CLIMATE CHANGE PLAN
HUILA 2050: PREPARING FOR CLIMATE CHANGE

JULY 2014

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For more information, see the full plan document and other documents developed under the Project Huila 2050: preparing for climate change, on the web pages of the CAM, E3 and FCMC:

www.cam.gov.co www.e3asesorias.com www.fcmcglobal.org

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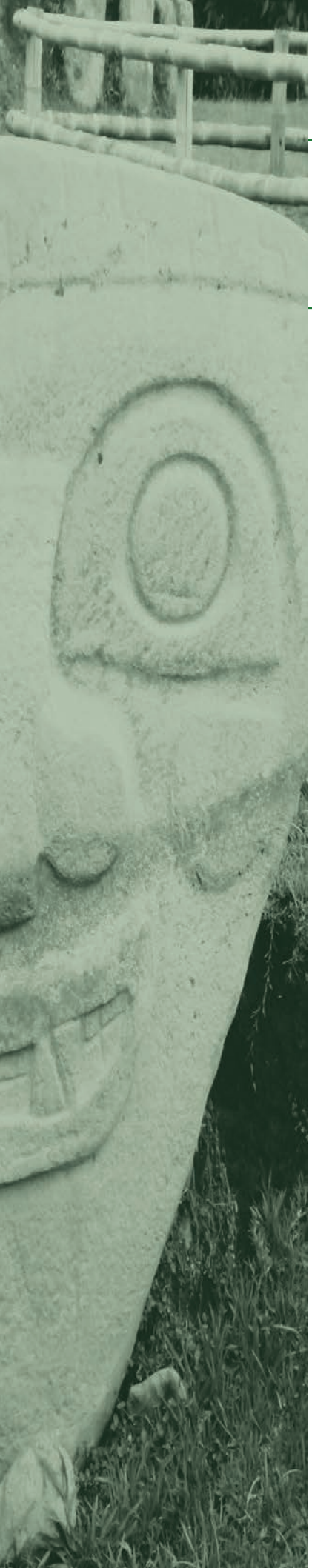
GLOSSARY OF ACRONYMS

Most acronyms come from names in Spanish.

ACUAPEZ	Fishing Technology Development Center
ANLA	National Authority for Environmental Licenses
ASOMAC	Association of Municipalities of the Colombian Massif
BMIC	Municipal Climate Information Bank
CAF	Latin America Development Bank; formerly: Andean Development Corporation
CAM	Regional Autonomous Corporation of the Upper Magdalena
CATIE	Tropical Agricultural Center for Research and Teaching
CDKN	Climate Development Knowledge Network
CDM	Clean Development Mechanism
CENICAFE	National Coffee Research Center
CENIGAA	Research Center in GeoAgroEnvironmental Science and Resources
CEPASS	Department of Huila Research Center for Technology Management of Passiflora
CER	Certified Emission Reduction
CIAT	International Center for Tropical Agriculture
CIDEA	Interagency Technical Committee on Environmental Education
CIPAV	Centre for Research on Sustainable Farming Systems
CORMAGDALENA	Regional Autonomous Corporation of the Great River of the Magdalena
CORPOICA	Colombian Corporation for Agricultural Research
CREG	Energy and Gas Regulatory Commission
CSR	Corporate Social Responsibility
CST	Climate-Smart Territory
DANE	National Administrative Department of Statistics
DNP	National Planning Department

ECA	Field School
ECDBC	Colombian Strategy for Low Carbon Development
ECLAC	Economic Commission for Latin America and the Caribbean
FAO	Food and Agriculture Organization of the United Nations
FCMC	Forest Carbon, Markets and Communities- USAID program
FFEM	French Global Environment Facility (in French: Fonds Français pour l'Environment Mondial)
FINAGRO	Fund for Agricultural Financing
FINDETER	Financial Agency for Development
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	German Society for International Cooperation (Gesellschaft für Internationale Zusammenarbeit)
HDI	Human Development Index
IAvH	Alexander von Humboldt Research Institute on Biological Resources
ICA	Colombian Agricultural Institute
ICR	Rural Capitalization Incentive
IDB	Inter-American Development Bank
IDEAM	Institute of Hydrology, Meteorology and Environmental Studies
IGAC	Agustin Codazzi Geographic Institute
INCODER	Colombian Institute for Rural Development
INGEOMINAS	Colombian Geological Service
IPCC	Intergovernmental Panel on Climate Change
IPS	Health Provider Agency
LAC	Latin America and the Caribbean
LSI	Living Standards Index
MADS	Ministry of Environment and Sustainable Development
NGO	Non Governmental Organization
OCAD	Collegial Organ of Administration and Decision- General Royalties System
ODA	Official Development Assistance
ONF Andina	Andean Division of the French National Forest Office
PES	Payment for Environmental Services
PGAR	Regional Environmental Management Plan
PGOF	General Forest Management Plan
PNACC	National Plan for Climate Change Adaptation
PNN	Natural National Parks
POMCA/POMCH	Watershed Management Plan
PORH	Water Management Plan
POT	Land Use Plan
PROURE	Program for the Rational and Efficient Use of Energy and Other Forms of Non-Conventional Energy

