INSIGHTS

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MEAT
HEALTH VS WEALTH

LAND RUSH
Deals in the Developing World

GRAIN EXPECTATIONS
The Tricky Business of Managing Reserves

INSIGHTS

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Meat is complicated. On the one hand, meat is rich in nutrients that are easily absorbed by the human body. Increased meat consumption presents one of the best opportunities to improve undernourished people's nutrition and health. On the other hand, consuming too much meat can be a nutritional and health calamity. Issues of production are equally fraught. Combining crop and livestock production on a modest scale? That's a boon for farmers and the environment. Building industrial-scale livestock "factories," which can greatly increase production? That can damage the environment, spread disease, and exacerbate climate change if the right policies and technologies are not in place. The challenge is creating a food system in which meat contributes to people's health, nutrition, and livelihoods, without jeopardizing the natural resource base on which we depend. The feature article in this issue of *Insights* looks at these concerns with a focus on poor people and poor countries.

I invite your comments on this article as well as on the many others describing IFPRI's current work.

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BUJA MATHOW, KENYA
In the midst of a drought, a pastoralist brings his camels to a water point recently rehabilitated by Oxfam.

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COVER PHOTO: Young pigs in a pen at the Grand Canal Pig Farm in Jiaxing, China; pork is by far the most popular meat eaten in China.
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Ready for Anything?

Research can help build resilience to climate change

The timing was perfect, unfortunately. This past June, a United Nations committee released a report called *Food Security and Climate Change*—just as the earth's land surface was experiencing its warmest average monthly temperature on record and a major drought was stunting much of the globally important US maize crop.

A New World

Clearly, it's a new world for farmers. "That's where resiliency comes in," says agricultural economist Gerald Nelson, a senior research fellow at IFPRI who led the team that prepared the report for the Food and Agriculture Organization's Committee on World Food Security.

Here's the idea behind resiliency, according to Nelson: "If the weather turns on a dime, you won't be totally wiped out." It's a simple concept. In practice, though, the process of building resilience into the global food production and distribution system, as the report recommends, is long and complicated. And although we know a great deal about how to create a more resilient food system, in many cases we are still waiting for answers to important questions.

Withstanding Weather Extremes

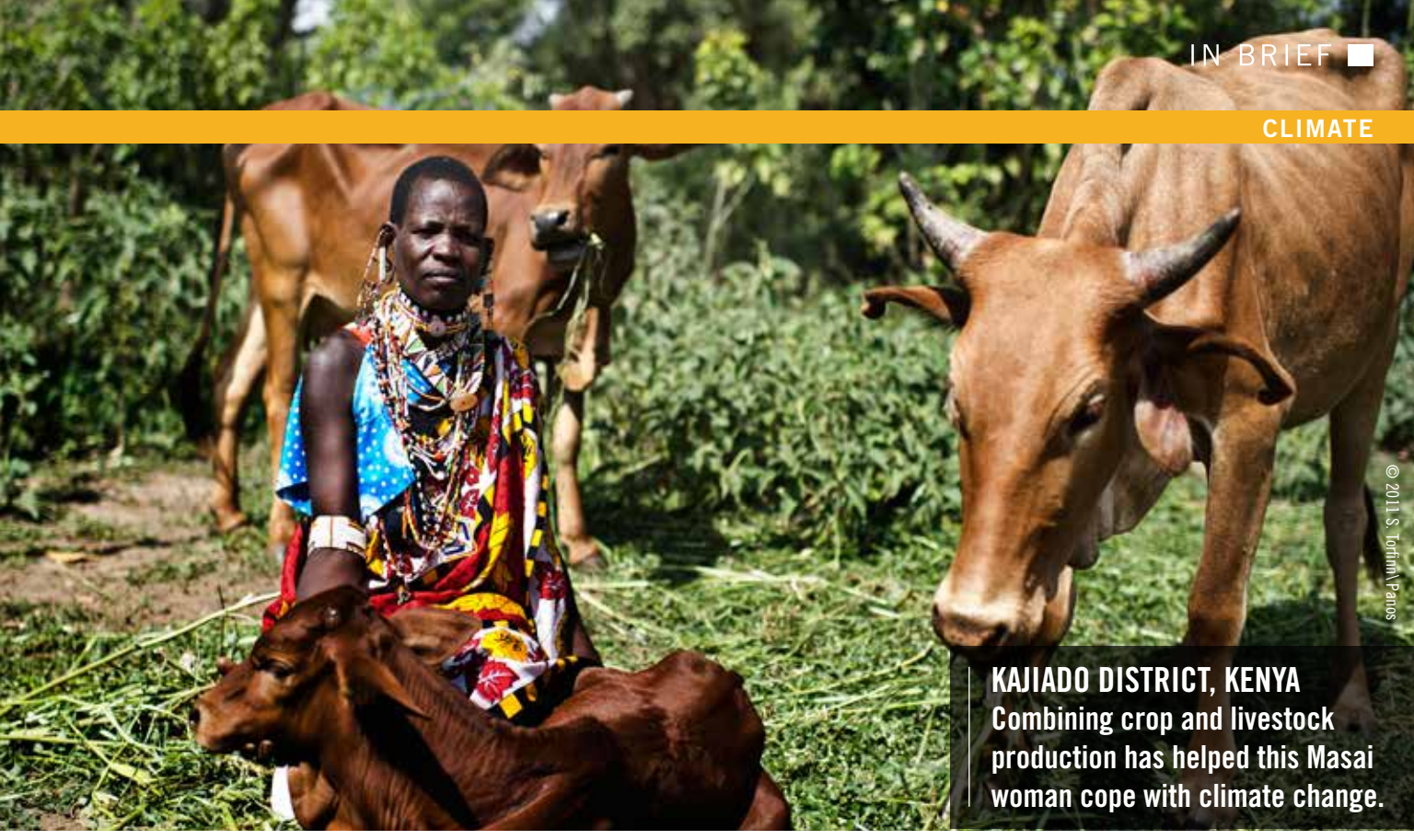
Any attempt to build a food system that can withstand climate change must deal with maize and the other staple grains—rice and wheat—that occupy most of the cropland, scientific attention, and plate space in rich and poor countries alike. These grains account for 50 percent of world calorie consumption, the report notes, and even more in developing regions.

How can the farmers who grow these staple grains become more resilient to weather extremes? Maize farmers could plant seed that's been genetically modified to resist heat, but Nelson says research on that front has a ways to go. Sorghum and millet do better in drier conditions, but yields are relatively low. How to raise them? Again, the answer is research.

Nelson and his colleagues also argue for devoting more research attention to fruits and vegetables, which have well-known health benefits but need to be made more adaptable to extreme weather. These crops make another contribution to resilience: they are far more profitable for small-scale farmers than staple grains. More income security allows farmers not only to eat better, but also to withstand the economic shocks that can follow floods, droughts, and other events in a changing climate.

—Peter Katel

SUNAMGANJ, BANGLADESH
Flooding and other weather extremes will become more likely as climate change advances.



KAJIADO DISTRICT, KENYA
Combining crop and livestock production has helped this Masai woman cope with climate change.

Kenyan Triple Play

Raising profits while coping with a changing climate

Farming for the planet can also be good for the bottom line. A new study has identified "triple wins"—specific farming practices accomplish three goals at once. They improve agricultural productivity, help adapt to climate change, and mitigate greenhouse gas emissions.

A team of researchers from IFPRI, the Kenya Agricultural Research Institute (KARI), and the International Livestock Research Institute (ILRI)—with support from the World Bank—collected data from more than 700 farm households in Kenya distributed across various agroecological zones and soil types. The team then used the data in simulations to show how various farming practices would affect crop yields, soil quality, and greenhouse gas emissions.

More Than Fertilizer

Several farm practices came up triple winners. One such practice, says Elizabeth Bryan, a senior research analyst with IFPRI and member of the research team, is soil nutrient management—which involves more than sprinkling some fertilizer on a plot of land. "This isn't just about using inorganic fertilizers," says Bryan, "but also manure, mulch, and crop residues."

By combining crop residues, fertilizer, mulch, and manure, farmers in most agroecological zones and on most soil types significantly boosted their net revenue from maize. They did face costs—they had to purchase fertilizer, and sometimes feed for livestock to replace maize stover—but in most cases these costs were outweighed by the increased profits from productivity gains. This combination of soil inputs also improves soil's fertility and water-holding capacity, making farms more resilient to climate change. And it helps soils store carbon, reducing future climate change.

