

The role of regional scenarios in CCAFS cross-scale research, planning and action toward improved food security, environments and livelihoods

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1. Introduction

Research and action toward better food security, environmental health and rural livelihoods under climate change in the developing world must deal with interacting natural and human systems change processes across multiple dimensions (e.g. biophysical, economic, policy, temporal) and scales (e.g. local, regional, short-term variability, long-term change) in food systems and their contexts. The CGIAR research program Climate Change, Agriculture and Food Security (CAAFS) engages in a wide range of research and capacity building activities focusing on climate change adaptation and mitigation across dimensions and scales. In this context, this document outlines the key potential of the CCAFS regional scenarios process as a tool for cross-scale and multi-disciplinary food systems research, planning and action.

This document aims to:

- Highlight the need to link research, strategic planning and action for food security, environments and livelihoods across dimensions and scales
- Introduce the CCAFS regional scenarios
- Discuss the role of the CCAFS regional scenarios process as an integrative process that can link research, strategic planning and action across dimensions and scales – both within and outside CCAFS.

Food security, environments and livelihoods – cross-scale dynamics

The key drivers of change in food systems and their contexts operate across different system dimensions and scales. With dimensions we mean the different aspects of systems, such as spatial, biophysical, temporal, socio-economic and policy dimensions. Scales signify different combinations of extent and resolution at which these dimensions can be examined, such as local, regional, national and local scale for the policy dimension or short-term and long-term for the temporal dimension.

Evidence is accumulating that supports the notion that institutions and organizations who consciously address linkages across dimensions and scales are more successful at assessing problems and finding sustainable solutions - and that this depends on access to credible science originating along different dimensions and at scales ([Cash 2006](#); [Adger et al. 2005](#);

[Lebel et al. 2005](#)) .

A number of examples can demonstrate the value of insights into cross-scale dynamics. On the one hand, the introduction of new technologies and practice can have different effects across different spatial scales:

- Planted fodder in West Africa in the 1990s: under the conditions pertaining at that time, even relatively limited uptake by farmers of planted fodder led to some social benefits: these were not huge, but more than enough to increase regional production of livestock products and reduce the price of meat and milk for consumers in the urban areas. Simple household-scale analysis, however, indicated that many farmers would see decreases in farm profit if they adopted planted fodder of the type being investigated: production increases were not enough to offset the decreases in producer prices that occurred because of the change in market equilibrium. The situation may now be different, but the point is that in this example, social welfare outcomes were at odds with private producer outcomes – and unsurprisingly, fodder adoption in the region at that time was rather limited.

On the other hand, drivers operating at and across higher biophysical, socio-economic and policy scales also shape the feasibility of new strategies and technologies. Climate change is clearly a key example. Global and regional markets also define the space of possibilities for innovation and change in food systems at smaller scales. Additionally, there are many examples of how national and regional governance characteristics are linked to agricultural production. The World Bank has produced a number of indicators for governance, and multiple studies have linked these indicators to yields and arable land change ([Mandemaker et al. 2011](#)). These governance indicators mirror some of the key outcomes of interest in the CCAFS scenarios:

- Political stability: In times of political unrest or violence, social and economic networks fail ([Hussian and Herens 1997](#)) and yields are often affected ([Fulginiti et al. 2004](#)).
- Voice and accountability: Yields were found to be significantly higher in countries with more political rights and civil liberties and where citizens are able to participate in governance ([Fulginiti et al. 2004](#)).
- Government effectiveness: the provision of government agencies, public good and services and the quality of these things, including infrastructure, affects rural production and livelihoods ([Thirtle et al. 2003](#)).
- Regulatory quality: the degree to and manner in which private sector development is stimulated affects rural economies ([Lio and Liu 2008](#); [Krueger et al. 1991](#))
- Rule of law: Poor law threatens property and rights of rural populations and blocks private investments ([Thirtle et al. 2003](#)).
- Control of corruption: Corruption can destroy accountability and funds are not used for what they are intended. ([World Bank 2010](#)).

