

Crash-testing policies;

How scenarios can support climate change policy formulation

A methodological guide with case studies from Latin America

Marieke Veeger^{1,2}, Daniel Mason-D'Croz³, Shahnila Dunston⁴, Joost Vervoort^{1 5 6}, Amanda Palazzo⁷

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Universiteit Utrecht
Copernicus Institute of Sustainable Development



¹ CGIAR Programme for Climate Change, Agriculture and Food Security (CCAFS)

² University for International Cooperation (UCI)

³ Commonwealth Scientific and Industrial Research Organization (CSIRO)

⁴ International Food Policy Research Institute (IFPRI)

⁵ Copernicus Institute for Sustainable Development, University of Utrecht

⁶ Environmental Change Institute (ECI), University of Oxford

⁷ International Institute for Applied Systems Analysis (IIASA)

Abstract

The objective of this handbook is to guide policy makers and practitioners from the public, private and research sector in the development and use of scenarios to support the inclusive formulation of policies and other decision-making processes related to complex issues taking place in changing environments. The lessons shared are based on nine policy formulation processes for climate in Latin America supported by the CCAFS future scenarios project since 2013. Five of these cases are discussed to exemplify the steps described to use scenarios and support the development of policies.

Key Words

Scenarios, Climate Change, Agriculture, Food Security, Anticipatory Governance, Central America, Andes

CCAFS FP1 LAM project: “Shaping equitable climate change policies for resilient food systems across Central America and the Caribbean”

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Introduction

The objective of this handbook is to guide policy makers and practitioners from both the public, private and research sector in the development and use of scenarios to support the inclusive formulation of policies and other decision-making processes related to complex issues taking place in changing environments.

The lessons shared in this handbook are based on nine policy formulation processes for climate in Latin America supported by the CCAFS future scenarios project since 2013. Five of these cases are discussed to exemplify the steps described to use scenarios and support the development of policies. Although the use cases are from plans and policies that address climate change, food security and environmental issues, the steps outlined for scenarios use may be applied to any decision making process where issues are complex and stakeholders with differing ideas needs to be involved; such as urban development, migration, public security, or water management.

The first section of the guide sets out the steps for scenario development by describing the participatory construction of scenarios in Central America and the Andes region under the CCAFS scenarios project. It also describes how scenarios can be modeled and what model results can be used for. The second section describes the different phases that support the uptake of recommendations that result from a scenarios exercise into policymaking. The third section describes five cases in which the outlined steps were used; a national policy of Costa Rica, Honduras, Peru and Colombia, and a regional policy for Central America. The handbook concludes by highlighting the crucial design decisions that ensure that scenario guided recommendations are considered in final policy documents, and also a few issues can complicate their uptake.

The CCAFS Future Scenarios Project

The future scenarios project, initiated in 2010, is a global research project of the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS), implemented in seven regions; East and West Africa, South and South East Asia, Central America and the Andes region, and the Pacific. The objective of the CCAFS future scenarios project is to generate socioeconomic and climate scenarios that support decision makers in the formulation of plans, policies, investments and institutional arrangements for agriculture and livestock, robust enough to confront climate change. The project is coordinated by the Copernicus Institute of Sustainable Development of the University of Utrecht. The methodology was designed in collaboration with the Environmental Change Institute (University of Oxford) and builds upon various streams of anticipatory governance, a term used to describe “the evolution of steering mechanism in the present to adapt to an/or shape uncertain climate futures” (Vervoort & Gupta, 2018, p.104). By collaborating with governments and institutions the scenarios exercises are designed around on-going policy processes, increasing the relevance of the recommendations that result from it, and their use to strengthen the effectivity and robustness of policies.

The CCAFS scenarios methodology

CCAFS directed seven regional scenario exercises that brought together regional stakeholders to develop plausible and relevant scenarios to explore future uncertainty and thereby improve policymaking. Initially, scenarios are developed at a regional scale. At a later stage, scenario narratives are adapted to a national scale and to indicators relevant to the policy they help formulate, thereby assuring relevancy of the

futures explored. Key stakeholders from the public and private sector are at the center of each scenarios process; they develop the scenarios and propose the policies under development that could benefit from a scenario guided review.

Central America and the Andes region of South America are two of the targeted regions within the global scenarios project. The scenarios work there is lead by the University of International Cooperation (UCI) in close collaboration with CCAFS and the University of Utrecht. Stakeholders from across each of the regions representing a broad range of perspectives from the public and private sectors joined together in a participatory fashion to develop four future scenarios up to 2050 for each of their regions. These scenarios were designed to explore a broad future possibility space around key drivers of high uncertainty and relevance for agriculture, food security and the environment under climate change. This broad scope enables the appropriateness of the scenarios for a wide variety of policies related to climate change within several countries of a region with similar socio-cultural, political and environmental challenges.

The CCAFS regional scenarios build off a body of work, which uses multiple scenarios and models to explore a broad possibility space and apply it to planning (Vervoort et al. 2014; Mason-D’Croz et al 2016; Palazzo et al. 2017). The CCAFS methodology applies uncertainty assimilation, using the premise that forecasting a “most likely” future is impossible, due to fundamental uncertainty and the complexity of human and environmental systems (Williamson 1994; McWilliams 2007). However, while perfect foresight is not feasible, methods are available to help policymakers engage and better understand future uncertainty, and thereby develop more robust policies that can work across a range of alternative futures (Kok 2007; Trutnevyte et al. 2016). The methodology therefor attempts to assimilate uncertainty at all stages of scenario development and use, beginning with the selection of stakeholders, and moving to scenario driver selection, scenario design, scenario quantification, and ultimately scenario use. It applies a multi-model ensemble that includes 2 global economic models, 2 crop models, and four global circulation models (GCMs).

Participatory multi-factor multi-state multi-model scenarios development

The aim of this guide is to show how scenarios can be developed and used in a participatory manner to formulate policies and guide investment planning for climate change. Figure 1 summarizes the process used to develop the CCAFS regional scenarios and apply them to support policymaking in Central America and the Andes. Each step will be carefully outlined in the following sections.

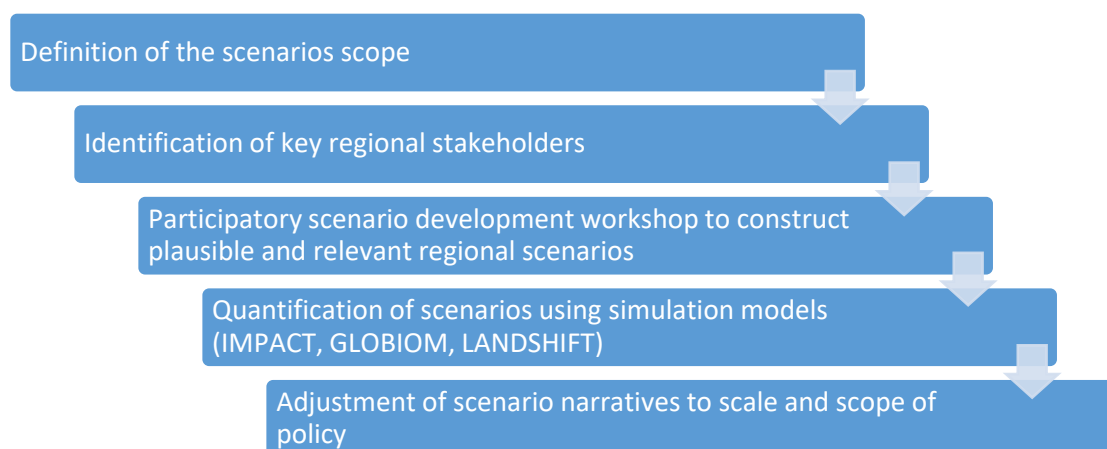
Section one of the guide describes **how scenarios are created** by using a methodology based on multiple drivers of change with each multiple states and how they can be quantified with multiple models to better understand economic impacts of events portrayed in the scenarios.

