



# INSIDE STORIES

## on climate compatible development

Climate & Development  
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### Key messages

- Agriculture plays an important role in Colombia's economy, contributing 10–14% to the overall GDP. But 25 of the country's most important crops may be threatened by climate change, potentially leading to significant economic losses.
- In cooperation with agricultural stakeholders, Colombian researchers are developing a comprehensive model to analyse vulnerability. This complements previous international efforts and sets the stage for adapting agricultural systems to climate variability more efficiently.
- The Agriculture, Vulnerability and Adaptation (AVA) Project applies a four-dimensional model for vulnerability analysis, which includes biophysical, political-institutional, economic-productive and socio-cultural factors. This kind of analysis is less sensitive to the uncertainties of one-dimensional models and more likely to be relevant, regardless of the accuracy of climate models.
- Participatory interdisciplinary approaches, knowledge-sharing, and sustained commitment are fundamental to the success of such vulnerability assessment methods.
- Future integrated vulnerability assessments could be scaled up and reflected in broader regional, national or international processes on adaptation planning.

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## Analysing vulnerability: a multi-dimensional approach from Colombia's Upper Cauca River Basin

**In Colombia, agriculture is an economic mainstay, creating direct employment for much of the country's population. Agriculture's dependence on predictable seasonal patterns leaves many communities vulnerable to climate change. Vulnerability assessments attempt to quantify the degree to which a system will need to adapt to climate change impacts – or whether it even has the capacity to do so. Such assessments have been criticised for their uncertainty and lack of applicability at the local or regional scale. However, a project in Colombia's Upper Cauca River Basin has taken a new approach to vulnerability assessment, using a model based on four dimensions of vulnerability. This brief provides an overview of the project as well as key considerations for vulnerability analyses that are inclusive, integrated and sensitive to social and political complexities.**

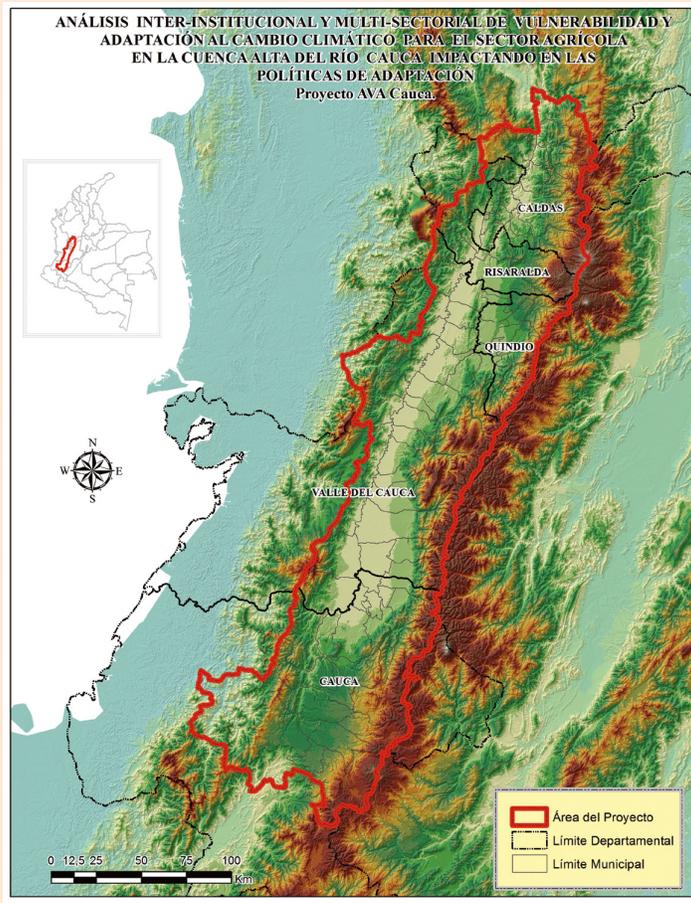
The agricultural sector in Colombia plays a large role in the overall economic activity of the country, contributing 10–14% to the National Gross Domestic Product (GDP) and creating livelihoods for more than 3.7 million people (Ramírez-Villegas et al., 2012; DANE, 2011). Agricultural exports make up a full 40% of Colombian GDP from trade (Ramírez-Villegas et al., 2012; DANE, 2011), with bananas, sugar and green coffee as the top commodities (FAO, 2010). The Upper Cauca River Basin, a 25,000 km<sup>2</sup> swath through Colombia's western departments, is

of particular strategic importance as it encompasses almost every production chain prioritised by Colombia's Ministry of Agriculture, as well as a diversity of agricultural systems ranging from small-scale operations to industrial farms. It also is the foundation for much of the country's technical and high-value agriculture, including the sugar industry and large parts of the coffee- and fruit-growing zones (Martinez and Figueroa, 2012).