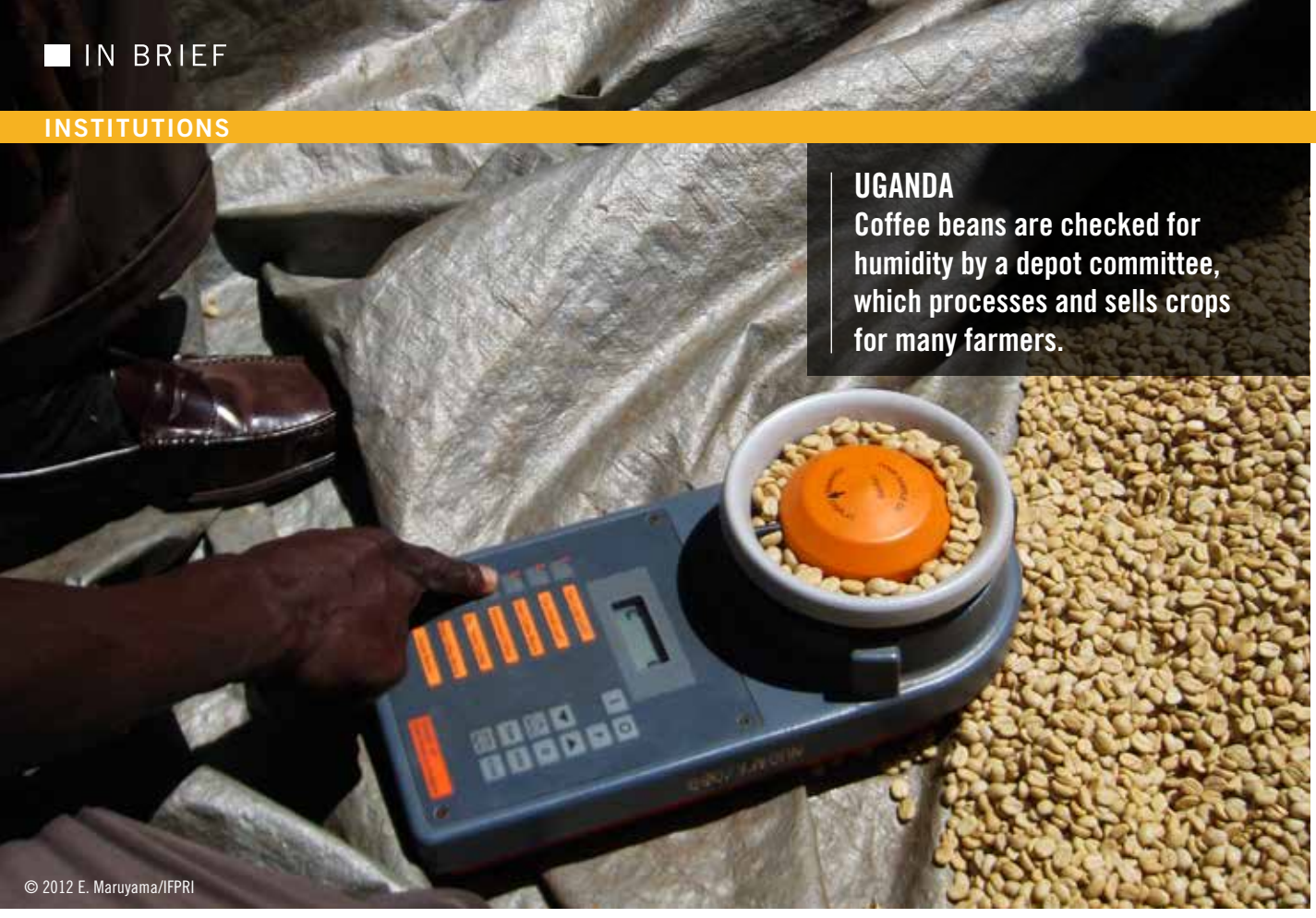
Another promising strategy is improved livestock feeding. Kenyan farmers feed their dairy cattle crop residues such as maize stover or graze them on rangelands or roadsides. If farmers replaced some of the stover in the cows' diets with locally available, higher-energy feeds like napier grass and *Desmodium*, they could both increase production of milk and cut emissions of methane, a potent greenhouse gas, for each liter of milk produced.

Promising Solutions

These practices have great potential to increase farmers' crop and livestock production in Kenya's various agroecological zones, says Barrack Okoba, principal research scientist at KARI and a member of the research team. "The findings should be of great interest to policymakers who want to reduce conflicts over resources and find ways to help the most vulnerable farming communities adapt to climate change," he says.

And given that resources are scarce everywhere, practices that address several problems at once can be especially cost-effective. As Bryan says, "Why not promote practices that provide multiple benefits for producers and for the environment?"

—Ian Johnson



UGANDA
Coffee beans are checked for humidity by a depot committee, which processes and sells crops for many farmers.

Where's the Money? How farmers' groups can work better for farmers

In villages across the world, smallholder farmers have banded together to cut their costs and raise their profits. These collectives of 10–30 producers give smallholder farmers many of the advantages of large-scale farmers by allowing them to share costs like fertilizer, processing, and transport and to jointly bargain with buyers for the highest price. So why do farmers often go around the groups and sell their crops individually—often for a lower price?

Too Much Uncertainty

IFPRI researchers Ruth V. Hill and Eduardo Maruyama recently completed a study of Ugandan coffee and maize farmers, showing that a bit of tweaking can make these collectives work better. The researchers identified two types of farmer groups in Uganda: village-level producer organizations and district-level depot committees. The producer organizations collect the crops at the village level. Then the depot committee gathers the output from several producer organizations, processes the crop, coordinates transportation, and finds a buyer.

Depot committees cannot give farmers any assurances about the final price. "They might have an idea of what price they could get," says Maruyama, "but they cannot easily predict the time it takes to bulk from all group members, find a buyer, and make the sale, and what the market price will be at the end of this process."

Farmers balk at the lengthiness and uncertainty of this selling process. "Though almost all of these coffee producers belong to a producer organization and are linked to a depot committee, they end up selling most of their product to traders," Maruyama says. These informal traders, who regularly pass through rural villages, offer cash on the spot. Although they often pay a lower price, the quick cash lets farmers pay off their immediate expenses.

Cash Up Front

To address farmers' need for cash, Hill and Maruyama tested a straightforward solution. Through the depot committees, they supplied producer organizations with funds they could use to pay farmers a percentage of the projected revenue upfront, in cash. The depot committees now had more output to sell and more time to find a buyer. When the coffee was sold to the highest bidder, the farmers would receive the balance.

This approach almost doubled the amount of output that farmers provided to the producer organizations, according to preliminary results of the study. Even better, participating farmers received significantly higher prices than those offered by itinerant spot traders. Some of the farmer groups participating in the study decided that this new approach was worth keeping: they are using the research results to secure bank loans and put the system in place for themselves.

– Susan Buzzelli Tonassi

UTTAR PRADESH, INDIA
One-third of the world's malnourished children live in India.

Indian Enigma

The disconnect between agriculture and nutrition

It shouldn't be like this. In India, where economic growth has boomed in recent years, more than 40 percent of children under age five suffer from malnutrition. Although India's Green Revolution averted outright famine decades ago, the country is now home to one-third of the world's undernourished children. Prime Minister Manmohan Singh has called child malnutrition in India a "national shame."

"It's a strange anomaly," says IFPRI Senior Research Fellow Stuart Gillespie. "Agriculture is not doing enough for nutrition in India." To investigate this "Indian enigma," IFPRI researchers undertook a project called Tackling the Agriculture-Nutrition Disconnect in India (TANDI) from 2010 to 2012.

How Are They Linked?

The researchers brought together nutritionists, economists, and experts from other disciplines to identify the major pathways between agriculture and nutrition. Among the key pathways they identified, some are straightforward and others less so. Clearly, for example, agriculture is the primary source of food and income in India, and agricultural policy and production patterns affect food prices.

More complicated links relate to the feminization of the farm labor force in India. As women make up an increasing share of agricultural labor, do they benefit from greater control over income, or do they find themselves overworked and unable to provide adequate care to their children? More evidence is needed to answer questions like this.

"We looked at knowledge gaps, the need for a cohesive national strategy to improve nutrition, and ways that policymakers and researchers from the agriculture, social, nutrition, and health sectors could work together more effectively," says Suneetha Kadiyala, an IFPRI research fellow.

Can't Agriculture Do More?

Given the economic importance of India's agricultural sector—it employs more than half the country's workforce—it could do more to reduce undernutrition.

The TANDI researchers suggest how. Existing agricultural programs, such as India's National Horticulture Mission and the Rashtriya Krishi Vikas Yojana, could take on nutrition-related goals. The country could improve access to nutrient-rich foods by reforming markets and developing nutrition-sensitive value chains, investing in research and development to boost production of pulses, and using safety net programs to distribute locally produced nutritious foods such as milk and eggs to vulnerable people. Women's cooperatives or producer groups could be a tool for bringing together agricultural, nutrition, and health interventions.

"To really improve nutrition sustainably in a country where poor people depend on agriculture for their livelihoods," says Gillespie, "agriculture should play a significant role."

—Robert Kiener

GENDER

TAIPEI, TAIWAN
Taiwan's oversupply of men in the 1960s contributed to economic growth.

The Upside of Too Many Men

Competition for mates spurs entrepreneurship

What happens when there are too many men for a given population of women? The men become entrepreneurs, work harder and longer, and save more. That's what two researchers revealed in a new IFPRI discussion paper, *The Economic Consequences of Excess Men*, on the economic impact of too many marriage-eligible men in 1960s Taiwan.

A Skewed Sex Ratio

In the late 1940s, defeat by the Chinese Communist Party drove 1 million Chinese Nationalist Party members—most of whom were young, unmarried men—to Taiwan. Their arrival skewed the sex ratio in the country of 6 million; by 1950, in the 20–24 age bracket, there were 150 men for every 100 women.

But these bachelors didn't throw the country's marriage dynamics off track—at least not immediately. The head of the Chinese Nationalist Party, Chiang Kai-shek, imposed a marriage ban so that his men would be ready to attack in the event of war with the Communists. He didn't lift the ban until 1959. That's when competition for mates kicked in.

Get Rich Quick

Examining datasets from the time period (and borrowing a page from Darwin), Simon Chang of China's Central University of Finance and Economics and Xiaobo Zhang of IFPRI discovered the economic consequences of this imbalanced sex ratio. They found that men in 1960s Taiwan engaged in economic behavior to make themselves more attractive to potential mates. In short, they tried to get wealthy—fast.

