Building Resilience for Global Food Security**

Christopher B. Barrett, Ph.D.
Stephen B. & Janice G. Ashley Professor and David J. Nolan Director, Charles H. Dyson School of Applied Economics and Management, Cornell University, Ithaca, New York, U.S.

Summary
Many of the world's chronically poor and malnourished people live in increasingly volatile settings. Although most of the world has enjoyed unprecedented progress against poverty and food insecurity, the dangerous interface of climate change, demographic transition, conflict, and food-price spikes has already pushed several poor regions into permanent crisis. Festering crises in these regions are increasingly becoming crucibles in which broader societal insecurity erupts. This disturbing state of affairs, along with our expanded knowledge of the intimate interactions between short-term shocks and long-term development, has sparked widespread interest in "building resilience," meaning the capacity to resist and recover from both natural and man-made disasters. While resilience offers a very promising lens through which to strategically address global food security issues, the concept remains ill-defined and its implications for science and policy under-developed. How might the global policy and science communities effectively deploy an emerging resilience framework to overcome these challenges?

Current realities
The world has never enjoyed greater food security than it does today; but it has perhaps also never faced greater threat of regress. Over the coming decades, the prospective stressors on food security in developing countries are many (e.g., political instability, market volatility, demographic change, and climate and environmental change), with tremendous variation worldwide as to which has the greatest local relevance. Moreover, micronutrient deficiencies have replaced protein/energy malnutrition as the predominant source of global food insecurity. Many scientists and policymakers have been slow to transition from the Green Revolution era mindset of maximizing cereals yields to food systems-based approaches that focus on a more diverse range of agricultural products, as well as on post-harvest processing and distribution channels. Population and income growth, plus urbanization, imply that food security increasingly depends on post-harvest distribution and processing systems, not just on agricultural production. Meanwhile, heightened challenges of managing common resources, such as climate and ocean fisheries, make the task of productivity growth harder today than 40 years ago, when global leaders last collectively addressed food security issues. Growing competition for scarce natural resources, in particular fertile soils and fresh water, will constrain agricultural production growth and raise tensions. This competition places an ever-greater premium on technological change, some of which are highly controversial, such as transgenic crop and livestock varieties. Public policy responses related to intellectual property rights, migration, trade, and humanitarian relief, among other things, not only affect the food security of target populations, but also require coordination to avert adverse spillover effects on others' food security.

As the risks faced by the world's poor seem to have become more intense and less predictable, many international organizations' strategic responses have concentrated on "building resilience" so as to enhance resistance to and recovery from natural and man-made disasters while advancing environmentally and socioeconomically sustainable improvements in living standards. But what is resilience and how do we most effectively advance it for food security?

Scientific opportunities and challenges
Resilience has become a popular but imprecise buzzword in international development circles. Scientists can help by imposing greater precision in the use, measurement, and evaluation of the concept, as well as by prioritizing research based on resilience metrics that require further

development. In the international development context, resilience is best understood as describing the well-being dynamics of individuals and populations, in particular, the capacity to avoid poverty and food insecurity in the face of stressors and shocks. Resilience offers the promise of a coherent, multidisciplinary approach to identifying how to most effectively help vulnerable populations gain control over their lives, as well as to identify which interventions most sustainably reduce the likelihood of people not having adequate access to sufficient, safe, nutritious food to maintain an active healthy life. But resilience also poses a scientific challenge because of the complexity of resilience measurement, which remains a work in progress.

Scientific advances throughout food systems will be essential to improve global food security. Advances in our knowledge of animal and plant genetics, as well as in soils and pest management, will be essential to build resistance to stresses such as drought, flood, salt, and evolving pests and pathogens as well as to increase availability and access to scarce vitamins and minerals. Engineering advances in water conservation and distribution grow more urgent in the face of climate change and rapidly expanding non-agricultural demand. Advances in post-harvest preservation and processing, as well as in our understanding of human nutrition, are needed to increase the bioavailability of essential minerals and vitamins as food consumption and production become more separated in space and time. Management and social sciences advances are likewise needed to overcome market and non-market institutional failures that impede the flow of healthy food among people and over time, as well as to improve eating behaviors. The potential financial, humanitarian, scientific, and social returns are huge.

