

# RETHINKING FOOD SECURITY FOR THE 21ST CENTURY

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*Hunger is a silent killer; the holocaust of our time.*<sup>1</sup>

Discussions of “security,” both homeland and global, have dominated the news since 11 September 2001. This topic has been linked to terrorism, weapons of mass destruction, regime change, failed states, religion, the world petroleum industry, and a host of other domestic and international issues. Word searches of leading newspapers reveal a familiar pattern. Between 11 September 2001 and 11 May 2005, for example, “security” appeared in 20,723 stories within the New York Times. Much more surprising, however, is the astonishingly few times—only twenty-four—that “food security” was mentioned.<sup>2</sup> This phenomenon was also evident in the *American Journal of Agricultural Economics (AJAE)*. Using even an inclusive definition of subject matter, only about 3% of the articles published in the *AJAE* during the past five years have dealt directly with the problems of food security.<sup>3</sup>

In this article, we examine why concerns about food security have diminished, at least

relative to earlier periods. We argue that it should be in the interest of agricultural economists to return this concept to the G-8 agenda in light of the clear linkages between agricultural development, economic growth, food security, and national security in poor countries. We are particularly concerned that issues of hunger not get lost in a world food economy that is now driven predominantly by animal product demand, super markets, and subsidies, and that is increasingly constrained by natural resources and their (mis)management.

Three themes are thus intertwined in the exposition that follows: We first examine the characteristics of food security to show its potential connections to other components of global security, civil conflict, and democratization. The focus then shifts to several institutional failures—or at least altered directions—that help explain why food security remains such a difficult problem. Finally, we argue that improved germplasm involving transgenesis, genomics, and a focus on crops produced and consumed by those who are food insecure, are among the best food-security investments for institutions such as the World Bank, the U.S. Agency for International Development (USAID), and the Consultative Group for International Agricultural Research (CGIAR). Our overall purpose is to make everyone slightly uncomfortable.

## Food Security and National Security

Popular and academic discourses are awash in discussions of wars and uprisings around the world. Data from numerous sources are in general agreement on the magnitude of deaths that have occurred during the past two decades as a result of interstate and civil wars. The latter greatly exceed the former, and in many years there were as many as thirty-five ongoing civil uprisings (Fearon and Laitin, Holloway and Stedman, COW). During the 1990s, approximately 1 million lives were lost annually

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Fellows Address.

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The authors have benefited from the substantial assistance of Marshall Burke. They are also grateful for comments from Coit Blacker, Dana Dalrymple, Cary Fowler, Lowell Hardin, Robert Herdt, Donald Kennedy, Ellen McCullough, Ronald Mitchell, Michael Morris, G. Edward Schuh, C. Peter Timmer, and Laurian Unnevehr. Author also retains responsibility for any errors.

Fellows Address presented at the AAEA annual meeting (Providence, Rhode Island, July 2005). Invited addresses are not subjected to the journal's standard refereeing process.

<sup>1</sup> Per Pinststrup-Andersen and David Beckmann in Jindrova and de Graff.

<sup>2</sup> A search done on “hunger” revealed a story count of 928. Many of those entries dealt with hunger strikes.

<sup>3</sup> The origin of the term “food security” is debated, as is its precise meaning (Maxwell). We use the standard FAO/World Bank definition, i.e., access by all people at all times to enough food for an active, healthy life (World Bank 1986). In this essay, we also use the word “hunger” as being loosely interchangeable with the term “food insecurity.”

in wars of all sorts (UN 2004). Two thirds of those killed were civilians, with women and children more than proportionately represented (Smith). Although the AK-47 remained the weapon of choice, it is likely that more people were killed by machetes than bombs. About 60% of all deaths were in Africa, and more than 25% were in Asia (Smith). More recently—between May 2003 and May 2005—1,850 members of the coalition forces were killed in Iraq, as were at least ten times that many Iraqi soldiers and civilians (ICCC).

Grim as the conventional security data are, they pale in comparison to the food security situation. The Food and Agriculture Organization (FAO 2004b) estimates that 5 million *children* die from hunger-related causes per year. The World Health Organization and other sources put the total number of hunger-related deaths at about 8 million annually (Hunger Project). This estimate has large error bars, which arise from both definitional and empirical causes. What, for example, is the “cause” of death of a starving person, caught in a civil war, who ends up in a refugee camp, and then dies of measles? Even if the official estimates are off by 20%, several things are clear. Food insecurity deaths outnumber war deaths by a factor of at least 5 to 1. As in the case of war casualties, food-related deaths are concentrated among civilians, especially women and children. About 20,000 persons per day die globally as a result of food insecurity, the majority in Africa and Asia. That number is approximately seven times the number killed in the 9/11 attacks—and it happens *every* day. If forty fully loaded 747s were to crash on a daily basis, would the world take notice? And if the answer is yes, why is media coverage and concern so much more ambivalent with respect to the comparable havoc caused by hunger?

### Links between Hunger Abroad and Homeland Security

A partial answer—at least the answer given historically—to the foregoing rhetorical question is that hunger abroad does not create a “threat” to U.S. society. It is only a small step from this “diagnosis” to the proposition that international food security does not rank high in terms of U.S. strategic interests. U.S. budget data seem to bear out this line of thought. When polled, Americans believe that 24% of the U.S. Federal budget is spent on foreign aid (PIPA). The actual percentage for all of-

ficial aid in 2004 was less than 1% (OECD). As compared with the more than \$100 billion that the United States now spends annually on antiterrorism and regime change in the Middle East, USAID currently disperses globally about \$2.2 billion on food and agriculture (USAID 2005b; Center for Strategic and Budget Assessments). About 80% of even this relatively small sum is in the form of food aid, more of which is linked to surplus disposal than to the development of food systems in poor countries (figures 1 and 2).

