

Nation-wide interdisciplinary assessments of climate change impacts on agriculture for adaptation planning

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Abstract

Impact assessments of climate change on a large-scale, such as nation-wide, produce valuable information to partake in national adaptation planning and policy making. However, the interdisciplinary nature of this exercise, involving multiple actors and institutions, often challenges the production of an integrated assessment. FAO is presenting here an approach dedicated to conduct the nation-wide assessments through the explicit integration of multiple actors, multiple disciplines, and multiple institutions through a modeling platform as the medium for integration.

Keywords: *Nation-wide impact, Interdisciplinary assessment, Planning, Assessment*

Introduction

The Food and Agriculture Organisation of the United Nations (FAO) has been supporting developing countries to further build their capacity to conduct nation-wide impact assessments of climate change on agriculture and food security. Such assessments strengthen the evidence base of current and future impacts, and support effective adaptation planning and policies at national level. Many climate change impact studies exist, yet with a diverse range of scales (in space and time) and foci, so that it becomes challenging to extract clear nation-wide information and messages for policy making. Local experts hold local knowledge and they are best suited to produce the assessments, and later disseminate and advocate them to a wider audience. However, in many cases, local experts take part in the process of those assessments, but often remain isolated from other national participants, particularly after the conclusion of the project or program, or they do not have further access to - or adequate skill to use - the assessment tools, such as those typically needed for nation-wide large-scale integrated assessment.

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By introducing robust and simple tools, and initiating the production of such assessments, we aim to develop specific and interdisciplinary capacities within the country. We believe that this step leads to producing nation-wide relevant impact assessment, by enhancing collaboration among stakeholders, and facilitating further development and engagement within the country. By involving the national experts from the beginning of the study design to its dissemination, we further aim to promote the communication between science and policy making at the national level.

Methodology

This activity is led by the Climate and Environment Division (CBC) of FAO, which has an objective to support countries by developing the capacity within to conduct assessments in the agricultural sector. It introduces the tools for data analysis, numerical simulation, and expert interpretation of the outcomes. A wide range of national experts who hold various disciplinary expertise (e.g. climate, crop, policy), and different positions in research or government bodies, are involved in this effort. Their interaction, during and beyond the activity, contributes to produce nation-wide assessments with sub-national dis-aggregation expressly targeting national policy making.

The challenges which arise from connecting multiple actors and discussing multiple disciplines can be helped by the introduction of a common platform, which includes a complete set of tools (not necessarily all available tools) that allows for handling of existing national climate data, from GIS management to the simulation of gridded nation-wide impacts and their economic implications. FAO developed such a platform: the Modelling System for Agricultural Impacts of Climate Change (MOSAICC³). It facilitates a collaborative and integrated research that examines climate impacts on crops, water resources, forests, household-level food security, and national economy (**Figure 1**).

³ www.fao.org/in-action/mosaicc/en/

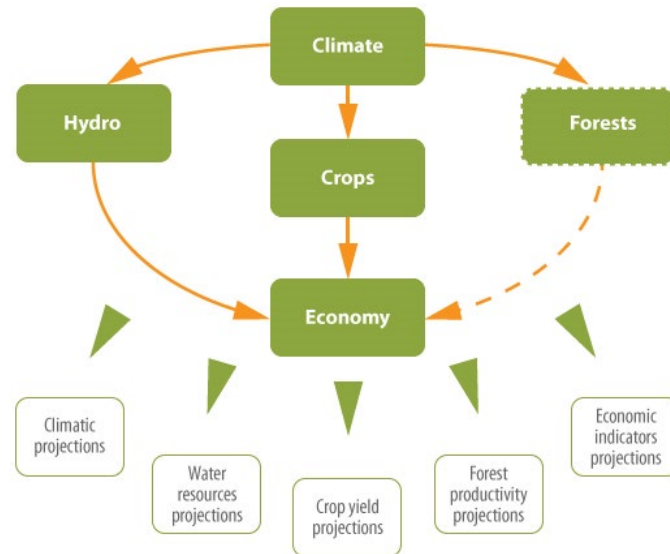


Figure 1. MOSAICC, interconnected models designed to facilitate the data flow from one to the other (Source: FAO, 2014⁴)

The platform also proves to be of sufficient simplicity and scope to interest all the partners, and to be a common hands-on support to reinforce existing, and develop new, skills. The capacity development and stakeholders' participation are an integral part of the process, as the trained national scientists ultimately are the ones producing the evidence, using their country's own data and running the impact models in order to produce information responding to the nation level stakeholders' needs.