REDD	Reducing Emissions from Deforestation and Forest Degradation
RICCLISA	Interagency Network on Climate Change and Food Security
RNSC	Civil Society Natural Reserve
RUNAP	National Register of Protected Areas
SEI	Stockholm Environment Institute
SENA	National Learning Service
SETP	Strategic Public Transport System
SIDAP	Departmental System of Protected Areas
SINA	National Environmental System
SIRAP	Regional System of Protected Areas
SIVIGILA	National System for Public Health Surveillance
SNPAD	National System for the Prevention and Attention to Disasters
UAESPNN	Special Administrative Unit of National Natural Parks
UN	United Nations
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNGRD	National Unit for Disaster Risk Management
UPME	Mining and Energy Planning Unit
USAID	United States Agency for International Development
VBD	Vector Borne Disease
WEAP	Water Evaluation And Planning System



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PREFACE

As the first department of Colombia that is determined to lead the way in climate compatible development, we are pleased to present the Climate Change Plan 'Huila 2050: Preparing for Climate Change'. The intention of the Plan is to assure that Huila remains a region that provides water to its people as well as to Colombians in general, guaranteeing the well-being of future generations, and the adaptation of people and productive sectors through the preservation of its ecosystem services. The Plan aims to launch a climate smart and competitive department, beginning today. This implies a department that contributes to sustainable development and remains first in coffee and fruit production, among the most productive in various crops and that guarantees food security for the people of Huila and Colombia as a whole. In order to achieve these goals, the Plan propounds to become the country's best agro-climatic system, producing coffee with zero carbon footprint and that is adapted to future climates, advancing the best silvopasture cattle ranches, taking into account the viability, productivity and performance of different crops in future climate, and thinking about crops that will be promising tomorrow, as the basis for rural development in Huila.

Given that Huila generates hydro-energy and is a supplier of petroleum, gas and important minerals, the Plan seeks to assure that these riches are well managed, assuring first and foremost water and biodiversity, forests and soils in the department, so that the richness in resources is transformed into the wealth and well being for the population of Huila.

The Plan proposes that each of the municipalities of Huila generates a resilient community and opportunities for its people. To do so, it presents the country's first climate change vulnerability assessment on a municipal level. The assessment addresses the fundamental necessity for each municipality to foster strategies that minimize their sensitivity and enhance their adaptive capacity. Consequently, development and land use planners should consider climate change in an intersecting manner within their agendas. The Plan proposes to generate cities and towns that are better adapted to future climate and that remain competitive. Likewise, the plan promotes adapted veredas (semi-rural communities under the jurisdiction of townships) that improve the quality of life for many generations through the community participation and knowledge sharing. In order to achieve this, health and education must be the priorities.

In our opinion, this can only be only possible by bringing together the public and private sectors, as well as each and every inhabitant of Huila who wants to generate prosperity for today and the future generations. We hope this Plan will become a decision-making tool for politicians that transcends current administrations, allows for on-going implementation of the actions proposed and is actualized and monitored through time.

The Plan Huila 2050 has been realized with this very motivation and based in an effort of all the respective regional and national entities. The Plan presents 5 general axes and 5 traversing axes, each with realistic lines of action to assure a climate compatible development. We want to express our gratitude to all those who contributed to this effort and we invite the people of Huila to join us with proactive and innovative solutions in the framework of the Plan for the good of the department.

Carlos Mauricio Iriarte Barrios
Governor of Huila

Carlos Alberto Cuellar Medina
General Director, CAM

1. INTRODUCTION

The climate is changing and with it, the way we inhabit the earth. Each region of the world will face unique challenges in achieving climate compatible development: in some regions, challenges will be related to control and management of large volumes of water -floods, rising sea levels and increased flow of rivers and streams. In other places, the changes will be seen through reduced precipitation, droughts and desertification. Some regions will experience higher temperatures, while others will undergo decreases.

For the department of Huila, Colombia's Institute for Hydrology, Meteorology and Environmental Studies (IDEAM) has predicted an average temperature increase of 2°C by 2040 (which may be higher according to more recent global projections) and a 30% decrease in precipitation. If we wait to deal with the consequences of climate change, the solutions will be much more costly and technically complicated, and will force future generations in Huila to invest time and resources in reconstruction, resettlement and restoration rather than investing in development, competitiveness and sustainability.

