How can the world feed more than 9 billion people by 2050 in a manner that provides economic opportunities to alleviate poverty and reduces pressure on the environment? This is the paramount question the world faces over the next four decades. Answering it requires a great balancing act of solutions to three needs. First, the world needs to close the gap between the food available today and that needed by 2050. Second, the world needs agriculture to contribute to inclusive economic and social development. And third, the world needs to reduce agriculture’s impact on the environment.

Achieving this great balancing act will require a menu of solutions that address both food demand and food supply. The World Resources Institute’s 2013–2014 World Resources Report, “Creating a Sustainable Food Future” (www.wri.org/wrr), identifies several menu items that would reduce growth in food demand, namely:

- Reduce the loss and waste between the farm and the fork of food intended for human consumption.
- Shift diets: Reduce the consumption of calories among people who are overweight or obese. Reduce the share of animal-based foods in daily diets in wealthy countries. And among animal-based foods, reduce the amount of beef consumed and substitute it with fish or poultry.
- Help every region of the planet in their efforts to achieve replacement-level fertility (roughly 2.1 children per woman) by 2050.
- Reduce the diversion of edible crops into biofuel production.

The report also identifies menu items that would sustainably increase the supply of food, including:

- Increase yields on existing agricultural land through the annual selection and adoption of higher-yielding seeds, accelerated by marker-assisted and genomics-assisted conventional breeding and increased attention to orphan crops.
- Increase crop yields on existing agricultural land by implementing improved soil and water management practices, such as agroforestry and water harvesting.
- Limit any crop or livestock expansion to land that is currently not used to produce food, not biologically diverse, and neither stores nor is likely to sequester significant amounts of carbon.
- Increase yields of milk and meat per hectare on existing pasture and grazing lands through sustainable intensification of grazing management and related practices.

“No single solution can achieve a sustainable food future by itself, and the relevance of individual menu items will vary between countries and food supply chains.”

These menu items would help close the food gap, advance economic development, and reduce agriculture’s impact on ecosystems, climate, and water. Of course, no single solution can

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Over the next 10 years, we must lay the groundwork for additional perennial grain, pulse, fiber, and oilseed crops. New domestication efforts directed at current wild perennials require many years to select promising domesticates. Similarly, establishing wide-hybrid populations that would be useful to conventional breeding programs requires numerous generations. In order to achieve ecological intensification with perennials by 2050, a long-term global effort will be essential.

In August 2013, the UN’s Food and Agriculture Organization hosted an expert workshop on perennial crops for food security. Attendees included almost every researcher from around the world who is doing genetics, breeding, agronomic, ecological, or socio-economic work related to perennial grains. That meeting made three things clear: (1) the need for cropping systems based on combinations of perennial species is widely recognized; (2) that need is not being filled, largely because most (but not all) of the people doing research on perennial grains are doing it as a supplement to their larger research programs on annual crops; and (3) with sufficient funding, many more programs focused full-time on development of perennial grains could be initiated.

For several years, we have been urging public and private funding institutions, both national and international, to help fill that gap, making it possible for the informal worldwide network of perennial-grain researchers to strengthen and expand. With such support, we envision a network of research “clusters” in as many as a dozen agriculturally strategic locations distributed across all continents. Each cluster would include breeders, geneticists, crop ecologists, and others with a clearly defined research agenda for developing and deploying a set of perennial cereals, grain legumes, and other species appropriate for the region where that cluster is located.

The most important benefit that perennials confer is protection of the soil. In addition, farmers in more developed economies are expected to benefit from significantly lower input and energy costs. In less developed economies, ecological intensification can become accessible to subsistence farmers and growers who have limited access to capital since the beneficial ecosystem services are derivatives of the crop ecosystem itself.

T. Crews, Research Director, and Research Scientists T. Cox, L. DeHaan, S. Damaraju, W. Jackson, P. Nabukalu, D. Van Tassel, and S. Wang, The Land Institute, Salina, KS; crews@landinstitute.org.

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achieve a sustainable food future by itself, and the relevance of individual menu items will vary between countries and food supply chains. But all are necessary.

Fortunately, there are signs of progress. Here are three examples from Niger, Brazil, and the U.K.:

Farmers in Niger have managed the natural regeneration of native trees growing in farm fields across five million hectares. Trees such as Faidherbia albida fix nitrogen in the soil, protect fields from wind and water erosion, and drop their leaves, contributing organic matter to soils. Yields of maize in such agroforestry systems can be double those of conventional farms in the country.

Brazil is exploring approaches to increase the productivity of existing grazing lands to both meet beef production needs and avoid conversion of forests into pastures. Increasing cattle grazing intensity across the country to just one-half of the sustainable carrying capacity would enable Brazil to meet its beef production needs through 2040 without converting another hectare.

In the U.K., the Waste and Resources Action Programme (WRAP) and major food retailers have been providing tips on food storage, adjusting promotions from “buy one get one free” to “buy one get one later,” and changing package labeling so that households will not confuse “sell by” dates with “consume by” dates. As a result of these and other activities, household food waste in the U.K. declined by 21% from 2007 to 2012.

At the global scale, a partnership has formed to develop a Food Loss and Waste Protocol, which will become the global standard and guidance for measuring food loss and waste. It will enable countries and companies to quantify in a consistent manner how much food is lost and wasted and identify where the loss and waste occur. Partners include the World Resources Institute (WRI), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the Consumer Goods Forum, EU FUSIONS, the World Business Council for Sustainable Development, and WRAP.

Despite these developments, there is a long way to go. The food gap is significant. Consumption patterns are difficult to change, and diffusion of new food production methods can take time. And climate change will increasingly hamper food production if left unchecked. Consequently, governments, the private sector, and civil society will need to act quickly and with conviction to implement this menu of solutions. If they do, the world just might be able to achieve a sustainable food future.

C. Hanson, Global Director of Food, Forests, and Water Programs, World Resources Institute, Washington, DC; chanson@wri.org.


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