Section two of this guide describes the **different phases of scenario guided policy formulation**; how the anticipation of plausible futures can support policy development.

Section three of this guide finally describes five **cases studies** in Latin America where this methodology was implemented; what motivated policymakers and non-governmental organizations to use the approach; how each process was designed, who was involved; what were the results; and what can go wrong.

The guide finalizes with **conclusions** and a **discussion** of lessons learned from the case studies; what design aspects of the facilitation process really make a difference and support the uptake of scenario guided recommendations? When can policy development benefit from a scenarios approach? What role can model results play when exploring uncertainties that can hinder the effectiveness of policies?

Figure 1. Outline of scenario development process for policy and investment guidance



STEP 1. Definition of the scenarios scope

Before being able to develop plausible scenarios, the scope of the scenario development process is to be defined. To achieve this, initiative takers must have a common level of understanding of the goal of the scenarios exercise, what topics or issues are to be explored, with whom, and at what time horizon.

In order to be useful for a broad range of policies related to agriculture and food security under climate change, the scope of the scenarios created under the facilitation of the CCAFS future scenarios was set on agriculture, food security, livelihoods, and the environment (Vervoort et al. 2014; Mason-D’Croz et al 2016; Palazzo et al. 2017). The time horizon was set at 2050, considering that the IPCC climate scenarios show the highest levels of uncertainty as of that moment, which in turn is defined by uncertainty regarding the pathways of socioeconomic development that national, regional and global economies will follow. The goal of the scenarios project was therefore to explore the uncertainties of socioeconomic, environmental and political development to support and robust the formulation of policies and investment plans relevant for agriculture and food security under climate change.

STEP 2. Stakeholder Identification

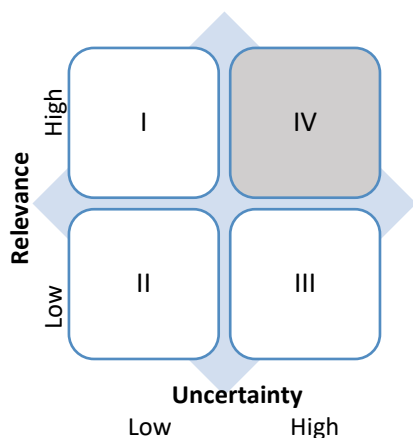
To create a diverse set of scenarios to explore a broad possibility space, it is necessary to have a broad range of viewpoints of the complex system in question, and how it may change in the future (Petersen et al. 2011). To ensure this when creating the regional scenarios in Central America and the Andes, special attention was given to the identification of stakeholders from across the regions, representing multiple disciplines and sectors, and with a certain degree of influence in decision-making. Organizations and research centers working in the regions helped select stakeholders. Table 1 summarizes the composition of stakeholders that participated in the two regional workshops.

Table 1 Summary of stakeholders that participated in scenarios development by region and sector

Region	Government	Private sector & Civil Society	Academia and INGOs	TOTAL
Central America	9	8	11	28
Andes	15	3	9	27

STEP 3. Identification of factors of change

Stakeholders identified factors of change they believed were important drivers or impediments to change. These factors of change were summarized and generalized (e.g. low literacy and teacher quality could be generalized as education) and then ranked based on which factors of change the stakeholders considered to be the most relevant and then most uncertain. Once this was done, it was possible to identify the four factors of change that scored highest in relevance and uncertainty (Quadrant IV in Figure 2). The latter ensured that the process of channeling the diversity of stakeholder viewpoints into a manageable set of scenarios kept a broad possibility space, while being open and transparent.

Figure 2 Ranking uncertainty and relevance

Stakeholders then worked to identify mutually exclusive **states** for each of the factors of change (2 to 4 states per factor of change). The objective of this step was to create an envelope of possibilities of how each factor of change could look in the future. This would then serve as the building blocks of the final scenarios. The factors and factor-states are summarized in Table 2.

Stakeholders then assessed the **compatibility of all the factors**, to discard combinations of factor-states that were not simultaneously possible. For example, in Central America 'State Capacity: Low' was not considered compatible with 'Markets: Participative with regulation', because regulation of markets would not be possible under a low institutional capacity of the state. This step filters out certain combinations of factor and factor-states, but still leaves an overwhelming number of combinations of factors and factor-states that are plausible starting points for scenarios.

Table 2 Factors of change and factor states identified in the Central America and Andes workshop

	Factors of Change	Factor-States
Central America	Markets	<i>Participatory, Non-regulated</i> <i>Participatory, Regulated</i> <i>Non-participative, Non-regulated</i> <i>Non-participative, Regulated</i>
	State Capacity	<i>High</i> <i>Fragmented</i> <i>Low</i>
	Water Resources	<i>High Availability</i> <i>Low Availability</i>
	Wealth Distribution	<i>Market-driven low inequality</i> <i>State-driven low inequality</i> <i>Market-driven high inequality</i> <i>State-driven high inequality</i>
Andes	Markets	<i>Highly regulated and sustainable</i> <i>Unregulated and sustainable</i> <i>Highly regulated and unsustainable</i> <i>Unregulated and unsustainable</i>
	Government	<i>Decentralized power</i> <i>Centralized power</i>
	Consumption Patterns	<i>Subsistence</i> <i>Over-consumption</i> <i>Sustainable</i>
	Economic Development	<i>High development with economic specialization</i> <i>Low development with economic specializations</i> <i>High development with economic diversification</i> <i>Low development with economic diversification</i>

STEP 4. Structuring scenarios


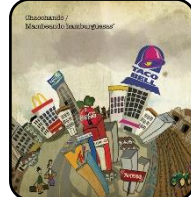



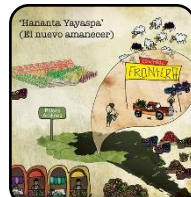

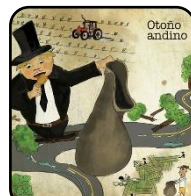
The most common way to create scenarios is combining two axes of uncertainty with each opposite or mutually exclusive states. However, the broad scope set out for the CCAFS scenarios, asked for an alternative approach, where several factors and states can be combined to create scenarios appropriate to exploring futures relevant for both agriculture, food security, as well as environment and livelihoods under climate change.

To manage the vast possibility of combinations of factors and factor-states the **OLDFAR** mathematical model (Lord et al. 2016) was used to select a set of six combinations that spanned the bread of diverse factors and states identified by the stakeholders. The OLDFAR model was designed specifically to identify diverse sets of combinations of factors and factor-states. After presenting these six combinations, stakeholders then selected the four combinations they considered the most interesting to fully develop into scenarios. Table 3 shows the basic structure of the selected scenarios, as well as the narratives describing the worlds created by combining the factor-states upon which they are founded.

STEP 5. Developing scenario narratives

After participants selected four combinations of factors and factor-states, they developed narratives for the four selected scenarios, exploring plausible pathways of how the region could evolve into the combination of factor-states identified. They were encouraged to think of newspaper headlines to describe storylines and build causal pathways that would provide an internal consistency to each scenario. After this, participants described the behavior of other drivers of change within the logic of each scenario. These had been identified at an earlier stage but did not make it to the cut of most important and uncertain. The results of this work are summarized in Table 3, which presents the combination of factor states that made up the scenarios, as well as a summary of the rich narratives and an illustration of how these futures might look like. These illustrations can be most useful in further stages to help communicate scenarios to decision makers and other stakeholders working with the scenarios to support the formulation of policies.

