.

Conway: The private sector is good at getting things to scale; the private sector is making real progress in developing input markets through the agro-dealers in Africa and output markets through small, private companies that buy the grain. But there's a big problem over infrastructure. Access to markets is not just about having a market – you've got to get there. And that means roads and railways. Can the private sector play a role there?

“We need to help local purchases. Politically, that's very difficult for donor countries. If we can purchase on local markets, it's going to help generate more economic viability, more agricultural growth. And there are international institutions like the WFP moving in that direction – it's to be encouraged.”

- Richard Williamson

Fresco: You have to find new and innovative financial arrangements. The old model, of having governments build roads or subcontract them to the private sector and then taking all the responsibility, has been disastrous, because nobody was responsible for the maintenance. There were all these white elephants of roads and bridges in Africa and elsewhere that haven't worked.

Why can't the private sector move sometimes? Because the risk is too great. This is where a fund – not individual governments, but a fund – can help to mitigate these risks, hedge these risks, and get a safer investment. And then have a long-term engagement. That's something you have to ask of the private sector; it cannot be about short-term gains. If you can get long-term agreements between governments and the private sector, and of course NGOs and the United Nations, to deal with the infrastructure problem – or the issue of slaughterhouses, animal production – let's find these long-term arrangements. This can be done.

Cackler: We believe in the role of the private sector. We have the International Finance Corporation, which is our private-sector wing. We believe in the role of the public sector. And we believe that both sectors need to work together.

But I'm going to disagree with Dr. Fres-

co on the role of money. Although certainly it's true that money can't solve all problems, money does solve a lot of problems. And there simply has been insufficient investment. Too often, the bad guys say, “It's useless investing more in Africa because they're just going to waste the money anyway.” That's a bit of a caricature, but you do see that in politics. And there is not enough money going into agriculture for development. Even the \$22 billion – and we'll see how much of that really is – wouldn't be enough by itself.

Yes – unless there's good governance, unless good things happen to make sure the money is well spent, obviously it'll be worse than useless. But we, working together, can use this money wisely. Agricultural productivity is going up. It's not going up as fast as it should; it's not going up as it would if there were decent investments in roads [and] basic agricultural research. That's why reform of the CGIAR, and a doubling of the support for the CGIAR, is that important.

Williamson: I'm very encouraged by the Obama administration's rhetoric on agricultural development, and I think they're trying to put something behind it. We have to translate that into some specific results. It's going to be good to monitor a year from now if there are back up over a dozen agricultural-development

experts in USAID. That number was much higher a decade or two decades ago.

Infrastructure does get built when you have economic incentive. Just look at the 1,000-kilometer oil pipeline in Sudan built by the Chinese. But there's no one who feels that incentive to develop agriculture when it's going to be in the out years. That's where other government donors or institutions like the World Bank have a role to play that others aren't able to.

When we're talking about this debate of more money, effectiveness, etc., we have to talk about conditionality on good governance. That's not talked about in polite company enough. But if we want more results, that is something we're going to have to address. That means institutions going into zones that are uncomfortable but required; while we would like more money, even then it's not going to be enough to do what's necessary for all the desperate people in an acceptable amount of time.

Cackler: We often talk about governance issues when it comes to poor countries. What sometimes makes us uncomfortable is talking about leadership and governance of rich countries. Just one example, we need the rich countries to make sure that agriculture is properly included into the Copenhagen agreement, so poor farmers in poor countries can get paid for environmental services that they provide and have the incentives to help us by putting carbon into their soils.

How do we measure these things, basically hold rich countries' feet to the fire – the U.S. government is now much more seriously track-

ing what money goes into agriculture. And there's the Global Donor Platform for Rural Development, which has 30 major donors, including IFAD, the World Bank, FAO,

and a number of bilaterals. Can we build on this initiative that the U.S. government has done to track monies going to agriculture, so the rest of us follow a common methodology?

Conway: One institution that is relatively new is the African Union. It's created the [Comprehensive] African Agricultural Development Program. There are five countries signed up, and 20 about to sign up, to spending 10 percent of their budgets on agriculture. And they have compacts, they have plans.

Nwanze: CAADP is only a framework. We should not be carried away by the fact that we have five or six countries that have now signed contracts. It's good to have a framework, but you want to go beyond the framework to have an action plan and to have deliverables, results-based action plans. Until you have those, you cannot hold countries accountable.

The Maputo Declaration of 2003, 10 percent of budgets to agriculture – less than 10 countries have met that 10 percent threshold. And the countries that have met the 10 percent threshold are the ones that you would have thought would not have been able to do that. The larger countries have not. The country where I was born is far behind the 10 percent. We need the will to transform Africa's agriculture from the political leadership. The Maputo Declaration is certainly a yardstick to measure that commitment.

It is good to talk about the money, to have the money – but it's basically what we do with the money. It's not enough to talk about [\$22 billion]. It's a question of how well we manage the resources, how well we put these resources. And it's got to be driven by results, not just by amounts of money.

Conway: But it also depends on leadership, doesn't it? In the developing countries, in the developed countries, in the international



“In the 1970s and 1980s, lots of graduates from developing countries, Europe, and elsewhere in the world had a chance to do their PhDs in U.S. universities. That created a tremendous body of knowledge and the basis for collaboration worldwide. That program has faded out, but it's an example of how institutions can create things that will work.”

- Louise Fresco

organizations. Is that the biggest challenge?

Fresco: But leadership does not come out of the blue. The feeding of leadership starts with young students, whether American or from overseas. We see so few young people going into agriculture or long-term development, because we are becoming worldwide a more urban-based society. The high status that agriculture had in the 1960s, that produced men like Norman Borlaug, is not there anymore. So we need to recruit some of the best minds to go back into agricultural science and policy. The best students in many developing countries go into business administration or something that has a high profile and a promise of quick, early money.

I would like to give a challenge to all the young people here: Please remain in agricultural science. Help us to produce leaders that can be science-based, that are willing to spend some of their lives, whether it's in the public or private sector, to help countries in

Africa and elsewhere to create leadership for the agricultural sector. That is where we need to spend money and where we can do it, as we know from the past, in a very effective manner.

Williamson: About the AU resolution on 10 percent – politicians and diplomats produce rhetoric; what you need is results. And that's why more money to educate, not only incentives in the United States but to bring others over here and in developing agricultural education in African universities, is important, and also why we should be funding more research. The rhetoric is improved because [experts] have forced the politicians and diplomats to talk more reasonably about the need for agricultural development. But there's a long way to go.

Nwanze: For the future, we shall increase our investment by about 50-75 percent in the countries where we work. Production and productivity will get about 40-50 percent, rural financing about 20 percent, and micro-enterprises, small infrastructures, feeder roads, and capacity building of community institutions, not of degree-holders. We build communities, particularly of women's groups, that can have their voice in policy dialogue. Women, and I repeat, women and youth are central to this process, and they must be key in all programs and processes of projects.

Fresco: Let me sound one note of caution on the women's issue that is very dear to my heart. I'm worried about programs for women that do not look at women as entrepreneurs in agriculture – sort of “small is beautiful” kinds of programs. The best way to help women is to give them an economic role and an independent and autonomous way of gaining their money. Otherwise, they will be a failure. ■



ROGER THUROW

Co-author*, *Enough: Why the World's Poorest Starve in an Age of Plenty*

Outrage and Inspire

“Outrage and inspire.” That was the mantra as we were writing our book, *Enough*.* Those were the two goals of our book, what we set out to accomplish: Outrage [the readers] that we brought hunger with us into the 21st century. And inspire that hunger is one of the problems in the world that can truly be conquered, that everyone can make a difference, that it can be the singular accomplishment of our generation.

Dr. Borlaug said, “Man can and must prevent the tragedy of famine in the future, instead of merely trying with pious regret to salvage the human wreckage of the famine, as he has so often done in the past. We will be guilty of criminal negligence without extenuation if we permit future famines.” As we reported about hunger, we were investigating one of the great crimes of our age. I mean, what else could you call it when

25,000 people die every day of hunger and malnutrition and related diseases?

We have to create a clamor that hunger won't be tolerated, a clamor that'll be heard in Washington and other capitals of the world. Let's make ending hunger the next great populist cause. In the past several years we've seen what can happen when clamor is raised. We've seen governments move on the debt-relief issue. We've seen them take great strides in launching an assault on AIDS. And we're seeing that kind of happen on the climate-change issues now.

Particularly on the climate-change and the AIDS fronts, nobody will be able to declare victory without declaring victory against hunger. On the climate-change front, you can't declare victory until the farmers of Africa and their conditions are addressed and dealt with, because they're

the ones, all the predictions are, that will have the greatest impact, and in the equatorial zones. On AIDS, the big push has been to get as many drugs into Africa as possible – and that's very laudable. But you can get AIDS sufferers all the drugs they want; if you're giving the drugs to hungry and malnourished bodies, what good do they do? And sometimes, because they're very powerful drugs, if the body is undernourished, they'll actually do more harm than good.

Outrage that more than 1 billion people go to bed hungry every day. That number is higher than it was before the Green Revolution, in absolute terms. Outrage that the prevalence of hunger has increased to 15 percent of the world's population compared to just 13 percent a couple of years ago. We're giving back the gains of the Green Revolution that had put us ahead of the population

curve. Shame on us.

Outrage that 25,000 people die every day of hunger and malnutrition and related diseases. That's three times as the 1994 genocide in Rwanda. There's an international war-crimes tribunal to deal with those deaths. What about the criminal neglect that has allowed hunger to kill three times as many on a daily basis? That's the equivalent of 60 jumbo jets fully loaded, crashing each day.

Outrage that investment in agricultural development, particularly in Africa, dramatically slumped from \$8 billion a year in the 1980s to less than \$3 billion this decade. Outrage that, in the rich world, agricultural subsidies amounted to about \$260 billion in 2007 while we who were giving out those subsidies, told African governments not to spend one single dollar on subsidies to their farmers. Outrage that African farmers – basically alone among farmers in the world – bear 100 percent of the risk in an inherently risky business. If a crop dies in the United States or in Europe, in most cases someone's writing a check – usually the government or insurance company. If a crop dies in Africa, people die.

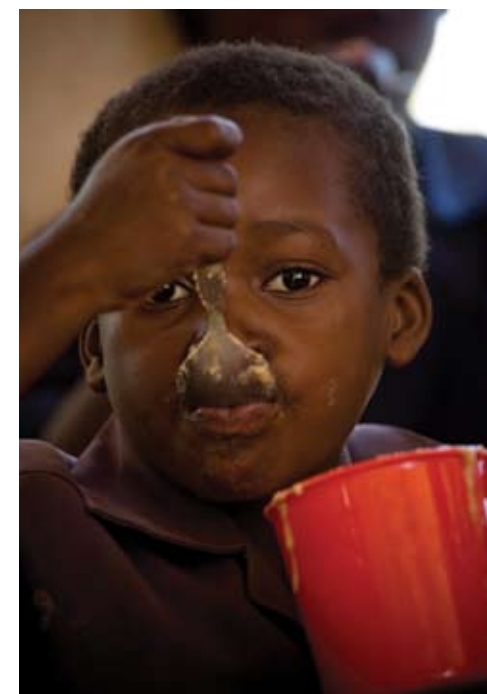
Outrage that American food aid has refused to go to some cash rather than all food. In 2003, 14 million Ethiopians on the verge of starvation were being fed by the international community. America spent more than \$500 million sending food aid. It saved an awful lot of lives. That same year, the United States spent less than \$5 million on aid to help Ethiopian farmers grow more food so they wouldn't be in a position of having to receive the food aid to begin with. What's wrong with these numbers? Why do they persist like that? There's a lot of convincing that still remains that modernization needs to happen.