More specifically, to attract the too-small pool of women, these unattached men became enthusiastic entrepreneurs—the fastest way to accumulate wealth. If they didn't start new businesses, they worked longer hours to earn more and move up the career ladder.

According to Chang and Zhang, this uptick in entrepreneurship and hard work, sparked by competition for mates, ultimately contributed to Taiwan's 20th-century economic miracle.

Zhang points out, however, that the goal of the study isn't to promote government policies to alter a country's sex ratios.

"The aim is to show that some aspects of human economic behavior might have a biological root," he says, "and that fusing a biological perspective with economic analysis can shed new insight on human economic behaviors and outcomes."

—Susan Buzzelli Tonassi

On the Road

Capacity strengthening from Addis Ababa to Ethiopia's regional capitals

In a vast, rapidly developing country like Ethiopia, data—about everything from literacy rates to the number of flour mills—is essential to policymaking. For the country's Central Statistical Agency (CSA) and its regional branches, translating mountains of raw data into useful information to support policymaking in a timely manner is a major task.

In 2009, IFPRI's Emily Schmidt, Mekamu Kedir, Hailu Shiferaw, and Helina Tilahun started to work with CSA's statisticians on how to use geographic information systems (GIS), a cutting-edge database and mapmaking technology, to organize, manage, and visualize their huge databases. The CSA staff ultimately produced a series of atlases that provide in-depth information about the country.

ETHIOPIA
IFPRI'S Emily Schmidt helps train Tsegaye Birkneh (center) of the University of Hawassa and Abebe Mengesha (left) of the Bureau of Finance and Economic Development in GIS technology.

Filling Data Gaps

But the CSA-IFPRI team didn't stop there. They offered to take their training on the road to the country's nine regional statistical offices in 2011. "The regional offices are aware of gaps in their datasets," Helina says. "They are really concerned about increasing the capacity of their personnel so they can collect and report important data and indicators."

At first, many were skeptical. "We weren't sure it could be done," says Schmidt. Given that technical courses outside of Addis Ababa are less common, it was unclear if resources needed for hands-on GIS training—such as computers and electricity—were available in more remote areas.

The CSA-IFPRI team designed a pilot training program in the Southern Nations Nationalities and Peoples Region (SNNPR) about four hours' drive from Addis Ababa. When they arrived in Hawassa, the regional capital, they were pleased with what they found. The regional officials and university professors invited to attend the training were eager and willing to expand their skills. The local university hosting the training was equipped with brand new computers, ready to be unpacked from their boxes.

Crisscrossing Ethiopia

After the hardware was assembled, the first training went so well that Schmidt and her team spent the year crisscrossing the country to train staff in the eight other regional offices—including the remote Afar Region. The technical skills spilled over beyond the training courses: many of the professors who took part in the training used IFPRI's materials to design university courses on computer-generated mapmaking and spatial database management. The CSA in Addis Ababa went on to analyze and publish its own atlas, and the regional branches of the CSA are now working together to update and maintain indicators on key infrastructure throughout the country.

The CSA-IFPRI training program has now traveled beyond Ethiopia's borders to Malawi and Mozambique. Schmidt and Mekamu worked with staff in the two countries' agriculture ministries to map and analyze spatial patterns of key agricultural indicators.

"This GIS technology can help institutions analyze and visualize their data in a more user-friendly manner," says Schmidt. "For example, by mapping literacy rates or health indicators throughout the country, researchers and policymakers can identify exactly where they should conduct more in-depth research or expand programs and interventions."

—Susan Buzzelli Tonassi

CGIAR

Talking with Frank Rijsberman

Frank Rijsberman joined the CGIAR Consortium as CEO in May 2012. Previously, he was director of water, sanitation, and hygiene strategy at the Bill & Melinda Gates Foundation. From 2000 to 2007 Rijsberman served as director general of the International Water Management Institute (IWMI), one of the 15 CGIAR Consortium research centers. We asked him how he sees the role of the CGIAR Consortium in global food security.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CGIAR provides scientific and technical tools for agriculture in developing countries, but it's often difficult for farmers to take advantage of these tools unless the right policies are in place. What role do you see for policy in CGIAR?

Policy is clearly very important. We have CGIAR Research Programs that are focused on commodity improvement, but we also have programs that are focused on systems. And in those, we expect to get much closer to the delivery of innovations to the farmer. Developing partnerships will be critical—partnerships with national systems, agricultural research systems, but also in many cases with seed companies that can deliver improved varieties into the hands of farmers.

But of course once farmers have crops, they need to sell them. Farmers' access to markets is critical. Countries have to help farmers by setting the right enabling environment—getting farmers access to inputs and investing in infrastructure that farmers need to have decent access to markets. IFPRI has, of course, been the key center that has provided policy advice to CGIAR, but also to countries.

After a long period of relative neglect, agriculture finally has the world's attention. How can CGIAR take advantage of this moment?

Let's first recognize that the reason agriculture almost fell off the agenda for several decades is, in a way, a response to our own success. The Green Revolution led to a period of relatively abundant food and low food prices. People started to believe that the problem was solved, and investments in agriculture became dangerously low. So the food price spikes of 2008–2011 were a very poignant reminder that food security is in fact the biggest challenge that humanity faces in the next few decades.

Now, food security is back on the agenda. There is new vigor, new investment in CGIAR. And that's necessary if we want to double food crops in many areas—70 percent by 2050. We need a science- and technology-driven innovation engine for change in agriculture, in addition to other investments in policy, in infrastructure, and so on. CGIAR and its many partners—through a tightly focused portfolio—can help bring the engine of innovation back up to speed.

CGIAR is taking advantage of this, and the world is responding. The last few years have seen a large increase in support for agriculture, and for CGIAR. This year, our budget is expected to go up to about US$850–900 million, up from just US$400 million a few years ago. That means an opportunity for CGIAR centers and their partners to play their role. Of course it's also their responsibility—they have to deliver.

Your experience gives you a good perspective on the role of private philanthropy in global food security. What are your thoughts on this role?

CGIAR has a history of close engagement with private philanthropic foundations. Many of the CGIAR centers were started by the Ford and Rockefeller Foundations, so we certainly know what an important role such foundations can play. More recently, the Bill & Melinda Gates Foundation and others are playing a large role in CGIAR. These foundations are a bit more nimble than governments, so they can play a leading role in coming up with new ideas and then following through. They can prod CGIAR to change its ways. There are also quite a few foundations that we are not yet dealing with—in the environmental arena, for instance—and I believe we can build new partnerships with other players.

You've mentioned partnerships often—why are they so important?

We in CGIAR say that we're good at developing partnerships, but there is a big gap between how good we think we are at partnerships and how good our partners say we are. Frankly I hear a lot of partners say that we stink at partnerships. That's not good news. So we need to bridge this gap. This requires being very specific about what our partnerships mean: whether they are partners that work with us at the cutting edge of research, whether they are managing research jointly with us, whether we are building their capacity, or whether they are the kind of partners that we consult to make sure that we are delivering research against the demands of society. In a way we are a service industry, so the clients are king. It's the partners' perception that counts.

—Susan Buzzelli Tonassi

Who's Farming? Farmers' gender makes a difference

Many agricultural development programs are launched with a faulty assumption: that the farmer is a man. But millions of small-scale farms in developing countries are actually farmed by women. When they get this wrong, interventions risk failure. In many cases, governments and aid agencies simply don't know who's farming where.

Better Data for Better Outcomes

To help fill in the blanks, IFPRI and the International Water Management Institute (IWMI) created the Gender Mapper, a crowd-sourcing effort to collect and share data on where men and women are farming in Africa south of the Sahara. By providing a more informed picture of farmers on the ground, the data should help development practitioners direct interventions to the right person.

"Any type of agricultural research should include information about gender. It's key to introducing interventions that are gender equitable and that accurately target the right farmer or decisionmaker," says Ruth Meinzen-Dick, an IFPRI senior research fellow. "And it leads to better outcomes."

At the Gender Mapper website (gender.mappr.info/explore.php), extension workers, researchers, or anyone who is familiar with a particular locale can specify who is doing most of the farming work, who makes the most decisions, and who controls the products or income in villages and communities throughout West, East, and Southern Africa. The Gender Mapper team will enrich the site by including gender data from agricultural censuses and other national datasets. "The more data the Mapper can house," says Meinzen-Dick, "the more useful it will be for current and future researchers and policymakers."

Gender Matters

There are many ways that interventions directed to women might differ from those directed to men. One difference can be as simple as the design of a farming tool. Most are constructed to fit a male physique. Providing a woman farmer with a smaller, lighter-weight hoe will generate better results. Training materials may also differ. In many areas women farmers receive less formal education than men, so designing agricultural training materials at lower literacy levels gives women farmers the opportunity to learn and apply new skills.

Governments and aid donors are increasingly aware of women's roles in agriculture, says Meinzen-Dick, but only when they take gender into account in their programs will they have their intended impact.

—Andrea Pedolsky

MADAGASCAR
A woman prepares her field for a peanut crop.

grain expectations

Grain reserves can be key in muting food price shocks and stabilizing food markets, but managing them is complicated. How can policymakers use grain reserves to insure against risk—without busting their budgets?

Sara Gustafson

At its core, the idea of a strategic grain reserve is simple. Droughts, floods, failed harvests, global market volatility, and other factors can reduce food production and push food prices higher than poor people in some countries can afford. When a country's domestic markets are poorly connected and when transportation and communications infrastructure is weak—as in many developing countries—it is particularly hard for a country to absorb price shocks. The result can be acute food insecurity or, in extreme cases, famine. By maintaining an emergency stock of grain and making it available during times of crisis, a government can help protect national food security.

