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Linking local agriculture into national policy by studying climate change economics in Colombia

Participatory research, using the FAO's Aquacrop model, is investigating crop yields under several climate change scenarios, and feeding the findings in to a national, cross-sectoral economic model. Stakeholders, from farmers to national decision makers, are using the same model to guide their decisions. The project will contribute to a National Adaptation Plan for Colombia, and be scaled across farming communities.

Overview

Climate change impacts in Colombia are likely to be huge. To tackle the challenges ahead, the Colombian government undertook an Integrated National Adaptation Project (INAP) between 2006 and 2011, bringing together science, wide consultation and pilot projects among farmers and other communities. Studies under INAP found that Colombia is already feeling many climate change impacts, and important effects are expected in the future. These include: (i) changes in water resources across 50 per cent of Colombia; (ii) floods in vast areas of insular and coastal zones, and salinisation that could affect 2041km^2 inshore of the Caribbean coast; (iii) risk of desertification across 27.3 million hectares, including soils used for agriculture; (iv) effects on road, manufacturing, port infrastructure and hydroelectric generation; (v) deterioration of high mountain and coral reef ecosystems; and (vi) human health effects due to a higher incidence of transmittable diseases such as dengue and malaria. Dengue in turn can have long-term effects on nutritional status as it damages the liver of the affected person.

In Colombia, agriculture is one of the sectors most affected by climate and climate change, and at the same time the sector that contributes the most to global warming. Climate conditions, and in particular changes in the availability of water, affect animal and crop productivity, compromising food security and livelihoods for the most vulnerable communities. According to GERMANWATCH, Colombia was the country third-most-affected by weather-related loss events (such as storms, floods and heatwaves) in 2010.[1] Colombian officials estimate that by 2050 climate change will threaten the livelihoods of 3.5 million farmers.[2] And for Latin America and the Caribbean, the International Food Policy Research Institute has calculated that per capita consumption of cereals and meats could fall 1 per cent by 2050 due to climate change, and that the availability of per capita daily calories would be reduced by 2.8 per cent.[3]

Farmers are already well aware of changes and have been expressing their concerns to government and research agencies (see Box 1). Consumers in the lowest wealth percentiles will bear the biggest burden of food price rises, as they spend the greatest proportion of their incomes on food. Nutritional outcomes are likely to suffer as people forego more expensive nutritious foods. This has major implications for social justice as well as knock-on effects for the national economy. One of the lessons from INAP is that better models and scenarios are needed to help farmers identify adaptation measures

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that can reduce hunger and improve nutrition for themselves and for urban consumers.

In response to the INAP, Colombia's National Planning Department (DNP) is now coordinating a major project: the Economics of Climate Change Study for Colombia (EIECC). This project involves the public sector, research institutes, national and international universities, farmers' organisations and NGOs. Using a Computable General Equilibrium Model,[5] the EIECC aims to quantify the economic cost of climate change impacts and determine the optimal responses that could be taken to protect the country's economy, particularly the livelihoods of people in lower wealth percentiles. Once these calculations have been made, the EIECC will propose and prioritise public policies that minimise the costs and maximise the benefits of adaptation and mitigation, taking into account their economic, political, social and environmental viability. In doing so, the EIECC will produce a short-, medium- and long-term national climate change agenda, which will be instrumental in shaping Colombia's National Adaptation Plan (NAP), which is due to be developed in 2013.

The EIECC project has held wide consultations through workshops and informal meetings where farmers are able to speak freely about their daily experience with climate factors and their concerns about climate change. As a result, the EIECC recognised the need for a sectoral model for agriculture that could be both reliable at the national level and accessible to farmers' organisations and other stakeholders at the local level. The FAO, DNP, the Ministry of Agriculture and Rural Development, and the Institute of Hydrology, Meteorology and Environmental Studies of Colombia (IDEAM) signed an agreement to jointly study the agricultural sector, using FAO's Aquacrop Model. Aquacrop has open-access software and covers a wide range of crops, though it needs calibration for national and sub-national contexts.