Table 3 Summary of Regional CCAFS Scenarios

Central American Regional Scenarios	Andean Regional Scenarios
 <p>Mayan prophecy (<i>14 baktún, el inicio de la profecía maya</i>)</p> <ul style="list-style-type: none"> • Strong states, a diversified economy with free trade within the region, long-term planning and a modern and inclusive education system focused on sustainable development inspires reimmigration • Markets: <i>Participatory, Regulated</i>; State Capacity: <i>High</i>; Water Resources: <i>High availability</i>; Wealth Distribution: <i>State-driven low inequality</i> 	 <p>Flipping Burgers (<i>Chacchando Hamburguesas</i>)</p> <ul style="list-style-type: none"> • A vulnerable economy powered by intensive agriculture and mining. Food security is secured but low in nutrition. High media influence. Widespread environmental degradation. Polarized governments • Markets: <i>Unregulated and unsustainable</i>; Government: <i>Decentralized</i>; Consumption Patterns: <i>Over-consumption</i>; Economic Development: <i>High development with economic diversification</i>
 <p>Libertarians without liberty (<i>libertarios sin libertad</i>)</p> <ul style="list-style-type: none"> • Chinese capital drives the regional economy. Under weakened states, some power groups have grown. Agricultural exports create food scarcity. Unsustainable use of natural resources cause social conflicts and migration. Water becomes a critical resource. • Markets: <i>Participatory non-regulated</i>; State Capacity: <i>Low</i>; Water Resources: <i>Low Availability</i>; Wealth Distribution: <i>Market-driven high inequality</i> 	 <p>Overcoming Obstacles (<i>Venciendo Obstaculos</i>)</p> <ul style="list-style-type: none"> • Challenges are confronted, slowing progress, but the region progresses nevertheless. The Andes is part of a Pacific Economic community with a regional vision. Progress made at for greater sustainability, and economic development • Markets: <i>Regulated and sustainable</i>; Government: <i>Decentralized</i>; Consumption Patterns: <i>Sustainable</i>; Economic Development: <i>High development with economic diversification</i>
 <p>Crowded (<i>Apiñados</i>)</p> <ul style="list-style-type: none"> • Large transnational corporations take control of natural resources. Authoritarian governments exercise strong social control. Farms disappear and small-scale farmers become domestic workers or laborers in sweatshops. • Markets: <i>Participatory, Non-regulated</i>; State Capacity: <i>Fragmented</i>; Water Resources: <i>High availability</i>; Wealth Distribution: <i>State-driven high inequality</i> 	 <p>New Dawn (<i>Hananta Yuyaspa</i>)</p> <ul style="list-style-type: none"> • Collective and cohesive societies with slower growth but greater equality. Regional production and consumption focused on sustainability. There is significant state control. • Markets: <i>Regulated and sustainable</i>; Government: <i>Centralized</i>; Consumption Patterns: <i>Sustainable</i>; Economic Development: <i>Low development with economic diversification</i>
 <p>Mayan collapse (<i>El nuevo colapso Maya</i>)</p> <ul style="list-style-type: none"> • Ecosystems have collapsed due to lack of government planning and enforcement. Multinationals ignore environmental regulations. Water resources are scarce and polluted and we see a lot of social unrest. • Markets: <i>Non-participative, Non-regulated</i>; State Capacity: <i>Fragmented</i>; Water Resources: <i>Low Availability</i>; Wealth Distribution: <i>Market-driven high inequality</i> 	 <p>Andean autumn (<i>Otoño Andino</i>)</p> <ul style="list-style-type: none"> • Unregulated open trade leads to non-competitive local production, with influx of cheap imports. Unsustainable production practices further degrades natural resources in the region. Inequality increases, with continued outward migration out of rural area. • Markets: <i>Unregulated and unsustainable</i>; Government: <i>Centralized</i>; Consumption Patterns: <i>Subsistence</i>; Economic Development: <i>Low development with economic specialization</i>

STEP 6. Scenario Quantification

Once developed, the scenarios were quantified in two global multi-market economic models to provide policymakers with systematic and consistent contextual scenarios with which they could test policies and improve regional and national planning. The model team of IFPRI and IIASA involved recognizes that it is best to use a model ensemble, such that one can see how robust the implications are across a range of scenario quantifications (Parker 2011). When multiple models independently come to similar conclusions then there is greater confidence in the results, and where there is greater disagreement, it highlights points of greater uncertainty.

In order to serve as useful test environments for the formulation of a policy and for stakeholders to take ownership of the scenarios, the narratives were adapted to the scale and scope of the policy. After adjusting the description of each scenario, participants explored the implications of these narratives on a range of indicators that had been identified as points of interest during the workshop or were critical for simulating the scenarios with the economic models. Participants identified the direction and magnitude of change of these indicators at different stages of the scenarios, and to ensure their reasoning was well understood by the modeling teams, participants described in detail the logic behind changes in each indicator; how they fit within the narratives, and if there had been any uncertainty or disagreement amongst the participants.

With the scenario narratives and semi-quantification complete, the modeling teams had the necessary information to begin simulating the scenarios with the models and combine the socioeconomic scenarios with climate change scenarios. The regional scenarios were designed to explore a broad range of plausible alternative futures in the region that could be linked to global scenarios of economic development and/or climate change. The regional scenarios were quantified following the consistency paradigm (Carlsen et al. 2013), such that they could be linked to the IPCC's shared socioeconomic scenarios (SSPs, Moss et al. 2010; O'Neill et al. 2014; O'Neill et al. 2017), which are a set of global socioeconomic scenarios designed to link to climate change scenarios.

There is great uncertainty on the regional implications of climate change for agriculture. It is impossible to select the best or most predictive climate model (Parker 2013), which provides estimates of future changes to temperature and precipitation patterns due to increasing atmospheric carbon. Additionally, the variation in the impacts of these climatic changes can vary significantly from crop model to crop model (Nelson, van der Mensbrugge, et al. 2014). Therefore, an ensemble of multiple climate, crop, and economic models is preferable to using one single model, and thereby can allow policymakers to better understand model uncertainty and its implications on planning.

In these regional exercises, the ensembles were made up of 2 global economic models, 2 crop models, and 4 climate models. The economic models selected were IIASA's GLOBIOM (Havlik et al. 2014) and IFPRI's IMPACT (Robinson et al. 2015). A model mix was chosen in order to broaden the breath of coverage of each model and these particular models were chosen because they had both previously participated in modeling inter-comparison exercises, which are both time and cost consuming to put together (Nelson, Valin, et al. 2014). They are highly disaggregated global partial equilibrium models, capable of representing the regions, and able to simulate scenarios of global climate change. Each economic model was associated with a different crop model. GLOBIOM was linked to EPIC (Williams and Sing 1995), and IMPACT was linked to DSSAT (Hoogenboom et al. 2012; Jones et al. 2003). The 4 climate models used were selected from the few available ones and had also participated in earlier projects

(Warzawski et al. 2014; Rosenzweig et al. 2014; Taylor et al. 2012), and all used the Representative Concentration Pathway (RCP) 8.5 (Riahi et al. 2011), which is a scenario with high greenhouse gas emissions. Additionally, a climate scenario representing no climate change was run by the two economic models. Table 4 summarizes the multi-model ensemble used.

Table 4 Summary of Multi-model ensemble

Economic Models	Crop Models	Climate Models
GLOBIOM	EPIC	GFDL-ESM2M (Dunne et al. 2012) HadGEM2-ES (Jones et al. 2011)
IMPACT	DSSAT	IPSL-CM5 (Dufresne et al. 2013) MIROC-ESM (Watanabe et al. 2011)

In the Andes region, the scenario exercise was extended to explore more explicitly the potential tradeoffs between agricultural development, land-use change, and biodiversity. This extension was done in collaboration with UNEP-WCMC's project on Commodities and Biodiversity (van Soesbergen and Arnell 2015). It built on the multi-model ensemble presented in Table 4, by adding LandSHIFT (Schaldach et al. 2011), a spatial explicit land-use model coupled with a Biodiversity index (Buchanan et al. 2011).

