

AGRICULTURE

What Next for Agriculture After Durban?

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Global agriculture must produce more food to feed a growing population. Yet scientific assessments point to climate change as a growing threat to agricultural yields and food security (1–4). Recent droughts and floods in the Horn of Africa, Russia, Pakistan, and Australia affected food production and prices. The Intergovernmental Panel on Climate Change predicts that the frequency of such extreme weather events will increase (5), which, when combined with poverty, weak governance, conflict, and poor market access, can result in hunger and famine. At the same time, agriculture exacerbates climate change when greenhouse gases (GHGs) are released by land clearing, inappropriate fertilizer use, and other practices (6).

Alternative agricultural practices, tailored to different regions, show promise for reducing net GHG emissions and maintaining or improving yields despite extreme weather (7). In Niger, agroforestry on 5 million hectares has benefited >1.25 million households, sequestered carbon, and produced an extra 500,000 metric tons of grain per year (8). In Denmark, agricultural emissions have been reduced by 28%, while productivity increased (9).

Agriculture, the FCCC, and Durban

Despite growing support for an integrated approach to agricultural adaptation to, and mitigation of, climate change, financial and policy actions have been slow to materialize in most countries and at the global level, including the United Nations Framework Convention on Climate Change (FCCC). At the 15th

FCCC Conference of the Parties (COP-15) in Copenhagen, negotiators developed text on agriculture, but no agreement was reached. In the lead-up to COP-17 in Durban in late 2011, political momentum grew for a work program on agricultural adaptation and mitigation within the FCCC's Subsidiary Body for Scientific and Technological Advice (SBSTA). This included a common position by African Ministers (10), the scientific Wageningen Statement (11), a joint letter from the United Nations and other agencies (12), and public statements by South African President Jacob Zuma and former UN Secretary-General Kofi Annan.

COP-17 produced the "Durban Platform for Enhanced Action" (13), which commits parties to reach a legal framework for reducing global emissions by 2015. The only specific agreement on agriculture was to consider adopting a framework for sectoral actions, which could include agriculture, and for the SBSTA to "exchange views on agriculture," with a 5 March deadline for parties and observers to provide evidence (13). This modest progress, without adoption of a formal work program on agriculture, can be attributed to the following issues:

- Views on inclusion of agriculture depend on the degree to which agriculture features in national economies. Countries vary in their vulnerability to climate change, their GHG emissions from agriculture, and their opportunities to reduce emissions from changes in agricultural practice. Forested nations that may benefit from Reducing Emissions from Deforestation and Forest Degradation (REDD+) policies may see the inclusion of agriculture as delaying or competing for climate finance.

- Actions agreed in Durban were in the mitigation track of FCCC negotiations, which are separate from adaptation discussions. This obscures opportunities for agriculture, which can deliver benefits for both, and has led to concern that the focus on agricultural adaptation—a priority for developing countries—will be reduced. Others worry that inclusion of agriculture under the mitigation track could lead to mandatory

commitments and/or that possible mechanisms (e.g., carbon trading) will not benefit smallholder farmers. Some countries do not welcome potential restrictions on conversion of land to agricultural use. Export-focused agricultural producers worry that mitigation measures for agriculture could restrict trade from "high-emission agriculture."

- Some negotiators are concerned that technical challenges (e.g., carbon monitoring by millions of farmers and pastoralists) are too great to develop agriculture agreements.

In general, higher-income countries, farmers' organizations, UN and agricultural agencies, and some nongovernmental organizations (NGOs) supported a SBSTA work program on agricultural adaptation and mitigation. Other nations, primarily low and middle income, supported by a different set of NGOs, resisted a work program and called for emphasis on agricultural adaptation to climate change.

What Now on Agriculture?

The Commission on Sustainable Agriculture and Climate Change was set up in early 2011 to synthesize evidence into policy actions to help achieve a food-secure world in the face of climate change. The Commission encouraged policy action inside the FCCC, as well as through other global processes (e.g., the UN Conference on Sustainable Development and the G-20) and bilateral, national, public-private, and "bottom-up" initiatives (14). Seven priority actions were identified:

1. Integrate food security and sustainable agriculture into global and national policies, including adaptation and mitigation;
2. Increase global investment in sustainable agriculture and food systems;
3. Sustainably intensify agricultural production while reducing emissions and other environmental impacts;
4. Target programs and policies to assist vulnerable populations;
5. Reshape food access and consumption to ensure that basic nutritional needs are met and to foster healthy and sustainable eating habits;