Colombian agriculture will experience the effects of climate change in a

CDKN helps developing countries to design and deliver climate compatible development. When decision-makers in government, business and civil society speak to us about their aims and needs, they often ask about 'best practice' in other countries or, indeed, mistakes to avoid. What are the leading innovations in integrating climate change planning with economic growth strategies and poverty reduction? What are the biggest challenges faced along the way: institutional, financial, political, technical? This paper is one of a series of policy briefs that explore the 'Inside stories on climate compatible development': briefing papers that aim to answer these questions.

**Figure 1. Area of the Upper Cauca project**



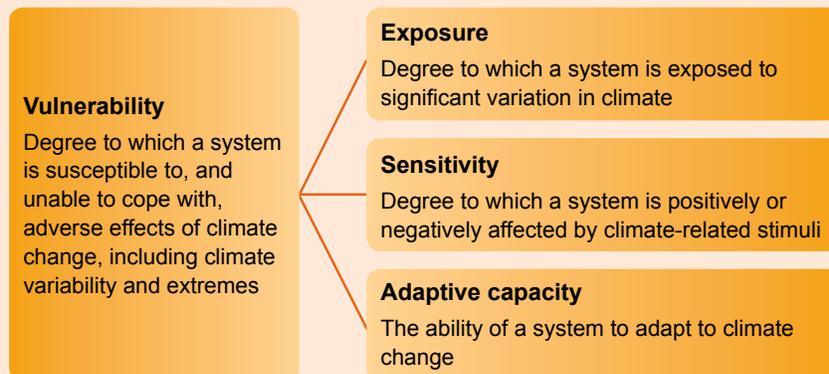
Source: CDKN, 2012

number of ways. An expected average increase in annual mean temperature of 2.5°C by 2050 and a 2.5% rise in annual precipitation will likely cause soil degradation and organic matter losses in the Andean hillsides, losses in climatic niches for coffee, fruit, cocoa and bananas, and changes in the prevalence and distribution of pests and diseases (Lau, Jarvis and Ramírez, 2010). Recent climate predictions reveal that up to 83% of Colombia's potential agricultural lands could lose their climatic suitability for 25 of Colombia's most important crops (Jarvis et al. in production). Yield reductions and increases in production costs are expected as a result of pest and disease fluctuations and the loss of crop climatic niches, particularly for specialised crops such as coffee (Ramírez-Villegas et al., 2012). By 2025, the economic damages associated with climate change in the Andean Region could be as high as US\$30 billion annually, mostly from the agricultural sector (SGCAN, 2008).

The above considerations, in addition to the fact that over 37% of the country's population is at or below the poverty line (World Bank, 2012), imply that Colombian agriculture and the Upper Cauca River Basin in particular are highly vulnerable to the effects of climate change. Vulnerability is defined by the Intergovernmental Panel on Climate Change (IPCC) as: "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes" (McCarthy et al., 2001: 27).

According to the IPCC definition, vulnerability is a function of three variables: exposure, the degree to which a system may experience climate

**Figure 2. Vulnerability as defined by the IPCC**



Source: McCarthy et al., 2001

variation; sensitivity, the degree to which a system is positively or negatively affected by climate-related stimuli; and adaptive capacity, the conjunction of capacities, resources and institutions that allow effective adaptation measures to be applied (Figure 2). Vulnerability analysis can evaluate a population's need or capacity to adapt to climate change based on an assessment of different combinations of these three variables.

