Responding to the World Food Crisis: Silver Bullets or Systems Changes?
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Dramatically increasing food prices and the implications for poverty and hunger around the world have commanded front-page headlines for the past six months. Serious attention is now being given to the long-term challenges posed by this food crisis. The Food Summit in Rome during the first week of June, convened by the UN Food and Agriculture Organization (FAO), was intended to address short, medium, and long-term challenges. Last month, I wrote in Daily Kos about the **role of 'markets' in addressing this food crisis**. Here, I address interrelated issues of resource limits and technological change.

Thomas Dobbs's diary :: ::

Medium and long-term responses recommended in a report (*Souring Food Prices: Facts, Perspectives, Impacts and Actions Required*) prepared by FAO in advance of the Food Summit included: (1) strengthening and sustaining agricultural research and extension; (2) improving infrastructure for agriculture; and (3) providing adequate price incentives, credit, and risk management instruments for farmers. The report called especially for efforts to increase the productivity of poor farmers. In addition, there were calls for "heightened advocacy in international trade negotiations to reduce international trade barriers and market distortions, and the creation of new international protocols and agreements surrounding biofuels."

With the exception of the language on trade agreements and biofuels, much of the medium and long-term response discussion in this FAO report concerned increasing agricultural production. The following statement summed up the food production challenge.

"At the same time, it is necessary to set in motion steps towards ensuring long-term global food security, taking into account the probable risks to global food supplies posed by climate change. Amongst the big issues to be addressed are how to develop a new generation of technologies for agricultural intensification that is sustainable from financial, environmental and social perspectives and is resilient to climate change and how to prevent further reductions in the availability of fresh water and land resources for future food production."

Let's look more closely at that food production challenge. In doing that, we first need a bit of history.

First, what was the understanding of *resource limits* in the years surrounding the Green Revolution? Certainly, there were Malthusian-like concerns among development economists about population pressures on the food supply prior to the Green Revolution. Lester Brown, long known for his writings on

resource limits at Worldwatch Institute and Earth Policy Institute, wrote an insightful monograph on the then growing population/food availability challenge in 1963, when he was with the USDA. In *Man, Land, and Food: Looking Ahead at World Food Needs*, he documented and described the growing population pressures on limited agricultural land in developing countries. He analytically and clearly laid out the land productivity increases needed to meet this challenge. Prior to the Green Revolution that was to occur a few years later, it was hard to feel optimistic after reading Brown's report.

Brown wrote a widely read book just seven years later (1970) that had a very different tone. In *Seeds of Change: The Green Revolution and Development in the 1970s*, he described the remarkable increases in productivity that had begun to appear in portions of the developing world that had access to reliable irrigation supplies. The revolution was based primarily on a package of inputs that consisted of improved seed (especially dwarf wheat and rice varieties), inorganic fertilizer, and irrigation water. I observed that revolution unfold myself while collecting agricultural data in northern India for my Ph. dissertation in 1967-68. Although Brown addressed a number of remaining challenges in spreading and sustaining the Green Revolution, the overall tone was much more hopeful than that of his 1963 USDA monograph. Potential harmful effects of chemical fertilizers and pesticides were acknowledged, but the book contained little or no mention of possible future fossil fuel limitations.

This brings us to the second piece of history about food production possibilities. That piece concerns dominant views about *technological change*. In his 1964 book *Transforming Traditional Agriculture*, Theodore Schultz, who was to later receive the Nobel Prize in Economics, advanced the thesis that farmers in the developing world were "efficient but poor". In other words, their agricultural output per unit of land was low not because they were poor managers or lacked information, but because generally there were few economically attractive output-increasing technologies available to them. The Green Revolution just a few years later appeared to confirm that thesis, in spades! Where the new package of inputs was applicable—namely in the areas with reliable irrigation potential—farmers rapidly adopted the Green Revolution technologies.

Just a year before Schultz's book was published, a book by economists Harold Barnett and Chandler Morse came out that was to have great influence on the thinking of many natural resource economists. In *Scarcity and Growth: The Economics of Natural Resource Availability* (1963), Barnett and Morse argued that natural resource limitations generally do not constrain growth. When some resources become scarce, market forces induce research and development that leads to substitute, or alternative, resources that can be used in the production process. They concluded:

"Advances in fundamental science have made it possible to take advantage of uniformity of energy/matter—a uniformity that makes it feasible, without preassignable limit, to escape the quantitative restrictions imposed by the character of the earth's crust. … Flexibility, not rigidity, characterizes the relationship of modern man to the physical universe in which he lives."

In other words, markets and technology can, in the end, triumph over natural resource limits!

A version of this view, applied more specifically to agricultural development, was central to another extremely influential book that was published in 1971, *Agricultural Development: An International Perspective*. Yujiro Hayami, a Japanese economist, and Vernon Ruttan, an American economist, presented evidence in that book to show that agricultural innovations are "induced", over time, by economic and political forces. When agricultural resources become scarce, they become expensive. This induces private firms to develop technologies embodying substitutes. Also, farmers put pressure on public institutions to invest in research to provide new technologies that substitute for the increasingly scarce, and expensive, resources. In Hayami and Ruttan's induced innovation model, a combination of market and political forces leads to technological solutions.