The food fodder example points to the need for bottom-up as well as top-down strategic planning across different scales. The governance examples show the need for a consideration of the effects of key drivers at different (e.g. national, regional) scales on the contexts of actors across those and lower scales. Hence research on food systems needs to work across scales, from the bottom up as well as the top down.

Activities in across dimensions and scales in CCAFS

CGIAR Core Research Programme 7: Climate Change, Agriculture and Food Security (CCAFS) was developed with four themes, acting together towards a common goal of enhancing the adaptive capacity in response to climate change of people involved in agriculture, natural resource management and food systems in developing countries. These themes are:

1. Adaptation to progressive climate change
2. Adaptation through managing climate risk
3. Pro-poor mitigation
4. Integration for decision making

Central to this framework is the notion of evaluating impact and alternative options in relation to three key indicators or outcomes: improved food security, improved rural livelihoods, and improved environmental health.

CCAFS was designed to help provide intelligent reasoning about the many options (and trade-offs) that may help rural populations improve their livelihoods, their food security and the natural resource base on which they depend, so that these could be implemented, tested and scaled up to result in substantial benefits after around 10 years.

While this ambition to integrate across food security, livelihoods and environments has been identified as a central tenet for research in CCAFS, the recognition of the need for cross-scale research and action has not been captured in its central framework. There are, however, many activities in CCAFS that are currently, and have additional potential to be, integrated across dimensions and scales. The CCAFS regional scenarios process can play a key role in developing these links.

For examples of how various activities in the CCAFS themes can be mapped across dimensions and scales please see appendix A.

The role of the CCAFS regional scenarios in cross-scale research, planning and action

As part of its theme 4 (integration for decision-making) activities, CCAFS is organizing regional scenarios development and use processes in East Africa, West Africa and South Asia together with stakeholders at the regional (sub-continental) scale in policy, private sector, NGOs and CSOs, media and research. These scenarios innovate on previous experience by CCAFS team and Scenarios Advisory Group members in a wide range of scenarios processes, in particular the cross-scale work in the Millennium Ecosystems Assessment ([2005](#)).

The CCAFS regional scenarios process aims:

1. to explore key regional socio-economic and governance uncertainties for food security, environments and livelihoods through integrated qualitative-quantitative scenarios describing futures up to 2030;
2. to use these scenarios with regional, national and local actors for strategic planning to explore the feasibility of strategies, technologies and policies toward improved food

security, environments and livelihoods under different socio-economic and governance conditions.

Figure 1 captures the difference between developing and using the CCAFS regional scenarios:

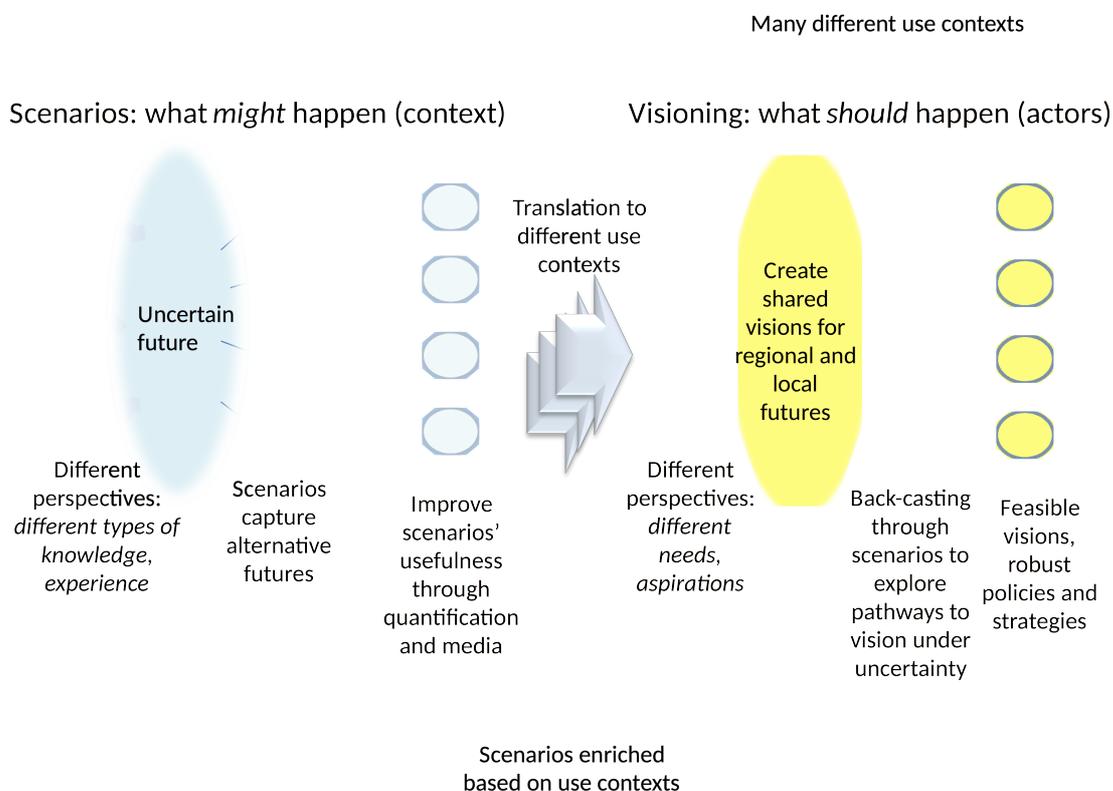


Figure 1. From developing scenarios to using scenarios in various contexts.

The development and use of multi-stakeholder scenarios provide a powerful way to bring key actors together to first explore, and then plan with, future uncertainty. Scenarios are different “what-if” accounts of the future. Scenarios are not meant to be predictive, but instead help partners acknowledge future uncertainty and explore the dynamics of widely different but plausible future worlds. As discussed elsewhere, strategic future processes involving scenarios show much potential to link knowledge and action across system boundaries ([Chaudhury et al. under review](#)).

The key benefit of the regional scenarios that explore socio-economic and governance uncertainties for food security, environments and livelihoods is their complementarity to other CCAFS activities:

- The CCAFS regional scenarios have a very similar function to climate change scenarios used by CCAFS – they function as alternate future contexts in which to test the feasibility of CCAFS-generated strategies, technologies and policies under alternate future conditions.
- The CCAFS regional scenarios also offer concrete platforms that can integrate various outcomes from CCAFS activities to make them salient to key actors across domains

and scales – either by integrating these outcomes in the scenarios themselves or by making CCAFS outcomes part of strategic planning processes that use the scenarios.

The regional focus of the scenarios makes them well-suited for the integration and translation of knowledge between local -and international scale activities.

The CCAFS scenarios process follows four steps in each region:

1. The development of regional scenarios with actors across sectors, based on an exploration of key regional socio-economic and governance uncertainties; The quantification of the regional scenarios through models and other means that explore the consequences of socio-economic and governance assumptions and their effects (e.g. through technology, government support, infrastructure) for food security, environments and livelihoods;
2. The use of the scenarios to test local and regional research outcomes and recommendations (strategies, technologies) within and outside of CCAFS;
3. The use of the scenarios as boundary conditions for regional and local planning with key actors toward improved food security, environments and livelihoods.
4. The use of the regional scenarios process as a case study to link to global research, strategic planning and action.

Figure 2 links these four steps to a summary of the different activities across the CCAFS themes – these steps and their links to other CCAFS activities are explored in the subsequent sections.

To put these steps into the context of current CCAFS scenarios progress, a quick update is in order:

- For East Africa, integrated qualitative/quantitative regional scenarios have been developed with stakeholders and the IMPACT (IFPRI) and GLOBIOM (IIASA) modelling teams and a report on the scenario narratives and model outputs is now being finalized by professional science publishers. Ideas for using the scenarios across CCAFS research have been started. The use of the scenarios in strategic planning processes across domains and scales in East Africa (with the EAC General Secretariat, non-state actors) will happen over the next six months.
- In West Africa, a final scenarios quantification workshop will happen on 15-17 May and the scenarios development will be finished by October after which similar processes of using the scenarios with key actors across domains and scales will be started.
- In South Asia, because of the scale of the region, a bottom-up approach with multi-stakeholder processes starting in sub-regions is being conceptualized.