Scenario Modelling Results

Figure 3 presents a selection of model drivers (income) and results (agriculture production and food availability) for both Central America and the Andes. Several key takeaways can be observed. First, the range of results increases over time, as uncertainty increases over the scenarios' time horizon. Climate change tends to lead to negative impacts, and increases the range of potential outcomes. This is particularly evident for food availability in 2050, which tends to decrease due to climate change in both regions. While both regions are impacted by climate change, Central America is more vulnerable to these shocks.

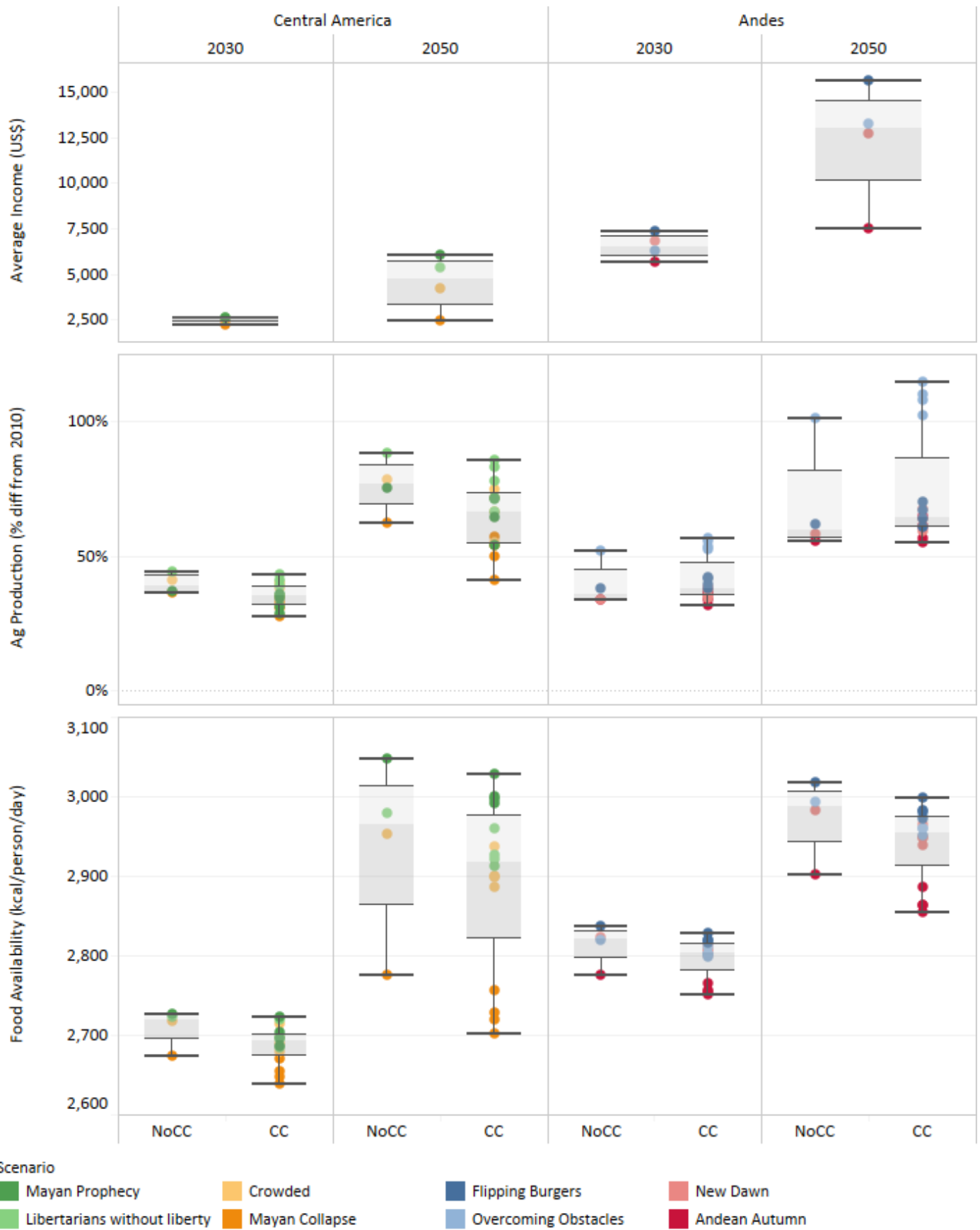
The scenario narratives directly drove the quantification of model inputs. To semi quantify the scenario stories, stakeholders validated a series of indicators relevant for the different models (such as economic development, soil degradation, or the use and price of agriculture inputs) indicating if they increased, decreased or stayed the same over time. For example, stakeholders indicated the highest income levels for the "Flipping Burgers" scenario, which considered high economic development as one of its drivers of change. Likewise, more negative scenarios like "Mayan collapse" in Central America, and the "Andean Autumn" in the Andes had much lower income levels representing slower economic growth in the regions.

Not all the drivers in each of the scenarios go in the same direction. For example, in "Overcoming obstacles", income levels grow at a slower rate than for "Flipping burgers", but a greater attention to sustainability leads to better natural resource use, and greater agricultural yields. The complexity of interactions across different factors of change is precisely why simulation models were used to quantify and simulate the scenarios. It is difficult to assess ex ante which drivers will dominate in the region, and how their many interactions and feedbacks will evolve. From these models, one can see that the improved use of natural resources leads to higher agricultural production in the "Overcoming Obstacles" scenario compared to the "Flipping burgers" scenario.

In the final row in Figure 3, we see how food security is a result of other drivers detailed in the scenario storylines, with the most negative scenarios in each region (Mayan Collapse, and Andean Autumn) having

the lowest food availability. Scenarios with more mixed positive and negative drivers have greater levels of uncertainty. This can be seen when different scenarios lead to similar levels of aggregate food availability. For example, in Central America, the “Mayan Prophecy” and “Libertarians without liberty” scenarios almost overlap once one includes climate change. Furthermore, in several occasions both scenarios present food availability under 3,000 kilocalories per person per day. However, the narratives are critical in interpreting these results. Without going back to the narrative one might assume that different development paths can lead to the same food security outcome. Once the narratives are considered this is quickly disproved. While both scenarios may have similar levels of food supply at the national level, the food security situation would be very different in the two scenarios. In “Mayan Prophecy” there is a significant decrease in inequality due to a capable state that focuses on decreasing inequality. In “Libertarians without liberty”, markets drive increasing inequality, so while overall food supply is high, access to food is not equal, and one could expect more food insecurity.