There is certainly no necessary intellectual need for linking hunger and terror. Worrying about one eighth of humankind’s poorest people has its own moral logic. However, the political economy for *solving* hunger problems may be affected importantly by the nature of this connection. A systematic reexamination of the “security” dimensions of food security thus seems warranted. Specifically, does the reduction of poverty and hunger through agricultural development and rural economic growth promote democratization and reduce violent conflict? *If* those relationships were clear-cut, it would no doubt be possible to alter food and agriculture’s placement on international agendas.<sup>4</sup>

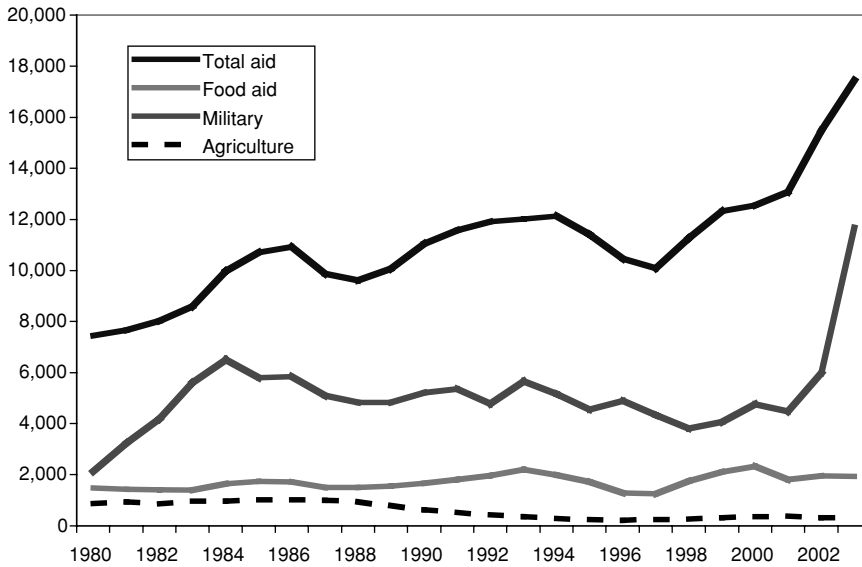
Three separate, but interrelated, questions seem relevant:<sup>5</sup>

1. Do poverty and food insecurity cause international terrorism?
2. Do poverty and food insecurity cause civil conflict?
3. Does reducing poverty and food insecurity lead to increased democratization and improved national security?

Evidence on this daunting array of issues is mostly preliminary and frequently inconclusive. For example, the argument that hunger and poverty directly breed terrorism finds little support in the literature. Data on terrorist organizations generally show that their members are more likely to come from educated middle-class families than from poverty-stricken

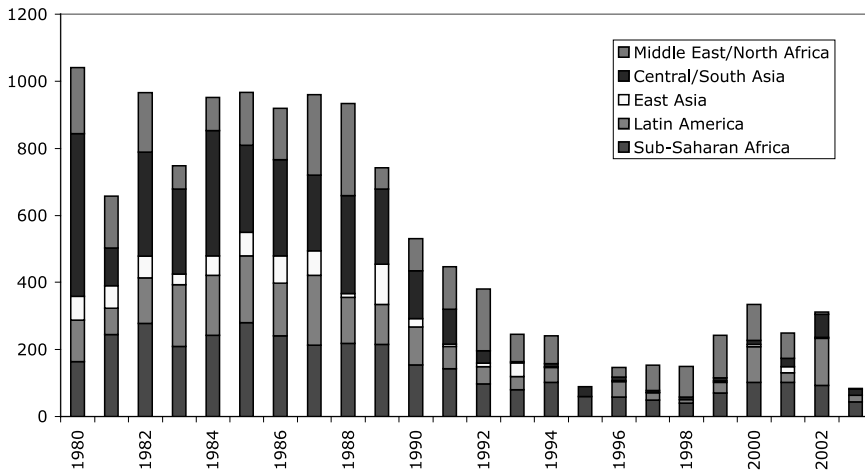
<sup>4</sup> A recent volume from the U.N. Secretary-General’s High Level Panel is a useful source for framing food security issues within a larger context (UN 2004).

<sup>5</sup> Most of the analyses to date have considered hunger and poverty jointly, since they tend to be driven by the same correlates. Disputes arising from land, water, and other resource conflicts are sometimes also included in the empirical assessments of food and agriculture (Kennedy, Homer-Dixon and Blitt). We are aware that the thumbnail summaries presented in this section of the paper do not distinguish adequately among these variables, in large part because the literature itself does not deal well with these boundary issues.



Source: USAID (2005a).

**Figure 1. U.S. overseas loans and grants, 1980–2003. Data are in millions of 2003 U.S. dollars**



Source: OECD (2005).

**Figure 2. Total real U.S. aid to agriculture by region, 1980–2003. Data are in millions of 2002 U.S. dollars**

households (Krueger and Maleckova). Not considered in that proposition, however, is the notion that poverty sustains the kinds of states that are havens for terrorist activity. Unconsidered also is the motivational role that the existence of poverty and global inequality has on terrorists who themselves are not poor.

Recent econometric work indicates that the presence of poverty is a key determinant of whether or not a civil war will develop in a country. Other standard explanations, like ethnic or religious tension, do not stand up well

under systematic cross-sectional scrutiny. The lack of income opportunities in agriculture or in the formal labor market has been shown to be an important underlying variable, affecting greatly the cost of rebel recruitment (Collier and Hoeffler; Miguel, Satyanath, and Sergenti). Several authors alternatively suggest poverty and hunger may simply be a proxy for bad government, and that governance is the causal variable (Fearon and Laitin).