Step 1: Multi-stakeholder scenarios development and quantification

The first step in the scenario development process is to capture key socio-economic and governance drivers and uncertainties at the *regional scale* with key regional actors in policy, the private sector, civil society, the media and epistemic communities and explore their consequences for food security, environments and livelihoods up to 2030. The scenario sets are structured along the two drivers that are seen by regional actors as both highly relevant and highly uncertain – but many other key drivers feature across all scenarios. An example of four scenarios divided by two key uncertain drivers is the East Africa scenarios set, the narratives of which are summarized in figure 3. One key uncertainty chosen by the East Africa participants to structure the scenarios is whether East Africa will integrate economically and politically or whether it will maintain its fragmented status quo. Another key uncertainty was whether pro-active or reactive governance would dominate in the region.



Figure 3. Key uncertainties structuring CCAFS East Africa regional scenarios, with summaries of the scenario narratives.

Once regional stakeholders have developed the qualitative story lines that describe plausible, alternative futures, these scenarios are being modelled to allow quantification of important key outcomes and indicators.

Different modelling tools are being used to do this, notably IFPRI’s IMPACT model and IIASA’s GLOBIOM model. These are both partial equilibrium models, but they have different strengths and weaknesses. IMPACT is designed to examine alternative futures for global food supply, demand, trade and prices, while GLOBIOM is designed to provide policy advice on global issues concerning land use competition between major land-based production sectors. While IMPACT and GLOBIOM are global models, they are being modified to enable specific regional applications to be simulated.

Not all outcomes of interest can be simulated by the models – these are estimated using other means.

Quantified outputs of the scenarios for the regions include:

- GDP
- Yields, production costs, prices, trade measures for crops and livestock
- Area change for a range of arable land types and livestock production systems
- Calorie availability per capita
- Forest and other non-agricultural land cover change
- Various indicators for quantity and quality of water systems
- Infrastructure change
- Effects of IT developments
- Indicators for livelihoods and social capital

Non-quantified but equally important outputs include descriptions of how governance processes will unfold, changes in income distribution and equity, changes in rural social networks, health care arrangements and more.

Step 2: Scenarios as contexts to test the feasibility of local and regional-scale research outputs

By capturing different governance uncertainties in terms of concrete consequences such as crop yields and land use change, the CCAFS scenarios process allows local and regional-scale outcomes in CCAFS to be tested for feasibility in these different alternate socio-economic/governance futures. Two examples:

- CCAFS theme 1 research reports cassava as a crop that will grow more productive under rising temperatures and has unrivalled drought resistance. Regional socio-economic and governance contexts are key: preliminary modelling results from the CCAFS scenarios (produced with IIASA's GLOBIOM model) indicate that when East Africa develops toward regional political and economic integration and state and non-state actors take a proactive stance toward food security, environments and livelihoods, cassava production costs could be 50% less and there is a potential 30% increase of cassava yields as compared to a scenario where there is no regional integration and state and non-state actors adopt a reactive stance to food security, environments and livelihoods. The scenarios also show that regionally, different assumptions for socio-economic development and governance could have a large influence on the demand for cassava. In our preliminary results, differences in cassava demand for livestock feed in particular are much as 70% between the different scenarios. This implies that in these different scenarios, cassava might play a different role – in the scenario where there is high political and economic integration and proactive attitudes prevail, the increase of yields and drop of producer prices make cassava a particularly cheap, productive and climate-smart crop to be used for livestock feed. In the scenario where there is low integration and reactive attitudes prevail, cassava might only function as a food security crop consumed by the producers. However, an increased use of cassava for livestock feed has its consequences for mitigation.
- The results of the regional scenarios can also be used as context for high-resolution ex-ante modelling and evaluation of adaptation, risk management and mitigation strategies at the scale of the household, community or landscape. While regional modelling efforts provide aggregated information of the evolution of the agricultural sector, household modelling can help in identifying strategies that work for heterogeneous types of farming systems. At the household scale, scenario-specific commodity prices and land use patterns can be used to ascertain their impacts on food security, incomes and key environmental indicators for households in different types of farming systems. This provides consistency for analysing the impacts of climate change from the global to the household level. This information is also essential for identifying how robust adaptation and mitigation strategies can be, for identifying the most vulnerable target groups, and also for designing ways of delivering information for farmers with different characteristics (wealth, education, entrepreneurship, etc). Additionally, the scenario-based household model results can help refine the parameterisation of the regional models. CCAFS is facilitating the development of household models that can be used for this purpose (van Wijk et al. 2012).