Outrage that much of the chronic hunger of today is largely man-made. Certainly there are natural disasters. Of course, hunger follows in the wake of war and corruption. But so much of today's hunger is caused by bad policies, in the rich world and in the poor. There's our food-aid policy, the farm subsidies, the self-interest of Western countries. Outrage that we have the tools and know-how to end hunger, yet we don't.

Yes, it does get hopeful. For with the



“Much of the chronic hunger of today is largely man-made. Certainly there are natural disasters. Of course, hunger follows in the wake of war and corruption. But so much of today's hunger is caused by bad policies, in the rich world and in the poor. **We have the tools and know-how to end hunger, yet we don't.**”



“outrage” comes the “inspire.” The inspire fuels more outrage, because we can conquer hunger. We have the knowledge, the tools, the science. There's African entrepreneurs, Midwestern families, philanthropists, priests, politicians, Southern housewives, corporate executives, evangelicals – all fueled by some measure of outrage, all providing inspiration.

Permit me to read from the book and you'll get an idea about inspiration and its linkage to outrage: *Aengus Finucane had left Limerick and was a parish priest in the Biafra region of Nigeria in 1967. War erupted; famine spread. As Father Aengus recalled later, “Parishioners were dying all around. Parents burying their children, children crying at the gravesites of their parents. You heard of cannibalism. A man kicked to death in a market because he had stolen food. The parish house was surrounded by hungry people. The basement windows were lined with faces. You developed a horror of famine.”*

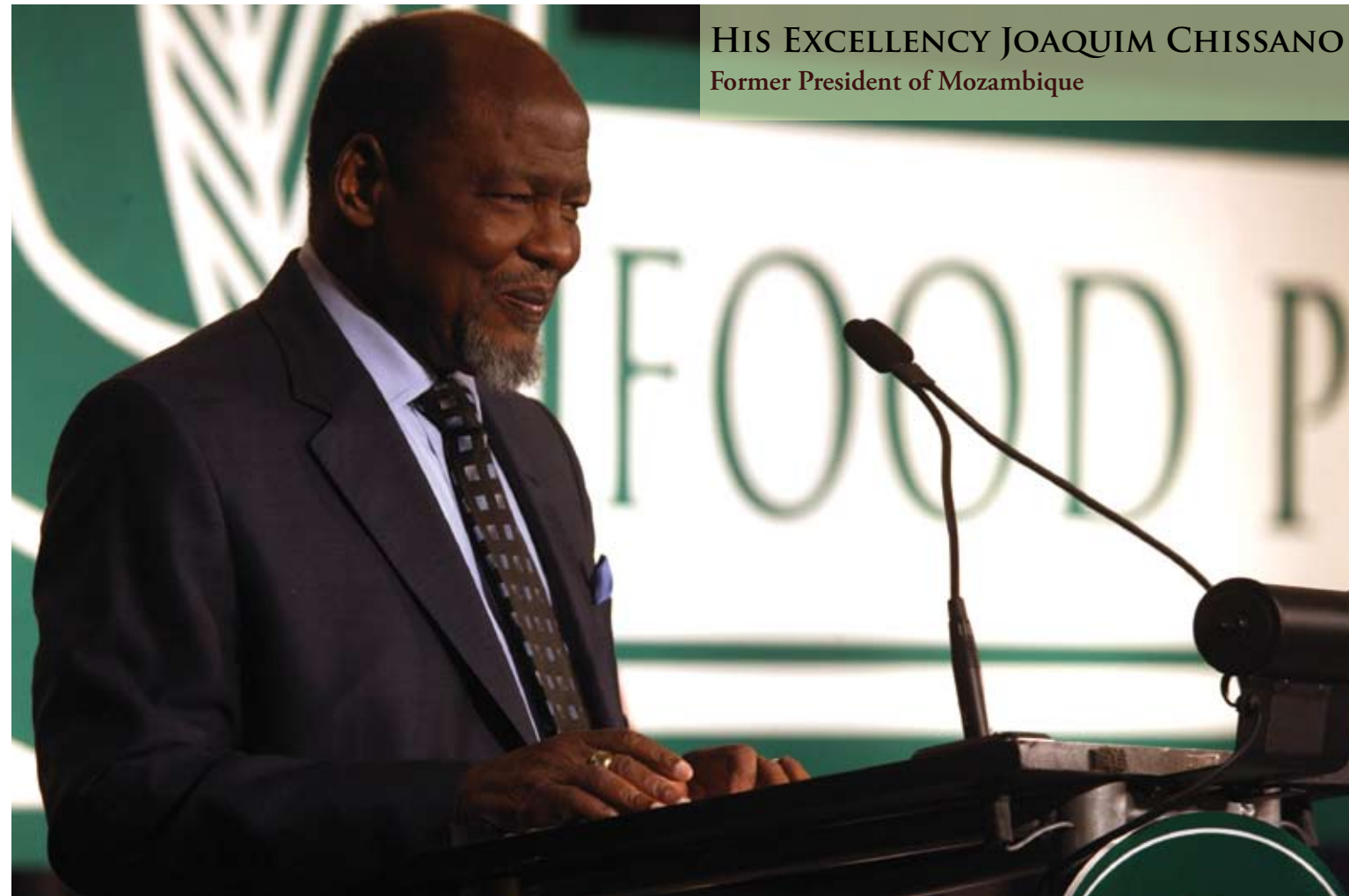
Father Aengus believed he had stepped back in time to the days of the Irish Famine. He watched an old Biafran man crawl the final yards to a refugee camp, only to collapse at the gate. How many Irish people, the priest wondered, had done the same, crawling on all fours to the poorhouses, even perhaps to the poorhouse across the street from his home in Limerick.

Back in Ireland, a small flock of churchgoers who heard these tales from Father Finucane formed a group called Concern Africa, and devoted themselves to gathering up relief supplies. Though most of the Irish had little to give, donations poured in; within three months, a ship filled with aid sailed from Ireland to the west coast of Africa. Other ships followed. Concern Africa would become Ireland's largest humanitarian organization, with Father Aengus at the helm. His abiding mantra to his fellow citizens had been, “It's the right thing to do.” And they understood. Even the poor would come up and put money in and say, “Ah, Father, we know what it was like to be poor and hungry.”

The outrage is the job isn't finished yet, that there is still so much work to do. And inspire – that against all the odds, let's roll up our sleeves and get after it. There's a clamor that needs to be created. ■

* Thurow co-wrote *Enough* with fellow *Wall Street Journal* reporter Scott Kilman

Despite several drawbacks, I am confident that the African continent has the human capital and sufficient know-how to successfully implement a Green Revolution that can work for the current socioeconomic and environmental conditions.



HIS EXCELLENCY JOAQUIM CHISSANO
Former President of Mozambique

Securing Africa's Livelihoods through Agriculture

In Africa, the majority of the population live and work in rural areas. About 70 percent of the African population [are] smallholder farmers with agriculture as their livelihood. The vast majority have low crop productivity, thus reducing their ability to generate savings, making them very vulnerable to food insecurities and climate conditions. With those limited resources, farmers simply cannot afford to purchase the necessary inputs to increase their crop production. The most direct and effective way of raising the standards of living and alleviating poverty, hunger, and malnutrition of the African population is through the

increase in productivity and incomes from smallholder agriculture.

With effective agrarian and land-reform practices, we can increase the participation of farmers in commercial agriculture, which transform the rural economy through the development of rural-based agro-industries and the private sector. If reform is carried out in a sustainable manner, we will not face the risk of production uncertainties due to declining soil fertility, nor will we be compromising the food security of local communities.

There is a need for greater availability and accessibility of fertilizers by local farm-

ers to create more productive and sustainable agriculture practice. In the case of Mozambique, this availability and accessibility has to be created through agricultural extension workers in order to change the current peasant farming attitude with concrete results. In southern Africa and other subregions, this issue of accessibility and availability can be addressed by the construction of fertilizer plants so that the prices of these products can be lowered to cater to the needs of the local farmers.

Without adequate attention to the use and adoption of improved agricultural technologies, production growth may slow,

hampering rural development and spreading rural poverty. In Mozambique, improved agricultural technologies have contributed to a relative growth of rural communities' output levels – but played an overall minor role. Smallholder farmers that use fertilizers, animal traction, or small-scale irrigation systems have only been able to increase their production 4-7 percent. At the moment, only a very limited number of smallholder farmers use drought-resistant varieties or have access to improved seeds and adequate irrigation systems.

Although we have technological constraints, Mozambique possesses all the essentials to materialize its considerable agricultural potential. The country is endowed with a wealth of natural resources, including numerous fertile agroecological zones, even though only 10 percent of its 36 million arable hectares are being cultivated. Mozambique wants to increase agricultural productivity using science to improve crop varieties, creating incentives to farmers who want to adopt the Green Revolution approach and promote job creation in the rural areas. Incorporating science in agriculture is a key factor to the modernization of the economy.

There is also a need to promote processing industries that are based on local agriculture and forestry. A great portion of the effort has to be placed on the crops that Mozambique can produce with comparative advantage so that all the benefits are fully utilized. Most of this work can be done by the extension services we currently have, whereby relevant knowledge and technologies are successfully shared with small farmers.

Infrastructure development is another essential element for the success of the Green Revolution in Mozambique. This includes the construction of feeder roads, rural commercial networks, silos, electricity, irrigation, and water systems. Since people are the main engine of development, we should never underestimate the need for adequate health infrastructure and service

for the local communities.

To build on the existing opportunities, several actions have to take place:

We need to guarantee that the costs of agricultural inputs such as improved seeds, fertilizers, and pesticides are affordable to the smallholder farmers. This means [producing] these inputs locally so that we can lower the costs to the farmer. Mozambique

“We need to guarantee that the costs of agricultural inputs such as improved seeds, fertilizers, and pesticides are affordable to the smallholder farmers. This means [producing] these inputs locally so that we can lower the costs to the farmer.”

has sufficient raw materials and a perfect location to produce and supply fertilizers for the southern African region and other parts of the continent.

In biotech farming, Mozambique has made some advances in breeding several important crops, such as maize, sweet potatoes, and rice, for better nutritional value, disease resistance, drought resistance, and higher productivity. Much more research is needed so that the African continent can produce the right seeds for the environmental conditions we have. We have to continue investment in breeding and multiplication technologies.

We also have a laboratory that can produce in vitro material for the farmers – but its impact has not yet affected the small farmers, due to an insufficiency of well-trained agricultural extension workers. Our research findings have to reach the agricultural-extension services in an efficient and cost-effective manner so we can better provide all the necessary assistance to the rural farmers in their times of need.

We need to recognize our agro-industry so that jobs are created and value is added to our basic products. The sugar industry is a good example of this revival, but we need to do a lot more; our cashew nut industry is not in its best shape. Cereals, cassava, vegetables, mango, orange, bananas, coconuts, and other fruits must be processed also to



facilitate their preservation, transportation, and consumption.

We need to build storage capacity and promote crop-conservation techniques. Many of our farmers lose their production due to lack of proper silos, conservation techniques, [and] know-how. We should learn and share experiences among the countries of the South, in particular the African nations, so that different partnership models can be applied to improve the overall agricultural productivity in our countries.

To speak about food security in a globalized world is a complex task, since many factors influence the results that can be obtained. However, as Dr. Borlaug and Dr. Ejeta have shown, it is possible to achieve great breakthroughs in agriculture. All we need to do is to try and understand the complexities involved in each process, address them one at a time, and whenever necessary, apply a multi-disciplinary approach. ■

Gender in Agriculture, Nutrition, and Health

Catherine Bertini: When I was with the World Food Program, our mission was to end hunger. But moving food to people isn't enough – it has to be the right kind of food at the right time in their lives, and it has to be consumed. So we talked about the end users of our product, the people who need to eat it, and the women are key because they're going to cook it. Not only are women going to cook the food, but they're going to find it; they're going to grow it or bring it home from the market. They have to find the water and the firewood. So if we are really going to end hunger, we have to partner with women.