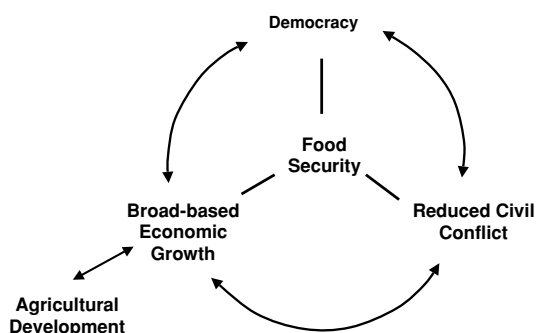
Most of the new literature rejects the hypothesis that poor people take up arms

“because” they are poor relative to their neighbors. In particular, there seem to be no systematic correlations between measures of income inequality and the timing of civil wars (Collier and Hoeffler). There is some evidence, however, that both low and unequal per capita incomes cause civil wars to last longer than “normal.” This prolongation occurs primarily because poor people are cheaper to recruit and retain, and because they have relatively more to gain if they are victorious (Collier, Hoeffler, and Soderbom).

The evidence that civil conflict increases the likelihood of terrorism is mostly anecdotal. Civil conflict sometimes creates weak states and safe havens for terrorists (Bannon and Collier), but we can find no systematic scholarly evidence on this point. Civil wars also create political and ethnic grievances, and these disputes may spill over into broader terrorist activities. Although Sudan, Afghanistan, and Lebanon would seem to be cases in point, many terrorists have also come from countries without civil wars (Collier and Hoeffler). For example, an overwhelming percentage of Middle-East suicide bombers have come from Saudi Arabia and Morocco (Pape).

The final question linking poverty alleviation to democratization and national security is the most compelling of the three. In particular, the relationships in poor countries between improved agriculture and reduced civil conflict seem clear and direct. Several empirical studies have shown that slow income growth, low per capital income, and other economic variables trump political and social factors in determining the incidence and duration of civil conflict (Collier and Hoeffler). The risk of a civil war occurring is roughly halved by a doubling in per capita income (Bannon and Collier), and in many poor countries agricultural development has been largely responsible for rural per capita income growth (Timmer 2005). Miguel, Satyanath, and Sergenti also show that exogenous variations in agricultural production, such as those caused by climate, help to explain civil war onset in Africa. Given the fundamental role that agriculture plays in pro-poor growth, it seems that a strong rural sector can perform the dual roles of improving food security and improving national security (figure 3).

For many leaders in the developing world, national security goals are intertwined with the goals of meeting basic needs (UN 2004). Americans, on the other hand—both inside and out-



**Figure 3. Food security linkages**

side of Washington, D.C.—appear to care less about humanitarian needs and are more interested in terrorism as a threat to security. They are also interested, though less intensively, with civil conflict around the world—witness, for example, the flurry of media attention surrounding Sudan and various other civil wars. Although the evidence suggests that the roots of civil conflict have a strong economic component, it is probably unwarranted to conclude that poverty and hunger “cause” terrorism, at least based on our current understanding of the motivation for terrorist activities.

At the present time, for better or worse, issues of food security are therefore unlikely to shift to the Department of Defense. What might alter this situation is a bio-terrorism attack on food supplies per se. For example, bombings of agricultural and irrigation infrastructure in South Asia, the addition of botulism to milk supplies, or the deliberate spread of a major crop pathogen would surely tighten the food–terror linkage. Fortunately, these kinds of attacks on food security and food safety have not yet occurred, although several have been simulated in the literature (Wein and Liu; U.S. Food Safety).

With or without terror linkages, however, it is puzzling to us why food security is not of more concern to the World Bank, the State Department, and USAID. It is also puzzling why the U.S. evangelical movement, numerous nongovernmental organizations, and other special interest groups have not taken up food security more actively as a right-to-life issue.<sup>6</sup>

<sup>6</sup> These groups often have been active on questions of food aid but have not generally weighed in productively on the development dimensions of food security.

## Altered Priorities of Domestic and International Institutions

The political economy of food security has experienced remarkable changes during the past forty years. Four vignettes from the 1970s, originating from the State Department, the World Bank, the CGIAR, and academia, are remarkable in their own right. They also make stark statements about the past as compared to the present.

The World Food Conference of 1974 (where the term “food security” gained popular usage) was primarily an outgrowth of economic shocks and rapidly rising food prices of the previous two years. The world food economy then appeared out of control, and the prevailing view was that supply shortages were at the heart of the food security problem. Kissinger’s famous proclamation that “in ten years, not one child shall go to bed hungry” was a signature statement for the Conference and for the mood of the decade. His statement was bold, some would say reckless, but it emphasized that hunger was a problem that could be fixed, and that the United States, including the State Department and USAID, would be the central players in the solution.

The rhetoric around the formal creation of the CGIAR in 1971 had a similar ring. The early vision that had originated with the Ford and Rockefeller Foundations was amplified and took new institutional form following a crucial meeting in Bellagio, Italy. As David Hopper, a later Chairman of the CGIAR, remarked, the CGIAR’s original mission was a strategic, science-based focus on increasing “the pile of rice on the plates of food-short consumers” (World Bank 2003).

At approximately the same time, Robert McNamara gave his now-famous Nairobi speech in which he outlined the nature of the poverty problem in rural areas, and what the World Bank should do strategically to improve food security. Again, the idea of active involvement with a fixable problem was evident.

... is it a really sound strategy to devote a significant part of the world’s resources to increasing the productivity of small-scale subsistence agriculture? Would it not be wiser to concentrate on the modern sector in the hope that its high rate of growth would filter down to the rural poor? The answer, I believe, is no.... Without rapid progress in small-holder agriculture, there is little hope

**Table 1. Global Cereal Production, 1970–2004**

	Area (Million ha)	Yield (Tons/ha)	Production (Million mt)
1970	676	1.77	1,192
1980	717	2.16	1,550
1990	708	2.75	1,952
2000	674	3.06	2,060
2004	681	3.31	2,252

Source: FAO (2005).

either of achieving long-term stable growth or of significantly reducing the levels of absolute poverty (McNamara).