The Huila 2050 Action Plan is an important contribution to understanding and managing current climate challenges to prevent future expenses. Implementation of the Plan seeks to take advantage of existing resources in a cost effective way and to generate options for the department to be economically competitive. In the long run, mitigation and adaptation to climate change offer many possibilities: to build a more prosperous department, ensure effective management of water resources, develop productive and sustainable lands, guarantee that crops can adapt to future climate conditions, generate clean energy, help cities, people and neighborhoods seek efficient energy, water and waste options, construct buildings that are climate appropriate, create micro-climate green areas, and build sustainable transportation. The Plan works to improve public health by controlling diseases like dengue and malaria and responding to heat waves.

The department of Huila has successfully implemented climate compatible projects and sustainable production that have been taken into consideration in the formulation of the Plan. Some examples are the management of the Las Ceibas River, creation of regional parks, integral crop

management (sustainable coffee), and forest pasture grazing systems. These are current examples that generate interesting opportunities to create climate compatible development.

The department of Huila also has strategic importance for Colombia . Huila is productive for the economy and is a major source of water, home to headwaters of the Magdalena river. Activities in Huila have an impact all along the river (upper, middle and lower basins). Land management in Huila will favor municipalities all along the waterway.

The Plan presented here is the departure point for a long-term vision that is fully shared among the different stakeholders of Huila. It is spearheaded by the Departmental Governor and the Regional Autonomous Corporation for the Upper Magdalena (CAM), a variety of public and private entities, the mayors of the 37 municipalities in the department, who understand the vulnerability of their towns, and finally, civil society stakeholders who may become involved in numerous ways on a local level. The plan is also the result of nearly two years of arduous work that was carried out by regional, national and international agencies that contributed innovative solutions to climate challenges and brought investors who are confident that early intervention is needed, given that the world needs concrete examples of cities and regions that are prepared to combat climate change.

The impulse for this plan stems from dialogues with a variety of stakeholders and from a set of studies that make up the technical foundation of a diagnosis for the department. Based on these sources, a vulnerability study for the entire department was carried out and the results are presented in a separate analysis for each of the 37 municipalities, together with a detailed examination of greenhouse gas (GHG) emissions. The plan also included a compendium of mitigation and adaptation measures that have already been implemented in the department.

The Huila Action Plan is drafted around 5 areas of action, each of which highlight concrete measures that can be developed in the short, medium and long term. It is contingent on the fundamental intersection of areas such as territorial planning, education and training, communication, science and technology and risk management. The feasibility of each of these measures is examined to facilitate their eventual implementation and development. The proposal is to generate a plan that evolves over time according to the development of concrete programs in each of the zones of the department, as different economic sectors join in efforts and as local mayors begin to show clear results in terms of competitiveness and sustainability in their jurisdictions. The “Huila Climate Observatory” will monitor progress of the Plan and disseminate information. The Plan will become an open platform that unifies and promotes action around the creation of a climate-smart department that generates employment and economic benefits, increases sustainable productivity, produces quality water that supports renewable environmental and energy services, attracts tourists who enjoy ecological conservation and that becomes a point of reference for sustainable investment and regional competitiveness.

2. CONTEXT

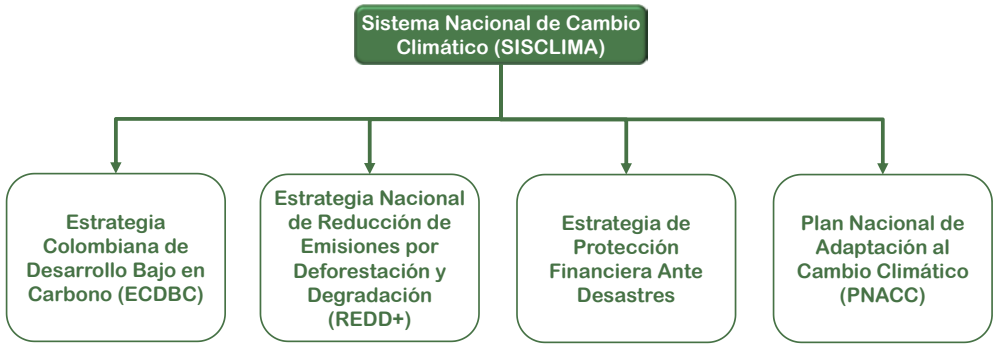
CLIMATE CHANGE IN COLOMBIA

The Colombian government has identified climate mitigation and adaptation as a national priority, recognizing that the phenomenon is not only an environmental challenge, but a social and economic one as well. The national government, regional and local representatives, and citizens in general are beginning to understand that action is required for climate compatible development to ensure the country's competitiveness and viability in the future[1].

