

Theme Overview: Revisiting the Evidence and Potential Solutions on Climate Change

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An 2008, a *Choices* issue theme examined climate change just after the release of the 2007 Intergovernmental Panel on Climate Change (IPCC) report series. The last few years have seen the release of another round of IPCC reports along with the National Climate Assessment, reports from the National Academies and several other climate change assessments throughout the world. These reports and the literature more generally contain substantially more evidence on climate change effects and impacts and we have seen additional policy attention devoted to ways to mitigate and adapt to the risks. Thus, this *Choices* theme revisits the issue and, in doing so, the articles address some of the controversies, imperatives and unmet expectations that have arisen in the last decade plus the challenges that lie ahead.

The connection between climate change and agriculture is multifaceted. A major assertion in the 2014 IPCC and National Assessment reports is that climate change is already affecting agricultural productivity and adaptation is occurring in response. Evidence suggests that these effects are spatially heterogeneous and are likely to intensify in the next century. Furthermore, adaptation has evolved to be a much more prominent theme than in the past, with extensive coverage by the National Academy and prominent coverage in IPCC, 2014. Moreover, the reports again define a role for agriculture in greenhouse gas (GHG) mitigation. Through all this, there remains debate and substantial research on the nature, scale, and severity of future climate change, means of adaptation into the future, and potential mitigation actions.

Articles in this Theme:

Climate Change, Vulnerability and Food Insecurity

Climate Change Impacts on U.S. Crops

The Inevitability of Climate Adaptation in U.S. Agriculture

Elaborations on Climate Adaptation in U.S. Agriculture

Why Have Carbon Markets Not Delivered Agricultural Emission Reductions in the United States?

GHG Mitigation in the Absence of a National Carbon Market

The articles in this thematic package address key dimensions of the effects, adaptation and mitigation facets of the climate change and agriculture issue:

- The projected impact of climate change on agricultural productivity and food security in domestic and international settings
- The motivation for adaptation efforts along with potential strategies and roles of public versus private entities

Prospects for and policy towards an agricultural role in climate change mitigation

In the first article on the climate effects facet, Elodie Blanc and John Reilly review the latest climate change impact assessments on crop productivity in the United States. Their findings suggest that under current agricultural practices, a lower future yield trajectory is expected for the major crops grown in the United States, but that adaptation strategies can alleviate these negative impacts. The second article, by John Antle, takes a global view of food security as a potential form of climate change vulnerability. Antle discusses how climate change acceleration, together with population growth, economic growth, and other forms of environmental degradation, could create high hurdles to food access for the world's population. He argues that, despite these concerns, we know quite little about the likely impacts of climate change on food security. His article explains the apparent gap in our understanding of climate-related food security, why current modeling efforts do not adequately capture food security problems, and how future research can address these knowledge and application gaps.

The next two articles turn attention primarily to the adaptation challenge. Steven Rose reviews evidence and projections that indicate the global emissions rise and climate change will likely continue for some time, even with mitigation efforts being undertaken arguing that this will make inevitable the need for adaptation. Rose argues that agriculturalists are already well-versed in adapting practices to trend changes in technology and markets, and thus climate adaptation is not a completely foreign concept. However, adaptation to climate change will require investments in capacity for research, outreach and information decision, as well as the institutions to support these activities. Bruce McCarl builds on those by Rose and Blanc and Reilly and highlights the significance of the challenge facing agriculture. Drawing on data from the IPCC assessment report, he argues that the agricultural sector needs to prepare for two phases of climate change—one between now and 2040 that is more or less “dialed in” at about 1° C, and the post-2040 phase that could range from 2-6° based on the mitigation actions taken from this point forward. McCarl identifies about a dozen categories of adaptation, from standard changes in farm management practices to large scale changes, such as purposeful relocation of entire

ecosystems, with roles for the public and private sectors. He highlights the current status of adaptation and areas for concern, attitudinal and economic hurdles to ramped up adaptation measures, and the need to intelligently link adaptation and mitigation.

The mitigation facet of this collection looks beyond specific practices, as that was well covered in the 2008 and earlier *Choices* theme issues and in other reports (McCarl and Schneider, 2000; Murray et al., 2005; IPCC, 2014). Specifically, the theme mitigation articles cover the evolution of mitigation policy over the last several years and expectations moving forward. Brian Murray recalls the pronouncements and speculation from the last decade that the inevitable emergence of carbon markets in the United States would drive substantial participation from the agricultural sector in GHG mitigation. He describes why these market forces did not materialize at the level anticipated. Reasons range from the political failure of a national, economy wide, cap-and-trade program, to the minor role of agriculture in the carbon markets that do exist, to the unforeseen costs of undertaking and aggregating mitigation measures in the sector. He describes a possible future path where agricultural mitigation could ramp up as part of the broader use of carbon markets that is now actually being observed, coupled with targeted public and private sector programs. Jan Lewandrowski and Kathryn Zook look at policy directions examining recent experiences and future pathways for complementary targeted programs. These efforts include the expansion or refocusing of traditional government conservation and bioenergy programs to target mitigation, assistance in the development of private sector initiatives such as supply chain imperatives for sustainably produced foods, and the use of economic incentives for the provision of a wide range of ecosystem services, including carbon sequestration and other forms of agricultural GHG mitigation.

Naturally this special theme issue cannot cover all aspects of climate change and agriculture, coverage of which has consumed thousands of pages of assessment reports, regularly published journals, special issues, books and individual papers. The bibliography below contains references that provide a much more comprehensive treatment.

For More Information

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