Finally, there were key statements originating from academia. Theodore Schultz, at the 1979 Nobel ceremony, began his address with perhaps the greatest rallying cry ever for agricultural economists.

Most of the people in the world are poor, so if we knew the economics of being poor, we would know much of the economics that really matters. Most of the world’s poor earn their living from agriculture, so if we know the economics of agriculture, we would know much of the economics of being poor. (Schultz 1992)

### *The Production and Hunger Numbers*

Understanding what happened during the subsequent three decades thus seems crucial if the difficult food security problems that remain are to be addressed intelligently. The simplest historical version is that global food supply problems for several major commodities were largely solved, but that the far more difficult problems of economic access to food were not conquered.

Food production trends are generally well known, although a brief synopsis may help set other data in context. Growth in world supplies of food was indeed remarkable. Table 1 indicates that global cereal production went from 1,192 million metric tons (mmt) in 1970 to 2,252 mmt in 2004, cropped area was virtually unchanged (676 million hectares (ha) vs. 681 million ha), and aggregate cereal yields increased from 1.77 tons per ha to 3.31 tons per ha (FAO 2005).<sup>7</sup> The Green Revolution—“a

<sup>7</sup> It is worth noting that the world will again need at least to double cereal production again by 2050 to accommodate projected income and population growth.

**Table 2. Prevalence of Undernourishment in Developing Countries, 1979–2002**

Proportion in Percentages	Sub-Saharan Africa	Near East & North Africa	Latin America	Asia (Excluding China)	China	Developing World
1979–81	36	9	15	33	30	28
1990–92	35	8	14	21	16	20
2000–2	33	10	11	17	11	17
Absolute numbers in millions						
1979–81	125.4	21.5	38.3	634.3	303.8	920
1999–92	170.4	24.8	47.1	484.6	193	823.8
2000–2	203.5	39.2	41	443.2	142.1	814.6

Source: FAO State of Food Insecurity in the world, various years.

technological hammer looking for a nail”—was instrumental in these changes, especially for wheat and rice in Asia, parts of the Middle East, and Latin America (Naylor and Manning). Despite considerable interannual variation, global cereal prices fell by roughly 50% in real terms during these thirty-five years (FAO 2004a), indicating that cereal supplies were indeed exceeding effective demand for them.

Two political-economy dimensions of the lower cereal prices also deserve special comment. First, those countries which greatly improved food security, of which Indonesia is a good example, increased crop productivity in terms of yield per hectare per day. These productivity gains permitted the growth dividend to be shared between producers via higher incomes and consumers via lower prices. Second, and more controversially, we believe that lower prices took international food security off of the political agenda of the richer countries. Surplus-disposal and food aid became more important topics. Despite widespread trade evidence that agricultural growth enhances agricultural trade, we also believe that support for agricultural development was cut back, implicitly if not explicitly, in fear that such development might cut into the export markets of G-8 nations.<sup>8</sup>

Increased food supplies, lowered food prices, and rapid growth made a significant dent on hunger, at least in some areas.<sup>9</sup> The incidence of global undernourishment went

from about 30% in the 1970s to about 15% at the turn of the century. China and Indonesia were the classic large-country successes. The number of hungry people in China alone was reduced by almost 200 million.

But the overall picture is far less rosy, especially in many rural areas where two thirds of the food-insecure now reside. As shown in table 2, the incidence of global hunger fell during the past thirty-five years, but the proportion of people in sub-Saharan Africa who are undernourished remains at about 35% of the present much larger total population. For the entire developing world, excluding China, the absolute number of food insecure individuals actually increased from about 600 million to about 700 million between 1980 and 2000 (FAO 2004b).

Low-income consumers whose staple crop was not wheat or rice typically fared more poorly over the past three decades.<sup>10</sup> Twenty countries have more than 35% of their populations in hunger, another twenty-eight nations have food hunger rates of between 20% and 34%, and an additional fifteen have ratios between 10% and 19% (FAO 2004b). Africa dominates all of these categories, but Asia, Latin America, and the Middle East are also represented. Progress toward reaching the 1996 World Food Summit targets is lagging badly, and there is great doubt about whether the Millennium Development Goal of halving global hunger (to 400 million persons) by 2015 can be reached.<sup>11</sup> In some fundamental sense, the war on hunger has not been won. It has

<sup>8</sup> We suspect that some of this thinking may also have been at the heart of the G-8 discussions in Scotland during July 2005 (Schiffers). Interestingly, health improvement was included in reports from the meeting, but improving food security in Africa was not. We infer that G-8 disagreements over their own agricultural subsidies were seriously inhibiting in the discussion of African agricultural development.

<sup>9</sup> For an excellent twenty-year retrospective on poverty alleviation, see Chen and Ravallion.

<sup>10</sup> See Evenson and Gollin for a discussion of the first Green Revolution's impact on other crops and in Africa. The World Bank (2005) provides a useful typology of staple crops.

<sup>11</sup> For a more optimistic view, see the U.N. Millennium Project (2005) report. That review presents a very long list of recommendations for improving food security, but offers little advice on the sequencing of necessary actions.

not even been seriously engaged in numerous nations of the world.

### The Institutions

In light of the foregoing security and hunger data, the response of the earlier-described institutions is vexing. If there were no productive agricultural investments to be made, the institutional behavior might be rationalized; however, research has repeatedly indicated that investments in agricultural R&D bring social rates of return of greater than 50% (Pardey and Beintema). Yet globally, the real value of total aid to agriculture in the late 1990s was only 35% of its level in the late 1980s (IFAD).<sup>12</sup>

Evidence from the World Bank since 1980 shows a significant retrenchment from investments in agriculture, especially in rural infrastructure. Agriculture's share of total Bank lending fell from an average of about 25% in the mid 1980s to only 10% in 2000 (Pardey and Beintema).<sup>13</sup> Total World Bank funding of agricultural research has also declined since the early 1990s, despite a short-lived peak in 1998 when three large R&D loans were approved simultaneously. Moreover, the Bank has lost almost half of its technical staff in the area of agricultural development (World Bank 2003).

