

Potential Impacts of Climate Change on Agriculture and Food Supply

by [Cynthia Rosenzweig](#) and [Daniel Hillel](#)

It seems obvious that any significant change in climate on a global scale should impact local agriculture, and therefore affect the world's food supply. Considerable study has gone into questions of just how farming might be affected in different regions, and by how much; and whether the net result may be harmful or beneficial, and to whom. Several uncertainties limit the accuracy of current projections. One relates to the degree of temperature increase and its geographic distribution. Another pertains to the concomitant changes likely to occur in the precipitation patterns that determine the [water](#) supply to crops, and to the evaporative demand imposed on crops by the warmer climate. There is a further uncertainty regarding the physiological response of [crops](#) to enriched **carbon dioxide** in the atmosphere. The problem of **predicting the** [future](#) course of agriculture in a changing world is compounded by the fundamental complexity of natural agricultural systems, and of the socioeconomic systems governing world food supply and [demand](#).

What happens to the agricultural economy in a given region, or country, or county, will depend on the interplay of the set of dynamic factors specific to each area. Scientific studies, typically based on computer models, have for some time examined the effects of postulated climate and atmospheric [carbon](#) dioxide changes on specific *agroecosystems*--a now common term that defines the interactive unit made up of a crop community, such as a field of wheat or corn, and its biophysical environment. We have **more** recently gone a step [farther](#) by developing methods to study these systems in more integrated regional and global contexts. Both biophysical and socioeconomic processes are taken into account in these [integrated](#) studies, since agricultural production is a player in both worlds: it is very much dependent upon

environmental variables and is in turn an important agent of environmental change and a determinant of market prices.

Climate change presents crop production with prospects for both benefits and drawbacks, some of which are shown schematically in [Figure 1](#). To [address](#) any of them more clearly we must first define the main interactions that link a chain of processes together: food is derived from crops (or from animals that consume crops); crops in turn grow in fields, which exist in farms, which are components of farming communities, which are sectors in nation states, and which ultimately take [part](#) in the international food trade system. Understanding the potential impacts of global environmental change on this sequence of interlocking elements is a first **step** in modeling what will happen when any one of them is changed as a result of possible global warming, and a prerequisite for defining appropriate societal responses.

In this summary we look first at the possible biophysical responses of agroecosystems to the specific environmental changes that are anticipated as a result of the buildup of global greenhouse gases, and then at the range of adaptive actions that might be taken to ameliorate their effects. In subsequent sections we draw on our own and other modeling studies to show examples of regional and global assessments that have so far been made, including discussions of the effects of uncertainty, thresholds, and surprises, and the possible consequences of **global warming** on agricultural sustainability and food security. Finally we give our own views on two potentially misleading notions regarding climate change and agriculture.