But obstacles are legion as well. In particular, intellectual property regimes are increasingly burdensome to navigate, especially for smaller organizations. Short-term interests in decision-making, not only among elected leaders and publicly listed firms, but increasingly also among philanthropies, biases investments towards often-illusory "quick fixes" and away from necessary long-term financing of research and development, infrastructure, and education. Meanwhile, the generation-long decline of scientific capacity in the world's most vulnerable and ultra-poor region, sub-Saharan Africa, poses special challenges for the development of context-appropriate, science-based solutions to address the most vexing cases of food insecurity.

Policy issues

The Barrett and Constas (2014) framework for conceptualizing development resilience highlights three broad classes of enhanced food security interventions to build productive assets, reduce downside asset risk, and induce technological and institutional innovations designed to change behaviors that eliminate poverty traps. Building resilience for global food security will require both public and private-sector actions, with priorities necessarily varying according to context.

Government and international organization (e.g., United Nations World Food Programme [WFP] and Food and Agriculture Organization [FAO], World Bank) priorities include:

- Provide effective safety nets: Employment guarantee schemes, conditional cash transfer programs, and food assistance programs protect vulnerable peoples from catastrophic losses, while encouraging investment and productive risk-taking necessary for innovation and economic growth. These are the domain of national governments, but the most vulnerable places require coordinated international support. The UN, led by WFP, must build a multicountry system of long-term sentinel sites in the most vulnerable countries so as to improve early warning systems and evaluation platforms for safety.

- Re-invest in building agricultural scientific capacity in sub-Saharan Africa and south and central Asia: Roughly 90% of the food is consumed in the country in which it was grown because low value-to-weight and perishability make foods inherently local commodities. Agroecological variability requires extensive adaptation of technologies just as variation in

sociopolitical institutions requires adaptation of policy prescriptions. Effective adaptation is impossible without building and maintaining adequate local scientific capacity.

- Reduce trade barriers: trade remains the most effective means of transferring food price and availability risk. Negotiators need to adapt the World Trade Organization's (WTO) latest round of trade negotiations (WTO Doha Round), launched in an era of historically low food prices, to the new high global food price regime. More effective agreements are also needed to manage global common pool resources (e.g., climate change mitigation and adaptation efforts, trans-boundary water and fisheries management). Australia's recent abandonment of carbon taxes is a warning sign of what is to come if China, the United States, and the European Union do not begin to cap emissions.

- Explore innovations in intellectual property rights. For example, convertible patent coverage to incentivize innovations of exceptional societal value for which there is scant commercial market (e.g., vaccines for tropical diseases, improved varieties of "orphan" crops).

While public policy is crucial, the private sector's role is large and especially needed to develop:

- Improved animal and crop genetic material for drought, flood, and pest resistance, and cost-effective means of enhancing and preserving micronutrients in food processing and distribution systems. Life sciences and food industries can profit from this, especially with reforms to intellectual property regimes and philanthropy-funded prizes to ensure a commercial market for discoveries targeted at poor populations' needs.

- Financial innovations for enterprise and employment growth. Financial innovations in impact investing, microequity, index insurance, catastrophe bonds, and other creative approaches are needed to induce debt and equity investment and to insure productivity-enhancing private investment in Africa and Asia. Index-based livestock insurance (http://livestockinsurance.wordpress.com/) demonstrates viability and impact.

- Cost-effective delivery of maternal and child health. Improved vaccine and micronutrient supplement delivery systems are needed to reduce disruptions to essential nutrient absorption during the crucial "first 1000 days" from conception through a child's second birthday.

- Cost-effective information delivery. Mobile information and communications technologies (ICT) can promote uptake of new technologies, labor mobility, and access to finance and markets. Invest in expanding ICT networks that, like Safaricom in Kenya, provide effective platforms for extension, education and financial services to reach poor, remote populations.

References

Barrett, C.B., ed. (2013). *Food Security and Sociopolitical Stability*. Oxford: Oxford University Press.

Barrett, C.B., & Constas, M. (2014). Toward A Theory of Resilience for International Development Applications. *Proceedings of the National Academy of Sciences,* in review.

Barrett, C.B., & Headey, D. (2014). Measuring Resilience in a Volatile World: A proposal for a multi-country system of sentinel sites. 2020 Conference Paper 1, International Food Policy Research Institute (IFPRI) Washington, DC.

*** A policy position paper prepared for presentation at the conference on Food Safety, Security and Defense: Focus on Food and the Environment, convened by the Institute on Science for Global Policy (ISGP), on October 5–8, 2014 at Cornell University, Ithaca, New York, U.S.*