Figure 3. Selected results from quantified regional scenarios



The facilitation of scenario guided policy making

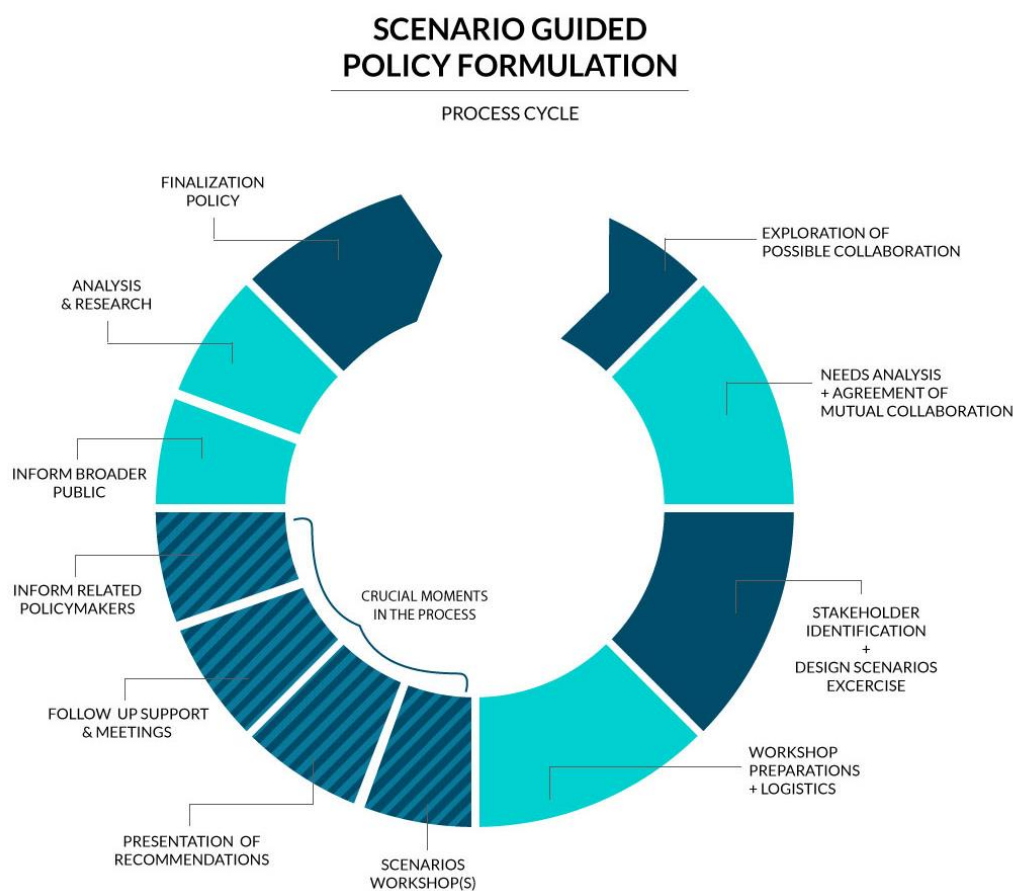
One of the challenges encountered by institutions that promote scenarios development is to link the knowledge obtained from exploring the future to present day decision making. Literature has covered some of these challenges (Vervoort et al, 2014). The following section of this guide aims to shed light on the critical phases of scenario-guided policy making that ensure the feedback of future exploration in the design of policies.

On a global scale, the CCAFS scenarios project has supported the development of eighteen national and regional policies in ten countries and across seven global regions. Fifty percent of these policies are being implemented. A differentiating characteristic of the CCAFS scenarios project is that key stakeholders from each region are actively involved both in the development as well as the use of scenarios to support the formulation of policies. These processes can take place at the regional, national or subnational scale.

In Latin America, between 2013 and 2018 the CCAFS scenarios project and the University of International Cooperation (UCI) have facilitated the creation of future scenarios in four regions (Central America, the Andes, the Trifinio and the Tempisque water basin) and six countries (Honduras, Costa Rica, Peru, Bolivia, Ecuador and Colombia). These scenarios were used in ten different cases to guide policy and decision-making. Although each of these cases were unique, over the years relevant lessons were learned about design of the process and what steps are critical to ensure that the anticipation of multiple futures support the formulation of plans, strategies and policies for climate change adaptation and mitigation in agriculture to increase food security. These have been summarized in a process cycle for scenario guided policy formulation (Figure 4) and will be discussed in the following paragraphs.

It should be mentioned that a considerable part of these steps are based on lessons learned from the global CCAFS scenarios work in East and West Africa, South Asia and South East Asia that took place before and during the scenarios work in Latin America.

Figure 4. Process cycle for scenario guided policy formulation



PHASE 1. Identification of decision-making processes to support with scenarios

The first step to scenario-guided policy making is rather obvious, but when implemented strategically, it can make all the difference. In the global CCAFS scenarios project, the identification of decision-making processes that can benefit from a scenario guided approach starts even before scenarios are created. Stakeholders to participate in a scenario workshop are carefully selected, based on recommendations from governments, NGO's and research organizations working in agriculture and food security. Ideally, they are considered experts in their field with a direct or indirect influence on decision-making, and together compile a mix of disciplines related to the scope of the scenarios. At the end of the workshop, they are asked to suggest decision-making processes that can benefit from such an approach. After the workshop, follow-up is given to each proposal with a **needs analysis**. In this phase, partners **explore the possibilities of a collaboration**, and how a scenarios approach might address specific needs of the policy formulation process. What are the particularities of the process that ask for a foresight based approach? What is the goal of the process and what results can be expected? This is also when **alignment** can be sought for with other organizations that wish to support the client (a government, a ministry, an NGO, or the private sector) resulting in the sharing of costs, responsibilities, and the alignment of objectives between partners that wish to support a similar cause.

In some cases, requests for use of the scenarios or the methodology come in one or two years after a scenarios workshop. Stakeholders that participated in the exercise find themselves leading a policy process where they consider a scenarios approach would be useful. The fact that they themselves created these stories of the future make them the best advocates for their use. Section three of this guide gives more details on a case in Costa Rica where this occurred.

Additionally, a strong collaboration with associates working in the same field can facilitate the identification of policy processes that can be supported by a foresight approach. The Latin America, the complementarity of objectives and continuous alignment of activities between the local partner implementing the scenarios project (UCI) and CCAFS, resulted in several successful scenario guided policy formulations. The Honduras and Central America case in section 3 highlight the relevance of this collaboration, as well as the Colombia case, although with a less successful outcome.

PHASE 2. Design and preparation of scenarios exercise

After involved partners **agree on mutual collaboration**, and the goals and expected results are defined and clarified, the scenarios coordinator draws out an initial **design of the scenarios** exercise. The workshop design is carefully revised with policymakers to ensure that expected results will be achieved. At this stage, goals and expectations may still change, which is why it is important to ensure that all relevant decision makers are involved and informed of the reasoning behind different methodology choices of the workshop.

This phase is also the moment to think thoroughly about the **stakeholders** that need to participate in the scenarios exercise. To create legitimate, challenging and complex scenarios one aims for a group of maximum 25 participants from multiple disciplines and stakeholders groups, preferably a mix of beneficiaries of the policy and experts in the field it addresses.

During the finalization of the design phase, the **workshop preparations and logistics** also take place, including the invitation of stakeholders, the reservation of a workshop space, accommodation, catering and the gathering of materials. Sending out an introductory note about workshop objectives and the way in which foresight will be used to work on the policy is a vital step in these preparations.

PHASE 3. The scenarios workshop

With the scenarios workshop we mark the beginning of a crucial phase in the Process Cycle for Scenario Guided Policy Formulation. The method developed by CCAFS and the Environmental Change Institute (Oxford) to robust policy and decision-making through explorative scenarios is based on the concept of *futureproofing*. The **scenarios workshop** is carried out in two to three days, and starts with a critical review of the policy in its draft version, where stakeholders indicate what is still missing to address its goals and edit these changes in the policy document. The objective of the exercise that follows is to test whether the policy is robust enough to function in multiple plausible futures that describe cultural, political, environmental and economic aspects of society that are relevant to the policy. Instead of making new scenarios, a difficult and time-consuming task, stakeholders adapt the narratives of regional CCAFS scenarios to the geographic and thematic scope of the policy document, thereby also making the scenarios their own. After this, the policy is tested and improved for robustness in the adapted scenarios. Stakeholders do this by validating one by one the effectiveness of the policies objectives and actions in each scenario setting. If an objective cannot be reached, or an action cannot be implemented, participants indicate why and recommend how it should be adjusted to address the difficulties faced in the scenario.

This policy crash-test is done in all four scenarios. The recommendations from all scenarios are then compared. Objectives and actions that are effective in most scenarios maintain the same, but items that do not work out in various scenarios are carefully reviewed and discussed to decide what adjustments need to be made for it to function under most scenarios. These recommendations are then also edited in the policy document. **Box 1** gives detailed description of these different steps of a scenarios policy review workshop.

Box 1 - Scenario guided policy review workshop

STEP 1. In the scenarios workshop, participants divided in groups first review and add recommendations to a preliminary version of the policy; each group reviews a section close to their field of expertise.

STEP 2. Second, regional scenarios are downscaled to the scope and scale relevant to the policy by using a list of variables addressed in the plan. This ensures that the scenarios discuss matters relevant to the issues addressed by the policy.