Box 1. "My name is Maria Mosquera Rodriguez, and I am from Cundinamarca, Colombia. The majority of the products we grow here are taken to the markets in Bogotá and Villavicencio, which only leaves us crops like maize and some fruits to eat for ourselves. That means we are depending on the external market. We used to grow coffee, but because of the change in temperature it's not possible anymore.

We depend a lot on maize now; it is the main crop supporting us. The difficulty is that more and more during the summer we are left without water, which means we lose our maize crop. Sometimes we don't even have enough water to cook the food we do have.

My neighbours, friends and I have noticed how over the years the change in the climate has got stronger, especially in the summer. In this area we've recently had two very strong droughts, the first one in 1996 and the second one in 2006. We were left without anything to live on because our maize crops died. Some families had to get out of farming altogether and find another way to feed their children, and others even left for Bogotá to survive. Everyone here agrees that 20 years ago the climate was much more stable, and the river had much more water."

Adapted from reference 4.

Intervention and impacts

The project has had four stages:

1. Crop selection and regional validation. Maize, rice, potatoes and sugarcane were selected as the first crops to consider, based on their economic and food security importance, availability of information and inclusion in Aquacrop. The crops were matched to production regions, where information about soils, soil use, type of agricultural practices and climate conditions was collected. FAO staff showed Colombian researchers how to adjust and calibrate the Aquacrop Model to the agro-climatic conditions of the different regions. This activity included constant work with farmers' associations and Colombian research institutes to validate the model for local conditions. Farmers' organisations were crucial knowledge providers, often having access to the only reliable local data.

2. Learning to use Aquacrop. To ensure that people at all levels, including farmers, knew how to use Aquacrop, the project ran six workshops. One at the national level was for heads of farmers' organisations, the national meteorological service, universities and the public sector. Five regional workshops, covering different crops, were for local farmers and agricultural secretaries from local government. All workshop participants had a computer to learn and test the model by adjusting parameters.

3. Estimating crop yields using different climate change scenarios in order to include them in the EIECC. The project identified climate scenarios for each region; and simulated growth and yields for each region under different climate scenarios. Results suggest that La Niña events can cut sugarcane productivity by 10 per cent, while El Niño events can cut potato yields by between 62 per cent and 76 per cent, and rice yields by 13 per cent. The calibration process also revealed that water is not being used effectively to grow rice. Preliminary results suggest