While the country has contributed little to climate change globally – GHG emissions are 0.37% of global output – it is highly vulnerable to its effects. Therefore, it must promote long-term adaptation strategies. Colombia has begun to create policies that are compatible with economic development, territorial planning and future climate challenges . Interest in adaptation to climate change grew in response to the winter wave of the La Niña phenomena in 2010-2011, which led to estimated expenditures of $11.2 billion pesos (USD 6,052 million)[2] ,equal to nearly 2% of the national GDP.

In 2002, the Ministry of the Environment established the first Office for Climate Change with a series of guidelines around the issue of environmental policy, including Clean Development Mechanisms (CDM – Kyoto Protocol). Later, in the context of the United Nations Framework Convention on Climate Change (UNFCCC), Colombia began to develop a national strategy for climate change that included adaptation, mitigation, reduction of emissions from deforestation and forest degradation, and a financial strategy to achieve these goals.

Figure 1. Strategies of the National System for Climate Change (SISCLIMA acronym in Spanish).



Fuente: Elaboración propia con base en Calderón, 2013.

The purpose of the National Plan for Adaptation to Climate Change (PNACC for its acronym in Spanish) is to reduce risks and socio-economic impacts of variations in climate. Each department and different economic sectors are expected to make plans to adapt according to national guidelines[3]. The PNACC has three pillars: community level adaptation, ecosystem adaptation, and adaptation of insfrastructure.

Likewise, the Colombian Strategy for Low Carbon Development (ECDBC for its acronym in Spanish) seeks to uncouple GHG emissions from national economic development by designing and implementing plans, projects and policies that reduce emissions while strengthening social and economic growth, according to global standards in efficiency, competetiveness and environmental performance. The ECDBC focuses on industrial sectors, energy and mining, transporation, housing, waste and agriculture, taking into account business as usual (BAU) scenarios and Marginal Abatement Costs Curves[4].

Additionally, the country is preparing the National REDD+ Strategy, which focuses on the design and implementation of a monitoring and reporting system on the state of forest coverage. This, together with an analysis of socio-economic changes, helps identify the causes of deforestation and forest degradation in order to intervene in a concerted and effective manner to mitigate and reduce impacts. Furthermore, actions are intended to develop institutional structures that are deemed necessary to carry out these strategies[5].

The tropical environment and the mega-diversity of Colombia's territory, together with its socio-economic and institutional alignment make it a perfect candidate to develop REDD+ projects. In a large portion of the territory the causes of deforestation can be controlled if sustainable alternatives and incentives for conservation are provided to stakeholders. REDD+ certification represents a substantial incentive by increasing the opportunity costs of converting natural ecosystems to productive land, and thereby, together with other measures, altering decisions about converting lands that are subject to deforestation or degradation[6].

Together with these three strategies, the government is devising a National Policy for Climate Change, which includes the financial mechanisms to achieve it. With new methodologies and global climate projections, the government is developing the third National Communications for Climate Change under the leadership of IDEAM. Colombia has been recognized for taking a leadership role in international debates about climate change, with a committed team that brings constructive and concrete proposals. The challenge is to bring these proposals down to earth so that issues such as adaptation and innovations to advance the country take precedence.

HUILA: A BIODIVERSE AND COMPETITIVE DEPARTMENT

The department of Huila is located in the Southern region of the Colombian Andes. It is part of the upper basin of the Magdalena River (the most important river in Colombia)[7] and of the Colombian central mountain range, a place that constitutes the most important source of water in the country [8].