STEP 3. Then, measures and objectives of the policy are tested in the new set of scenarios (is it possible to implement this particular measure in the face of scenario a, b, c and d?). Participants then give recommendations that enhance the effectiveness of each section of the plan in the face of each scenario.

STEP 4. Finally, recommendations of improvement are compared over the four scenarios, after which each measure is reformulated to increase the possibilities of feasibility under multiple scenarios. Suggestions that are given in the face of several scenarios are more likely to be included.

PHASE 4. Follow-up support and meetings

After the workshop, resulting policy recommendations from the scenarios exercise are gathered and summarized by a core team and then presented and **debated** in key **decision-making spaces** regarding the policy. These are often complemented by meetings in a smaller group of policy advisors actively involved in determining which recommendations should be incorporated, how, and what further follow-up is needed. As will be detailed in the series of case studies, this phase of the scenario-guided policy making cycle is vital when the actual uptake of recommendations is desired. Key decision makers such as ministers and vice ministers, often not available to participate in the entire process, have the capability of placing policy recommendations within a broader governance context, linking them to other decision-making processes for example. Their interpretation, analysis and support are there for decisive for the uptake of recommendations. In order to create institutional and political support for the policies approval and implementation, public presentations or policy debates may follow. The finalization of the policy follows, although an official approbation can take one or two years and in some cases does not take place.

PHASE 5. Analysis, research and communications

In the final stage of the cycle, the core team made up of the scenario coordinator and policy makers collaborate to **analyze and evaluate** the scenarios guided policy formulation process, both from a research and policy perspective. They ask themselves up to what extent and in which way the scenarios analysis

supported the policies development, and how the lessons learned in the process can contribute to new knowledge about anticipatory climate governance. This are then written up in a policy brief and news blogs to **inform policymakers** and the broader **public**. This work is eventually also resumed in a scientific paper and presented on national, regional or global conferences.

CASE STUDIES

The successful application of a scenarios approach like the one outlined in this guide depends on the exercise's alignment with the policy formulation process, the level of collaboration with policymakers and the political landscape within which it takes place. To illustrate this, we will present five scenario use-cases that took place in Latin America, where the regional CCAFS scenarios fed into policymaking and policy-informing processes. Table 5 summarizes key aspects of all five cases.

Table 5 . KEY ASPECTS OF FIVE CASES OF SCENARIO GUIDED POLICY FORMULATION

Country	Honduras	Costa Rica	Peru	Colombia	Central America (SICA)
Policy	National Climate Change Adaptation Strategy for the Agro-Food Sector	Intended Nationally Determined Contribution	PLAN GRACC - Risk Management and Climate Change Adaptation plan.	Action Plan for the Agriculture and Livestock Climate Change Adaptation Strategy	Estrategia Regional de Agricultura Sostenible Adaptada al Clima para la región SICA
Time span policy	2015-2025	2015-2050	2012–2021	Not indicated	2018-2030
Model results used	IMPACT, GLOBIOM	-	LANDSHIFT	LANDSHIFT	IMPACT, GLOBIOM
Purpose of scenario guided policy review	To involve sub-national stakeholders and representatives of farmers' organizations that would be effected by the policy.	The scenarios approach was used to complement marginal abatement cost curves that were not able to show the ambitious emission reduction goals that the government had in mind. By involving stakeholders from all high emission sectors, the Ministry of Environment was able to prove they were willing to upgrade the measures planned to reduce emissions.	Validate regional scenario model results and use these to evaluate the robustness of country-level policies addressing development and food security in the face of current and future changes in biodiversity and ecosystem services, under a changing climate.	Validate regional scenario model results and use these to evaluate the robustness of country-level policies addressing development and food security in the face of current and future changes in biodiversity and ecosystem services, under a changing climate.	To involve a wide range of stakeholders in the formulation of the policy. To enhance the policies' robustness for future uncertainties considering the complexity of the problematic addressed by the policy
Purpose of model results	Clarify scenario narratives and orient stakeholders on future changes of specific crop yields under different socioeconomic scenarios	In order to prevent a stakeholder discussion on the quality of other data used during the INDC development process, model results were not used.	Model results were used to show changes in future biodiversity & ecosystem services due to land use change in different socioeconomic and climate scenarios	Model results were used to show changes in future biodiversity & ecosystem services due to land use change in different socioeconomic and climate scenarios	To clarify and complement the scenario narratives
Level of engagement with policy makers	Medium	High	Low	Medium	Medium
Engagement with policymakers before scenarios workshop	5 months of preparation with a few online meetings and emails discussions. High engagement during scenarios workshop.	3 months. Frequent and continuous engagement before, during and after workshop.	One month. Brief engagement before workshop. High engagement during workshop	One month. Quite some engagement before workshop. High engagement during workshop.	6 months of preparations with face to face and online meetings, email conversations. High engagement during workshop.
Engagement post scenarios workshop	Delivery of policy recommendations within 2 weeks. Brief engagement after workshop. Two policymakers present in the scenarios workshop reviewed recommendations and decided what to	Recommendations were handed in within 1 week in separate sections to use during dialogue processes with stakeholders in five emission sectors. At the moment of writing up the INDC they were used again as reference material.	Little engagement after workshop	Quite some engagement after workshop to organize meeting to discuss policy recommendation	The scenarios coordinator had little direct engagement after workshop, but CCAFS was part of an executive committee that discussed what recommendations would be included in the policy.

	include and present to team in charge of policy.				
Initiative taker of scenarios approach for policy review	Secretariat of Agriculture and Livestock (SAG)	Climate Change Department of the Ministry of Environment and Energy (MINAE)	UNEP-WCMC and CCAFS took the initiative to organize a regional scenarios workshop. The Ministry of Agriculture of Peru suggested to work with the policy in question	UNEP-WCMC and CCAFS took the initiative to organize a regional scenarios workshop. The Ministry of Agriculture of Colombia suggested to work with the policy in question	Central American Agricultural Council (CAC)
Level of impact on policy	High	High	Low	Low	High

Honduras

In 2014, the regional scenarios for Central America were used to support the development of Honduras' Climate Change Adaptation Strategy for the agro-food sector 2015-2025 (SAG, 2016).

The request to collaborate with the Secretary of Agriculture and Livestock's (SAG) in the formulation process of this policy emerged from an existing relationship between CCAFS and the SAG climate change department in which both had collaborated to develop a country profile on the status of climate change risk management and had identified the need for a national strategy through which SAG could coordinate actions towards climate change adaptation. Engagement with policymakers initiated about 7 months before the workshop. Most preparations (workshop design, stakeholder engagement and logistics) took place within the last 3 months.

The 3-day scenario-use workshop was part of a series of regional engagements aimed at getting feedback on a preliminary version of the strategy, developed by governmental and non-governmental experts. The SAG team in charge wanted to know if the policy addressed the issues end users were struggling with and if the strategy was feasible to implement in its current form, or needed to be adjusted. The workshop took place at a regional office of the SAG ministry in Choluteca, one of Honduras's most climate vulnerable regions. Participants included regional and local SAG field personnel working with farmers, farmer organizations, agronomy students, research organizations as well as national SAG policymakers. The latter played an active part in the workshop facilitation, for which they had received on the spot training.

Stakeholders reviewed an advanced version of the climate change adaptation strategy and suggested improvements they considered relevant. Then, the Central American scenarios were downscaled to the scope of Honduras and indicators relevant to the policy, such as access to water resources, knowledge management and capacity building to improve agricultural practices; thereby ensuring that the different scenarios would explore possible states of these issues addressed by the strategy.