- The CCAFS scenarios team is currently preparing to provide such inputs into regional research projects on vector-borne diseases under climate change, grassland expansion in East Africa and futures for regional migration. These “expansion” activities will help CCAFS to make links to other initiatives but also enrich the current story lines with new aspects.

Given that the regional scenarios are developed in relation to axes of key regional uncertainty (such as, the strength of regional integration in trade and policy formulation in 20 years’ time, or the accessibility of markets in the North to local producers), being able to identify the “winning” or “no regrets” alternatives that provide substantial benefits even under what may be radically different futures is critically important. Crucially, many strategies and technologies are likely to succeed under only one or two scenarios – which reinforces the need to consider a broader range of options under all key uncertainties rather than going for single solution strategies.

Such alternatives can then be tested and implemented in the CCAFS benchmark sites and elsewhere, with a long-term view to scale up those that are highly promising to much broader domains. CCAFS is currently collecting detailed information at the household level to ex-ante test adaptation and mitigation strategies with potential for upscaling.

The interaction between the CCAFS regional scenarios works both ways – CCAFS theme outcomes can also be used to inform and enrich the scenarios to include other issues and quantify different outcomes. Furthermore, CCAFS theme outcomes can be offered to regional and local policy makers as part of the possible strategies and technologies to consider in policy planning, to be tested under the different scenarios (step 3).

Step 3. Using the scenarios for strategic planning with regional state and non-state actors

Another key step in the CCAFS regional scenarios process is to use them as plausible future contexts for strategic planning toward a desired future for food security, environments and livelihoods with state and non-state actors. Such strategic planning processes are being organized by the CCAFS scenarios team with high-level regional policy makers and non-state actors, as well as with key local scale actors. In order to begin to developing feasible strategies toward a desired future, regional/local actors representing different agendas and aspirations will come together to co-create shared visions for improved food security, environments and livelihoods.

These actors will then map what actions are needed to work back from this desired future to the present – a technique called “back-casting” ([Kok et al. 2011](#)). The advantage of back-casting is that it takes strategic planners away from planning forward to the future, an approach that often leads to plans that build on and plan for the past, rather than for the future. The CCAFS regional scenarios will be used to explore what strategies and investments are needed to realize the vision in each of the alternative futures and what the major obstacles and opportunities in each future world are. In this way, the scenarios act as alternate future contexts in which different policies and strategies can be tested under different plausible future conditions. (see figure 4).