But it's not just talking about partnering with women – it's actually doing it. We have to find out first what they need, or we might send them the wrong food or send them food that takes too long to cook or not otherwise be supporting their needs. We have to find ways to listen to women. And that means women have to be in different leadership positions so they can tell us what they need. And we need to have more women on our staffs to be able to talk to the women who are going to be our beneficiaries.

Throughout Africa over 80 percent of the people that work in agriculture are women; in Asia, over 60 percent. Yet extension workers are mostly men, even when women farmers are more likely to listen and watch other women farmers. If somebody's going to give expert advice to farmers and the farmers are women, it makes a lot more sense for the advisors to be women.

Women are not the primary landowners; they are not the people that normally get the training. We have to think about what women need as well as men. This is not a generic exercise of generic farmers – this is women farmers and men farmers,

and they have different needs, and many of those are gender-based. Think about your definition of a farmer – what visual comes to mind? When you think about farmers in the future, put the face of a woman in your scope, because she is the farmer that we're trying to reach.

Geeta Rao Gupta: It's important to underscore the significance of the constraints and structural barriers because of the role that women play, not just in producing the food for their families, but in earning additional income through that. The barriers that they face significantly affect both income as well as the food available to households.

There are legal barriers; women lack the right in many countries to inherit property, particularly land. There are financial barriers; access to credit, access to financial services.

Barriers to accessing agricultural extension. In most countries around the world, the agricultural-extension system is in disrepair; but even where it exists, it doesn't necessarily reach women farmers. The lack of access to inputs and technologies, seeds, fertilizer, resulting in lower yields for women farmers. The lack of physical access to markets, which is true for all smallholder farmers, not just for women, where you don't have feeder roads or storage capacities. For women in particular, the barriers to membership in local farmer associations and cooperatives puts them at a disadvantage, because they cannot be in a decision-making role.

Then sociocultural barriers to mobility, to controlling the income, as well as attitudinal barriers, not just at the national and local level but in international development agencies, in agribusinesses that do not directly contract with women farmers nor invest specifically in women farmers.

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Advancement Committee

We know from decades of research that, when women have control over decision-making on how money is spent within the household, when they can control their own income, it has enormous benefits for children and can break the intergenerational cycle of poverty. We've known the barriers for quite a while, but there hasn't been enough action on the ground to address [them].

Bertini: Some of the action on the ground that has been successful has been in Bangladesh. The Human Development Index for Bangladesh has gone up quite substantially and one of the reasons is the empowerment of women.

Mahabub Hossain: Bangladesh, at the time of separation with West Pakistan, had the worst gender disparity in the country. The disparity started at birth, with male children regarded as assets and female children as liabilities – because many parents think that, with female chil-



dren, they will have to pay a dowry. During the early years, if you have an illness, it's the male child who gets priority. When you have scarcity of food, the female children eat last with the mothers. There are few female children who have opportunity to go to schools; and even if they went to schools, they would drop out after one or two years to take care of their siblings. And then they would be married very early in their life and would have the same cycles as their mothers.

And now the Global Hunger Index launched a couple of days ago mentioned that Bangladesh and the South Asian countries have done the best in regard to reducing hunger. And one of the factors that they mentioned is reducing the gender disparity [since] 1990. I would mention particularly three aspects.

On the educational front, at independence, the literacy rate was only 24 percent. It was 36 percent for men, and half of that for women. A government policy was introduced in 1994, providing stipends to girls in secondary schools. Now the gender disparity in education, both in primary and secondary school, has disappeared as a result. In fact, in secondary education now, we have a little bit of higher percentage of girls attending than the boys. We also see the intergenerational effect that, with mothers being literate and a little bit educated, they would like to send all their children to schools.

And we see that in the primary schools. Attendance in the primary schools, of the primary school-aged children, has reached nearly 93 percent from a level of 60 percent only two decades ago – that's a tremendous advancement. Seven percent of children are not going to school, mostly because of poverty, and we are picking them up in BRAC. We target children who have not been reached by the government schools, and they come mostly from the extreme poor homes – as well as the children who dropped out early.

The second, which probably has contributed significantly more in reducing the gender disparity particularly, is access to



Ngongi



Hossain



Rao Gupta



Bertini

new economic resources and opportunities. Land is the most valuable asset, and very few women own that. In Bangladesh that's because of the Muslim inheritance law that the daughters are entitled to one-third of the property of their parents, and the sons get two-thirds. But this entitlement is not even practiced. The brothers tell their sisters that, if they want to have access to security, in case of divorce or if they want to get help from their brothers, they better not to take the entitlement of the land that they have. So very few women own assets. But many of the NGOs and the government are now providing new assets, new resources.

Micro-credit is a significant movement that has been done in Bangladesh. Micro-credit organizations now target nearly 24 million households out of 30 million households in the country. And almost all channel the credit to women. It's not that the women utilize all the money; sometimes they share this money with their relatives in the household to engage in self-employment. But these organizations recognize that, if the money is channeled to women, they will have status in the family and control of the other members of the family. In Bangladesh, nearly every year, micro-credit organizations provide about \$2.5 billion, which is two times more than the credit given by formal financial institutions to the agricultural sector.

And almost all of this is channeled through women.

Besides providing credit, we look at the activities that women are interested in, and we focused on homestead gardening and livestock and poultry producing; provided them training and skill development; provided business management, feed supply, and other things. And now nearly 2 million women are engaged in these activities and have been increasing family income.

The third – access to information is

“Throughout Africa over 80 percent of the people that work in agriculture are women; in Asia, over 60 percent. Yet extension workers are mostly men, even when women farmers are more likely to listen and watch other women farmers. If somebody's going to give expert advice to farmers and the farmers are women, it makes a lot more sense for the advisors to be women.”

- Catherine Bertini

quite important. When we provide credit, we organize 30 to 40 women into groups. We have a three-week training course for the women to receive training on the laws and regulations that affect their lives – inheritance laws, laws with regard to divorce, their entitlement – so that they can claim, at the time of distress, the legal rights that

they have. The other thing that we have been doing is organizing women from disadvantaged groups into village federations to provide them information about their rights [and] often invite local government officials. This is helpful in developing social capital, having a common pressure to give demand so that the services are available to them.

Namanga Ngongi: When I visited Bangladesh, I was most impressed by a lady whom I asked what was the greatest benefit she got from BRAC. She said the [confidence] to stand up and speak in public. And those are the programs which are very much lacking. We all can focus on technical problems, on making people, use new seeds and fertilizer. But they're not able to communicate their needs to the people who are likely to make decisions. That's a good lesson we can learn from Bangladesh.

In my home village, if the Germans had not come, it would have been matrilineal inheritance.

Where you have matrilineal inheritance, the issues which we're trying to resolve today did not arise because the women had the power over assets, had the rights over land. But those were changed by the new masters of the countries. In many parts [of Africa] today, an unmarried daughter has exactly the same rights – my unmarried sister has

exactly the same rights I have – in inheriting land from my father. So we should disaggregate this in the different countries, in different communities, as we discuss and try to bring about solutions. African male farmers, most of them don't own the land from which they work. Except if you plant a permanent plant like coconut or cocoa or coffee – you more or less have the long-term usage right over that land. But you don't have the title to have assurance that if you died, that land would automatically pass to your children. In Ghana, where we are working quite extensively, 10 percent of the certificates of family farms are owned by women, 20 percent by men. It is something which needs to be addressed with a long-term approach to try to give the assets to women.

The critical problem is not really the ownership of land but security of tenure, of use. If you want to improve land, which is the major asset for income production in rural areas, you should have certainty that down the line, you would still have access to that piece of land – or else why would you spend the little resources that you have to buy all the inputs to improve land that may go to somebody else? That does not require changing the constitution in the country, to be able to give more security of tenure. That should be able to be done.

Some of the blockages that were raised, in terms of access to information and credit – we are now in 2009; there is no reason why we could not have a special program for female extension agents in Africa. There is no reason why, if women have poor access to credit, we could not have credit systems directed toward women, so that women could have access to credit without having a land certificate, without having a building certificate, without having all those conditions the banks are looking for. Some of these are temporary hurdles which can be jumped over so that we can faster empower women to make use of the most predominant asset that they have, which is land [and] their ability.

The real issue for the women is not for women to be given more work in agriculture – I don't think so; they're already working hard enough. It's to make their work more remunerative, for them to derive more benefits and satisfaction for the work that

they're already doing.

And there are many simple ways to do that. We can improve access to inputs. That requires only systems like agrodealers which bring inputs closer to the farmers. Also, packaging those inputs in smaller packages, so that women with smaller disposable in-

“Women are more credit-worthy than men. They're more eager to invest rather than wasting in conspicuous consumption or other things that men do. The family, the children, the food is their responsibility. If you give money in their hands, they know how to get [a better] return on the capital. But women hardly have access or power to spend the money.”

- Mahabub Hossain

come can also access and buy. How about credit systems that support women without asking for all of those collateral needs? You don't need to change a whole country's constitution and cultural values, or whatever it is that we all hide behind, for women to have access to inputs. We can find simple things that we can do.

Rao Gupta: You're absolutely right. We don't need to think of these as huge hurdles that require big changes. A lot of this can be done in a very context-specific way at the local level through changing incentive systems, changing the way in which we provide information, understanding what the barriers are. But some of these things will not take root until you create an enabling policy environment. So I don't want us to undermine the importance of that, because we have seen in countries where laws do exist for women, for example, to inherit property or to own land – when it comes down to it, those laws are not enforced.

The change has to begin from the bottom up, so I couldn't agree more with the idea that you have to include communities, women in particular, and men to discuss these issues, and [communicate] the costs of these barriers, so that they can come up with the solutions. All of the successes

that we have, including the BRAC model, have succeeded because of the involvement of communities. When we have come top-down with large infrastructure projects, they have failed.

I just want to underscore about micro-finance – it's a great thing for women, but we need women to be able to have economic enterprises and economic activities that thrive, not just survive. And we need women to not be ghettoized into micro-finance permanently but to use that as a step to building enough assets to have the collateral that the formal banking system requires. The indicator of the success of micro-finance programs should be not just the

rate of repayment of loans – most women are socialized to be good women and always follow through on their promises. They will repay loans – around the world, we've seen proof of that. The indicators of the success of a micro-finance program should be the growth of women's incomes in businesses.

Bertini: So what, for instance, specifically is AGRA doing in order to ensure that some of these things are happening that you just talked about?

Ngongi: One is to increase the access of women to inputs. By the end of this year, it probably will have been 8,000-9,000 [agrodealers] that have been given capacity, of which at least 35 percent or 40 percent are women. And there are many areas in which you have agrodealer women running their own businesses – instead of just working on a farm, they have now become their own entrepreneurs.

We have also worked to get credit guarantee schemes in banks. I can cite Kenya as an example, where we gave a credit guarantee of \$2.5 million, and IFAD gave \$5 million, and we were able to mobilize \$50 million dollars from Equity Bank to give loans to small-scale farmers. A large proportion are still men, because they are still go-

ing through the culture of the communist mold, land certificates and assets. But we especially give group loans to women's groups – it's easier than to try to identify individual women.

We are also having a training program at the PhD level, of which about 35 percent today are women. It is a little difficult – if you do not find women who have gone through the bachelor's degree level, it is difficult to find them to train at a master's degree level. So we have to go one step lower to be able to find how to encourage girls in secondary school to take agriculture as a profession.

Hossain: Women are more credit-worthy than men. They can take better care of money. They're more eager to invest rather than wasting in conspicuous consumption or other things that men do.

Microfinance is often high-cost lending. Often these organizations charge a 20-30 percent rate of interest compared to the formal financial system which is just 10-15 percent. So if [women] can move from high-cost lending to the formal business sector, that would be good for them. But what happens in practice is that, even if you have collateral, you don't have access to formal financial institutions; for both men and women, that's true. Many governments, since they are targeting the poorer sections of society, ask a very low rate of interest of commercial financial institutions.