The idea may be simple, but the execution is not, says IFPRI Senior Research Fellow Shahidur Rashid, who studies grain reserves in Africa and Asia. Under the right conditions, strategic grain reserves can prevent widespread hunger and even save lives. However, if not managed properly, grain reserves can "become expensive, breed corruption, and be dictated by special interests," says Rashid.

Costly and Complicated

Holding strategic grain reserves is not cheap. According to Rashid, the cost of holding and transporting a sufficient stock can range from US$35 to US$40 a ton. These costs alone can put pressure on a developing country's budget. In India, the net cost of emergency stocks increased tenfold—from US$160 million to US$1.6 billion—between 1992 and 2002. Similarly, Pakistan's bills for its grain reserves fluctuated between US$49 million and US$245 million from 1990 to 2003.

Beyond the cost, managing a grain reserve is a complex logistical operation that requires multiple public organizations to work together effectively—"always very difficult," says Rashid. Creating and managing a reserve involves purchasing the grain, building and maintaining storage facilities, transporting the grain to and from storage facilities, rotating the stock, and deciding when and at what price to release the grain.

Determining the optimal stock level is one of the greatest challenges. If a reserve is too large, not only will the government's subsidy bills go up, but also the release of the stock will depress market prices and destroy private traders' incentives to participate in the market. If it is too small, the government will fail to address emergencies and stabilize prices. The political risks of such a situation can be high: witness the food riots in several developing countries during the 2007–08 global food price hike.

Without strict and transparent management, strategic grain reserves, particularly large ones, may open the door to corruption. In a 2007 study of grain-marketing parastatal companies, Rashid and his coauthors found that Indian politicians and

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farmers in regions that produced surpluses of wheat and rice exerted significant influence in determining government support prices between 1996 and 2001. During this period, government support prices for wheat rose 25 percent faster than wholesale prices, and support prices for rice rose 10 percent faster. By lobbying for these high, guaranteed prices, politicians in surplus regions could bring in higher tax revenues, ensure happy constituents (especially if they were large-scale farmers), and improve their chances of re-election.

Stocking Up Right

Despite the complexity of operating grain reserves, most countries have such stockpiles. One country that has largely managed to sidestep the pitfalls in the past couple of decades, says Rashid, is Ethiopia. Created in the 1980s, the country's Emergency Food Security Reserve Administration (EFSRA) has a transparent institutional design that minimizes the risk of mismanagement and corruption. All withdrawals from the reserve are subject to strict rules. Well-established, reputable relief agencies, such as the World Food Programme, can borrow grain from the reserve's inventory and must replace the grain within an agreed-upon timeframe. During large-scale humanitarian crises and times of widespread shortage, other food security programs, such as government social safety nets and price stabilization programs, can withdraw from the reserve.

Two other important features have contributed to the success of Ethiopia's grain reserve, according to Rashid's 2011 discussion paper, *Strategic Grain Reserves in Ethiopia*. First, Ethiopia has kept stock levels low. The guiding principle has been to keep a stock large enough to feed the country's vulnerable population for three to four months. This policy has kept Ethiopia's subsidy bills from mushrooming, ensured that private traders are not pushed out of the market, and maintained the quality of the stored grain (lower overall quantity eases the task of rotating old grain out of the stock).

Second, the strategic grain reserve is closely coordinated with the country's safety net and emergency assistance program, which provides food transfers and cash transfers to vulnerable people. In recent years, as food prices have risen, recipients have begun to prefer food over cash transfers. As a consequence, withdrawals from the grain reserve have jumped. EFSRA's close ties with the safety net program not only help poor people cope with sudden shocks, but also keep maintenance costs low and ensure that stocks are rotated regularly. And there is potential for more ties of this kind: Rashid points out that linking the reserve to school feeding programs would provide another important safety net.

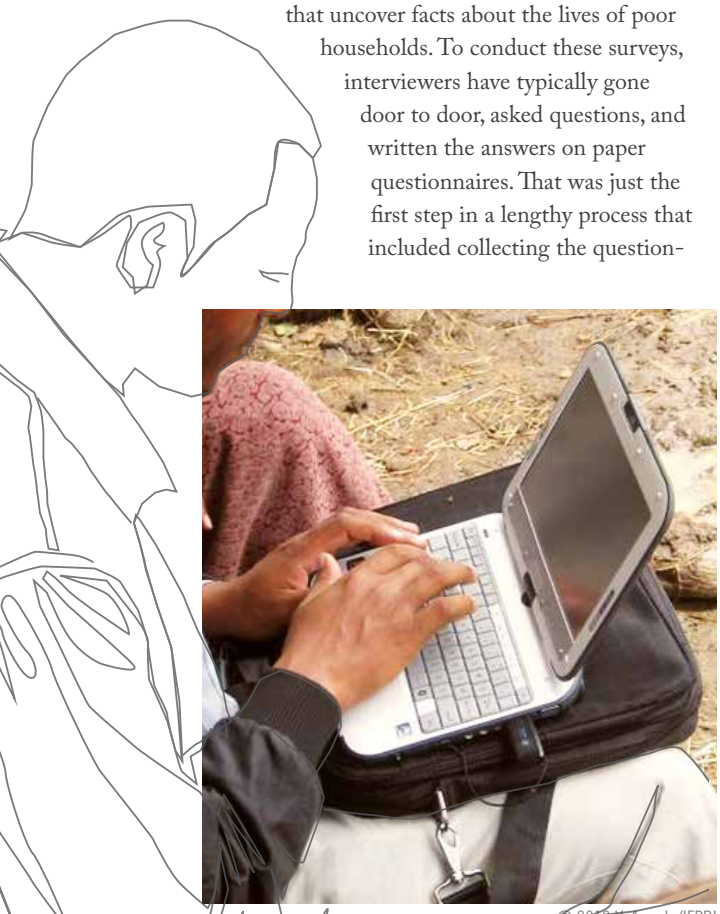
SWITCHED ON SURVEYS

Household surveys, once a mostly low-tech activity, are becoming increasingly digital—with benefits for the quality and timeliness of IFPRI's research results.

Marcia MacNeil

The digital divide can work in unexpected ways. When developing-country farmers want instant information on, for example, prices or weather, they increasingly turn to 21st-century technologies such as smartphones. When food policy researchers want to find out what crops farmers grow, what children eat, or how much rural households spend, they have typically turned to much older technologies—pen and paper. Now researchers at IFPRI and elsewhere are joining a revolution in data collection: computer-assisted personal interviewing (CAPI).

Much of IFPRI's research depends on surveys that uncover facts about the lives of poor households. To conduct these surveys, interviewers have typically gone door to door, asked questions, and written the answers on paper questionnaires. That was just the first step in a lengthy process that included collecting the questionnaires, hiring people to input the answers in computers, "cleaning" the data by removing or correcting inaccurate information, and analyzing it using statistics software programs. Months later, researchers had their results.



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That era is coming to an end. With CAPI, a survey designer writes and programs a questionnaire and loads it onto handheld computer devices such as tablets or netbooks, and the interviewers type respondents' answers directly into the devices. CAPI eliminates a major step in the data collection process: staff are no longer needed to enter responses from each paper questionnaire into a computer—the information is already there. That saves time and money. Plus, survey managers can see the data immediately and make needed changes to questionnaires while the survey is ongoing.

The result, says Esteban Quiñones, an IFPRI senior research analyst, is "better-quality data collected—and available—much faster."

Better Input, Better Output

So why didn't data collectors adopt computer technology long ago? It is only recently, says Quiñones, that computers have become cheap, rugged, and mobile enough for this use and that suitable software has become available. And, he says, "many researchers are risk averse and aren't willing to try something like this until the kinks have been worked out and the benefits have been demonstrated."

And the benefits are many. Electronic questionnaires can capture more complex and detailed information, allowing for multiple versions of the questionnaire and customized questions that evolve as the interview proceeds. Survey designers can include photos and videos in the questionnaire to capture richer information. Supervisors can track the location of interviewers.

A number of IFPRI researchers—including Quiñones and fellow researchers Jef Leroy, Deanna Olney, and Susan Rich-

ter, led by Poverty, Health, and Nutrition Division Director Marie Ruel—are working on a CAPI survey measuring child malnutrition in Guatemala. To find out how well nutrition interventions are promoting child growth and development, the project involves interviewing pregnant women and then following up when their children are 1, 4, 6, 9, 12, 18, and 24 months old.

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Richter, who is leading the field management of the survey, says these frequent follow-ups would have been nearly impossible without CAPI. "Infants and young children change quickly, and follow-up surveys that allow us to track their development at frequent intervals will help us better understand which nutrition interventions are making a difference to their health and growth," she explains. "Conducting the frequent follow-up surveys on paper would have made including information from previous surveys difficult." Now, says Richter, one week after a survey is done she can have information analyzed and ready to be included in the follow-up survey. This increases the quality of the data collected and cuts down on interviewer errors.

Senior Research Assistant Mike Murphy agrees. He is surveying the impact of a US Feed the Future initiative on rural incomes, agricultural productivity, and nutrition in Honduras. "With a paper survey, the interviewer would have to be on top of a lot of details," he notes. "With CAPI, we can completely automate it."

No Panacea

Of course, problems do occur with CAPI. Murphy had to deliver extra battery packs to the field when the interviewers' tablet batteries ran out. Richter's software program crashed because it didn't recognize accent marks. She lost data, and her team had to implement the first few weeks of the survey on paper before figuring out how to correct the problem.