Results

The approach has been, and continues to be, implemented in various developing countries such as Morocco, Peru, Philippines, Paraguay, Indonesia, Uruguay, Malawi and Zambia. We briefly refer here to the key processes and lessons from recent Malawi and Zambia cases. Each country holds the MOSAICC platform on national servers maintained by local experts - meteorological Services in both countries. The platform is accessible through a web interface and allows the various modules to access the different data sets to build interdisciplinary simulation experiments (e.g. climate, crop). By explaining below the full process of an integrated assessment, we want to particularly highlight the robustness of this approach toward producing the information responding to independent needs of the countries.

- **Climate** – Using the available weather station records in the country and getting support from international experts, the national climate experts do the quality control

⁴ <http://www.fao.org/climatechange/mosaicc/66705/en>

of climate data and perform the statistical downscaling for at least two Representative Concentration Pathways (RCPs) and three Global Climate Models (GCMs). This data is then uploaded and consequently made available to all modules in the platform.

- **Crop** – Various crop growing characteristics can be calibrated following the simple concept of crop coefficients (Allen et al., 1998). Climate, crop coefficients and soils (FAO global soil database) are used in the WABAL model to simulate crop related water balance (Gommes, 1999). The users also set the planting date (including rain-based planting rule) and growing length. Zambia simulated seven crops and Malawi simulated six, allowing for sufficient crop representation.
- **Climate Change impact on agriculture** - With the yield projections of multiple crops, under multiple GCMs, under multiple RCPs, the teams can analyze the crop production changes in time through simple statistics (e.g. change in mean, compared to historical standard deviation). The data is spatially aggregated according to user preferred scales (e.g. provinces in Zambia, Agricultural Development Divisions in Malawi) so to be more relevant to policy makers.
- **Capacity Building** – Beyond the technical skills needed, each team member develops a dedicated understanding of, and collaborative skills with, connected disciplines. Despite external support for the initial training and follow up support, the climate change impact assessment is the exclusive product of the national expert teams, who become the understanding messengers of new and scale relevant evidences of climate change impact for agriculture, hence leading to a more efficient dissemination of actionable interdisciplinary information for adaptation planning in their country.
- **Connecting beyond** – Although different from one county to another, the result of the assessment produced by the national team is shared with national and regional stakeholders (e.g. international organisation, national government, NGOs), leveraged in background analysis of future projects, and takes a role in adaptation planning initiatives at country level (e.g. National Adaptation Plans).

Conclusion

Both *Zambian*⁵ and *Malawian*⁶ teams are in the process to record and disseminate their results. With various degrees of agreement due to spatial aggregation and future projections range, they could identify consistency in climate projections in specific areas, crops particularly sensitive (or non-sensitive) to this change, or areas particularly impacted independently of the crops considered for instance. The nation-wide information, directly related to policy relevant

5 <http://www.fao.org/in-action/mosaicc/on-the-ground/zambia/en/>

6 <http://www.fao.org/in-action/mosaicc/on-the-ground/malawi/en/>

administrative boundaries, makes the dissemination relevant and provides a new basis for discussion, as well as improvement (e.g. new crops of relevance, irrigation option).

This in-country, simple, robust and modular nature of the platform makes it a useful and accessible tool for nation-wide, nation-relevant, collaborative and integrated assessment. This approach contributes to build more sustainable institutional capacities within countries, hence improving ownership, relevance and uptake of the assessment. It also enables national actors to periodically and independently revisit climate change information in response to new science and evidences. The local development and relevance of the evidence produced, more adequately supports the policy and practice changes effort at national levels, hence largely supporting FAO ambitions on that front.

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