Four factors seem to underlie the decline. First, serious difficulties with integrated rural development projects in Africa between 1975 and 1985 certainly conditioned later investments (World Bank 1988). Second, lower real food prices added to the problems of finding socially profitable projects. Third, the Bank, in its attempts to become ever more corporate, moved to a country assistance strategy (CAS). This framework gave renewed emphasis to returns (impacts) within a three- to five-year-time period. In many respects, such a shift is economically sensible; however, there are some investments, such as public goods in agricultural infrastructure and agricultural research, where the strategy is clearly inappropriate.<sup>14</sup> Moreover, the CAS tends to reinforce the short-term outlook of local political leaders in ways that can be very counterproduc-

**Table 3. Views on Agricultural Development**

Role	Optimists	Pessimists
Rural infrastructure	Yes, for input and output markets	Mostly wasted
Agricultural research	Yes, to raise yields and lower costs for supply chains	Private sector
Price stability	Needed to maintain producer incentives and food security	Impossible to implement within WTO rules

Source: Timmer (2005).

ive. Finally, the Bank seems surprisingly to have forgotten just how "important" food and agriculture are in both the Bank's intellectual and financial portfolios. As but one example, the much-acclaimed review, *East Asian Miracle* (World Bank 1993), scarcely mentioned the role of agriculture in the East Asian development process. Whether the Bank now believes that the agricultural phase can be skipped in poor countries is unclear; in any event, a pessimistic view abounds at headquarters about the future of small farmers, especially in Africa. That view contends that most investments in rural infrastructure are wasted, that the private sector will provide the necessary agricultural R&D, and that efforts to provide special incentives to agriculture are inappropriate under World Trade Organization (WTO) rules (table 3). Perhaps many poor countries themselves are also losing (or never had) interest in food security, or perhaps it is easier for the Bank to deal with middle-income countries and more commercial sectors such as power generation. But it seems clear to us that the magnitude of the Bank's recent investments in agriculture is congruent neither with the earlier McNamara vision nor with more recent Bank rhetoric on poverty alleviation.<sup>15</sup>

Evidence on food security from the State Department and USAID shows trends similar to the Bank. Food security and agricultural development would seem to fall squarely within the Department's mantra of "diplomacy, defense, and development." Given also the presumed comparative advantage enjoyed by the

<sup>12</sup> See Herdt (2005) for a thorough and thoughtful historical assessment of development assistance to the various subsectors of agriculture.

<sup>13</sup> Philip Pardey and his colleagues are currently updating the agricultural R&D data through 2004. Their estimates are expected to be available in early 2006 (Pardey).

<sup>14</sup> More formally, there are numerous projects that have high internal rates of return, but that do not show large impacts during the first three to five years.

<sup>15</sup> See, for example, President James Wolfenson's introduction to the World Development Report (World Bank 2000): "Our mission to fight poverty . . . [is] at the center of all the work that we do."

United States in food and agriculture, it is perplexing that USAID reduced its agricultural technical staff by over two third from its peak in 1990 (Alex). USAID funding to agricultural research followed a similar trajectory, falling in real terms by two third between the mid 1980s and 1996 (Pardey and Beintema). Although there has been some increase in agricultural expenditures since 2000, food aid continues to dominate resource flows. The good news is that food-aid organizations constitute one of the few organized lobby efforts arguing for additional aid; however, the bad news is that food aid is frequently an ineffective instrument for dealing with medium- and longer-run food security problems (Falcon). In many cases, food aid provides disincentives for agricultural development and rural economic growth and can thus weaken both food security and national security.

Although USAID field missions have always had some leeway in program allocations, mission directors frequently have taken their cues from strategic documents generated within the Agency and the State Department. However, "development" has tended to be faddish, and agriculture has seemingly not fit well into recent agendas. In the early 1990s, the "Washington Consensus" deemed that the private sector was the engine of growth, a view that was largely antithetical to increased spending on public goods such as global R&D for agriculture. Nor did agriculture fit neatly into the so-called "Post-Washington Consensus" of the late 1990s, with its emphasis on institutions, good governance, and finance. And since 2001, the agenda has been dominated by security and democratization concerns. We believe that agriculture should have occupied a strategic role in a security-dominated world, but it did not.

USAID publishes a joint strategic plan with the State Department every five years. The most recent version for the years 2004–9 is entitled "Security, Democracy, and Prosperity" (USAID 2003). This 63-page report gives brief mention of famine, and not once mentions agriculture. It is little wonder that USAID mission directors typically do not see agricultural initiatives as the way forward, either for their host countries or for their own careers.

Ongoing changes within the CGIAR are more complex than for the World Bank and USAID, but the system's vision and energy of earlier periods now seem beset with donor fatigue, increasing financial restrictions, and disagreements on both organizational

form and objectives. CGIAR expenditures on productivity-enhancing agricultural research, presumably the CGIAR's comparative advantage, declined by 6.5% annually in real terms between 1992 and 2001.<sup>16</sup> Overall, CGIAR expenditures stagnated over the past decade at about \$350 million in nominal terms, implying a fall in real terms of about 2% annually (CGIAR).<sup>17</sup> Increasingly, CGIAR activities are linked to the specific (and varying) orientations of donor countries.

The CGIAR can be rightly criticized for its own performance, but the national agricultural research programs (NARS) must also bear much of the responsibility for what has happened in Africa. The CGIAR funds only about 3% of total agricultural R&D expenditures for Africa, and thus serious questions must be raised about the other 97% as well. Perhaps a larger issue is the question of overall magnitude. For *all* of sub-Saharan Africa, *total* agricultural R&D is only about \$1.5 billion (slightly less than Stanford University's budget for 2004–5, by way of comparison) and "funding has become increasingly scarce, irregular, and donor-dependent" (Beintema and Stads).