With this bit of history, let us return now the recent Rome Food Summit. U.S. Secretary of Agriculture Ed Schafer took to the Summit a position that seemingly embodied a faith in technology that came out of the early Green Revolution successes and ideas advanced by economists such as Chandler, Morse, Hayami, and Ruttan. Schafer's prepared remarks for the Summit placed a great deal of emphasis on new technologies, including biotechnologies, as long-term solutions to the world food crisis. Quoting a segment of **Schafer's prepared text**:

"Let us work together to identify and introduce existing and new technologies with the potential to significantly increase crop yields.

In some countries, this may mean adopting the most recent Green Revolution technologies, such as hybrid varieties.

In countries with greater vulnerability to climate or weather-related challenges, new biotechnology-based solutions are imperative to growing viable yields."

According to a June 5th **New York Times article by Andrew Pollack**, Monsanto pledged during the week of the Food Summit to "develop seeds that would double the yields of corn, soybeans and cotton by 2030 and would require 30 percent less water, land and energy to grow." Monsanto apparently stands ready to patriotically support the USDA vision!

I am concerned that this faith in new technologies represents a *silver bullet* mentality. This mentality fails to recognize the new understanding of resource limits and critical importance of *ecological sustainability* that has emerged over the past two decades.

One does not have to disown the Green Revolution in order to acknowledge the need to move beyond the predominant views on resource limits and technology that prevailed in the 1960s and early-1970s. I was a practitioner in the Green Revolution myself, serving as an agricultural economist with the U.S. Agency for International Development in Pakistan in the mid-1970s, where my primary responsibility was to provide assistance to increase applications of chemical fertilizers. Lester Brown was a major actor in the Green Revolution during his years at the USDA in the 1960s, but it was not long after publication of his 1970 *Seeds of Change* book that he returned his attention to resource limitation issues.

Subsequent to the Green Revolution, the field of *ecological economics* has developed to the point where it now offers major insights into the strategies that must now be followed in response to the new food crisis. Progressive economics now incorporates notions of resource limits that are both neo-Malthusian and quite sophisticated. Ecologists and economists have worked together to develop theories and policies for a world of limits that was not yet widely recognized in the early-1970s. Oil shocks that began in the 1970s forced a reexamination of Barnett and Morse-type views of resource scarcity. Mounting problems of chemical fertilizer and pesticides externalities—which Brown only touched on in his 1970 book—have forced attention to more environmentally-sound agricultural practices and systems. And, in the last few years, growing concerns about fossil fuel limits and climate change have magnified the need for very different kinds of farming systems than those that came to dominate agriculture in much of the world during the last half of the twentieth century.

We should know by now that what is needed is not technological *silver bullets*, but *systems changes*—changes to farming systems that are much more ecologically sustainable.

Fortunately, there is reason to be hopeful, if not actually optimistic. Some of the best sources of hope can be found in the writings of Jules Pretty, Professor of Environment and Society at the University of Essex, UK. (Disclosure: I have worked and co-authored articles with Pretty.) Pretty's 2002 book *Agri-Culture: Reconnecting People, Land and Nature* includes summary results of a large survey of sustainable improvements in developing countries that he and University of Essex colleagues conducted. They looked at more than 200 projects in countries in Latin America, Africa, and Asia. They found that improvements in food production are occurring through one or more of four different mechanisms: "intensification of a single component of a farm system, with little change to the rest of the farm" (such as home garden intensification with vegetables); "addition of a new productive element to a farm system" (such as fish in paddy rice); "better us of nature to increase total farm production, especially water (by water harvesting and irrigation scheduling) and land (by reclamation of degraded land)"; and "improvements in per hectare yields of staples through the introduction of new regenerative elements into farming systems, such as legumes and integrated pest management, and new and locally appropriate crop varieties and animal breeds". Overall, in the sustainable agriculture projects surveyed, Pretty and colleagues found an average 93 percent increase in per hectare food production.

The productivity increases Pretty and colleagues discovered involved technologies, but they generally were not of the *silver bullet* variety. The technical improvements that played substantial roles in the food-production increases were: "soil health improvements; more efficient water use in both dryland and irrigated farming; pest and weed control with minimum or zero pesticide use; and whole-system redesigns." All of these *techniques* or *technologies* require attention to the farming system, even though not all involve *whole-system* change. And most importantly, they have a high probability of satisfying the previously cited FAO report's criteria of being "sustainable from financial, environmental and social perspectives".

Pretty expands on his ideas about ecology, food production, and survival of human civilization as we

currently know it in his latest book, *The Earth Only Endures: On Reconnecting with Nature and Our Place in It* (2007). Here, he places ecological restoration issues and examples in deeply historical and philosophical contexts.

In the book's final chapter, Pretty says about ecological restoration:

"At the local level, there has been remarkable progress in the past couple of decades across a wide range of countries. … At national levels, too, there has been much to celebrate in positive policies."

However, he adds:

"… it is still true that much of what is good has happened despite policies rather than because of them. What would happen if we could scale up the many efforts at ecological restoration and regeneration for the whole world?"

Each of us will have to decide for ourselves if there is hope in that statement. There is little basis for hope, however, if we do not actively pressure our government's to make the needed policy changes—changes that focus on *systems*, rather than *silver bullets*!