IMPACT and GLOBIOM results were discussed in groups, mainly used as a medium to further illustrate to stakeholders the dynamics and possible impacts of each scenario. Model results of interest to stakeholders were those related to crop yields of cash crops (coffee, cacao) and staple crops (rice, beans, maize) and the production and demand of livestock products. Finally, participants tested the effectiveness of the strategies' objectives, measures and activities in the multiple downscaled scenarios and wrote up recommendations to increase their robustness. Clear comments were given as to why certain measures were not possible to implement in a scenario. An analysis of these comments, across all four scenarios, then amplified the missing gaps and crucial pathways to achieve objectives.

Since three of the policy makers leading the formulation process had an active facilitating role in the policy review workshop, engaging closely with stakeholders, very little further support was needed from the CCAFS scenarios coordinator afterwards.. They discussed the recommendations within two weeks); made a first selection of top recommendations, which were then presented to the interinstitutional board in charge of the policy development, where final decisions were made on what to include.

As a result of the scenario exercise, a new objective was added to the strategy, focused on promoting adaptation measures for the agri-food sector. Other additions to the strategy that resulted from recommendations included:

- The establishment of an agro-climatic information system to increase the resilience of vulnerable communities during extreme weather events
- Territorial planning to promote the increase of resilient agriculture and livestock by planning production according to the most compatible land use of each territory
- Capacity building for producers in topics related to climate change adaptation and risk management and the promotion of new technologies related to irrigation and resistant seeds.

The final version of the policy was approved by the Honduran government in 2016, about one and a half years after the scenarios workshop.

Costa Rica

The regional scenarios for Central America were used in 2015 during the design process of Costa Rica's Intended Nationally Determined Contribution ([INDC](#)) (MINAE, 2015). A 2-day scenario-use workshop was the first step in a national dialogue to define, test, and improve adaptation and mitigation measures to address and decrease emissions of greenhouse gases (GHG)

What motivated the Ministry of Environments INDC team to consider a scenarios approach was that GHG inventories and GHG mitigation measures based on marginal abatement cost curves were not sufficient to achieve the ambitious emission reduction goals Costa Rica had in mind. The forecasts, made by a team of recognized consultants following international guidelines to define emission goals (CDKN 2015; GIZ 2014; UNDP/WRI 2015), were based on historical data and social, economic and environmental assumptions such as the demand for electricity, consumer patterns, private and public-sector investments, and the availability of natural resources. Considering the high uncertainty of the future course of development of these factors, and their relevance to the increase or reduction of GHG emissions, the INDC team was looking for an alternative approach to complement abatement curves; a methodology that could affirm that the ambitious goals they had in mind, could be met in the future. This is when the coordinator of a UNDP project supporting Costa Rica's INDC development, requested CCAFS' support to use a scenarios approach. He had been familiarized with the methodology in 2013, when he participated in the creation of the set of scenarios for Central America.

Preparations for the scenarios exercise started in June 2015, about three months before the workshop took place. In order to give tangible recommendations about the possibilities and restrictions for future emission reduction, a document summarizing government proposals of mitigation and adaptation measures to reduce GHG emissions, was prepared for the workshop. During the 2 days workshop, key stakeholders from public and private sector and civil society revised this list and added or edited measures that they considered vital for climate change adaptation and mitigation. Regional scenario narratives for Central America were adapted to Costa Rica and translated to the five major emission sectors (transport, electric energy, agriculture, waste and forests). These measures were then tested and improved for effectiveness in the alternative pathways of development explored in the scenarios (Veeger et al 2015).

As opposed to other mentioned cases, the IMPACT, GLOBIOM and LANDSCHIFT model results presented in this chapter were not used to support the policy development process. The INDC team decided to focus the debate on innovative emission reduction measures instead of on the quality and origin of numeric model results.

The INDC team used the national scenarios and recommendations resulting from this exercise to test the former mentioned emission forecasts and increase insight on possible future changes that could affect

mitigation and adaptation measures. By not only looking at emission reduction in numbers, but also at possible economic, political, environmental and social development, experts and decision makers were able to identify the preconditions needed to create a country in which emissions can be reduced, as well as obstacles that might be encountered along the way. This systemic approach also shed light on the collateral effects that reducing emissions in one sector could have on other sectors. This was considered relevant since it enabled the selection of measures that have an impact on several sectors. Finally, the scenarios workshop also allowed the INDC team to test and confirm that key stakeholders from major emission sectors were prepared to take significant steps to reduce emissions.

The recommendations that resulted from the workshop were presented within a week after the scenarios workshop, and were used to feed into further participatory dialogue sessions for five emission sectors and later again for final analysis by the INDC team. INDC document was presented at the COP in Paris in November 2015. In the months following, two policymakers collaborated with CCAFS to write a policy brief and paper about the research findings that surged from the process.

Peru

The Andean scenarios were used in a scenario-use exercise in Lima in 2014 where four national policies were reviewed and tested simultaneously. The objective of the workshop, organized by UNEP-WCMC, was to validate regional scenario model results and use these to evaluate the robustness of country-level policies addressing development and food security in the face of current and future changes in biodiversity and ecosystem services, under a changing climate. National and regional stakeholders specialized in agriculture and food security from the public and private sector and research organizations identified policies in Bolivia, Colombia, Ecuador, and Peru that were in the process of formulation or review that could be further developed in the workshop.

The organizing workshop team coordinated with government officials to validate whether there was political interest in reviewing and formulating recommendations of improvement for each policy through scenarios analysis. In the case of Peru, private and NGO stakeholders suggested to work with [Plan GRACC-A](#), a strategy for climate change adaptation and risk management for agriculture and livestock formulated with support of FAO a few years earlier (MINAGRI, 2012). The ministry of agriculture affirmed that although the policy was formulated recently, it was in their interest to have stakeholders from multiples sectors review the document since a half term evaluation was going to take place in the near future.

In the 3-day workshop, public and private stakeholders as well as academics reviewed Plan GRACC-A, suggesting recommendations for improvement. Maps showing changes in future biodiversity and ecosystem services due to land use change in each scenario, were used as supporting material to complement scenario narratives with detailed quantitative information. These were generated by LANDSHIFT. This model simulated the scenarios by coupling with scenario results from IMPACT. Using colored stickers and markers, stakeholders also spatially visualized each scenario in a map of the region, indicating where they foresaw the scenarios key future developments, and areas of interest or possible threat for food security. The effectiveness of each policy was then tested in all four scenarios, resulting in a second round of recommendations to increase the policies resilience to external changes. The workshop ended with the definition of short and medium-term actions needed to ensure that recommendations were to be communicated to decision makers, considered and incorporated in the policy.

Despite of the thorough design, extensive modelling results and multilateral support for this scenarios exercise, the recommendations that resulted from this review process were not incorporated in Plan GRACC-A. Possible identified causes were the timing of the exercise (after the workshop the Peruvian team in charge of the policy was occupied with the organization of the COP in Lima), the lack of funding to implement the policy, and the limited length and intensity of engagement with policy makers. There was little communication with government officials before and after the workshop and limited time to talk through the details of the policy review.

Colombia

The Andean scenarios were also used to inform the Colombian action plan for the climate change adaptation and risk management strategy for agriculture and livestock. The Ministry of Agriculture proposed to work on this policy, which was close to completion.

The design of the exercise was the same as the approach applied to the Peruvian policy described earlier. A team of 10 key Colombian stakeholders from multiple sectors, some of whom participated in the earlier formulation process, reviewed a preliminary version of the policy, adding recommendations of improvement. The new version of the policy was then tested in multiple scenarios relevant to the variables considered in the policy. Maps with LANDSHIFT model results were used by participants to understand the future changes in biodiversity and ecosystem services due to land use change in each scenario and further recommendations were given to improve the policy resilience to future changes. At the end of the workshop a plan was set up with detailed steps regarding to whom, where and when the recommendations should best be presented and what further steps to take to ensure their uptaking in the policy finalization.