But those institutions find that doing business with a small amount of money involves a very high cost of administration. So when the government asks for giving loans at very low rate of interest, they go into agricultural enterprises which would need larger amounts of money, rather than serving the small people. So I'm not sure whether this will work in practice.

Bertini: Could you go a little bit into how women use the resources that they have and invest in the family? Because I think that's something that people don't appreciate.

Hossain: They are the real caretaker of the family. At times of crisis, when you have poverty, men often abandon the family. We see the migration of men in search of better economic opportunities. During that time

the women have to take care of the family, and they don't have the income that the husband [has]. More basic is that the family, the children, the food is their responsibility. That's why, if you give money in their hands, they utilize it much better than if the money is used by men. We have heard from African experience and others that if men earn income, they go for drinking and all those sort of things, rather than investing



“Microfinance is a great thing, but we need women to have enterprises and economic activities that thrive, not just survive. We need women to not be ghettoized into microfinance, but to use that as a step to building enough assets that the formal banking system requires.”

- Geeta Rao Gupta

the surplus for the welfare of the family. In India in several states you have this same phenomenon that men squander the money. Women know how to invest and get [a better] return on the capital than men do.

But despite providing all these resources [to] the women, the additional income that comes to the family, women hardly have access or power to spend the money. The power remains with the men, about the how to utilize the money. And we see that in BRAC. Despite working for 20 years,

giving access to credit, giving opportunities – if they get more income, we thought, then the power of utilizing that income would remain with women. But that is happening very slowly; there's not really a big achievement in that.

The problem there is the insecurity of women. They look at security within the family, so that there is no occasion for divorce and other things, because that places

women at risk. There are also other kinds of insecurity, like rape, and they need to have support of their male guardians in order to deal with that. So they don't want to antagonize too much and exercise their power over their husbands or parents with regard to this claim on the resources.

Rao Gupta: What we are bringing about is really social change. For social change to occur in women's lives, it's not just about women; it's about gender relations. It's about

how men and women relate to each other, which is why none of these programs could succeed if you didn't involve both women and men in the changes that you're seeking. Because otherwise, there will be backlash against women, and we have to ensure that we don't do something that causes more damage than good.

Because these are embedded in socio-cultural norms, you need proactive, delib-



“The real issue for the women is not for women to be given more work in agriculture – I don't think so; they're already working hard enough. It's to make their work more remunerative, for them to derive more benefits and satisfaction for the work that they're already doing.”

- Namanga Ngongi

erate efforts to change those norms, even at the local level. And to do that you need women in decision-making positions at all levels. There are some very creative, innovative programs. The AWARD program in Africa, which is seeking to increase the talent pool of women agricultural researchers, is a very important one. It's providing incentives and giving advantage to women to try and push back the historical legacy of disadvantage that women have faced in entering these professions.

You do need to change the incentives. You need to change the rules of the game fundamentally by saying, “No, we've said now that this much percentage has to be women” – or else you're not going to change it. Because of an act of Parliament in India, there was a law saying that 30 percent should be women, and 30 percent of all panchayats, the local village councils in districts, should be led by women. In the

Hossain: I would like to [discuss] leveraging of aspirations for the children from poor families. It's no good just focusing on primary education. We have initiated a program giving scholarships to children who do exceptionally well in the school certificate examinations. We particularly pick up children from households where the main source of income is selling labor. We are now working with the ministry of finance in Bangladesh, to see whether contributions from better-off households to this program could be made tax-free, so that we can accumulate enough funding for expanding this program so that they can go through colleges and universities, those meritorious students.

Rao Gupta: The economic appeal is a good one; a return on these kinds of investments has appealed to many decision-makers. A new program that the Rural Development Institute is undertaking with microplots in Karnataka and in West Bengal in India, is proving that with small pieces of land, one-fifteenth of an acre targeted to women, you can get a lot of impact in terms of increases in income at the household level.

Leadership cannot be emphasized enough, and the fact that you need leadership at all levels, from the farm cooperatives right up to the big institutions that make decisions on the allocation of dollars or resources. Leveraging aspirations – that is our challenge. How do we get girls from primary school into secondary school to maintain those aspirations? And then the biggest challenge is the transition from school to work.

The message that I always give when we are involved in communities is, empowering women is not a zero-sum game – power is not a finite concept. More power to women, more power to the household, because when women earn more, the household earns more. And that's a concept we need to build on. And the way to build on that is to work with women and men and with communities – not just with women. That's where we've gone wrong in the past. ■



Tom Campbell, Purdue University

Tracking global agricultural efforts requires a focus on nutrition, livelihoods, and the well-being of vulnerable groups, including young people.

Assessing Progress in Global Agriculture

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Joachim von Braun: For Norman Borlaug, progress was a clear concept – increase the yields, increase the production. It was certainly not simply pointing at potentials. He kept saying, “You can’t eat potential.” So we want to be results-oriented in looking forward. “Results-oriented” means that yields increase, water-use efficiency is increasing, poor people eat better, hungry people eat more, micronutrient deficiencies are decreased, food safety is improved, the environmental footprints are shrinking. So it’s a multidimensional progress set of indicators which we need to drive at. It’s not just one. But we must not get confused among them.

J.B., you have seen strategies come and go. Some have left good traces, and others have no traces. How do you assess the current energetic debates and strategies of the new administra-

tion and of the G20? Are you optimistic?

J.B. Penn: All of this renewed attention is a good thing, and these initiatives are a good thing, because it does concentrate additional resources to the problem. It also gives the private sector reassurance that this time things may be different, that there may be a critical mass of effort and funding. If development is to succeed, we must have the investment of the private sector. Governments never have enough money to get the job done, and we must have the innovation from the private sector. So I am heartened that the private sector is showing so much interest in these new initiatives.

The big question is – will this be sustained? Farmers are good economists – you get high prices, they farm more land, they use higher-quality inputs. We’ve seen two huge harvests at the same time that we have seen a very severe global recession dampen food demand. So we have corrected the strained situation that we had in the middle of last year in terms of supplies



“The ecosystem, society, and the economy – they all need to work together in harmony. We still rely too much on narrow, technological inventions or implement narrow technologies rather than looking at the wider system. Technology has to be a solution to a problem rather than a solution looking for a problem somewhere.”

- Hans Herren

and stocks. Commodity prices have fallen, and the forecast of the global harvest for 2010-2011 will be less of an increase than we’ve seen in the past two years because of the decline in prices.

Now, when prices fall, interest wanes; even though the hunger numbers don’t change or go up, the interest wanes in agricultural development. So we have to see whether the interest this time is going to be sustained or not. Lots of people make pledges. Governments make pledges on proportions of their budgets for rural development. I am optimistic that this time is different, that this time we are seeing some practical, level-headed approaches to development. The discussion in the United States about how to go about this is especially heartening.

von Braun: [We’ve] listened to visionary statements from top global leaders in the private sector. But you have just said they are responding to price elasticity. When you say “farmers,” you also say, broadly, “private sector.” So would you care to comment on [what] we had heard from the leaders of the corporate sector? Will they say the same [things] next year?

Penn: My sense is there is a better understanding of the fundamentals, the long-term supply and demand. We’re going to add 3 billion people; we’ve got to perhaps double food supply in just 40 years’ time. And we’re not going to have any more resources to use. So I think the business community – at least the business community that I’m familiar with – is recognizing the fundamentals and taking a longer view than they might normally take. And my sense is that they are prepared to make the investments.

An enabling policy environment – that’s the key for business. If you have that, then you look at the fundamentals of the sector. If they look good, then the investment will occur, the ingenuity and the innovation will occur. But if you don’t have that enabling environment, it’s just not going to happen.

von Braun: Hans, you have been at the heart of this International Assessment of Agricultural Science and Technology; it included the private sector until it dropped out, a lot of active NGOs, and many governments. And it resulted in a very com-

prehensive report. But it also continues to have an aura of divisiveness. I recall Bill Gates’ statement here that we really need to bring together, and not divide, the environmental aspects and the technology aspects for agricultural development. [Is the] message still the same as in that important report?

Hans Herren: Let me just mention that only, basically, private sector from the North in one group quit; there were private sector [participants] from the South who remained part of the assessment.

The key message is one sentence: Business as usual is not an option. The other main message was the emphasis on agriculture as part of the system and the multifunctionality of agriculture. So we have the ecosystem, the environment, society, the people, and the economy – they all need to work together in harmony. And I have not seen much moving. We still rely too much on narrow, technological inventions or implement narrow technologies rather than looking at the wider system. We’ve heard many times about the need to have biotechnology, for example. But that’s just one part of what is needed. We need to manage better our natural resources. If technology needs to be in there, that’s fine, but it should not be the cart in front of the oxen. Technology has to be a solution to a problem rather than the other way around – a solution looking for a problem somewhere.

I’m not sure much has changed yet. Some countries are talking about changing the way they provide support to the farmers, moving toward rewarding ecosystem services so farmers do the right thing: producing quality food in good quantity, but also maintaining the resource base, which is going to be required not only the next five years until we get out of a crisis but for the many generations to come.

We felt that genetic modification can contribute, but more research has to be done across the board from ecological suitability – what are the long-term consequences? – all the way to health issues. We just don’t know enough. As of today – and this was confirmed by a study from the Union of Concerned Scientists – these

* Dr. von Braun stepped down from his position at IFPRI in December 2009

crops do not yet increase the yield potential or yield. They may facilitate farming, mostly large-scale farming. But that doesn't mean it's something that we need to take out of context and push more than sustainable agriculture, agroecology.

von Braun: At a conference in Rome a couple of days ago, somebody said, "African agriculture is, by default, ecological. And that's an opportunity; that's the direction we should take."

Herren: A lot of people say that the problem in Africa is that they do organic agriculture, they don't use any inputs. This is very wrong, to think that because you don't do anything, you do organic. Organic or ecologically sound agroecology means that you're taking care of your environment. The problem [for] African farmers is they don't have the means – because the crop price is so low – to take care of their soil. And you need amendments in organic form or in mineral forms to get going.

Marco Ferroni: Hans says business as usual is not an option, and I resoundingly agree. We're not producing enough food. And the perspective, if we continue with business as usual to 2050, is precarious. So if we look back from 2050 to now, what is the measure of [success] in feeding 9 billion people at that time? The answer [depends on] the way in which we will have been able to address the performance gaps at the present time – 1 billion people hungry, population growth out of control, grain-yield growth declining. And the smallholder community – the 400 to 500 million small farms that will continue to be important in that horizon of 40 years – not being able, for lack of technology and services and adequate supporting policies, to make the contribution to food security, economic growth, and livelihood improvement that they might be doing under another scenario.

The most important priority going forward is to live up to the Borlaug challenge. But by adding one adverb to it. The Borlaug challenge was, Intensify agriculture. We now have to say, Intensify agriculture *sustainably* – using land and water wisely, stopping the mortgaging of our ecosystems,

“As we think about going from future risks to hedging those risks, we need to think beyond global grain production to meet future demands. We need to think about incorporating diversity at every level of the food chain. That will be our best hedge against threats that we can predict – but also those that we can't.”

- Brian Halweil

and so on. This requires that we make full use of technology as well as the best of our policy and management capabilities.

I deplore that there seems to be part of an important community of shapers of opinion, mostly in rich countries where we can have the luxury to have such debates, about basically two schools of thought: the productivity school, as I would call it, and the sustainability school. I would hope that by 2050 – actually way, way before that – we would have an opportunity to bring those two ways of thinking together in some constructive anyway. It is about intensification of agriculture, but it is about doing so sustainably.

von Braun: Brian, your writing focuses on risks and uncertainties and around the environment and agricultural system. If you take a fair look at risks, the world has become a less risky place. Humankind lives longer. But when people get more wealthy, as the average world citizen does, they don't want to put up with risks anymore. So the demand for insurance and risk reduction is increasing very quickly. With that precursor, I'd like to ask you to elaborate a bit



about the big risks which you and World-watch see and what to do about them.