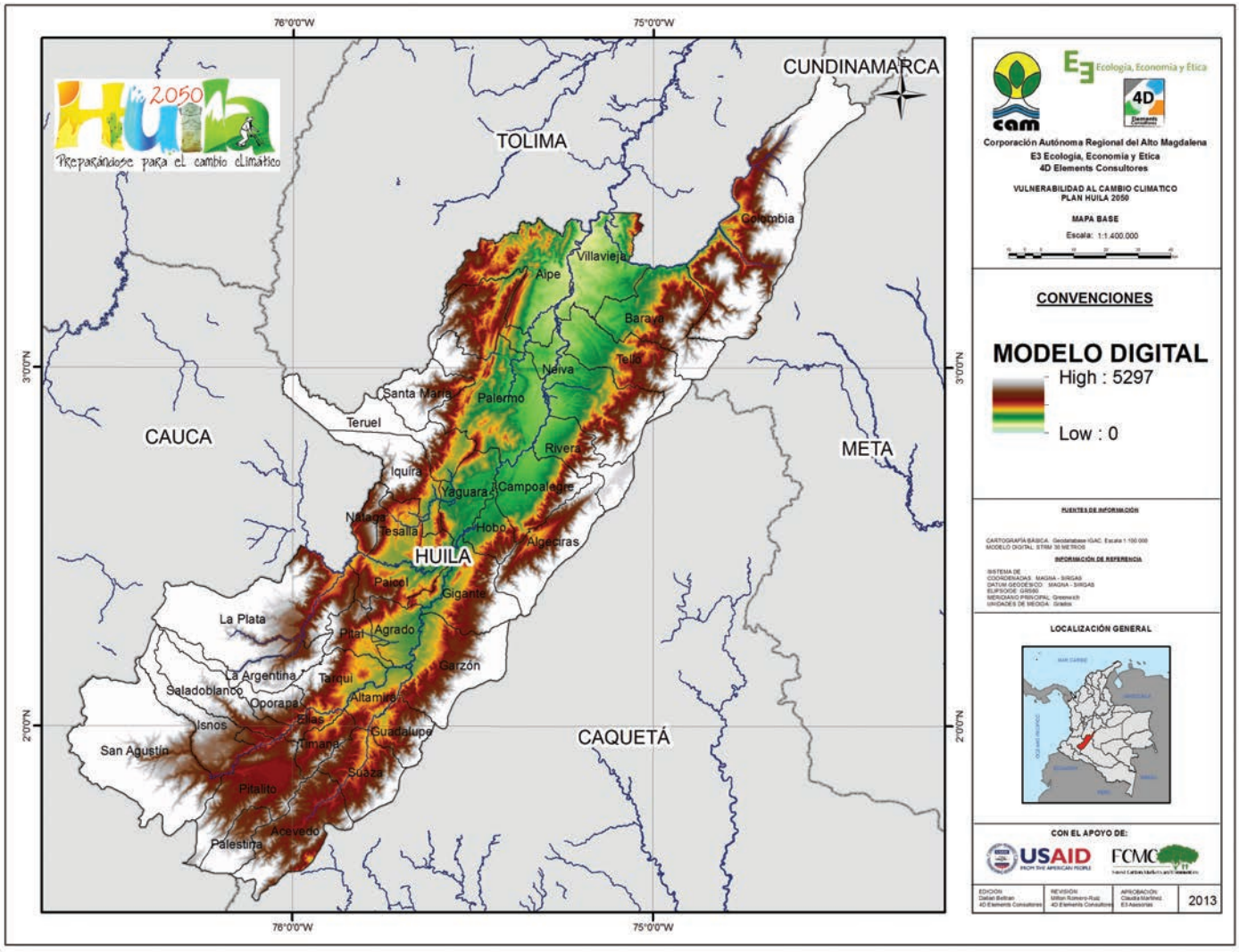
Given the department's location between the Central and Eastern Andes ranges, the department connects the Andes Mountains, the Amazonian and the Pacific zones. 54% of the country's life supporting zones are located in the department, which has a range of ecosystems from extremely dry wooded areas known as Tatacoa, to Andean and High Andean woodlands, to the snow-capped mountain peaks known as the Nevado del Huila. Thanks to this biodiversity, the region provides a wide range of ecosystem goods and services that support regional development and productive ventures (agriculture, tourism, energy and mining), as well as high quality of life for its inhabitants [9].

According to DANE (National Administrative Statistics Department), the department has a population of over 1,140,000 people. Over one third live in Neiva, the capital city. Other cities and towns are located along the corridor between Neiva and Pitalito, with

1 Comstock, 2012.
2 Cepal, 2012.
3 National Plan for Adaptation, 2013.
4 MADS, 2013.
5 Ibid.
6 Ortega-P., S.C., A. García-Guerrero, C-A. Ruíz, J. Sabogal. & J.D. Vargas (eds.), 2010.

the exception of Garzón, Gigante and Pitalito. The rural population makes up 30%, including indigenous people (1.02%), afro-Colombians (1.34%) and small farmers who are located primarily in the southern part of the department (See Figure 2) [10]. There are large areas of livestock and rice plantations, as well as numerous small landholdings that support the peasant economy, which remains fragmented due to pressures from displaced populations from other regions of the country. Displacement takes place primarily due to lack of natural resources, land and water and the social consequences of armed conflict. Economic development in the region has traditionally been associated with extraction of hydrocarbons and some commercial agriculture. However, in the last decade other sectors have increased their contribution to the department's GDP. Today, sectors including construction, commerce, agriculture and fish farming are growing in importance (See Figure 3).

Figure 2. Map of Huila – Digital Elevation Model.



Source: 4D Elements Consultores, 2013.

7 The river basin occupies 24% of the national landmass, passes through 18 departments where 80% of the country's population resides and producing 86% of the GDP.