In the face of all the other trends, it would be gratifying to be able to report that U.S. academia had risen to the food security challenge. Our conjecture is that U.S. university expenditures on international development issues have declined substantially in real terms over the past thirty years. Three major private universities—Chicago, Harvard, and Stanford—that historically have produced a large number of agricultural policy analysts have recently eliminated key academic units and are essentially out of the food security "business," although Stanford is now trying to rectify this loss. The situation is little better in Land-Grant institutions. There appear to be more demands on professionals to look after state agricultural interests, and several states, including California, have made it very difficult to fund foreign graduate students. More generally, the agricultural component of development economics is increasingly neglected, and "development" is a declining field within economics. Given global poverty problems, this decline is both curious and troublesome. Perhaps Krugman was correct in arguing that the path-dependent and disequilibrium nature of development processes are at odds with the

<sup>16</sup> See World Bank (2003) for an excellent review of the CGIAR.

<sup>17</sup> Preliminary reports indicate that CGIAR funding for 2005 will exceed \$400 million, a welcome increase from the past decade.

mathematical directions of modern-day economic theory.

### Escaping the Food-Security Quagmire

The current food security situation, though improving in some regions, can still be described as a quagmire. We believe that a series of faulty assumptions have been made in the last two decades, five of which have proven particularly troublesome that

1. solving global food supply problems would simultaneously solve hunger and malnutrition problems;
2. the international donor community could reduce (or avoid) investments in productivity-increasing research on foods grown and consumed by poor households;
3. agricultural development in poor countries meant reduced markets for rich countries;
4. it is more efficient to focus development-aid efforts directly on democratization and other political variables in poor countries than it is to worry about poverty, hunger, and economic growth in the countryside; and
5. agricultural development in poor countries could be side stepped in the development process.

Perhaps the foregoing points should be treated as hypotheses rather than as conclusions, but collectively they appear to add up to an over-determined story of failing food security.

Altering current approaches to hunger alleviation will take enormous efforts and great scientific and political leadership. The basic task of the world food economy remains unchanged—providing economic access to sufficient food for current and future generations at reasonable prices, without destroying the environment. In contrast, we believe that many of the approaches for solving hunger now need to be changed.

Lest we not appear myopic in the suggestions that follow, four additional points need to be stipulated, even though for reasons of space they are not developed fully in this essay. First, food security problems must be solved within a global food system that is undergoing significant change. The rapid growth of per capita incomes and the consequent impacts of meat and feed demand in middle-income countries are driving the world food economy. Super markets are an integral part of this force (Timmer

2005); hunger is not. This rapid growth is also having severe environmental consequences, as is vividly illustrated by the deforestation of the Amazon to supply soybean products to Brazil, Europe, and China (USDA 2003 and 2004). <sup>18</sup>

Second, whether world cereal production must double or triple by 2050 depends crucially on the rising demand for animal products. Meeting this growth is a scientific challenge of the first order, with exceedingly important consequences for both the environment and food security. Hungry households typically consume more staple crops than they produce (Timmer, Falcon, and Pearson). Should the real prices of cereals and oilseeds rise significantly because of accelerating feed and/or bio-energy demands, hunger problems will be amplified. The pile of grain issue that David Hopper referred to earlier (p. 10) still cannot be overlooked.

Third, recent rulings by the WTO regarding U.S. agricultural subsidies (Hudson et al.), coupled with the Doha Round of agricultural trade negotiations (Josling, Pingali and Stringer), could further alter agricultural trade patterns and commodity prices. These negotiations might also diminish some of the rationale for heavy reliance on food aid, which could actually turn out to be a blessing for agricultural development in poor countries.

Finally, there are no magic bullets for addressing hunger problems. Low-income countries themselves must organize much of what needs to be done.<sup>18</sup> But the external world ought to be able to do much better than the “let them eat imports (or food aid)” attitude that is now all too pervasive in some government circles.

Among the many food security recommendations in the U.N. Millennium Project (2005) report, we focus on what we believe are four key issues.

### *Putting Agricultural Development Back into the Theory and Practice of Development*

Academics are good at offering advice to others on matters of public policy. It would be helpful sometimes if they were equally adept at taking their own advice. Except for a few countries with exploitable natural resources such as oil, we see few growth opportunities other than agricultural development for most

<sup>18</sup> For cogent thoughts on this point, see Timmer's (2004) review of *Eliminating Hunger in our Lifetime* (Runge et al.).

of the low-income countries. *Nothing is more important in support of food security than sustained economic growth that includes the poor.* With half their populations, a quarter of their GDPs, and most of their hungry people associated with agriculture, the food sector sits as a food-security albatross on the back of any poor country that ignores it. The historical evidence seems sufficiently clear on this point that it should hardly need repeating. Yet a look at development curricula at major universities (at least in the United States) shows a sharp decline in the prominence given to food and agriculture in development courses. Did T. W. Schultz's traditional agriculture become transformed (Schultz 1964)? Did A. K. Sen's malnourished millions suddenly receive entitlements (Sen)? Did W. A. Lewis's surplus labor get absorbed (Lewis)? Did Bruce Johnston's and John Mellor's agriculture-industry linkages suddenly get severed (Johnston and Mellor)? Or have the development and policy professions forgotten some of the basics?

If academics are not making the agricultural development food security connection, is it really so surprising that USAID and the World Bank also are not? Of course, the arrows run in both directions. Because the Bank and USAID do not worry much about food and agriculture, universities can feel vindicated in ignoring these topics. Many of the same institutions that profess concerns about poverty reduction seem to be able to ignore the rural locations and vocations of the poorest segments of society when it comes to financial allocations. Migration will solve some of the rural hunger problems provided that people are pulled into productive urban jobs. But rural to urban migration will amplify poverty problems if it occurs as a result of countryside failures and rural pushes.