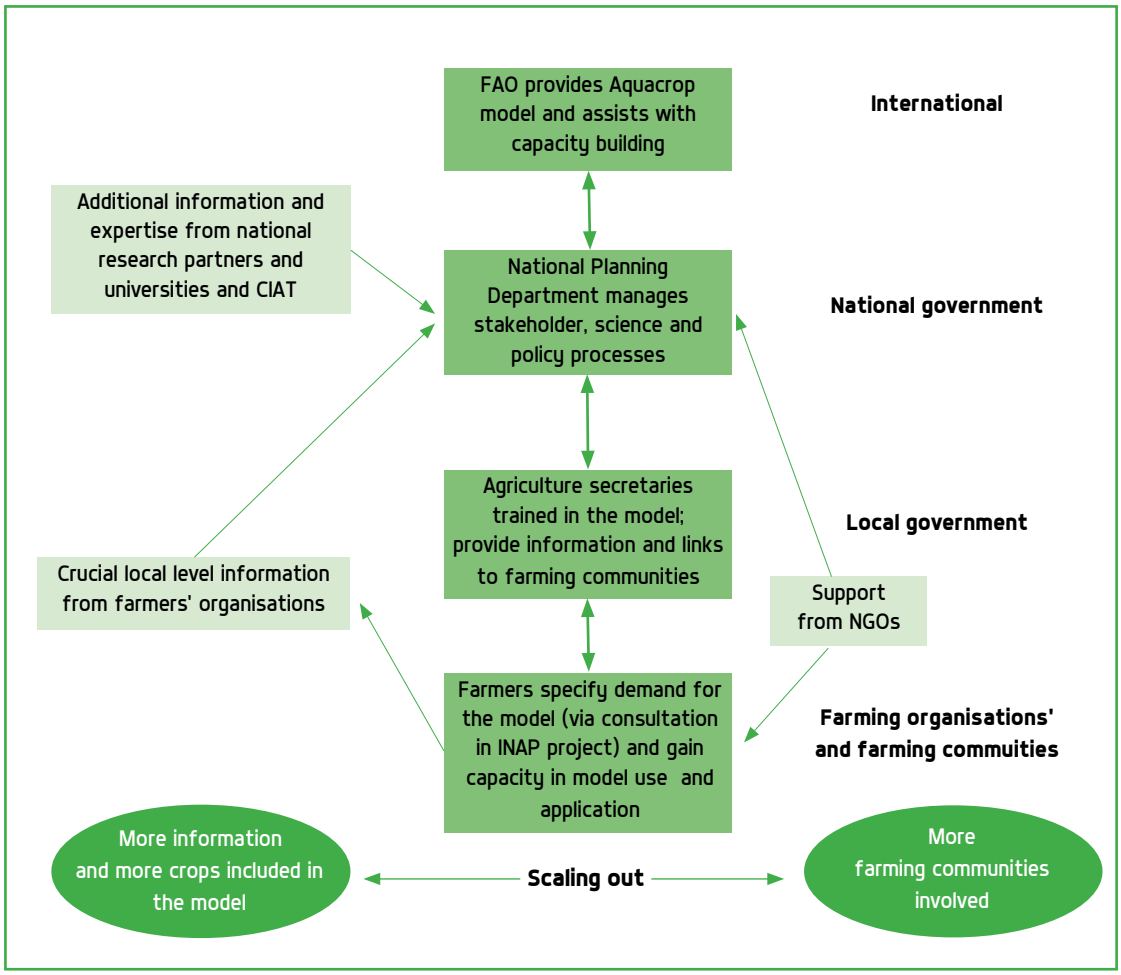

Figure 1. Linking local and national in the agricultural component of the EIECC in Colombia

that even with rapid economic growth, low population growth and many new technologies, a 7 per cent climate-related increase in food prices will drive the number of poor households up by 3.3 per cent by 2040, leaving almost two million more people in Colombia below the poverty line.

4. 'Scaling out'. The project has published a final report, including methodology, processes and results of the simulations; and has held two regional and one national workshop to disseminate the results among a wider set of participating institutions and other stakeholders.

Main achievements and challenges

Policymakers, researchers and communities have worked together to accomplish a common goal in the EIECC (see Figure 1). DNP has been a crucial player in this process – in charge of formulating inter-sectoral policy and allocating budget resources to the different ministries. The EIECC is an experiment in which academic researchers and specific interest groups (such as farmers) are interacting continuously with policymakers to formulate policies that can have real benefits for communities.

The EIECC's integrated cross-sectoral economic analysis reveals whether interventions or impacts in one sector could entail higher costs to the economy and thus result in falling national income, higher unemployment, or have other downsides such as increases in poverty that generate problems of hunger and nutrition.

Using FAO's Aquacrop model to understand how changes in climate variables can affect agricultural productivity – and hence foods prices, poverty and nutrition – has added an innovative 'bio-economic' aspect. This approach provided robust results that can be easily incorporated into the agendas of national decision makers and also into farmers' daily decisions. DNP plans to scale out the model to reach more farming communities. If possible, other crops that are important to farmers' nutrition and livelihoods, but that are not on the current Aquacrop list (such as plantain), will also be included. This approach has let the project contribute to better understanding of issues and responses related to climate change both at policy and grassroots levels.