But problems can—and do—occur with the old-fashioned paper-and-pen interviews as well. Stories abound about lost or accidentally destroyed paper surveys—whether dropped in a fire or eaten by goats—as well as sloppy data entry, unreliable interviewers, and any number of other human errors.

CAPI does take time, effort, and money at the outset. Survey managers must choose and tailor the software program to run the survey, buy computer equipment for the survey staff, and train the interviewers. Sometimes a fix that is minor on paper is time-consuming and expensive with CAPI. And if a hard drive fails, there is no paper version to turn to.

Still, the technology, equipment, and user know-how are improving quickly, making CAPI increasingly easy to use. And ultimately, timelier data that more accurately reflect realities on the ground could pave the way to better policies.

LAND rush

Ian Johnson

Large-scale land deals are increasingly common in some developing regions. What happens to the poor people who are already there? And what happens to women?

The food price crises of recent years have unleashed a global land rush. Between 2000 and 2010, foreign investors negotiated to lease or acquire at least 71 million hectares of land—an area slightly larger than France—in other countries. Nearly half of this total is in Africa. A recent International Land Coalition (ILC) report, *Land Rights and the Rush for Land*, to which IFPRI contributed, says the number and size of recent deals point to the "unprecedented scale of the land rush over the past decade."

For some people, these land deals represent attractive opportunities to inject much-needed capital into the agricultural sector of poor developing countries. For others, the deals are a disturbing trend in which investors from wealthy countries snap up land in poor countries for their own benefit, displacing and threatening the livelihoods of smallholder farmers and other local people who use the land.

"What happens to the local people is the litmus test," says Ruth Meinzen-Dick, a senior research fellow at IFPRI. Many of the hundreds of land deals have not been examined in sufficient detail—sometimes because investors deny access to researchers—but current empirical evidence suggests that skepticism about the deals is warranted. "In the first IFPRI policy brief on this topic in 2009 ["*Land Grabbing" by Foreign Investors in Developing Countries*], we laid out the potential benefits and risks, but there are now so many cases of how these deals have harmed local people that, if anyone wants to say these can be beneficial, the burden of proof is on them to show that they are, in fact, beneficial," says Meinzen-Dick.

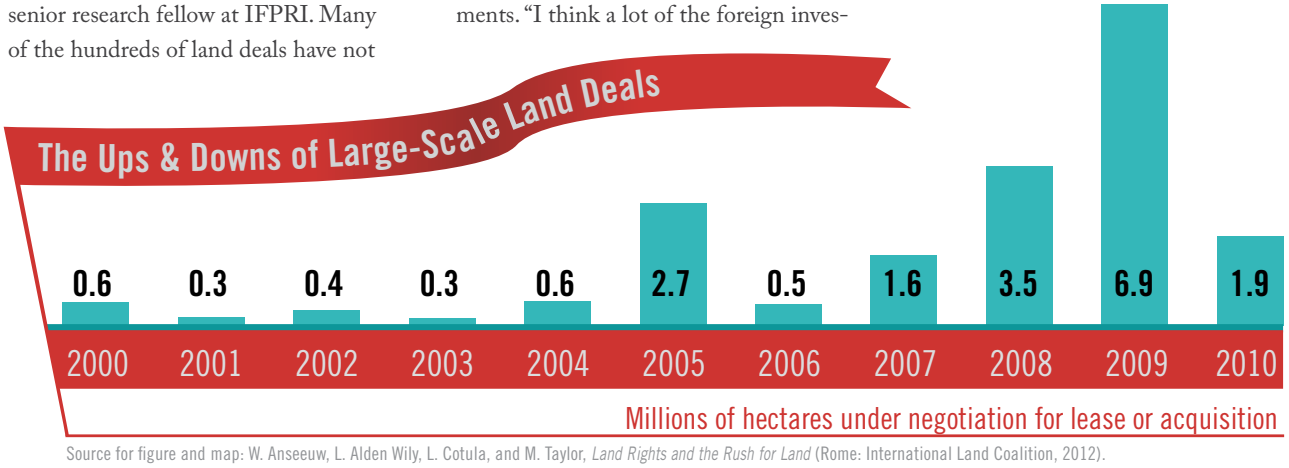
Whose Land?

In rural areas, land may appear to be available for acquisition when actually it serves as the foundation for local livelihoods. Land that looks unused may be where locals graze their animals, gather firewood, or collect medicinal plants. Smallholder farmers often do not hold formal title to their land, but may have effectively owned it for years under customary or indigenous tenure arrangements. "I think a lot of the foreign investors are going in without full awareness of the costs and the complexities," says Meinzen-Dick.

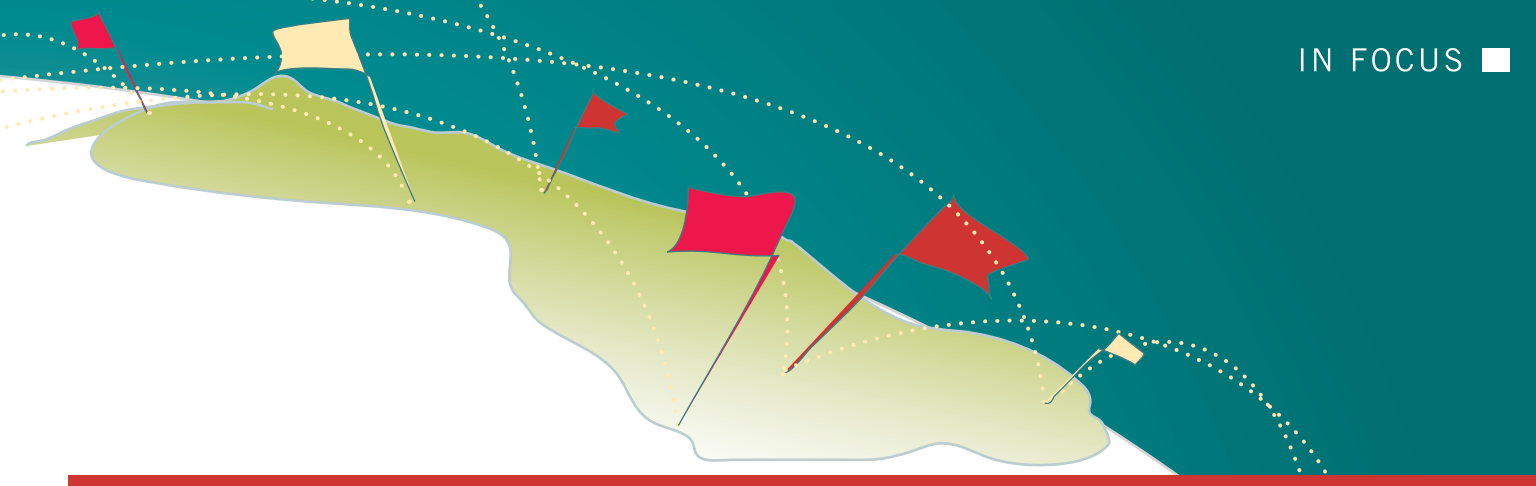
When legal systems requiring formal land titles are introduced into societies where customary tenure arrangements have been used for generations, the results don't automatically protect the rights of existing landowners, particularly the rural poor—instead, they often serve the interests of governments and elites. As the recent ILC report notes, laws may fail to recognize land owned under customary tenure as real property and deem this land untitled, allowing governments to claim it as state property. Even those holding formal titles may have their land expropriated by the government in order to serve the "public interest," such as the need for more foreign investment in rural areas.

Women Left Out

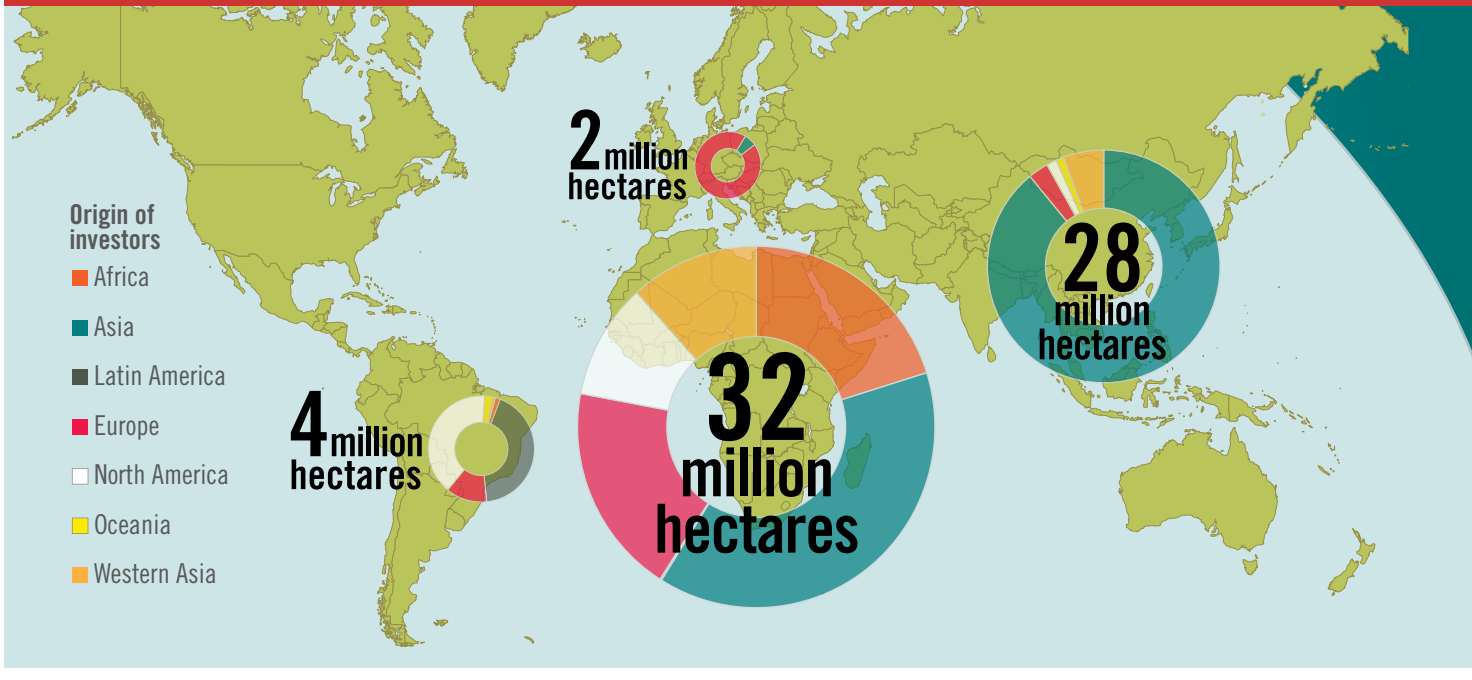
Land deals often have different impacts on men and women. Poul Wisborg of the Norwegian University of Life Sciences,