After the workshop, the aforementioned recommendations were further structured to facilitate their lecture and analysis by policymakers. The organizers of the workshop, with close connections to the Colombian ministry of agriculture, requested a formal meeting with the ministries' policy team where a few key stakeholders that participated in the scenarios exercise could present and discuss recommendations. Unfortunately, the meeting did not take place. Later inquiries showed that internal changes of leadership within the ministry shifted priorities and put this policy on pause.

Central America

After taking a vow at the 21st Conference of Parties (COP) in Paris to reduce emissions and increase climate change adaptation in agriculture and livestock, the Central American Agricultural Council (CAC) took up the task in 2016 to develop a strategy that would promote Climate Smart Agriculture (CSA) in the Central American Integration System (SICA), a political region formed by Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, Belize and the Dominican Republic. In close collaboration with CCAFS Latin America, the CAC designed a consultation process through which the policy would be developed.

Determined that the policy was to be developed in a participatory manner, CAC involved regional technical agriculture committees set up by the SICA integration system, all composed by stakeholders from multiples sectors and countries. The formulation process consisted of the following phases: 1) an email exchange and workshop where initial guidelines for the policy were set out; 2) a future scenarios workshop; and 3) an online open consultation to review and comment on the policy. In the first phase, agricultural experts from the Technical Group on Climate Change and Integrated Risk Management (GT-

CCGIR) and other technical groups adjacent to the CAC, discussed over email to identify the policies' strategic axes as well as the main measures that would promote climate smart agriculture and articulate countries actions at a regional level. These were refined and finalized in a first workshop, producing a document that were to be discussed and strengthened during the next phase of the formulation process.

In a second workshop, regional experts, policy makers and representatives of a wider public, now including stakeholders outside CAC such as research organisations and representatives of small scale farmers associations, tested and robusted the strategy against diverse socio-economic and climate scenarios up to 2050. This was achieved with a workshop design similar to ones showcased in the Honduras, Colombia and Peru case outlined in box 1. In contrast to the Colombia and Peru case, there were several meetings prior to the workshop with the policymakers in charge. Other than understanding the details of the policy process and how a scenarios approach could best complement it, these gatherings were also aimed at describing what can be achieved and expected from the methodology. The close collaboration between CCAFS, CAC, the Ministry of Agriculture (MAG) of Costa Rica, and UCI (the scenarios coordinator) was essential to the process. CCAFS had been working side by side with CAC for several years to promote climate change adaptation within SICA, and CAC and MAG had chosen the scenarios methodology from a range of possible tools through which CCAFS and UCI could support the development of the policy.

After the scenarios workshop policy recommendations were reviewed by an executive committee within two weeks. This version was then presented to the general public in an online open consultation. The Board of Ministers of Agriculture of CAC, who were continuously informed by CCAFS of developments in the process, approved the policy in June 2017. This was about 4 months after the scenarios workshop and 8 months after the first guidelines were set up. Since it's approval, the regional CSA strategy has been used to create a national policy to increase CSA in El Salvador and Honduras.

Discussion and Conclusions

Participatory scenario development and analysis have shown to be an effective way to increase the credibility, salience and legitimacy of policymaking (Alcamo and Henrichs 2008, Vervoort et al 2014, Chaudhury 2016). Nevertheless, an initial analysis of these case studies shows that there is no bulletproof method to effectively achieve this. In each of the cases, a similar process was designed and implemented and nevertheless the time and work invested had different outcomes. In only three of the five cases the recommendations to strengthen policies were taken into account. In our opinion, this is mainly related to two aspects: the way in which a scenarios approach is embedded in a policy development process, and the level of engagement with policy makers. Another aspect highlighted is that the use of model results to support policymaking can be versatile and have different outcomes, depending on their integration in the process.

First, when designing a scenarios workshop special care should be taken to carefully weave the exercise within the planned policy formulation process. The exploration of possible futures has more likelihood to inform policies when it addresses the specific needs of the policy process, considering what aspects make it unique and require a foresight approach, what difficulties have been encountered so far, who should be involved, and in which phase of the policy formulation a scenarios exercise would be most useful. Then, after the scenarios workshop, it should be clear in which decision making spaces recommendations are to be debated, and who should be involved. These discussion meetings and the analysis of what plausible climate futures may mean for current policies, play a crucial role in the effectiveness of the approach and in the adoption of the recommendations resulting from the process.

In both the Honduras and Costa Rica as well as the Central America case, we see the benefits of this work method. Policymakers were involved from an early stage in the co-creation of the process design, which ensured that the scenarios approach responded to their needs. They were also actively involved in post workshop meetings with key decision makers and in research conducted a posteriori. In the case of Peru and Colombia, the workshop design was determined beforehand, and although policy makers were able to decide what policy to work on and participated in the scenarios workshop, the demand for a scenarios approach did not come directly from them. Although quite some work was invested in preparing materials to present the resulting recommendations to the Colombian government, the interest of policymakers faded after the workshop, due to other priorities of the ministry.

A second aspect highlighted in the five cases presented in this chapter is the added value of a close engagement with technical advisors and policymakers. This is done by involving them in key decisions regarding the process design and training them on the spot in the essentials of foresight and scenarios work. By participating in workshops - exploring the future and what it might entail - they increase their understanding of the recommendations that result from the process and thereby the possibility of taking them forward to higher ranked decision makers. Having had an active role in these thinking processes, also increases the chance that a similar approach will be used in the future.

A further look at these cases teaches us that a scenarios approach can be relevant when the institutionalized procedure for policy formulation does not seem suited to achieve the expected goals. In the Honduras and Costa Rica case, both ministries were looking for an approach that would involve stakeholders from multiple sectors, including beneficiaries of the policy. In the Costa Rica case, the

internationally determined method to define future emission goals did not result in the ambitious goals the government had in mind, which motivated the Ministry of Environment to look for a method to complement marginal abatement cost curves of emission reduction strategies.

Within the global CCAFS scenarios program and the cases discussed in this chapter, economic partial equilibrium models to simulate scenarios of global climate change have shown to be a useful tool to support policy formulation. Stakeholders involved considered model results a valuable addition to the scenario narratives, mainly to obtain a deeper understanding of the logic of each scenario. Farmers as well policymakers were able to interpret scenarios in a more profound way when they related the scenario narratives to aspects close to their day-to-day life, such as differences in crop yields, prices or land use change in each scenario. It is important however to consider that model results have limitations. After all, they are simplified representations of systems and therefore cannot grasp the full extent of reality, let alone of possible futures, however sophisticated or complex they may be. Models are also based on sets of data and a predefined scale, which do not always match with the area and scale they are applied to. Apart from that, there is not always time and funding to involve modelling, let alone the capacities to run models or interpret model results.

In the Costa Rica case presented in this chapter, model results of scenarios were deliberately not used, in order to avoid a discussion among experts on the quality of data used in the policy formulation process. Given that climate change is a branch in science still continuously in development, the use of new methods to calculate current, past or future greenhouse emissions is not uncommon, and thereby putting in doubt earlier methods and the data derived from it. Leaving out scenario modelling in these cases is a legitimate and effective alternative and in this case even a motivation to work with a socioeconomic scenarios approach. Also, not all cases portrayed here were successful in terms of adoption of recommendations (Peru and Colombia), although model results were the motivation to support policy formulation process.

A mix of economic, crop and climate models as applied in the global CCAFS scenarios program can be a valuable proposition to broaden the range of each model. The time and funding invested and expertise needed is considerable though and therefore not a viable option for all projects. When resources are limited, the use of models could be reduced to one economic or crop model (depending on the focus of the policy and the interests of stakeholder groups) and one climate model.

A final conclusion from the cases presented here is the added value of collaboration when supporting policy development. The majority of the cases presented here would not have taken place nor be beneficial for the governments concerned without the technical or financial support of another agency. If the objective of giving support is to increase a countries capacities to manage climate change challenges, this should be done by aligning goals and actions with other agencies with similar aims.

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