

## PolicyPennings by Daryll E. Ray & Harwood D. Schaffer

### Chicago Council on Global Affairs identifies “blue skies” research areas to improve global food security

The recommendations offered by the Chicago Council on Global Affairs in its publication, “Advancing Global Food Security in the Face of a Changing Climate ([www.tinyurl.com/mb4pj5s](http://www.tinyurl.com/mb4pj5s)), follow directly from its analysis of the challenges to increased global food production and food security posed by human-caused climate change. Our overview of the Council’s analysis can be found at <http://agpolicy.org/articles14.html> in columns 723-725.

In this column, we want to focus on a few of the ideas that can be found in the discussion of the four major recommendations. The US government needs to:

1. “Make global food security one of the highest priorities of US economic and foreign development policy;
2. “Bolster research on climate change impacts and solutions, increase funding for data collection, and partner widely;
3. “Include climate change adaptation in trade negotiations; [and]
4. “Advance climate change adaptation and mitigation through partnerships.”

In order to ensure their own access to water and food production, some nations have either leased or purchased large tracts of land in some the least developed countries where the level of food insecurity is already among the highest in the world. These types of agreements could increase in the face of climate change. The Council notes that “in at least some cases the long-standing informal use rights of local farmers were ignored... Efforts to address climate change and food security should be sensitive to the rights of farmers in places where these rights are not already well enforced. Better developed property rights and transparency in all land purchases are important for food and nutrition security generally and adaptation to climate change.”

The Council, as a part of its call for greater funding of agricultural research, identifies a number of broad areas that it calls blue skies research. The term, “blue skies, refers to scientific research where ‘real-world’ applications are not immediately apparent but could potentially have great value.” Each of the areas identified draws on examples from nature.

The first area deals with the concept of increasing the efficiency of carbon fixation in photosynthesis in food plants. Three percent of all plants, including corn and sugarcane, use a method that scientists call C4; all other plants use the C3 method. “C4 plants have an advantage in environments with drought, higher temperatures, and low nitrogen availability and use carbon dioxide more efficiently.” If varieties of the

most important food crops could be bred to use the C4 method, it potentially would go a long way towards “improving the productivity” of these crops “in the face of climate change.” Who would own this technology was not addressed in the report.

The next “blue skies” idea is one that has long been promoted by Wes Jackson and the Land Institute in Salina, Kansas (<http://landinstitute.org>)—the breeding of food crops that are almost exclusively annuals into perennials. As Jackson has pointed out and the Council’s publication notes: “fields with perennial crops offer many benefits for food security and climate change adaptation. The benefits include reduced soil erosion because perennial crops have greater root mass and protect the soil year-round; reduced chemical runoff and more effective fertilizer uptake because their extensive root systems are more efficient at absorbing chemicals; and lower fossil fuel emissions than annual agriculture because annual tillage is not needed.” Many of today’s crops have wild ancestors that are perennials.

A large number of plants have the ability to either fix nitrogen or grow in saline soils. Breeding other plants to carry either or both of these traits has the potential to increase the security of food production. Growing plants that have the ability to fix nitrogen would reduce the need for inorganic fertilizers. “If [the saline tolerance] mechanism could be transferred to food crops, it would make production possible in some marginal areas and keep coastal agriculture viable in the face of rising sea levels.”

In addition, research into the mechanism that bacteria use to fix nitrogen “might reduce the cost and energy use of current fertilizer manufacturing technologies.”

Most of the water in the world is the salt water of the oceans. At present, the desalinization of sea water is “expensive and requires large amounts of energy.” Research that finds ways to reduce the amount of energy required for desalinization could increase the availability of fresh water.

The report also raises another area of research that Jackson has long advocated for: the benefits of polyculture—growing multiple crops at the same time in the same field. In the report this is called a mixed farming system. These systems have many advantages.

“To benefit from mixed farming systems, farmers must experiment continuously to find desirable practices. On individual farms, farmers experiment over generations to find combinations that take advantage of local conditions and meet local needs. The question is

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whether these local optimizations can be scaled up. If recent breakthroughs in analysis of big data, application of information technology to farm management (including automated devices), and computational biology are combined with farm-level data of sufficient quality and diversity, the scaling up [of mixed farming systems] may indeed be possible,” the Council writes.

The details of the Council’s recommendations that run 35 pages—much more than we can cover in our column—provide a starting point for identifying

strategies that will increase food security in the face of climate change.

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