Source for figure and map: W. Anseeuw, L. Alden Wily, L. Cotula, and M. Taylor, *Land Rights and the Rush for Land* (Rome: International Land Coalition, 2012).



Who's Investing Where



and recently a visiting researcher at IFPRI, conducted an in-depth case study of a Norwegian company that leased land in Ghana to grow jatropha for biofuel production. The company asserted that its project would benefit women specifically, but Wisborg's study found otherwise.

The first consultations with the local community consisted predominantly of meetings with local chiefs. "Women had less power than men to influence the early negotiations—after all, women are excluded from the chiefly institutions in Ghana," says Wisborg. The project did create some jobs, but men tended to get the full-time, permanent positions while women were hired mostly as temporary day labor.

In addition, says Wisborg, "when land uses were affected by the project, these disproportionately hurt women." For example, the Norwegian company cut down many trees during land clearing, but it pledged to protect certain species, such as shea nut trees, which are highly valued by West African women for use in food, medicines, and cosmetics. Once the other trees were gone, however, local charcoal producers started harvesting the shea nut trees, and many were lost.

The power imbalance between governments and investors on one side and poor, rural communities on the other is a crucial factor. In a recent journal article, "The Gender Implications of Large-Scale Land Deals," IFPRI researchers Julia Behrman, Ruth Meinzen-Dick, and Agnes Quisumbing point out that developing-country governments alone often cannot be relied on to enforce rules in favor of local people.

According to Michael Taylor, program manager for Global Policy and Africa at the ILC, "The negative outcomes result from the context in which these investments take place: poor governance, poor democracy, poor regulations and policies on land use, and a poor view of small farmers compared with large-scale commercial farming operations."

Protecting citizens' rights in land deals often requires help from the media, farmers' organizations, domestic and international nongovernmental organizations, and community organizations. These groups can put pressure on governments and help communities advocate for their rights.

REAL-WORLD IDEALIST

Ousmane Badiane has been instrumental in ensuring that Africans take the lead in setting the agenda for agricultural renewal in Africa.

DON LIPPINCOTT

It is commonplace to talk about the economic rise of Africa, but Ousmane Badiane first noticed that things were changing there more than 15 years ago. In the mid-1990s, after decades of economic stagnation, Africa's economic growth indicators were starting to turn upward, says Badiane. "Anybody looking at the statistics could see that Africa was turning the page," he says. Now based in Dakar, Senegal, and Washington, DC, Badiane directs IFPRI's Africa Program, working in support of African policies for economic and agricultural growth at a time when the continent faces substantial opportunities—and a few risks.

Badiane has been a major player in Africa's shift toward agricultural renewal. In 2003, African heads of state met in Maputo, Mozambique, and pledged to pour more resources into agriculture after decades of neglect. Through the Comprehensive Africa Agriculture Development Programme (CAADP), African leaders committed to spending 10 percent of their national budgets on agriculture and boosting agricultural growth to 6 percent a year.

The following year IFPRI agreed to provide technical support for implementing CAADP and brought in Badiane, who had been working at the World Bank, to oversee its support for the program. "Having seen the strong drive toward Africans taking ownership of their development agenda, I knew there was huge potential to effect real change in Africa," he says.

But he also saw challenges. This new program would need to determine how to implement the spending changes, coordinate actions among different countries, and make sure that Africans—not the international development community—took the lead in setting and carrying out CAADP plans. Initial plans, says Badiane, were "very top down, as if Africa had a central government that could decide to irrigate so many hectares and build so many kilometers of roads." In addition, Badiane noticed that CAADP plans were silent about agricultural policies and strategy.

African Ownership

Badiane was key to the effort to keep Africans in charge. "I and the NEPAD leadership that I was advising were very hard-headed in making sure Africans set the agenda," says Badiane. Country representatives used CAADP documents as guidelines rather than marching orders. And Badiane helped introduce a mechanism for reviewing policies and sharing knowledge between countries.

In some countries, CAADP has generated impressive results in the past eight years. Eight countries have exceeded the 10 percent target for budgetary spending on agriculture, and nine have surpassed 6 percent agricultural growth. Many other countries have made significant progress toward these goals.

Badiane has also helped build communities of African professionals to rigorously examine thorny policy issues. One such community is ReSAKSS—the Regional Strategic Analysis and Knowledge Support System—a network of analysts who provide insights and evidence on CAADP's progress. He was also behind the creation of the African Growth and Development Policy Modeling Consortium (AGRODEP), a group of Africans who use economic modeling to address important policy questions. The objective, says Badiane, was to create "a critical mass of world-class modelers in Africa."

Split-Second Decision

Badiane's work on CAADP for IFPRI represented his second stint at the Institute, after a roundabout journey. He grew up in the Groundnut Basin of Senegal in a family whose farmland was gradually surrounded by urban sprawl: "We turned slowly into Sunday farmers."

His career in agricultural economics began with a split-second decision. After finishing high school, he was offered a scholarship to attend university in Europe—and had to decide instantly which country he wanted to study in. "I used to watch German soccer," says Badiane. "They had a good team called Borussia Mönchengladbach, and I knew almost all the players by name." "Germany," he wrote on his form. As he was leaving the building after making his choice, however, he had second thoughts. He raced back and told the teacher, "I think I made a mistake. I know nothing about Germany, not even the language." The man just laughed.

Germany it was. Badiane ultimately earned his PhD in agricultural economics from the University of Kiel. In 1989 he joined IFPRI to study regional markets in West Africa before going to work at the World Bank in 1998 as a senior economist and later lead specialist on food and agriculture policy for Africa.

Catching Up to Do

Badiane's most recent research has looked at how public spending on health and education can make poor rural farmers more productive so that their investments in inputs such as land, seeds, and fertilizer generate higher payoffs. A forthcoming article by Badiane and two coauthors in the journal *Agricultural Economics* provides evidence on this issue for Uganda.

On Africa's future prospects, Badiane is a hard-nosed realist who sees new risks for the continent, including growing economic inequality in the context of faster economic growth in many countries. Traditional family structures—which served as social safety nets in the past—are breaking down, and governments have little experience with programs to meet the demand for social protection for the most vulnerable people. "If African countries don't find programs to deal with social demand in the next 10 years, Africa may face a serious issue of social instability," he says.

But Badiane is also an idealist. As he received an honorary doctorate from South Africa's University of KwaZulu Natal in 2010, he called on the graduating students to work not just for individual gain, but for the common good. "We are now witnessing the longest period of sustained, geographically shared economic growth in the continent's history," he said. "The result has been an improvement in the lives of millions of Africans. The lost decades prior to the recovery mean that we have a lot of catching up to do, however—and we cannot do it fast enough."

Design: © 2012 C. Hallowell/IFPRI. Source: Worldwatch Institute, "Farm Animal Populations Continue to Grow," http://vitalsigns.worldwatch.org/vs-trend/farm-animal-populations-continue-grow, based on data from the Food and Agriculture Organization of the United Nations.

THE MEAT OF THE ISSUE

Large-scale meat production and consumption are harming human health and the environment in wealthy countries. But in poor countries, raising livestock boosts wealth and nutrition. How much meat is enough?

Jennifer Weeks

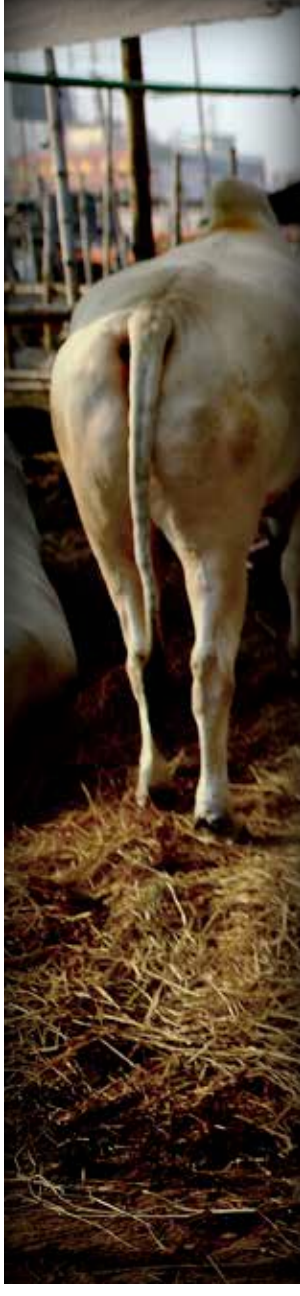
With demand for meat in developing countries increasing at a staggering rate, the world's population of farm animals nearly tripled between 1970 and 2010.