The Agriculture, Vulnerability and Adaptation (AVA) project (also known as the Inter-institutional, Multi-sectoral Analysis of Vulnerability and Adaptation to Climate Change for the Agricultural Sector in the Upper Cauca River Basin Impacting Adaptation Policies project) was launched in 2011 when a team of researchers, engineers and technical experts from four major entities in Colombia – the University of Cauca, the International Center for Tropical Agriculture (CIAT), the National Coffee Research Center (Cenicafé) and the University of Caldas – united in their concern over the lack of protocols for calculating vulnerability. The project currently aims to address the urgent need for an integrated system of analysis that unites biophysical, sociocultural, economic and institutional variables associated with agricultural production and climate change in the region. The pilot area is the Upper Cauca River Basin, which encompasses five departments: Caldas, Cauca, Quindío, Risaralda and Valle del Cauca. Almost 20% of the country's population lives in this region (DANE, 2011).

Rather than creating a static picture of vulnerability, the approach of the AVA project recognises that participatory

action and institutional capacity are critical to creating effective climate adaptation policies. In particular, the project engaged stakeholders at the outset to identify priority agricultural sub-sectors, key indicators and a methodology for vulnerability assessment, before these were incorporated into public policy. The project also disseminates information on the impacts of climate change on agriculture, and strengthens existing platforms for sharing hydro-meteorological, biophysical, social and economic knowledge. Lastly, the initiative is meant to serve as a reference for future regional or national processes on adaptation measures. The vision is to bridge science, politics and development with a methodology that is universally available and understandable.

### **Upper Cauca stakeholders develop a more comprehensive vulnerability assessment**

Previous vulnerability assessments have been criticised for not being comprehensive enough, focusing solely on analysing biophysical variables, or producing uncertain results. The challenge is to find a way to accurately assess complex agricultural systems that are influenced by difficult-to-measure socioeconomic variables (Benedikter et al., 2011; Patt, Klein and de la Vega-Leinert, 2005). The approach must capture the interactions between social, economic and environmental variables, as climate change affects not only farmers but also businesses, institutions and consumers (Benedikter et al., 2011). The AVA project recognises the need for a more inclusive kind of analysis. It has developed a vulnerability assessment that is sensitive to multiple dimensions of climate change impacts,

giving more weight to social variables and emphasising evaluation methods that are regional or local in scope (CIAT, 2011).

The AVA project accordingly places emphasis on four integrated dimensions of vulnerability: biophysical, political-institutional, economic-productive and sociocultural (Figure 3). The latter has been given special consideration due to the rich sociocultural diversity of the region and the differential exposure to climate change impacts of certain social groups. Each dimension comprises a variety of indicators (Figure 3), which were selected to quantify a particular phenomenon – such as low crop yields or biodiversity loss – that makes populations more vulnerable to climate change.

It has been necessary to collect data to populate, or quantify, each indicator. For some indicators, rich stores of data already exist. In this case, the job of researchers has been to locate the data, collect them from various institutions (government entities, universities, research organisations, etc.), verify their authenticity and convert them to a compatible format. Other indicators – especially those in the social dimension – have needed to be carefully defined, and it has been necessary to identify sources of supporting data.

### **Participation of a broad range of stakeholders in defining indicators**

Another key aspect of the AVA project is its participatory approach to populating these new indicators with usable data. For example, the gathering of cultural data that can reveal climate-



**Figure 3. The four dimensions of vulnerability in the AVA project**



**Integrated, inter-institutional work is of the greatest importance in order to share resources, knowledge and experiences, and thus optimise the results of projects like this one.**

Francisco Boshell, Director of Human Resources, National University of Colombia

sharing the responsibility of developing a comprehensive, functional system of analysis that incorporates the indicators that matter, not just those for which there are existing data.

**Not just for scientists: an accessible tool**

related shifts in crop calendars, such as sowing and harvesting times, has only been possible with the help of local farmers. Through a preliminary workshop, indicators were first identified by stakeholders, including members of the agricultural and environmental sectors, industry representatives, research institutes, academics, farmers' organisations, and department and municipal government authorities. Participants defined each indicator's magnitude (the extent to which it affects the sector or region in question), on what geographic or institutional level it should be applied, its prioritisation in the analysis, and the necessary field data. A

subsequent workshop gave farmers and other groups the opportunity to share their knowledge and experiences with researchers, providing qualitative data to further flesh out the indicator.