This essay is not the occasion to create a new development theory or even to resurrect old ones. But our bottom lines are stark: there are few ways for food insecure nations to get around the necessity of rural development, and universities are failing in their research and training programs to emphasize this point adequately.

### *Returning the World Bank to Its Rural Roots*

The World Bank is an exceedingly complex organization, with frequent disconnects between its rhetoric and its actions. Such is the case with the Bank on the topic of food security. As the premier development institution, there are two

key leadership roles that the Bank could reassert with respect to agriculture. Both involve public goods.<sup>19</sup>

Many of the poorest ninety countries, especially those in Africa, suffer from severe underinvestment in rural infrastructure—ports, roads, power, and irrigation. Without the ability to get inputs in and outputs out, the economic basis for rural modernization is thwarted at every step. Fortunately, the new Bank President, Paul Wolfowitz, recognizes this fact. Pointing to the importance of rural investments, he expressed surprise “that the Bank had pulled out of infrastructure support as much as it has” (Katzenellenbogen). As the first Bank President to have lived for substantial periods in a developing country—in Indonesia where he was involved directly with that country's successful efforts to alleviate rural poverty—the depth of his conviction and the powers of his persuasion will be vital in reversing trends in rural infrastructure investment.

In supporting certain types of rural investments, including roads and irrigation, Wolfowitz and the Bank will also need to reassess agricultural/environmental tradeoffs. Both the environmental and agricultural communities have long recognized the need in many situations for both productivity-increasing technology *and* better resource management. In other situations, however, there may be serious agriculture/environmental tradeoffs. The difficult question then is where lines should be drawn, not whether the world needs all of one at the entire expense of the other. We are often made uneasy by those who see the conservation approaches of richer countries directly transferable to poorer countries, and who, in that thought process, underplay the importance of productivity gains and the importance of scale. In countries where half the population is below the poverty line, we doubt that the operational meaning of “sustainable agriculture” is the same as it is in the United States or Europe.

The second broad area in which the Bank needs to reassert its leadership is via its support for agricultural R&D. This support is critically important through both its loan program to poor countries and also its grants to the CGIAR. The former requires that the Bank actively “promote” such loans with its

<sup>19</sup> For an amplification of public-goods arguments related to agricultural investments, see Unnevehr.

client countries. The latter requires a renewed, McNamara-like commitment to the production of public goods, especially improved germplasm.

Given the size of the Bank's total operation (some \$20 billion annually), a \$100 million annual increase in support for the CGIAR would appear very modest. In fact, the grant- or trust-fund component (as opposed to the loan portion) of the Bank's portfolio totals only about \$4 billion, of which the Bank's own contribution is approximately \$400 million (World Bank 2004). There are many demands for these funds, and, without putting too fine a point on the matter, successive Bank Presidents have seen particular uses of grant funds as part of their own legacies. Creating or expanding other grant programs has sometimes meant limiting the growth of the agricultural portfolio.

The CGIAR and the green revolution that it created have arguably been the most successful investments in development ever made (Jindrova and de Graff). Countries that were involved with this revolution have crop values per acre roughly six times those who did not.<sup>20</sup> Increases in total factor productivity were negligible in countries not experiencing a green revolution, and none of the countries without a green revolution became industrially competitive. A central question for the future of food security is thus whether the Bank and its new President will seek to put the creation of public goods, especially those related to germplasm and agricultural productivity, as a major recipient of trust funds.<sup>21</sup>

### *Focusing More on Orphan Crops*<sup>22</sup>

Additional grant funding is important, for no less than another green revolution is now required.<sup>23</sup> To date, most investments in agricultural technology, especially germplasm, have centered on crops that are produced in temperate zones and traded internationally. In contrast, neither the public nor the private sector has invested significantly in genetic technolo-

gies for the more diverse minor or "orphan" crops, such as finger millet, tef, and yams, which are often critical in the world's most disadvantaged regions. Yet hunger solutions extend far beyond the global supply of major crops, even though the size of that pile is extremely important because of its impact on food prices. Agriculture promotes food security most when it contributes directly to the incomes and productive employment of poor people.

Although wheat, rice, maize, and soybeans are of great global importance—occupying a combined total of nearly 600 million ha annually—*orphan* crops also play key roles. There are some thirty crops that each occupies between 0.5 and 40 million ha, and that collectively sum to about 250 million ha annually. They are particularly important regionally. In sub-Saharan Africa, for example, sorghum and millet are more important than rice and wheat both in area and in contribution to diets (Naylor et al.).<sup>24</sup>

*Orphan* crops are typically produced and consumed by poor households, have high nutritional value, and are adapted to harsh environments. However, few, if any, breeders work on individual *orphan* crops, and these crops remain low yielding and susceptible to a wide range of pests, pathogens, and abiotic stresses. Systematic breeding for desired traits would most likely require contributions from both genomics and molecular biology. Fortunately, science in this field is progressing rapidly. The preservation of chromosome order across various genomes of the plant kingdom (*synteny*) assures that prior work on rice is relevant for the improvement of, for example, tef in Ethiopia.

Transgenic processes may also be needed in the development of appropriate germplasm for *orphan* crops. Genetically modified organisms (GMOs) have sometimes pitted consumers against industry, Europe against the United States, and environmentalists among each other. These debates, which have largely focused on herbicide resistance and Bt transformations, may be legitimate in their own right. However, other types of transformations, such as *bio-fortification*, may have entirely different benefit–cost ratios in the context of food insecure regions. Moreover, genomics, the use of molecular tools to

<sup>20</sup> See Evenson, Pingali, and Schultz and Evenson and Gollin for assessments of eleven crops in eighty-one developing countries.

<sup>21</sup> See World Bank (2004) for a similar (more internal) view of the Bank's challenge *vis-à-vis* the CGIAR.