Late last April the US Department of Agriculture made a surprising prediction. India—where cows are venerated and legally protected from slaughter, and vegetarianism dates back thousands of years—was about to become the world's leading beef exporter. (Actually, India exports water buffalo, which is leaner than conventional beef and sells at a lower price.) The USDA projected that in 2012 India would ship 1.5 million tons of water buffalo meat, prepared following halal guidelines, to price-conscious consumers in the Middle East, North Africa, and South Asia.

India's new prominence as a beef exporter demonstrates the popularity of meat and the globalization of the meat industry. Worldwide meat production has tripled over the past 50 years. Demand is growing sharply today, driven by income growth and urbanization in developing countries. In 2010 the world supported more than 26 billion farm animals, up from 9 billion in 1970.

Meat production and consumption raise complex questions about health, wealth, and sustainability. Moderate amounts of meat, eggs, and milk can be valuable elements of a healthy diet, but today consumers in wealthy countries are compromising their health by eating too many animal products, while many people in poor countries are undersupplied. Raising livestock is an essential income strategy in many developing regions, but small-scale livestock operations are inefficient and provide low yields for their owners. Concentrated production methods increase yields per animal but also magnify harmful impacts, including transmission of zoonotic diseases. And moving animals off pastureland to raise them on grain intensifies food–feed trade-offs.

The impacts of raising and eating meat cut across multiple fields, including nutrition, public health, agriculture, and environmental regulation, and no single strategy is universally relevant. "It's important to differentiate between types of livestock, production methods, and people's needs depending on their positions," says IFPRI's John McDermott, director of the CGIAR Research Program on Agriculture for Nutrition and Health.



Too Much or Too Little?

Food choices vary from country to country, but as incomes rise, people almost invariably eat more meat, along with milk and eggs. North Americans and Europeans consume more than 83 kilograms of meat per person yearly, compared with 58 kilograms in Latin America, 28 kilograms in East Asia and the Pacific, and 11 kilograms in Africa south of the Sahara. Initially, eating more meat may improve the quality of poor people's diets and their nutritional status. But humans don't seem to have a good sense of how much is enough. "When people can afford more access to meat, they often start consuming amounts that exceed their needs," says Marie Ruel, director of IFPRI's Poverty, Health, and Nutrition Division.

> "Meat is especially important for young children, who go through a critical phase of accelerated physical growth and brain development in the first two years of life."
> – Marie Ruel, IFPRI

Demand growth for animal products is gradually flattening in wealthy countries because of factors including market saturation, slowing income growth, and health concerns. Diets heavy in meat and dairy products have been linked to excess intake of calories and saturated fats and to increased risk of a variety of cancers, heart diseases, and stroke. Organizations like the World Cancer Research Fund and the American Heart Association routinely encourage people to reduce consumption of red meat and high-fat dairy products, but change has been slow. In the United States, after several decades of health warnings, red meat still represents the largest share of meat consumed.

Over the next several decades, virtually all growth in demand for meat will come from the developing world. According to IFPRI modeling, annual per capita meat consumption will jump to 77 kilograms in Latin America, 52 kilograms in Asia and the Pacific, and 24 kilograms in Africa south of the Sahara by 2050. That shift could improve nutrition in developing countries, where for most consumers the problem is a shortage of meat, not a surplus.

"Meat is especially important for young children, who go through a critical phase of accelerated physical growth and brain development in the first two years of life, and for women, who have high iron requirements during their reproductive years" says Ruel. "Meat and dairy products contain micronutrients, including iron, zinc, calcium, and vitamins A and B12, in forms that are readily available and taken up by the body more easily than when they are obtained from plant sources."

Even when animal products are available, it can be difficult to get them into poor people's diets. Milk and eggs are steady income sources for farmers, so they may sell these products instead of consuming them. For nonproducers, their high cost limits access. And cultural beliefs may intervene: in Ghana, for example, a longstanding belief holds that children who are fed eggs will become thieves.

Infrastructure can also pose challenges. Recent work by IFPRI's Ethiopia Strategy Support Program shows that consumption of meat and dairy products is extremely low in Ethiopia, even by African standards, although the country has one of the largest livestock populations in the world. Options for boosting meat consumption in rural areas (which currently averages 4 kilograms per person annually) include creating more markets and storage systems for meat in rural areas.

Changing the Menu

Reallocating global meat supply and consumption on a large scale would improve nutrition in poor countries, but not as much as proponents of low meat consumption might expect, according to Mark Rosegrant, director of IFPRI's Environment and Production Technology Division. Using IFPRI's IMPACT model, Rose-

Gabtoli, the biggest cattle market in Dhaka, Bangladesh.

grant and IFPRI Senior Research Fellow Siwa Msangi have calculated that cutting per capita meat consumption in high-income countries to 50 percent below baseline levels by 2030 would reduce world meat prices by 12–22 percent and boost meat consumption in developing countries by more than 7 percent. Malnutrition among children under age five across the developing world would be reduced by about 700,000 cases.

If meat consumption were also cut in half in China and Brazil, where demand is rising sharply, the effect would more than double. Meat prices would be reduced from 33 to 59 percent, and meat consumption would increase in Africa and India by nearly 50 percent. More than 2 million cases of child malnutrition would be avoided—an encouraging number, but only a dent in the more than 130 million cases of child malnutrition that are projected. Rosegrant points out that livestock products and maize would become more affordable in the global market, but consumers in developing countries would still rely mainly on rice and wheat, whose prices would be little changed. "People sometimes assume that every grain not fed to animals goes to humans," says Rosegrant. "It doesn't work that way." So the biggest beneficiaries of a cut in meat consumption in rich countries may be the people who live in those countries, who could see health and environmental benefits.

A serious decline in consumption will not happen without vigorous intervention, given the strong preference people show for eating more meat as incomes rise. "The slowdown in demand

What about Going Meat-Free?

Many people around the world choose to eat little or no meat for ethical, religious, or other reasons. In India, for example, 31 percent of the country's more than 1 billion people eat no meat. Will natural resource constraints force more people to go nearly or entirely meat-free? A recent analysis from the Stockholm International Water Institute projects that by 2050, reduced world water supplies will only be able to support a global diet in which just 5 percent of calories come from animal-based foods.

Limited access to animal-based food, however, is not always ideal for human health. IFPRI's Marie Ruel points out that many vegetarians are unable to meet their nutritional needs without taking vitamin and mineral supplements or consuming fortified foods. According to Ruel, "In populations that don't have access to specially formulated fortified foods or products, infants and young children should be consuming animal source foods daily."

in the developed world is very gradual, and it takes a large reduction to make a real difference," Rosegrant says. "You could start taxing meat, but that would be difficult politically. Stronger moral suasion in schools and social settings might work, as it has on tobacco use. But people may not see smoking and eating meat as equivalent in terms of health risk."

Ruel agrees that education is the main strategy, but says governments should act sooner. "Ideally we would prevent people from falling into the trap [of overconsuming meat] in the first place, but countries have typically waited until disaster arrives," she says. That can happen quickly. In China's cities, meat and dairy products jumped from 11 percent of the average daily diet by weight in 1982 to 25 percent in 2002, and edible oil consumption nearly doubled. Prevalence of diabetes, hypertension, heart disease, and stroke all jumped sharply in the same period.

> "...people may not see smoking and eating meat as equivalent in terms of health risk."
>
> – Mark Rosegrant, IFPRI

Raising Livestock Sustainably

Increasing access to meat for the world's poor is part of a larger development challenge: making livestock production in developing countries more efficient (to increase yields per animal), while mitigating negative impacts on human health and the environment.

Hundreds of millions of farmers in low- and middle-income countries own livestock. In areas with favorable rainfall, smallholders may survive on farms as small as a few hectares, raising animals and crops together. According to the International Livestock Research Institute, most of the staple foods consumed in developing countries come from these small mixed farms. Animal manure is a significant source of nutrients for crops, and large animals such as oxen can be used for transportation and plowing.

Farmers in semi-arid zones of Africa and Asia raise animals and drought-tolerant crops on tracts of 4 to 8 hectares. As droughts become more severe in these regions, livestock will become increasingly important to farmers' survival, since animals can eat failed crop residues and generate income in years that are too dry to raise crops. Pastoral livestock producers in the Horn of Africa earn an estimated US$1 billion yearly exporting cattle, sheep, goats, and camels to African and Gulf State markets.

Responding to rising global demand for meat, some developing countries have adopted Western-style intensive livestock production systems. This approach is epitomized by concentrated animal feeding operations (CAFOs), in which hundreds or thousands of animals are reared in small spaces, fed on

grain instead of being allowed to forage. Hog and poultry CAFOs are especially prevalent in China, Thailand, and Vietnam, where they have been built to meet booming Asian demand for meat, poultry, and eggs. Worldwide, the Food and Agriculture Organization of the United Nations estimated in 2006 that 80 percent of growth in the livestock industry came from industrial production systems.