The identification, definition and population of indicators with data from the Upper Cauca is now almost complete; the comprehensive vulnerability analysis incorporating all four dimensions and their indicators has yet to be carried out. However, the end vision – and the great challenge – is to create a methodology that can be used by everyone. To this end, despite their different motivations, researchers and stakeholders alike are

What do stakeholders really want out of the Upper Cauca River Basin project? Their motivations can differ depending on their socioeconomic status; smallholder farmers need food security, whereas industrial-scale farmers want to reduce their investment risks. Regardless of these differences, all farmers in the Upper Cauca region have experienced the impacts of climate change in one way or another. Project leader Apolinar Figueroa explains: "They know that climate change is happening, but they may or may not understand why. They have even less understanding of what might happen in the future – they



Farmers' groups attend a climate change workshop at CIAT, September, 2012. Photos: N. Palmer (CIAT).

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**They know that climate change is happening, but they may or may not understand why. They are concerned with how they are going to survive today.**

Apolinar Figueroa, Project leader, AVA project

are concerned with how they are going to survive today.” Thus, all agricultural producers have one hope in common: to find a practical tool that can help them plan for the productivity and health of their farm, compare regions, compare crops, and understand the benefits and drawbacks of different farming systems in the face of climate change.

## Lessons learned so far

### **Interdisciplinary knowledge-sharing is crucial**

A key insight garnered by AVA workshop participants is that not only is inter-institutional cooperation possible, but it is also critical for assessments to be fully supported by existing data. Information is much more useful when standardised, but good data can be overlooked if they are dispersed and uncoordinated. In addition, the identification of indicators is best done by involving the institutions and people who manage the required data. They are the best judges of the pertinence and viability of the selected indicators.

### **Stakeholder participation ensures inclusive, multidisciplinary and cross-sectoral action**

Without a doubt, one of the strengths of the AVA project is its participatory approach. Several actors with a shared interest in the region’s agricultural

productive system have been actively involved in all stages of the project, from the discussion of existing vulnerability assessment models to the design and formulation of a new methodology. This in turn has set the stage for a more inclusive agenda for action, one that bridges the gap between science, politics, producers and consumers and ensures mitigation and adaptation options that are both multidisciplinary and cross-sectoral. While such an approach may be costly and may not produce unanimity due to the challenge of coordinating different types of knowledge among disciplines, it is an exercise that any adaptation and mitigation planning strategy should undergo.

### **There is no success without commitment**

Inclusive agendas, a multidisciplinary approach and good indicators are not enough to ensure the creation or implementation of an adaptation or mitigation plan. In order to translate an ambitious agenda into concrete policies that the public and private sectors will adhere to, there must be strong stakeholder commitment. Even if continuous engagement is difficult to monitor – especially in the political arena, where legislatures and national development planning priorities change often – this should not discourage initiatives to address climate change adaptation planning.

### **Some indicators can be difficult to measure**

To be helpful, an indicator must have associated data that are widely available, accessible, unique, measurable, specific and trustworthy. In the biophysical dimension, for example,

there are ample and easily accessible databases containing decades of data on temperature and precipitation. Other variables, however, such as wind, solar radiation and humidity, lack enough consistent data for a useful analysis. Lack of data can confound attempts to apply the project’s methodology in other countries, such as Ecuador or Bolivia, where existing databases are even more sparsely populated than in Colombia.

Further, political-institutional indicators can be especially difficult to define due to their tendency to overlap with indicators from other dimensions. They require deep scrutiny to ensure that the analysis for one indicator is not being repeated for a similar indicator in another dimension. Political-institutional indicators are also difficult to classify under one of the three variables of vulnerability; almost all deal with adaptive capacity but they can also reflect aspects of exposure or sensitivity as well.

### **Inherent uncertainty complicates – but doesn’t prevent – a useful integrated assessment**

The complexity of natural systems means that the models used to project future climate change impacts come with built-in uncertainties. This creates problems for vulnerability assessments that are based solely on changes in biophysical indicators, such as the previous assessments carried out by the Colombian Government. The incorporation of other key dimensions, especially the sociocultural and political-institutional dimensions, gives an analysis that is less sensitive to the uncertainties of one-dimensional models and more likely to be relevant regardless of the accuracy of climate models.

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The Climate and Development Knowledge Network (CDKN) aims to help decision-makers in developing countries design and deliver climate compatible development. We do this by providing demand-led research and technical assistance, and channelling the best available knowledge on climate change and development to support policy processes at the country level.

## About the Agriculture, Vulnerability and Adaptation project

The AVA project is supported by CDKN and implemented by the University of Cauca, University of Caldas, International Center for Tropical Agriculture (CIAT), and the National Center for Coffee Research (CENICAFE).

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