8 IDEAM-Cormagdalena, 2012.

9 Corporación Autónoma Regional del Alto Magdalena (CAM), 2011.

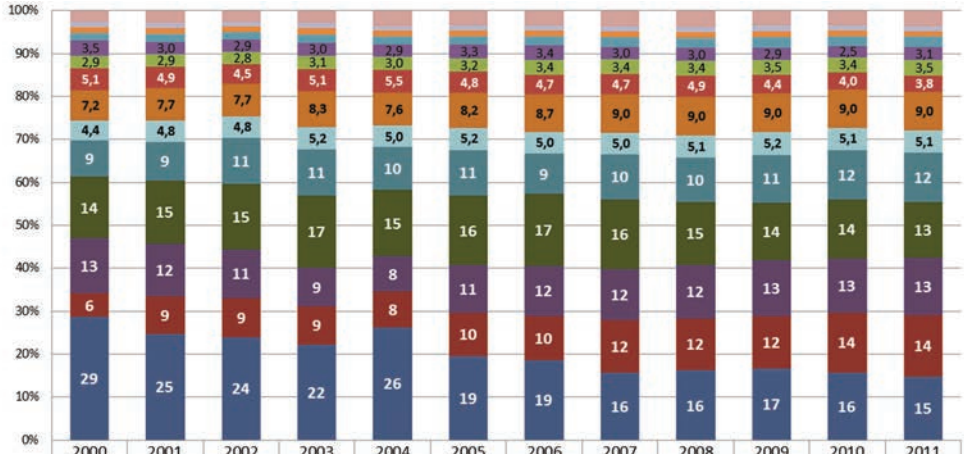
10 Gobernación del Huila, 2012.

Table 1. Information about the department of Huila.

Capital City	Neiva
Number of municipalities	37
Land area (km2)	19.890
Participation as percentage of National territory	1,7
2014 Population (projected by 2005 DANE census)	1.140.539
Urban population	674.454 (59,13%)
Rural population	451.862 (39.61%)
Indigenous population	10.355 habitantes (1,02%)
Afro-Colombian population	11544 habitantes (1,14%)
Projected population to 2020 (DANE 2005 census)	1.225.343 habitantes
Average annual rate of exponential growth of the department for 2015-2020	1,84%
Annual GDP in 2011 billions of pesos (DANE)	11.851.000
Percentage of contribution to national GDP	1,9
Per capita GDP (millions of pesos)	10.139
Index of Basic Unmet Needs 2005 (DANE)	32,6%

Source: DNP – National Planning Department

Figure 3. Department of Huila. Composition of GDP by areas of economic activity (2000-2011).



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Derechos e impuestos	2,7	3,0	2,6	2,9	3,6	3,4	3,4	3,6	3,8	3,5	3,5	3,7
Agua, gas y saneamiento básico	1,1	1,1	1,0	1,1	1,0	1,1	1,2	1,2	1,1	1,3	1,2	1,1
Mantenimiento, reparación y servicio doméstico	1,4	1,4	1,4	1,4	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,2
Intermediación financiera	1,7	1,8	1,8	2,0	1,9	1,9	2,1	2,3	2,4	2,5	2,3	2,5
Generación, captación y distribución de energía eléctrica	3,5	3,0	2,9	3,0	2,9	3,3	3,4	3,0	3,0	2,9	2,5	3,1
Hoteles, restaurantes, bares y similares	2,9	2,9	2,8	3,1	3,0	3,2	3,4	3,4	3,4	3,5	3,4	3,5
Industria manufacturera	5,1	4,9	4,5	5,1	5,5	4,8	4,7	4,7	4,9	4,4	4,0	3,8
Servicios a industrias, telecomunicaciones e inmobiliarios	7,2	7,7	7,7	8,3	7,6	8,2	8,7	9,0	9,0	9,0	9,0	9,0
Educación (pública y privada)	4,4	4,8	4,8	5,2	5,0	5,2	5,0	5,0	5,1	5,2	5,1	5,1
Admon pública, cultura, deporte y seg social (pública y privada)	8,5	9,1	10,8	10,7	9,9	10,7	9,4	10,5	10,4	11,1	11,5	11,6
Agrícola, pecuaria, silvicultura y pesca	14,4	14,6	15,4	16,9	15,5	16,2	16,7	16,3	14,7	13,5	13,7	12,9
Comercio y transporte	12,8	12,2	11,2	9,0	8,2	11,1	11,8	11,8	12,4	12,9	12,6	13,3
Construcción	5,6	8,9	9,1	8,8	8,3	10,2	10,3	12,2	12,2	12,2	14,0	14,5
Minería e hidrocarburos	28,6	24,7	24,0	22,2	26,2	19,5	18,5	15,7	16,2	16,6	15,7	14,7

Fuente: DANE, 2005.