Brian Halweil: We of necessity will be moving from a situation of short-term thinking to long-term thinking. It's not a moment too soon; interest in agricultural issues and development is recovering from being at a low, but finally it's inserting itself into climate discussions and economic development discussions and others. But the other reason we need to change that perspective is that we're moving from a situation of agricultural stability – where farmers and others in the agricultural sector have been able to predict with some reasonableness what climate, water availability, the growing situation [were] going to be like – into a situation where those things can't be taken for granted. And the major driver is climate change. Agriculture may be a relatively small industry in the global economy, but it is the industry that will be most affected by a more erratic climate.

We've all seen the statistics that a one-degree increase in average temperature across much of the globe can lead to a 10-percent decrease in grain yields. But we're

now beginning to understand that, in an atmosphere where there's a higher carbon content, the carbon-to-nitrogen ratio in plants goes up; that means less nutritious plants for the human and livestock to eat those plants. And we're beginning to see other effects that we haven't anticipated – we're seeing the range of major fishery species changing. From the bottom of the marine food chain up, we're seeing productivity decline.

If we just focus on grains, we've hardly begun to understand how the setting in which farmers and agricultural businesses operate has changed dramatically. And it will be virtually impossible to anticipate all of the impacts. As we think about going from future risks to investing in hedging those risks, we need to think beyond global grain production, or what agricultural production needs to be at to meet future demands.

We need to think about incorporating diversity at every level of the food chain – in the crop varieties we choose; in farming systems, that is, mixing livestock and aquaculture and water features on farms with traditional crop production; in giving farmers not just additional markets but additional products in markets. That diversity will be our best hedge against threats that we can predict – but also those that we can't predict.

von Braun: How about crop insurance? Would that fit into your concept? That would be a market-oriented approach.

Halweil: There's a full range of untapped insurance approaches for both poor and wealthy farmers to hedge against any sort of loss of crops. But I'm thinking in a broader term than a policy that a farmer is buying.

The late-blight outbreak in the northeastern United States this year — the causes were everything from a damp, cold growing season to consolidation in the food chain that supplies tomato seedlings and seed potatoes. The best insurance policy against that is a diversification of the sources of planting materials and of those crops that farmers depend on. Areas that only grew potatoes or only grow tomatoes were devastated, whether they had crop insurance or not.



“We get focused on farming and on farm inputs, improved seeds, and even machinery. But we have to be thinking about the entire value chain as it relates to productivity – how we reduce post-harvest losses, how we preserve and enhance the nutritional content, how we retail it. We have to have huge gains in the entire system.”

- J.B. Penn

The majority of our investments have been at the input side of the value chain – seed breeding, focusing on increasing productivity and profitability, focusing on the inputs to production. We've neglected the rest of the links in the value chain, including the setting in which that seed is grown – the soil, the water-management technique, the economic structure in which it's grown.

von Braun: Thousands of households in North America and Europe have started gardening again. What's behind that? And what does this mean for our agenda in the developing world? Are people who are gardening themselves more open to our agenda so that it isn't a one-year thing, but keeps people engaged?

Halweil: There is no question that this food enthusiasm could be harnessed. Not just the environmental community but the food-interested community in this country could be harnessed as a much more effective ally in international hunger issues. Regardless of what motivates people to get interested in this – and it is in the tens of millions – these are the sorts of people

who will not just buy fair-trade goods and support developing countries farmers in that way, but will be interested in speaking to their elected officials about changes in American food-aid policy and the Farm Bill and world-trade agreements that are currently barriers or hindrances to reducing hunger and poverty.

von Braun: Let me come back to risk. I think we need a seriously reconsidered approach that deals with market risks, with technology opportunities, with an investment portfolio. Do we have a comprehensive approach to deal with increased uncertainties in the world food system? And if not, what should be the strategy? These uncertainties are very bad for business and make you hesitant to invest. Isn't that right?

Penn: That is true, but the businesses that are able to sort these out are the ones that survive and thrive. So they're also seen as opportunities. We're reexamining lots of things that we have taken for granted. We're assessing production agriculture, what that system is and how it works. We're looking at organics in a new way. And we're seeing

risk to the food system in places that we haven't seen before. I think we'll see some evolution of the food system because of this risk assessment.

There is a lot of focus. When we're talking about increasing food production and largely focusing on the developing world, we get focused on farming and on farm inputs, improved seeds, and even machinery. But we have to be thinking about the entire value chain as it relates to food, about productivity improvements – how we store the food, how we reduce post-harvest losses, how we process it; how we preserve and enhance the nutritional content; how we retail it, how we price it. We will have to have huge productivity gains in the entire system, not just in crop and livestock yields.

The Global Harvest Initiative is these four agribusiness companies, examining a new way to measure productivity growth for global agriculture – maybe regionally, maybe partial-factor productivity measures along with total-factor productivity measures – but to see, on an ongoing basis, if we are really producing more food with the same bundle of resources and if we're doing it in the farming side, in the processing side, in the distribution and the retailing side. It gets to Marco's notion of sustainability – you've got to work that in as well.

von Braun: Total-factor productivity in developing countries is what I would advocate we focus on. Yield per unit of land, or output for labor day, or crop per drop are partial productivities – they're important, but they don't give the answer. The current total-factor productivities in agriculture are showing growth rates of about 1.5 per annum. And that's why we are in a food-insecure world. If we don't add at least half a percentage point to that annual total-factor productivity growth, we can try what we want; it will remain a very risky, unpredictable situation because of the lack of supply.

Penn: There are three things that we're talking about: one is uncertainty, another is risk, and another is variability. Uncertainty is the unknown unknown; there's

“Vegetables are not only important in gardening in [rich] countries. They're extremely important, and overlooked oftentimes, in developing countries. We must focus on vegetables not only for nutritional reasons but for their potential as a cash crop. Income improvements are essential for farmers to be able to adopt technology.”

- Marco Ferroni



not much you can do about that. Risk is something that you can assess and generally can insure against.

In the developing markets, we have instruments for farmers to deal with that. We have crop insurance, we have the futures markets, we have forward purchases in sales. We used to have heavy government involvement directly in production agriculture. We had price supports [to] encourage production regardless of the market, regardless of demand. And the result was huge stockpiles, and a flatline of prices, and that's what farmers didn't like. They didn't like the predictability of knowing that these prices were very low.

And there we're talking about variability. If we let the markets work, within reason, then we're going to have times in which there is some interruption of supply. Prices will move up – that will cause farmers to respond. They will produce, and prices will move down. Demand is fairly predictable.

von Braun: Hans, were there things such as – women's [being] 70 percent of agriculture; did you look into whose labor it

was in your assessments, sustainability of women in agriculture? Maybe broaden it a bit, the future of small-farm agriculture.

Herren: The report came out strongly in favor of new agricultural knowledge, science, and technology for small farmers and family farms. We felt that there was a lack of appropriate science directed toward the women in particular and the small farms. And that's why we cannot just import the science which has been done in the North on a different farm size to the South; we have to adapt it and actually to work with the people. And I think, Marco, you forgot to say, declaring, “We need more science and technology.” What we need is to marry this with the farmers' knowledge. That has to be taken into account.

Ferroni: I agree with the importance of bringing farmers' knowledge on board. This is extremely important, and we should discuss it in the context of agricultural extension – a major missing area that has not been addressed adequately.

There is so much water, land, fertilizer, other inputs that are being wasted. To me,



“Whereas the average world citizen today can cope with the uncertainties a lot better than ever in human history, the poor have been left behind. It's not just some statistics of prices jumping up and down. It is the hunger statistics which relate to the poorest of the poor which we have to address.”

- Joachim von Braun

precision agriculture is part of that technological package that tries to rely on the full gamut of resources in terms of technology, science, management, and so on. Now, precision agriculture is also linked with the question of risk, because risk management is not just crop insurance – it's about managing your resources in the best possible way. So technology, again, comes in as indispensable.

Then we've got the whole question of diversification. Livestock is important, diversification is important – and that is where vegetables and home gardening are coming in. Gardening is a very good trend – because, in addition to nutritional benefits, there is promise in educational terms. If people do home gardening, they begin to learn and understand where food comes from. Potentially that is the way into resolving that debate between the productivity and the sustainability “churches” that does damage to our search for prioritization of what really needs to get done and how it needs to get done.

Vegetables are not only important in the context of gardening in [rich] countries. They're extremely important, and over-

looked oftentimes, in the research agenda in developing countries. We must focus on the basics, grains and oilseeds and so on, but we also must focus on vegetables not only for nutritional reasons but for reasons of exploiting their potential as a cash crop. Income improvements are essential for farmers to be able to adopt technology.

Halweil: It would be interesting to answer this question about who those 9 billion people will be [in 2050]. We should ask who we want them to be. It's safe to assume they'll have much more diverse and healthy diets. And if there are productivity increases on farms, many people will not be working on farms anymore. But there will be processing and added-value jobs and agricultural-extension and agricultural machinery and engineering jobs that are all related to robust rural economies. If our agriculture is more agroecological-intensive, knowledge-intensive, there will still be a demand for lots of people in the agricultural field. They may not all be farmers, but they will still be connected to farming in some way.

And, speaking primarily about climat-

ic unpredictability; the fact that a rain-fed farmer — who plans to have some rain in the spring after they plant their seeds, will not be able to plan for that in the same way that they've done in the past. We will need climate-ready crops and climate-ready farmers, crops that can deal with more unpredictable weather, but farmers who have also set up their farms to deal with more unpredictable weather.

von Braun: Things went overboard the last two years. Whereas the average world citizen today can cope with the uncertainties a lot better than ever in human history, the poor have been left behind. The risks that have them exposed, have deeply undermined their livelihoods and have led to hundreds of thousands of incremental deaths among the poor due to the food crisis and the financial crisis – let's not forget it. It's not just some statistics of prices jumping up and down. It is the hunger statistics which relate to the poorest of the poor which have worsened, and it relates to the volatility of the issues, which we have to address.

And I would like to close with two very positive assessments. The new role of the private sector is indicating breakthrough and makes all of us very, very positive and optimistic [about] the future. And secondly, the new emphasis of government, including the U.S. government, on food security. There's large investments with smart investments, with a lot more partnership, a lot more focus on women – all this is great news.

Let's keep these two grand messages from the symposium in mind and stick with Norman Borlaug's mission – we have to focus, get the crops grown, and get the people to eat them. ■

Modern agriculture can offer relief and save Africa. An African Green Revolution can be a reality. We have the know-how to boost crop productivity, trigger profitable enterprises and opportunities, and chart a sustainable livelihood for rural and urban Africans – provided that we have the will to avoid past mistakes, strengthen Africa's institutions, empower its professionals, challenge its leadership, and inspire its people to launch science-based economic development.

Africa will not be able to make this development of its agriculture and economy without significant external assistance. I am certain, however, that no amount of external funding will bring about transformative change unless it is locally led by inspired citizenry and driven by unequivocal support and commitment from African leaders and policymakers.

In the 1960s, when the Asian Green Revolution was being launched, independent Africa was being born. At the end of WWII and into the mid-1960s, few Africans with graduate degrees in agricultural science existed. Very little functional science infrastructure was in place. The few entities left by colonial leaders had no substantive research programs aligned with Africa's development.

In the euphoria of independence, Africa was bracing itself to put in place the essentials for self-rule and development. With such a backdrop, a long, painful journey of science-based economic development might have appeared to be an unnecessarily bitter pill. Nevertheless, investments were made from both internal sources and foreign assistance for building institutions of education, research, and technology-transfer. Agriculture was to be emphasized. The seeds of development sown then have been crucially important in supporting the modest human-capacity building and institutional-development successes achieved.