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6. Reduce food loss and waste across supply chains; and

7. Create comprehensive information systems on human and ecological dimensions.

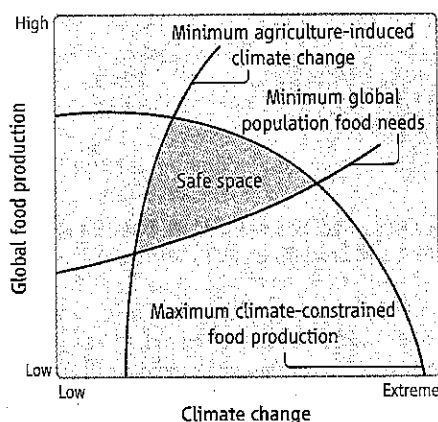
In light of these recommendations and the obstacles and opportunities highlighted in Durban, and acknowledging the many factors beyond science, we suggest areas for scientific contribution to policy progress under the FCCC:

•Common definitions. Terms like “climate-smart agriculture” (CSA) and “sustainable intensification” are widely used in relation to FCCC; however, common understandings of how these terms address adaptation and mitigation is needed. The following elements are essential to defining these terms: maintains or increases production of food, fodder, fiber, and fuel; supports livelihoods and builds prosperity; sustains environmental resources and ecosystems; adapts to existing and future climate; and, sequesters carbon and/or reduces GHG emissions. Through efforts like the CSA source book (15), led by the UN Food and Agriculture Organization, scientists can develop objectively grounded “standards” and can address concerns about an unbalanced focus on mitigation.

•Forestry and agriculture. Although agreements reached at Durban for REDD+ did not explicitly mention agriculture, it is implicitly recognized as a driver of deforestation. Scientists can more clearly describe adaptation and mitigation strategies that span agriculture and forestry and improve food security and livelihoods.

•New information systems. To help countries evaluate potential policies and practices for agricultural adaptation and mitigation, geographically explicit estimates of risks and benefits are needed. These should better describe and manage tradeoffs and synergies among the biophysical and human dimensions of systems affected by agriculture and emissions from agriculture. We need to assess who has benefited from actions in agricultural landscapes and food systems and to develop and test a broad range of potential mechanisms for both mitigation and adaptation (i.e., not just market-based approaches). This must be supported by a global, public-domain system of repeated observations of terrestrial systems at scales suitable for small-holder agriculture.

•Scaling up to “safe operating space.” The Commission emphasized that the world is already outside a safe operating space with respect to agriculture, climate change, and food security, as defined by three theoretical limits: the maximum amount of food that



A schematic of an integrated conceptual framework for the scientific community to define and test limits, thresholds, and dynamics that affect food security in the face of climate change. Modified from (14).

can be produced under a given climate; the minimum quantity of food needed by a growing population; and the minimum effects of food production on the climate (see the figure) (14). To mobilize increased investment, scientists must document ways that farmers, industry, consumers, and government can move toward, expand, or shift the safe space and achieve multiple benefits from sustainable farming practices (1, 7–9, 12, 14). More integrated research and improved knowledge systems on what works in different regions, farming systems, and landscapes is needed, especially in the most vulnerable socio-ecological systems.

•Climate financing. We are already seeing investments in agriculture through the Adaptation Fund of the Kyoto Protocol. There are two other opportunities: the Green Climate Fund (13), which is to invest \$100 billion per year for mitigation and adaption to climate change in developing countries, and the Clean Development Mechanism (13). For both, we need processes that allow investments in integrated agricultural adaptation and mitigation.

•National action. Linked to the FCCC are national plans for adaptation and mitigation that should consider agriculture (13). For developed countries, this means transforming incentives and markets to steer public and private investments toward efficient, sustainable agricultural practices. For developing countries, this means increasing investment in agricultural development emphasizing “climate-smart” practices and food security.

Conclusions

Converging trends in climate change, population growth, and use of resources threaten

global food security and environmental sustainability. Widespread use of sustainable agricultural practices can help by reducing risks to food production and farmer income and by decreasing GHG emissions and resource degradation. Investments and policy changes are needed from local to global scales. A SBSTA work program on agriculture, looking at adaptation and mitigation and an agreement on a framework for agriculture are needed at COP-18 in Qatar 2012. By expanding understanding of cultural practices that deliver multiple benefits and of the links between agriculture, forestry, scientists can make critical contributions to these initiatives.

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