<sup>22</sup> This section draws heavily from Naylor et al.

<sup>23</sup> The first green revolution's was concentrated on wheat and rice, predominantly in the more productive agricultural ecosystems of Asia, the Middle East, North Africa, and Latin America. The second (doubly) green revolution, as described by Conway, put renewed emphasis on sustainability, resource use, local knowledge, and ecosystem services.

<sup>24</sup> The long list of *orphan* crops that are important regionally includes yams, indigenous fruits and vegetables, tropical legumes, cassava, pigeon pea, chickpea, sweet potatoes, bananas, plantains, and tef.

understand the genetic basis of crop traits for indirect selection and breeding, is beginning to offer alternatives to traditional transgenesis.<sup>25</sup> These new approaches would help alleviate some of the constraints surrounding intellectual property rights and bio-safety regulations (or lack thereof) that now limit the dissemination of GMOs in developing countries.

A third green revolution of the type we propose would both permit and require active cooperation among numerous organizations. As a practical matter, the World Bank would need to proclaim the provision of public goods in the form of improved orphan-crop germplasm as a high priority use of grant funds in its fight on poverty. An additional \$100 million annually for this purpose could change the nature of both the debate and the solutions. The NARS would also have to make new commitments, both of manpower and funding. There are scandalously few breeders working on some of the more important orphan crops. Partly as cause and partly as effect of limited breeding efforts, the germplasm collections for many of these crops are limited and limiting. Since many of them were not included in the new international treaty on plant genetic resources, special national efforts will need to be made to overcome the serious undercollection problem.

The CGIAR would need to rethink some of its positions as well. Increasingly, the CGIAR system has become a broad-based development agency. Much of the problem lies with declining unrestricted funding, and the consequent need by Centers to pursue bilateral funding with various strings attached to it. But, in addition, only about 17% (\$66 million) of its current budget is devoted to productivity-increasing investments (CGIAR). The return to a more germplasm-based institution would be controversial, but in our view, it would be the most cost-effective way for the CGIAR to scale up its attack on food insecurity. Within the germplasm arena, a third revolution would require a major readjustment among commodities and partnerships across commodities. Although Centers in the CG system now allocate limited funds to the breeding of orphan crops, the total is surely less than \$25 million annually. Investments across commodities would also need to be complemented with three-way institutional partnerships among recipient countries, international

publicly funded centers, and the private sector.<sup>26</sup> Much of the relevant intellectual property for germplasm development is controlled privately, yet the market potential for orphan crops is inadequate for private investments. Therefore, if significant progress is to be made with orphan crops, the public goods dimension of the public sector would need to be married to the entrepreneurial capacity of the private sector. Because of differences in culture, this marriage will not be easy.

Finally, we emphasize that the technology approach outlined above is not *the* answer. For plant agriculture alone, there are critically important related components that encompass seed industries, resource management, incentives, financial intermediation, and education. But germplasm is a good place to begin. A focus on income and job creation in poverty-ridden rural regions is an excellent mechanism for attacking the access dimension of food security. While the growing global pile of major crops is necessary for reducing hunger, we believe that improved orphan crops may now be even more important for improving welfare of the food insecure. A combination of low-hanging fruit, coupled with the economic vulnerability of those who rely on these crops, make for compelling arguments and investments.

#### *Making Food Security an Integral Part of National Security*

Leadership on food security from the World Bank is critical, and so too are new policy approaches from the United States. This essay thus ends where it began. We believe that fostering food security is a sound investment in development and also good for homeland security. Food and agriculture are surely fields in which the United States has a comparative advantage. To exclude them from the U.S. aid strategy seems totally bizarre.

The current status of U.S. assistance, especially to Africa, is in a state of flux. The magnitude of the aid, the allocation criteria, the institutional mechanisms, and the impact of debt relief are as yet unclear as they relate to food security.<sup>27</sup> However, even accepting the promotion of democracy as a (or even *the*) primary goal of U.S. involvement in developing

<sup>25</sup> See Naylor and Manning for a much fuller technical discussion of this point.

<sup>26</sup> The issue of partnerships and intellectual property is covered much more extensively in Falcon and Fowler.

<sup>27</sup> See, for example, discussion surrounding the Millennium Challenge Account (Sourcewatch).

countries, our reading of what makes sense is still the same. Improving agriculture is a necessary condition for fostering growth and eliminating hunger. Such a focus has a better chance of promoting democratization in many poor countries than do “democracy” projects per se.<sup>28</sup> Our final conclusion, therefore, is that perhaps the most direct ways to security and democracy, as to love, may be via the stomach!

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<sup>28</sup> Rich countries are democratic. See Rowan for interesting cross-sectional evidence on income growth and democracy. Based on his regression analysis and China’s rapid rate of economic progress, Rowan boldly declares that China will be democratic by 2015!

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## Queries

- Q1** Author: Is the edit ok?
- Q2** Author: Please note that U. N. Food and Agriculture Organization (as given in reference list) has been abbreviated as FAO in its respective citations throughout the article. Please check whether it is correct.
- Q3** Author: Please include USDA 2003 and 2004 in the reference list.
- Q4** Author: Please update reference Evenson et al., in press.
- Q5** Author: Please provide the year of publication for reference Falcon.
- Q6** Author: Please provide the page range for reference Holloway and Stedman (2002).
- Q7** Author: Please provide publisher details for reference Katzenellenbogen (2005). Also check whether it is necessary to retain the month.
- Q8** Author: Please provide page range for reference Miguel et al. (2004).
- Q9** Author: Please update reference Naylor and Manning in press.
- Q10** Author: Please provide the location of the publisher for reference Organization for Economic Cooperation and Development (2005).
- Q11** Author: Please check the tagging 'a' and 'b' in Ref. FAO for correctness in Ref. as well as in text.
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