The impetus for modern agriculture that started in the 1970s grew significantly in the 1980s. African men and women pursue[d] graduate education in agricultural science at European and North American institutions. Farming systems emphasized locally relevant and appropriate technologies, to first understand better the local farm and household environments before designing solutions.



GEBISA EJETA

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The African Green Revolution need NOT be A MIRAGE

Today there is a developing, though not yet robust, agricultural-research infrastructure in Africa. Significantly increased linkages with international agricultural-research centers, foreign universities, and other scientific organizations are now in place. African scientists and leaders of programs readily engage in global collaboration. Earnest commitment has swept the continent [and] is receiving synergy from new foreign assistance. Some may call this the second coming of Green Revolution to Africa. But thanks to the growing list of allied forces behind it, this may well be the first earnest effort.

However, [we] cannot accomplish an

African Green Revolution without an earnest public-private partnership that is primarily homegrown. The last 15 years have seen decreased investments in building human and institutional capacity over the continent. Over-reliance on external funding for agricultural development [has made] recipient national programs susceptible to frequent paradigm shifts generated by foreign agencies. Badly needed external assistance has become a perennial necessary evil. For a number of years, there wasn't confidence in African institutions – basically, “We don't trust you; we'll give you external cadres of technical assistance, and we'll feed

you with food produced elsewhere.” And that certainly had not worked. The lack of substantial local investment most heavily failed in mission-oriented agriculture and rural development.

What to do to increase the chances of success? The generous financial support and eminent leadership coming forth are remarkable. But crucial as they are, they do not guarantee success. The call for an African Green Revolution is not merely to increase crop yields but also to change livelihoods for the better. Transformative change is not likely to be primarily a function of money expended. It will require the empowerment of local people, local institutions, and local governments.

The new African Green Revolution needs to be laid by African nations – set and guided by local organizations seeking external assistance only when inadequate local capacity sets limitation. The primary resource investment in African development needs to be made from within and leveraged with

external aid, and not vice-versa. Able Africans should not be relegated to followers in response to the external resource.

A social and political environment that encourages the best and brightest of Africa to engage in agriculture needs to emerge. Bright Africans have done wonders around the world when given the chance to be gainfully employed in highly conducive and productive environments. A new and dynamic local cadre can do the same in Africa if provided with functional institutions, policy support, and encouragement. Entrepreneurship and private institutions are weak in all African countries. Without strengthened market institutions and the robust infrastructure to support the emerging private sector, science-based development will be hard to sustain.

We know *what* we need to succeed in Africa. We just need to agree on the *how*. Agricultural sciences can offer technological solutions for increasing production and conserving natural resources to catalyze economic development. Solutions for many of the current problems are already available or can be readily obtained.

I've grown greatly optimistic about Africa lately, as there appear to be improving trends in several areas, including governance, democracy, peacebuilding, and earnest development efforts. Conflict resolution by Africans has been on the rise since several wars stopped. More than 50 democratic elections have taken place in the last five years – although the more established democracies of Nigeria, Kenya, and Zimbabwe have faltered lately.

Economic reform has been very encouraging with the improved investment climate and some openness for emergence of the private sector. Annual economic growth in the continent of Africa [is] greater than 5 percent with single-digit inflation. New infrastructure and road-building, increas-

ing telecommunication networks, growing access to water and energy, expansion in primary, secondary, and tertiary education – investments in nation-building may be at an all-time high in many countries.

The agricultural sciences have entered the highest level of African political debate in the last several years. African leaders have

put agriculture on their annual agenda and made a historic pledge to commit 10 percent of their national budget to food security and agriculture-led growth. Many nations have proclaimed a

targeted annual productivity growth greater than 6 percent by 2015. Regional and subregional organizations have been put in place to facilitate technology generation and transfer.

There is increasing engagement by foundations, nongovernmental agencies, and the emerging private-sector activity. Unprecedented levels of financial support may be obligated by foreign government and donor agencies in support of African agriculture. Between ambitious pledges from external donors and domestic commitments, and the palpable resolve to succeed heard from African voices, this may be a new era for agricultural development.

With this resurgence of interest, we can lead African agriculture to generate badly needed impact. Insightful research can address the array of African agricultural problems and render lasting solutions. Though not yet strong enough, there is an institutional base in Africa for a credible agricultural revolution.

There is nothing inherently wrong about Africa. Agricultural sciences can trigger badly needed solutions in Africa, as they have elsewhere. I challenge everyone to rise up to the call of a new agricultural revolution in Africa. I'm certain that we can eradicate hunger, create profitable livelihoods for the poor, and enhance the conservation of our natural resources in the continent of Africa.

“No amount of external funding will bring about transformative change unless it is locally led by inspired citizenry and driven by unequivocal support and commitment from African leaders and policymakers.”

THE 2009 WORLD FOOD PRIZE LAUREATE

Dr. Gebisa Ejeta

Gebisa Ejeta's journey to the 2009 World Food Prize began with a mother's love and steadfast determination to provide an education for her only son.

Born in the Ethiopian village of Wol-lonkomi, Ejeta was raised in a one-room thatched hut and was no stranger to hardship, often lacking food and basic nutrition.

What he was not lacking, however, was the support of his mother, Motu Ayano, who was determined that through education her son could have a different future.

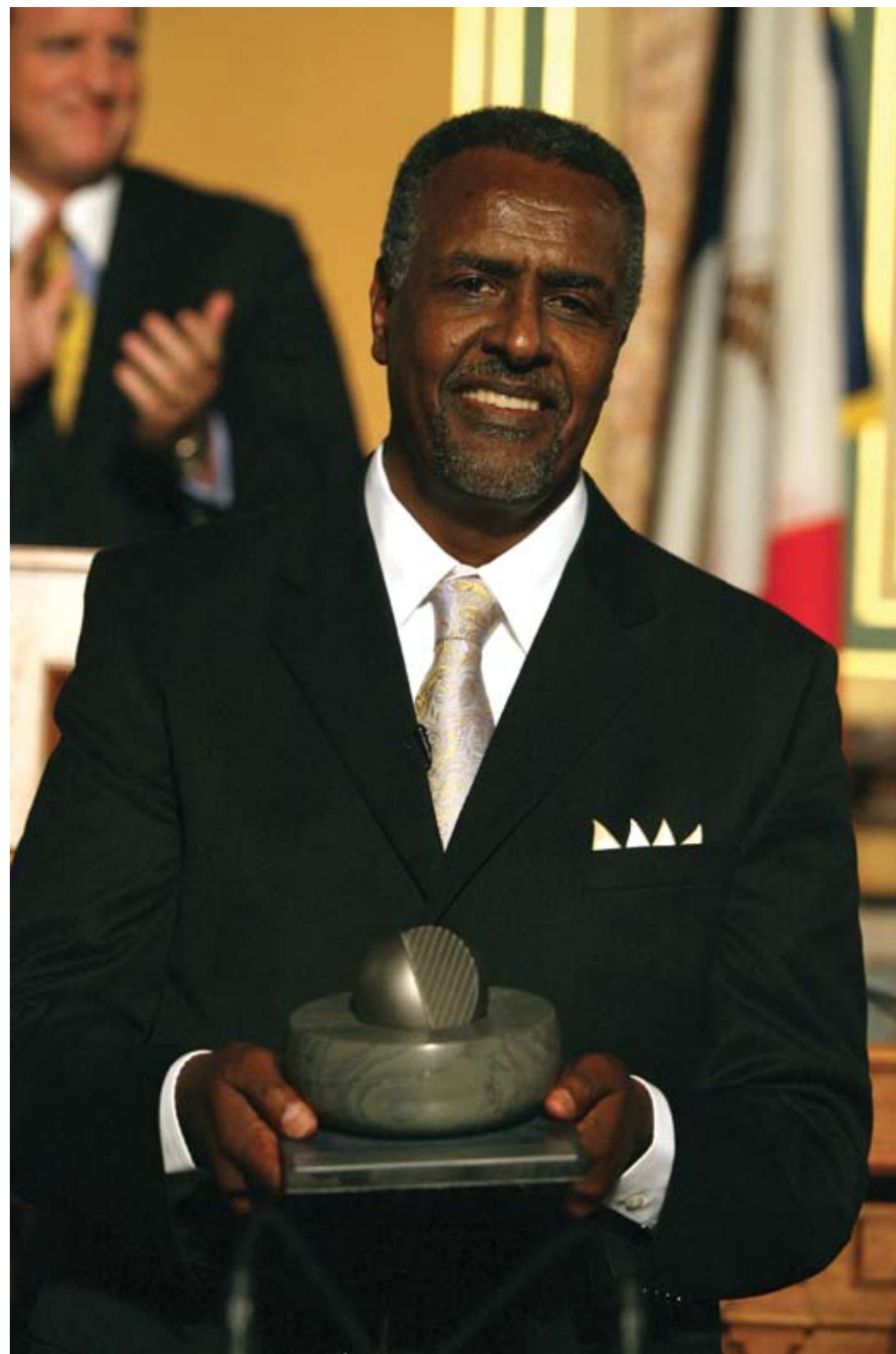
As Dr. Ejeta recalled at his Borlaug Dialogue address, his mother would say to him, "Poverty is not leprosy. It doesn't have to show. It doesn't have to define who we are, what our character is."

His mother made a series of sacrifices to provide him with an education, first scraping together the funds to enroll him in a newly opened school in the village, and later making arrangements for him to attend school in a neighboring town 20 kilometers away. He would make the walk to school every Sunday and walk home again each Friday.

After finishing eighth grade at the top of his class, Gebisa was selected to study at Jimma Agricultural & Technical School, where he graduated with distinction. He then entered Alemaya College, where he excelled not only in the classroom, but on the basketball court as well, eventually earning a position on the Ethiopian national team.

Originally intending to study agricultural engineering, Ejeta's mentor Brhane Gebrekidan convinced him to pursue a career in plant sciences by telling him the story of Norman Borlaug, who had recently received the Nobel Peace Prize for his work as the "father of the Green Revolution."

Shortly after receiving his plant science degree from Alemaya, Ejeta was invited to accompany Purdue professor and noted sorghum researcher John Axtell in collect-



Dr. Ejeta receives the World Food Prize as Iowa Governor Chet Culver looks on.

"Poverty is not leprosy. It doesn't have to show. It doesn't have to define who we are, what our character is."

- Motu Ayano

Mother of 2009 World Food Prize Laureate Gebisa Ejeta



Dr. Ejeta with his mother, Motu Ayano

Tom Campbell, Purdue University

ing sorghum species throughout Ethiopia. Dr. Axtell was so impressed with the young man that he offered him a place in his graduate program. Ejeta accepted and in 1974 enrolled at Purdue.

After completing his doctorate in 1978, he was offered a position heading ICRISAT's sorghum-breeding program in Sudan. Within five years, Dr. Ejeta had made his first major breakthrough by developing Africa's first sorghum hybrid — a drought-tolerant variety able to withstand Sudan's drylands. While the hybrid, dubbed Hageen Dura-1, showed tremendous potential for increasing yields, Dr. Ejeta knew that to effect real change, he would have to persuade local farmers of the seed's value.

The demonstrated superior qualities of Hageen-Dura 1 led to wide acceptance by farmers, and those that planted the new hybrid were rewarded by yield increases of up to 150 percent.

With funding from USAID, Dr. Ejeta launched a hybrid seed industry in Sudan, which led to an explosion of the commercial seed industry. Thousands of Sudanese farmers have now harvested over one million acres of Hageen Dura-1, and more than a dozen seed companies are operating throughout the country.

Yet despite the success of the drought-tolerant hybrid, sorghum growers in Sudan and throughout Africa were still experiencing devastating losses from an old foe — the parasitic plant *Striga*.