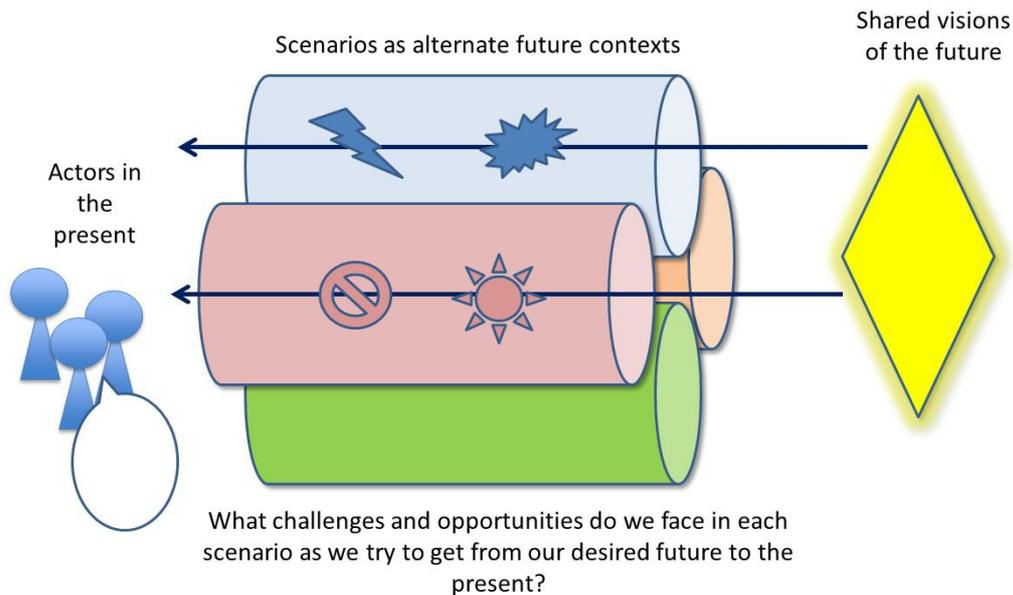


Figure 4. Using scenarios to test the feasibility of strategies and policies, “back-casting” from a shared vision.

Each use of the scenarios in strategic planning contexts generates feedbacks on the relevance of the scenarios for different state and non-state actors. These lessons are used to improve the scenarios and their presentation.

- An example from East Africa is our current strategic planning process with the East African Community General Secretariat, based on outside funding by USAID. In this process, we will engage the technical advisors focusing on food security, environments and livelihoods of 5 countries in East Africa, as well as donors. These actors will create a vision for East Africa and use the scenarios in back-casting exercises to explore the feasibility of alternate regional policies toward that vision. The workshop also includes a marketplace where a wide range of regional technologies and services aimed at increased adaptive capacity under environmental and socio-economic uncertainty are made available.
- Similarly, the CCAFS scenarios team is also organizing a strategic planning workshop for non-state actors involving both the private sector and civil society actors in the formation of strategic partnerships through visioning and back-casting.

These regional strategic planning processes are key spaces where CCAFS findings and recommendations can be mainstreamed into policy.

A key ambition for is to provide the CCAFS regional scenarios as alternate decision contexts for local scale strategic planning. At the local scale, actors have very different and generally more concrete priorities than state and non-state actors at national and regional scales. Regional scale environmental and socio-economic changes also have distinct and diverse impacts at the local scale. Examples within and outside of CCAFS:

- Within CCAFS, several futures-oriented processes are organized at the sub-regional scale, such as Farms of the Future and Social Returns on Investment (theme 1), local

scale climate change risk innovation (theme 2) and national climate change mitigation futures (theme 3). These activities follow their own local strategic processes in which the regional scenarios contexts can fit in a complementary fashion.

- A recent meeting with UNEP/UNDP's CC DARE programme for local climate change adaptation, the regional scenarios process was introduced and many of the CC DARE participants and programme organizers followed up on using the CCAFS scenarios for their local scale planning for action in about 50 projects throughout Africa.

Step 4: Links to global research

In step 1, the CCAFS regional scenarios process builds on global research to contextualize its regional assumptions. Through the use of global models such as IMPACT and GLOBIOM, the CCAFS regional scenarios use assumptions about global change from FAO and other data sources used by the models, translating this global information to a regional context that is in turn more suitable for local scale research, planning and action.

Conversely, when feeding into research at the global scale, regional scale strategic futures processes change roles from wider context to sub-global case, offering region-specific information to be fed into global scale work. For CCAFS, the regional scenarios can function as a boundary object, translating research between global and local scales.