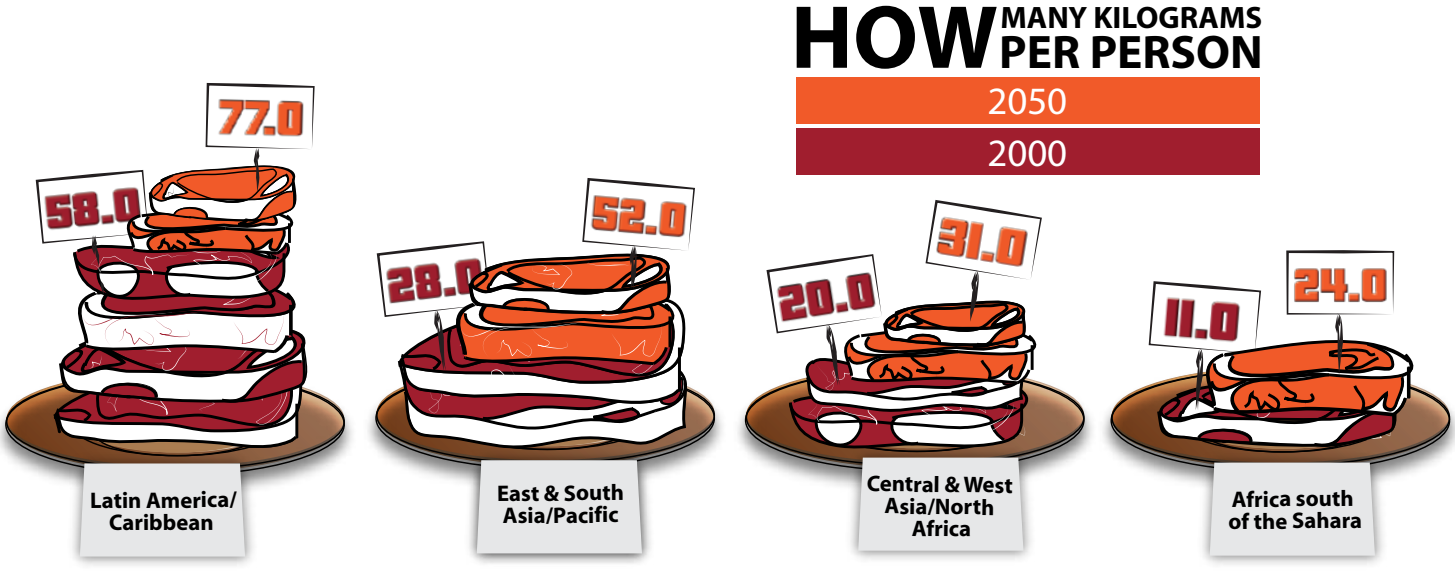
CAFOs are widely recognized as air and water pollution sources because they concentrate animal waste and emissions. McDermott points out another impact: disease transmission. "As you put more animals in contact with each other, you increase the risk of transmitting infectious diseases that can move from animals to humans," he says. Historically, influenza viruses have arisen from parts of Asia where poultry, pigs, and people live together in densely packed communities. In recent years, diseases such as Nipah virus infections in pigs and people have emerged with livestock intensification in Southeast Asia.

"Managing the intensification of livestock farming so we don't get outbreaks of known or emerging diseases is a big concern," McDermott observes. In his view the greatest risk is posed by small- to medium-sized farms where workers have less experience than at large operations in isolating and quarantining sick animals.

"We need to create incentives for people to get trained and certified in procedures that address big risks," he says. "That's a much more positive outcome than regulating from the top down."

Expanding livestock production in developing countries is an important way to help poor people increase their incomes and improve their food security and nutrition. "There are a lot of things we can do that will make operations more sustainable," says Rosegrant. Priorities include developing higher-quality and more digestible animal feeds; improving waste-management techniques; and breeding animals that can tolerate heat and drought, so they can be raised in marginal areas. Building more roads and processing systems in rural areas will connect farmers to markets. And since livestock production is a significant source of greenhouse gas emissions, carbon credits or similar measures will be required at some point to give producers incentive to reduce those impacts.

"All of the demand growth for meat today is in low- and middle-income countries, so we need to keep their perspectives in mind as we work to modernize the livestock sector," says McDermott. "Smallholder systems in Asia and Africa will be with us for at least several more generations. We can't expect poor countries not to have livestock, so we need pro-poor solutions to these challenges."

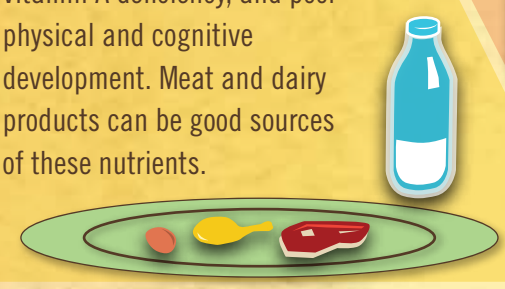


Design: © 2012 C. Hallowell/IFPRI. Source: IFPRI IMPACT projections.

MEAT: The Good, the Bad & the Co

Too little

A diet too low in iron, zinc, calcium, and vitamins A and B12 can lead to anemia, vitamin A deficiency, and poor physical and cognitive development. Meat and dairy products can be good sources of these nutrients.



Too much

A diet overly rich in saturated fats and calories from meat, whole milk, and eggs is associated with increased risk of obesity, coronary heart disease, and some forms of cancer.

KILOGRAMS OF MEAT CONSUMED ANNUALLY PER PERSON (2007)

BIODIVERSITY THREAT

In the Amazon, 70% of once-forested land is now pasture for livestock. Such dramatic deforestation is a threat to the rich biodiversity of the world's plant and animal species.

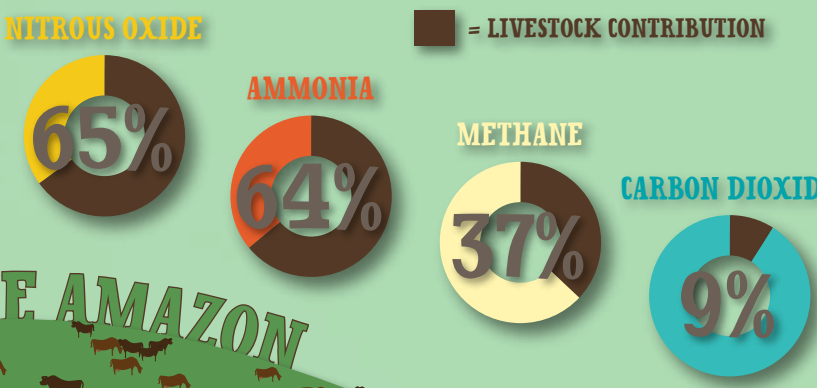
70%

THE AMAZON

CLIMATE RISK

Livestock production contributes to various greenhouse-gas emissions.

= LIVESTOCK CONTRIBUTION



Design: J. Vivalo/IFPRI. Kilograms of meat consumed: Food and Agriculture Organization of the United Nations and *The Economist*, http://www.scribd.com/doc/91840616/Meat-Consumption-Per-Person and http://www.economist.com *Issues and Options* (Rome: Food and Agriculture Organization of the United Nations, 2006). **Resource hog:** M. Rosegrant, N. Leach, and R. V. Gerpacio, "Alternative Futures for World Cereal and Meat Consumption," *Proceedings of the N* the Future's Changing Diets: Implications for Agriculture Markets, Nutrition, and Policy, 2020 Conference Paper 3 (Washington, DC: International Food Policy Research Institute, 2011). **A path out of poverty?:** J. Otte et al., *Livestock Sector D*

mplicated

IF RICHER COUNTRIES CUT BACK ON MEAT, WOULD IT IMPROVE CHILD NUTRITION IN POORER COUNTRIES?

In 2030, there will be an estimated 133.9 million malnourished children. Freeing up the resources that support meat consumption in rich countries, Brazil, and China would help reduce that number—but only by 2.3 million. While eating less meat will improve the health and environment of rich countries, it's not the solution to ending child malnutrition.

year 2030

133.9 Million malnourished children

133.1 Million if rich countries cut meat consumption in half

131.6 Million if rich countries, Brazil, and China cut meat consumption in half

A PATH OUT OF POVERTY?

752 Million
POOR LIVESTOCK KEEPERS WORLDWIDE

For many poor people, livestock is a source of food, income, and savings. With urbanization and incomes on the rise, and demand for meat in poor countries growing, boosting domestic livestock production could help increase rural incomes, create more jobs in rural areas, and stimulate rural economies.

RESOURCE HOG

It takes a lot of grain and water to produce a kilogram of meat.

To produce:	It takes:
1 kg of poultry meat	2 kg of grain
1 kg of pig meat	4 kg of grain
1 kg of beef	7 kg of grain

1 kg of poultry meat	3,500 liters of water
1 kg of pig meat	6,000 liters of water
1 kg of beef	43,000 liters of water

ARE YOU GOING TO DRINK THAT?

When livestock waste is produced in large, concentrated amounts, nitrogen and phosphorus can seep into water supplies, threatening human health.

/blogs/graphicdetail/2012/04/daily-chart-17. **Biodiversity threat, Climate Risk, and Are you going to drink that?:** H. Steinfeld, P. Gerber, T. Wassenaar, V. Castel, M. Rosales, and C. de Haan, *Livestock's Long Shadow: Environmental utrition Society* 58 (1999): 219–234; D. Pimentel et al., "Water Resources: Agricultural and Environmental Issues," *BioScience* 54, no. 10 (2004): 909–918. **If richer countries cut back on meat:** S. Msangi and M. Rosegrant, *Feeding Development for Poverty Reduction: An Economic and Policy Perspective* (Rome: Food and Agriculture Organization of the United Nations, 2012).

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