Commonly known as witchweed, *Striga*

is estimated to cause crop losses of up to 40 percent of Africa's total cereal harvest. The parasite inflicts most of its damage while hidden underground and can lay dormant in the soil for up to 20 years, rendering traditional control methods ineffective.

When Dr. Ejeta returned to Purdue to accept a faculty research position in 1984, he was determined to battle this scourge. Working with his colleague Larry Butler, he devised a novel approach to unravel the complex biochemical relationship between the parasitic weed and the host sorghum plants.

After nine years, Drs. Ejeta and Butler developed the world's first *Striga*-resistant sorghum. Despite the magnitude of the scientific achievement, Dr. Ejeta knew it wasn't enough. The varieties had to reach African farmers.

In 1994, working with USAID and World Vision, Drs. Ejeta and Butler produced 8 tons of *Striga*-resistant seed at Purdue for 12 African countries. They organized farmer-education workshops and trained agronomists on management and distribution. The improved *Striga*-resistant cultivars produced dramatic results, increasing yields by as much as four times over local varieties.

In 2003, Dr. Ejeta established an Integrated *Striga* Management project in Ethiopia, Eritrea, and Tanzania that emphasized combining the new varieties with water conservation and fertilization.

Working with leaders and farmers across sub-Saharan Africa and educational

institutions in the United States and abroad, Dr. Ejeta has strengthened agricultural networks and personally trained a new generation of scientists. As a distinguished professor of agronomy at Purdue, he oversees the world's leading sorghum-research program.

His accomplishments have inspired countless others throughout Africa, especially in his native country. In the summer of 2009, Dr. Ejeta returned home to a hero's welcome from hundreds of villagers who expressed pride that one of their own had been recognized on a global scale.

Less than a month after receiving the World Food Prize, Dr. Ejeta once again found himself back in Ethiopia — this time to receive the National Hero Award, Ethiopia's highest honor, from President Girma Woldegiorgis.

As Dr. Ejeta received the accolades of his native country, he no doubt thought of his mother, whose determination and commitment to education made it all possible.

"Of all the people who have made a difference in my life, she is the most important," Dr. Ejeta said. "I don't know to this day how a person with no education and limited perspective truly believed that education is the way to go. She believed in that, and I give her all the credit for who I have become both as a person and a professional."

Echoing his mother's commitment to education, Dr. Ejeta has announced that he will use the \$250,000 World Food Prize to establish an educational foundation aimed at assisting children in Ethiopia and other African countries.

AGRICULTURE AND CLIMATE CHANGE

Being part of the solution



Hans Herren: Our lifestyle is contributing to make life not only difficult for us, in our own generation, but for our children and, even worse, the people in developing countries who will bear the brunt of our excesses in contributing to climate change. Our belief in technological fixes has brought us into that situation. As we move forward, we should not rely just on these tech-fixes, which usually are short-term and address symptoms.

How to make agriculture green is necessary if we want to feed the world, not only

for the next 5-10 years or through this crisis, but to use our science, our technology, and, above all, the knowledge of the farmers to make sure that we have, all of us, a future. We have tools to do better. The question is, do we need any more training to use these tools? Can they be used just at random, or is there a system how to use these tools?

Helena Paul: Agriculture's impacts on climate change [include] many of the greenhouse-gas emissions – 14 percent from

agriculture, mainly nitrous oxide and methane; and 18 percent from land-use change, mainly deforestation for agriculture. The food system is hugely expensive in energy consumption. Also we don't know enough about emissions from the soil and particularly from peat destruction.

Many people know about the more extreme climate events, some of which we're already experiencing – unpredictable seasons; pest and disease patterns are bound to be a real challenge in the future; water

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ing at food-price] figures from IFPRI, they mention wheat, rice, and maize. How limited those figures are, just the crops that we all accept as being staples. There are many staple crops in other parts of the worlds about which I have not been able to find information as of yet. It's vital that we look into that.

[In] Central and West Africa, we have drought and desertification. Even the well-adapted farmer varieties may fail. Therefore, the land that's close to where farmers work, where biodiversity can continue to evolve as the climate becomes more intense, [is] going to be very, very important. Sub-Saharan Africa, we're all aware, is particularly vulnerable to climate change. With land-use change you get regional climate change. If you turn pastoral land over to crops in East Africa, you would get unpredictable and extreme climate change in some areas.

East and Southeast Asia and the Pacific – the worst worldwide impacts on rice and wheat will happen there, and decreased yields could threaten the food security of many. Scarcity of fresh water, especially in the large river basins in that region, is also predicted.

Latin American and the Caribbean – a similar story. One of the main things is the gradual replacement of tropical forest by savanna in eastern Amazonia. Significant biodiversity loss. People in Argentina are already suffering a lot from unpredictable climate change, due to the destruction of the Chaco, which happened very suddenly when soy reached the Chaco. Massive floods and droughts have been noticed.

[In] North America and Europe, [there's] the northward and upward movement of crops and biodiversity. Increasing photosynthesis and CO₂ fertilization mean pest problems. Ozone concentration has significant negative impacts on agriculture. And of course if you have increased CO₂, you also have nutrition declines in crops.

Take the Amazon as a carbon sink and biodiversity store and more – the recycling of rain through evapo-transpiration is extremely important. You have energy release that doesn't remain in the region but [has] effects around the world. And with teleconnection, it may increase droughts in North America. So now we begin to see climatic systems moving energy around the world and af-

fecting different areas that you would never think had a connection with each other.

Many of the proposed solutions are silver bullets. They are a desire to simplify the problem and, therefore, the solutions that might be available. One is conservation tillage. Different versions are promoted; chemical no-till, often involving genetically modified crops, is one of the main ones. It's really not clear how effective that is for carbon sequestration because the figures are variable. And I think there are some grave problems with it, certainly with the genetically modified version of it, in view of the herbicide-tolerant weed problem, which seems to be particularly clear in the United States and Argentina.

[Another] is biochar; this is charcoal produced by burning biomass in the absence of oxygen. The problem here is the big claims made on the basis of very limited research. It's very difficult to know how long it's going to stay in the soil in reality, how effective it is. Also, there's a problem of black carbon when airborne.

I've heard a lot over the last couple of years about how many millions of hectares there are of marginal land, and all we need to do is exploit it with, say, biofuel crops or advanced biofuel crops that can somehow improve the land. I just want to draw attention to the fact that marginal land is very often untitled land, which is used by local communities in a way that may be invisible to people from the outside looking in. It can also be a crucial hedge against emergencies, and can help stabilize, or keep stable, ecosystems.

Genetically engineered crops are being promised to help with climate issues to increase yields, extend the geographical and climate range of plants, tolerate salt, drought, and so forth. Some of these are being promised in a rather "This is the solution" manner rather than looking more carefully at other things that are possible. I was particularly interested to see [genetically engineered] enzymes for producing biofuels, the rhizobia for genetically engineered Roundup-ready crops. What is the impact of releasing genetically engineered rhizobia into the environment? I don't think we have any idea.

In South America, peasant agriculture still produces 41 percent of food for domestic consumption. Polycultures are incredibly



Reganold

important worldwide, and have huge, positive impacts. They have very high yields, especially if you don't take brute grain yield as your only measure, and can help to conserve, build, and retain soils. Diversified crop systems often have been measured to yield more than monoculture systems of the same crops. These people keep genetic diversity where it matters – in the fields – and they're watching it, collecting it, sifting it through, and swapping it around different regions in a way that has been going on for a very long time.

John Reganold: The atmospheric carbon pool roughly is about 750 billion metric tons. The biotic pool, mostly vegetation and everything else living on the surface, is about 610 billion tons. Soil carbon is 2,530 billion tons, more than twice what's in the atmosphere and all the vegetation on the



Armstrong-Gustafson

planet. The main part is in organic form, and that's what we can manipulate. So when we talk about soil-carbon sequestration, we're talking about adding to that organic component.

Conversion of natural areas to agricultural ecosystems has caused a big depletion in soil organic carbon over the years. And in some cases, like in temperate areas, the amount of carbon in the soil has been depleted by as much as 60 percent. In the tropical areas it's even been a little bit greater. We've lost in some places up to 75 percent, and there are a few places we've even lost more.

The historic loss of carbon is 55-78 gigatons, and most of that has happened in the last 150 years since the Industrial Revolution. The estimates are that we can get back 50-66 percent. It's difficult to get it all back because putting more carbon into an agricultural soil has a limit. Estimates of



Hansen

soil-carbon sequestration vary from about 0.4-1.2 gigatons of carbon per year. That's about how much we can bring in. And if we do that, we can probably hold that rate for 20-50 years. We could fill up the sink with that 50-60 percent of the historic loss. We could do it in maybe 40-50 years; it may take 70 years.

But we can sequester carbon in the soil, and that helps mitigate climate change. It is cost-effective, it is environmentally friendly. Strategies include adding high amounts of organic matter. There's no other way around it. It doesn't mean you can't use synthetic fertilizers, but you have to add carbon to the soil. It also means minimizing disturbance of the soil and conserving the soil and the water. Residue management is one [strategy]. [Another is] conservation tillage, where you leave 35 percent of the surface covered by residue; no-till is an extreme form of conservation tillage. Growing cover crops; managing nutrients efficiently; diverse crop rotations; 3-4-5-year rotations, not 1- or 2-year rotations; and, although controversial, biochar may play a role. Efficient irrigation is big – wasting water wastes carbon.

Growing energy crops on spare lands, marginal lands. We have about 40-50 million acres of marginal lands in the United States. It's possible that some of those could

grow deep-rooted grasses [to] benefit the soil. Improved grazing and agroforestry practices have potential. We need to start thinking of farms on the landscape as a mosaic – that we have not just monocultures, we have trees and diverse cropping systems on those fields.

Integrated farming systems blend the best of organic [farming] with the best of conventional. You build the soil, you add organic materials, and then you bring in any synthetic fertilizers you might need additionally to get those yields. You use biological pest controls, and if you need to use glyphosate or some other herbicide, you can do that, but it's a combination. Organic and biodynamic [systems] add a lot of organic matter.

Our grains are annuals – we plant; six months later, it dies, we harvest it. They want to perennialize wheats; for example, wheat has a wild relative, intermediate wheat grass, [whose] roots go down three meters. It's those roots that are building the soil. With perennial grains, we would have those roots, we could leave the plants in the ground for 3, 4, 5, 7 years – lower the energy, lower the inputs of fertilizer – and still have a yield. Perennial grains, in particular wheat, could be ready as early as 10 years. [This] addition of organic matter improves soil structure; it increases water storage, it increases nutrient storage, organism activity, fertility, productivity. It gives the soil better structure, makes it less erodible. It's fantastic.

Peg Armstrong-Gustafson: A Clean Development Mechanism is the official approval process for projects that create greenhouse-gas-emission reductions, and those reductions are certified by the United Nations and can be used for meeting Kyoto Protocol reductions. Looking at the Clean Development Mechanism, many of the methodologies had been in the area of energy – hydroelectric power plants, methodologies relating to landfills and methane reductions. So this little, kind of unusual, agricultural methodology really wasn't well received.

Basically, we are substituting urea by the use of inoculants for legumes. Now, many of you are going to say, "Well, everybody knows that legumes fix their own nitrogen. So therefore this is another claim that you're reducing carbon so you can make a lot of

money in the carbon market, and you're really not reducing any greenhouse gases." Yes, legumes do fix their own nitrogen by taking nitrogen out of the air. But according to the most current report from FAO on fertilizer statistics, urea is applied to many legumes. Places like China, it's 200 kilograms, on average; primarily on soybeans. Every ton of urea produced puts an equivalent ton of nitrous oxide into the air, which is 312 times more warming than carbon.