A comparison of the CCAFS regional scenarios with global scenarios work can lead to valuable insights because it can identify possible challenges and opportunities playing out at the global scale that have not been considered in the CCAFS scenarios where regional uncertainties were the focus.

Conversely, the CCAFS scenarios can serve as an excellent regional futures case study to feed into global futures processes:

- CCAFS has been asked by GFAR's Global Foresight Hub, a global network of food-related futures work, to use the CCAFS scenarios as a primary on-going example for the network and to help conceptualize different foresight approaches.
- CCAFS regional scenarios can be linked to the IPCC socio-economic development pathways. A number in the CCAFS scenarios team and their partners are involved in these development pathways in the IPCC process. We are also exploring links with colleagues leading the strategic futures work for policy guidance in the World Economic Forum and at the Global Climate Forum.

Temporal scales: extending policy horizons and linking and short-term variability, progressive change and longer-term mitigation consequences

The research, planning and action linked through the CCAFS scenarios process across the above mentioned scales and also works across the temporal dimension – it links the short term and the long term. The scenarios currently describe regional socio-economic/governance futures up to 2030. Implicit in many climate change adaptation strategies and technologies is a long-term view of climate change but a business-as-usual, or short-term view of socio-economic change. The CCAFS regional scenarios allow researchers in the CCAFS themes to

bridge this gap and consider their outputs in alternate long-term socio-economic and governance futures. They also provide a basis for

- Example: CCAFS theme 2 focuses on short-term variability and is therefore interested not just in short-term climate variability but also in short-term socio-economic variability. For theme 2, it would be useful to have scenarios which provide long-term data, but data that also provides variability in socio-economic indicators on a fine temporal scale. The currently quantified scenarios emphasise long-term change and do not capture short-term variability. In an elaboration of the scenarios quantification this can be addressed. IIASA's GLOBIOM has a stochastic version of the model in development that can be used to produce a version of the CCAFS regional scenarios that includes short-term variability in economic drivers and could therefore be more useful for CCAFS theme 2 and more realistic and detailed generally.
- Another example: for CCAFS theme 3, pro-poor mitigation, the carbon emissions produced by the agricultural sector in each scenario are particularly interesting. Therefore, we are aiming to explore the consequences of different measures in the quantified scenarios runs to understand mitigation trade-offs and longer-term effects in the scenarios even better.

Media engagement strategies – connecting to key audiences

The above sections have detailed cross-scale and cross-sector interactions within CCAFS and with specific key actors; the CCAFS scenarios process also aims for engagement of wider publics in its focus regions and at a global scale. This engagement allows the insights from the scenarios development and use processes to reverberate far beyond the more concrete interactions described above.

To do this, CCAFS works with the PANOS development journalism network that has regional offices in East and West Africa and South Asia. Together with PANOS, we develop booklets, videos, newspaper articles of the future, images and radio programs. Additionally, we are also exploring an on-line interaction platform for key audiences to explore the key insights of the scenarios process themselves. Outputs (strategies, recommendations, analyses etc.) from the different themes are integrated and streamed into media outputs connected to the regional strategic planning step in the process.

3. Final thoughts

The regional scenarios process plays a unique role in CCAFS. It can help to articulate and to start addressing the transformational challenges that climate change poses by its complementary focus on socio-economic changes and uncertainties; through its meso-scale position and its links across scales it provides a powerful tool for integrating the needs of a wide range of stakeholders and helping to inform CCAFS's research agenda on identifying synergies and trade-offs for improved environmental health, rural livelihoods and food security in the face of an uncertain future. This cross-scale, cross-sector, cross-theme strategic futures work aimed for in CCAFS has rarely been done, and CCAFS is innovating across these boundaries in ways that provide guiding insights to similar efforts.

The processes described in this document follow no linear order, and already, substantial iteration is occurring between the different scales within CCAFS, with overlaps back and

forth – but the process described can be expected to inform a substantial portion of the activities that CCAFS undertakes in the coming years.

4. Literature

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