Underground mineral resources offer an important source of income to the region (166,842 T/year)[11]; among these minerals are phosphorous (47% of national production), ornamental stone (marble, granite and sandstone), calcareous materials (limestone and dolomite), clay materials for dredging and construction, non-metallic minerals (bauxite, feldspar) and ferrous and non-ferrous metal ores (gold, silver). Sources of petroleum that have consistently produced 41,900 barrels (data from 2011) of crude oil per day constitute another important underground resource for Huila[12].

The department has a number of competitive advantages that make it strategically important to Colombia's development. There is significant food production, including coffee, fruit, and farmed fish[13]; furthermore, the hydroelectric potential can produce 43% of energy needs for the country. Finally, the tourism sector offers a significant and notable source of growth in services and infrastructure that includes 6 national parks, 82 properties with cultural conservation, seven more considered to be national heritage, and the Archeological Site of San Agustín, declared as a World Heritage Site in 1995. This natural and cultural patrimony attracted 63,661 tourists to the department in 2011[14].

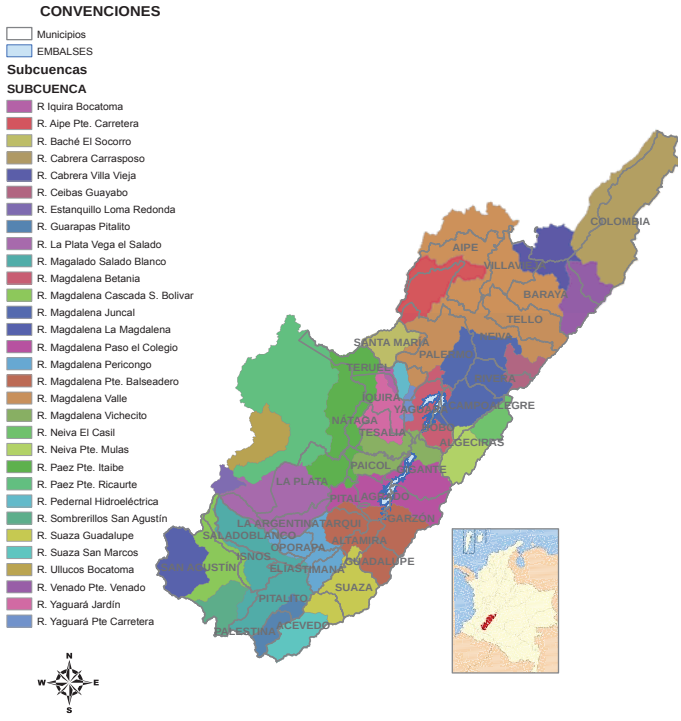
HUILA: PRODUCER OF WATER FOR COLOMBIA

Climate change manifests itself to a large extent in terms of the abundance or scarcity of water with respect to historical levels of precipitation, as well as through variations in temperatures and frequencies and intesities of meteorological extremes (storms, droughts, floods, etc.). Temperature fluctuations and precipitation will be altered in the near future, decreasing or increasing the hydrological capacities of regions. With a general increase in temperatures, the consequences of these changes will affect production and viability of crops, with serious outcomes for food security, public health and sustainability of human settlements and cities.

Huila, which is a part of the Colombian Massif, has large reserves of water, including extensive barren highlands known as páramos, for example the 'Potato páramo' where the Magdalena river begins, or the Nevado del Huila, the snow-covered peak that reaches 5,750 meters above sea level and has a shrinking glacier. The Magdalena basin, which covers a total of 22,171 km^2, spans the department. The sub basins of the Paez and the Cabrere rivers extend into the department of Tolima. The department of Huila has 12 sub basins (see Figure 4) that provide on average a maximum of 555 m^3/s and a minimum of 215 m^3/s during dry seasons and is the source that supports the Magdalena basin.

12 Asociación Colombiana de Petróleo, 2013.
13 Gobernación del Huila, 2007.
14 Gobernación del Huila, 2012.
15 Calculations based on Administrative Department of National Statistics (DANE) statistics. Departmental Accounts. Added value, by economic activity, in constant 2005 prices (2000-2011pr).

Figure 4. Hydrology of the Upper Magdalena[16]



Source: CAM-SEI.

The continual provision of water by the department of Huila for the rest of the country (a fundamental environmental service) depends on responsible water management, forest coverage and land use in the upper basin. These factors depend on human settlements, urban and agricultural uses, extraction and industry and infrastructure, and the generation of energy in the basin.

The department's priority in terms of water use is based first on satisfying the demand for consumption, concentrated in cities and urban centers, and second on irrigation for agriculture. More than 60,000 hectares of rice[17], and other crops, are dependent on water. A third priority is energy generation from dams along the Magdalena River. An example of this is the Betania reservoir, with the capacity to generate 540 megawatts ; additionally, fish farming occupies an area of 386 hectares of the reservoir and produces 720 tons of red tilapia and 60 tons of catfish per year[18].