We believe that the world not acknowledging that agriculture has a role to play in the carbon and the climate-change situation [is] overlooking an opportunity. And we wanted to prove that, in production agriculture, we had a right to be at the table. There are some very important points that we can use in that process to accomplish the direct transfer of technology to the farmer.

We invest in the research [for] a technology – in this instance, the identification, purification, and formulation of the inoculant to be used specific to certain legumes. We then provide that technology to farmers [in] an emerging economy. And we must show, down to the farmer who received the technology, the additionality from the carbon ton being available.

In our project, the farmers we enroll will receive the inoculant free. They must not have used inoculants in the past. We, in turn, will be deduced back the carbon ton. They receive all the savings that come from not having to

buy fertilizer. They receive the savings that come from increased yield; 20-40 percent increased yields can occur because the plants prefer bacterial nitrogen fixation to an exogenous source. We then take that one-fifth or one-third of a ton; monetize those in the trading community, and then take that money and reinvest it back in research. So there's no currency exchange between the farmer and us. The currency [is] a carbon ton.

Technology directly to those small farmholders; improved productivity; less of an environmental footprint; and a way to monetize the carbon that has been identified and reinvest in research. We started out with the belief that agriculture should be at the table, that we have solutions to offer. And in that journey we found out that, in fact, it could create a new model for the redeployment of technology. How many other processes in agriculture might provide solutions in mitigating the impacts of climate change?

Anita Idel: Livestock is the fastest-growing sector in agriculture. FAO documented, in 2006, the detrimental impact livestock can have connected with huge amounts of industrialized kept animals, the consumption of resources, the consumption and pollution of water, the loss of diversity. [Along] with the loss of genetic resources in animal production, we are facing a decrease of fossil-energy resources, because the industrialized way of producing is extremely energy-costly. No question – we have to reduce the

“The world not acknowledging that agriculture has a role to play in the carbon and the climate-change situation [is] overlooking an opportunity. There are some very important points that we can use in that process to accomplish the direct transfer of technology to the farmer.”

- Peg Gustafson-Armstrong

“A lot of traditional, supposedly lower-yielding, crops actually have higher nutrient density. Sometimes the things that yield a little less have more nutrients in them when you look at them carefully compared to high-yielding varieties.”

- Michael Hansen



Idel

amount of meat and milk products.

No livestock species is under more pressure than cattle. For decades, oil production has been delivering huge amounts of greenhouse gases; amongst others, methane. Methane is 23 times more dangerous for the climate than carbon dioxide. But the methane that has come with the production of fossil fuel for almost one century has so far not been a topic in public discussion. Instead, cattle are perceived as climate killers. Feeding [cattle] intensively with human foodstuff – corn, soy and grain – leads to consuming huge amounts of soil, water, and energy and the release of greenhouse gases. Most of the data scientists are dealing with are based on industrialized livestock-keeping systems. That's the case for cattle when fed every day with corn, soy, and grain.

To protect the climate, cattle need good grasslands and good grasslands need cattle. And both need good grazing management; otherwise, we have erosion and degradation connected with the release of greenhouse gases. Soils are an important part of the car-

bon cycle, with some two to three times the terrestrial biosphere carbon. The key to sequestration in soils is good management. Grasslands cover some 70 percent of the global land area – the dry lands included. Because of the extensive nature of grasslands, they hold enormous potential to serve as one of the greatest terrestrial sinks to carbon.

Being ruminants, cattle can do what we can't. We would die being fed on grass and hay. Cattle don't only survive digesting grass and hay; they are producing milk and meat. But this phenomenal ability is sinking into oblivion since industrialized agriculture has been raising cattle on corn, soy, and grain. Fed with grass and hay, cattle are not in competition with human food needs; fed with corn, soy, and grain, they are.

The positive effect of grazing results from the effect it has on grass plant species, composition, and litter accumulation. An even distribution of urine and dung enhances the vigor of mature perennial grasses. This effect is decreased, and even stopped, by intensive fertilization, which promote short-

rooted annual grass species instead of deeply rooted perennial ones. The options for grassland-based milk and beef economy are to be explored for healthy animal products, healthy animals, the protection of the climate, resources, and the environment – and human health.

“Soils are an important part of the carbon cycle, with some two to three times the terrestrial biosphere carbon. Grasslands cover some 70 percent of the global land area. They hold enormous potential to serve as one of the greatest terrestrial sinks to carbon.”

- Anita Idel

Michael Hansen: There has been a huge increase in the United States toward buying or producing at the local level. We've seen, in the last 10 years, over a tenfold expansion the number of farmers' markets and CSAs. There's also been a huge increase in peri-urban agriculture, backyard gardens – tens of millions of those. People try to eat as locally as possible because they're concerned about the long distances foods are often transported. A head of broccoli and cauliflower is transported an average of 1,500 miles in the United States from field to market. There are folks that want to decrease that movement because that does use energy.

Grains are increasingly being fed to livestock throughout the world; in fact, one-third of grains are used for this purpose. That's where we see this movement toward grass-fed happening for sheep and cattle and other grazing animals. There's health reasons. Low-input, grass-fed cattle and other animals [have] significantly lower levels of saturated fatty acids, significantly higher levels of conjugated linoleic acids [CLAs], omega-3 fatty acids and various fat-soluble antioxidants, carotenoids, [and] alpha-tocopherols. And there's also a much better environmental impact from grass-fed systems.

Since a lot of consumers want some of these products, part of the only way, unless they know the farmer, is to rely on the labels. Labels like “organic” are very important. Organic has been growing about 20 percent a year for the last 10-15 years. But some labels are problematic. There have been fights over “grass-fed.” In the regulations for organic in the United States, there have been fights over “free-range,” because people want to buy animals that have access to pasture or have been free-range. But, for example, chickens can often be raised in coops, and if they just have access to the outdoors – sometimes that means, in a conventional facility, you can have a balcony on one level or a little area where they can walk outside – those are allowed to be labeled as “free-range.” That is highly misleading.

Compared to 10 or 20 years ago, there's much more interest in how food is raised, its environmental impact. So consumers want to make ethical buying decisions, but they need the information to be able to do that. And there are new labels coming up, such



Paul

as “food miles,” “our carbon footprint.” Both of them are highly problematic in their ways. But on a positive side, consumers are trying to move away from factory farming and toward more local, sustainable agriculture. And we are seeing this plethora of eco-labels happening on all sorts of food, and the market is responding to consumer demand there.

Herren: The consumer has to be more active; they also need to be educated. So is it [true] that quality foods are only for the rich? Grass-fed beef is quite a bit more expensive than feedlot beef, and so are some of the organic foods – with the labels it is more expensive. You are adding all kinds of cost here, which makes what people should be eating more expensive – which means it's being eaten less.

Hansen: There are two ways out. In the developed countries, what we see in New York City is farmers' markets in all parts of the city, including the very poor areas, and they're allowing the use of food stamps. And sometimes when you're buying from the

“There must be policy changes. Don't let's imagine that we can trade our way out of all these issues. Particularly with climate, it's being reduced to a trading arena. We must be courageous and take policy decisions.”

- Helena Paul

the free-range chickens that the middle class in Malaysia can't buy. Middle-class people can't afford these chickens, whereas the very poor indigenous people, that's what they're eating. So it doesn't always have to be the case that the poor have the access to the lowest-quality food.

There is work showing that a lot of traditional, supposedly lower-yielding, crops actually have higher nutrient density. There's actually an inverse correlation between yield

and nutrient density. Sometimes the things that yield a little less have more nutrients in them when you look at them carefully compared to just the high-yielding varieties.

Idel: The problem is price competition. Grass-fed beef, in small amounts, have to compete with other products produced by externalization of costs, in huge amounts. So there, I think, is the biggest problem.

Herren: Is there a way where one can rectify the imbalance of all this externalization of environmental costs? Can they be correct-

farmer and you cut out the middlemen, the prices can be cheaper.

Another ironic thing – in Malaysia, the average middle-class person has to pay a certain amount for chicken. Free-range chicken costs three to four times as much, and so they can't afford it. But when you go out to the indigenous communities, like the Orang Asli, it turns out there are chickens that are running around,

the free-range chickens that the middle class in Malaysia can't buy. Middle-class people can't afford these chickens, whereas the very poor indigenous people, that's what they're eating. So it doesn't always have to be the case that the poor have the access to the lowest-quality food.

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Herren: Is there a way where one can rectify the imbalance of all this externalization of environmental costs? Can they be correct-

ed with ecosystem services – so that farmers that do bad things get taxed in some ways and the good guys get some benefit? Would there be a way to sort out the issue of price?

Paul: It's possible. There's the whole business of how you monitor ecosystem services. But if you take some of it on trust, it might be possible. I worry if these things get used as fodder for offsets and just feed that market; but if it's a genuine attempt to reward good practice, then that's a way forward.

Reganold: The sink for carbon sequestration in the soil is finite. That 1 gigaton that we can sequester per year – and that's at the high end – basically equals about 5-15 percent of our fossil-fuel emissions. So it buys us some time. That's all it does. We still have to make other corrections. And maybe that buys us 50-60 years where we can continue to sequester the carbon in the soil. However, irrespective of this climate-change debate, we should be doing this. It's important for soil productivity and increases our yields, our water-holding capacity. The benefits are incredible even if there were not climate change.

Armstrong-Gustafson: We must be very vigilant to make sure that we really measure and monitor that we are reducing greenhouse gases and that [reductions] are permanent. So we need to look for the simplest, yet the most effective way to measure and monitor, but we have to have rigor to make sure we really do what we intend to do by reducing greenhouse gases.

Paul: The main thing is that there must be policy changes to enable all these things to happen. And don't let's imagine that we can trade our way out of all these issues. Because I do worry very much, particularly with the climate issue, that this is one of the things that's going on – that it's being reduced to a trading arena. We must be courageous and take policy decisions. ■



Clockwise from top left: Global Youth Institute participants take part in an Oxfam America Hunger Banquet designed to simulate the unequal distribution of food in the world; 2009 Borlaug-Ruan Intern Sarah Dillard tells World Food Prize Laureate Gebisa Ejeta about her experiences in Turkey; Youth Institute students discuss issues of global food insecurity.

The World Food Prize Global Youth Institute

The World Food Prize Global Youth Institute brings together select high-school students from across Iowa, the United States, and other countries each October to discuss critical food security issues with their peers, World Food Prize Laureates, and other experts in agriculture, health, and international development.

In 2009, 116 high-school students from 16 states, as well as Afghanistan, Kosovo, Mexico, Nigeria, Peru, Tanzania, and Turkmenistan, attended the Global Youth Institute and had the opportunity to interact with the more than 700 policymakers, business executives, and leading researchers from over 65 countries attending the Borlaug Dialogue.

By participating in the three-day Global Youth Institute, students become eligible to apply for a Borlaug-Ruan International Internship placement.

The Borlaug-Ruan International Internship program provides select high school juniors and seniors an all-expenses-paid, eight-week “hands-on” experience

working with world-renowned scientists and policymakers at leading agricultural research centers in Africa, Asia, Latin America, and the Middle East.

To date, 127 students have participated in this valuable experiential internship program. In traveling to Bangladesh, Brazil, China, Costa Rica, Egypt, Ethiopia, India, Indonesia, Kenya, Malaysia, Mexico, Peru, Philippines, Taiwan, Thailand, Trinidad, and Turkey, interns witness poverty and hunger first-hand, experience diverse cultures, and take part in ground-breaking research in the field.

The Global Youth Institute and Borlaug-Ruan International Internship programs provide a unique educational experience and life-changing opportunity to increase awareness of global food security issues among high-school students and inspire the next generation of world leaders in food, agriculture, and natural-resource disciplines.

For more information on the World Food Prize Global Youth Institute and Borlaug-Ruan International Internship Program, go to worldfoodprize.org/youth.



World Food Prize Global Youth Institute participants helped package 15,000 meals that were shipped to Tanzania.

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