The next phase of the EIECC will incorporate the results of the models into Colombia's National Adaptation Plan (NAP), now being prepared. The NAP

consists of a set of tools to help ministries and local authorities include climate change in their daily decisions. One of these tools will be the EIECC and its results. The emphasis will be on demonstrating the effectiveness of addressing climate change in an integrated way across sectors. For the agriculture sector, a major outcome will be that farmers, farmers' organisations and agricultural secretaries in local government will be proficient in using exactly the same model as is being used for national policymaking.

Information rather than participation has been the main challenge. Generally speaking, data accessibility and compatibility were the serious hurdles. In particular there were obstacles in obtaining the necessary hydro-meteorological time series. Often, long time series simply do not exist, and in many cases the hydro-meteorological network did not cover locations needed for the analysis. Continuous dialogue with information providers proved crucial, as did drawing in information from others, such as farmers' organisations and other research institutes beyond IDEAM. Farmers were able to test the model using historical data sets and identify where better data were needed. In many cases they were then able to come forward with their own data sets, managed by farmers' organisations.

Crop differences were also apparent. For sugarcane, the model worked well, but for rice, where information was more of a problem, there was less success.

Lessons

Accountability and integrity of government agencies. For really effective linkages between local concerns and national policy, it is crucial that local stakeholders have faith in the mediating government agencies. DNP, the coordinating agency for this work, has taken a particularly collaborative approach. In collecting the data, and sharing and testing the model, it has been important for DNP to maintain transparency and keep to promised outputs and ongoing engagement. This will be even more important as the exercise feeds into the NAP.

Emphasis on the very poorest. As the research has shown, poor consumers, in the lowest wealth percentiles, will bear the biggest burden of food price rises and nutritional impacts under climate change in Colombia. The EIECC has been designed to include detailed analyses of outcomes for different wealth groups, so that future policies, particularly the NAP, can directly address the needs of the poorest.

Simple messages versus detailed tools. Governmental communications with the public frequently take the form of simple memorable messages (for example, the '5-a-day' nutrition message in United States, United Kingdom and Germany). The EIECC takes a different approach, putting farmers' organisations in full command of the analytic tool (Aquacrop) that will guide national policy. There are pros and cons of each approach. Simpler approaches are less costly and reach a wider portion of the population, especially the very poor. But they can be paternalistic and exclude participation. More complex and participatory processes are empowering, but may lead to unclear conclusions (for example, how the Aquacrop model expresses climate uncertainty, or copes with crops for which the data are poor).

Ongoing engagement versus over-burdening local participants. A potential shortfall of project approaches is that local participation and capacity building may be limited to one-off consultations (for example the national-level and regional-level workshops on the Aquacrop model). To provide effective local empowerment, government agencies need mechanisms for ongoing support and engagement. On the other hand, there is a fine line between stakeholder engagement and over-burdening farmers with too many demands for information, feedback and attendance at meetings.

Notes

[1] Harmeling, S. 2011. *Global Climate Risk Index 2012. Who suffers most from extreme weather events? Weather-related loss events in 2010 and 1991 to 2010.* GERMANWATCH http://germanwatch.org/de/3667 [2] Ministerio de Ambiente, Vivienda y Desarrollo Territorial (MAVDT), Institute of Hydrology, Meteorology and Environmental Studies of Colombia (IDEAM) and Programa de las Naciones Unidas para el Desarrollo (PNUD). 2009. Diálogo Interministerial de Cambio Climático. [3] Nelson, G.C. *et al.* 2009. *Climate Change: Impact on Agriculture and Costs of Adaptation - Food Policy Report: Series 21.* IFPRI. DOI:10.2499/0896295354 [4] Quiroga, A. et al. 2011. *Impacto del cambio climático en la seguridad alimentaria de Bogotá y en los medios de vida de pequeños productores.* International Centre for Tropical Agriculture (CIAT), Managua, Nicaragua and Cali, Colombia. [5] Computable General Equilibrium Models simulate the flows of incomes and expenditures of an economy.

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