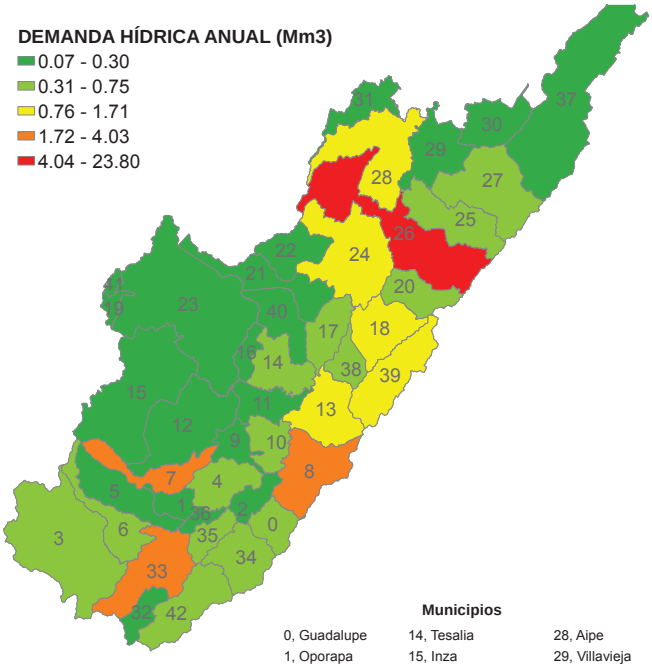
Total precipitation in the department varies by region: in the Magdalena Valley rainfall is between 900 and 1,000 mm/year; in the middle or upper valley and foothills, it is between 1,100 and 1,500 mm/year, and in the areas between 2,000 and 3,000 meters above sea level the average rainfall is around 1,500 mm/year. In the páramo (>3,000 m) the average rainfall is registered just above 1,500 mm/year[19]. This level of precipitation puts Huila in a medium rainfall range compared to other regions of Colombia.

In terms of water availability , the sub basins of the Upper Magdalena and of the Suaza, Paez and La Plata rivers provide sufficient water, even during droughts. This is not the case with the Aipe and Cabrera rivers where, occasional scarcity of water leads to conflicts. In other sub basins, supply is even with demand, but in some cases there is deficiency, again, leading to conflict[20], all of which will become more acute if climate change reduces water availability.

According to the National Study of Water (2010), demand for water in Huila is variable, with higher values in more densely populated areas and where agriculture is concentrated. (See Figure 5) Water supplies during drought conditions are critical in some municipalities such as Tello and Gigante with respect to average conditions reflecting geographical variations of climate effects. (See Figure 6)[21]

16 SEI, 2014.
17 Gobernación del Huila, 2012.
18 Pinzón and Assmus, 2003.
19 CAM, 2011.
20 Ibid.
21 IDEAM, 2010.

Figure 5. Water demand in the Upper Magdalena Basin (in millions of meters3/year)[22]

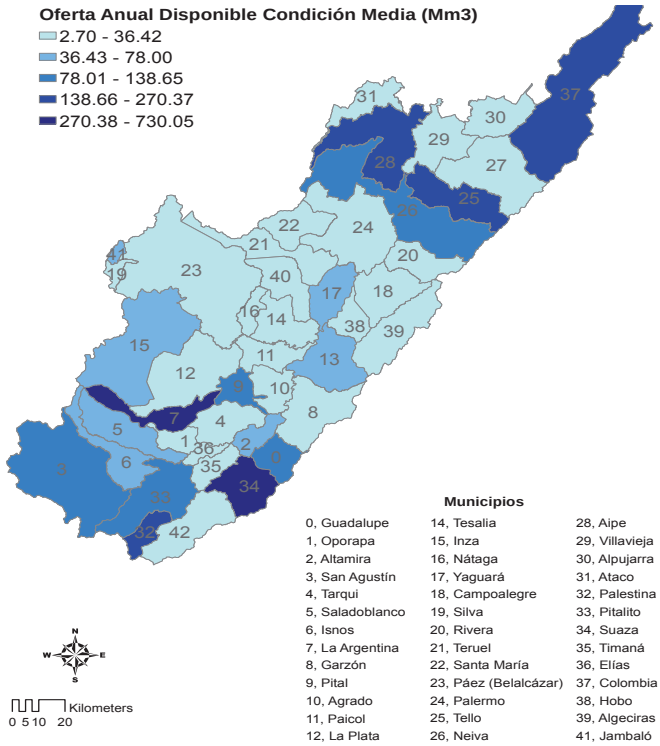


Municipios

0, Guadalupe	14, Tesalia	28, Aipe
1, Oporapa	15, Inza	29, Villavieja
2, Altamira	16, Nátaga	30, Alpujarra
3, San Agustín	17, Yaguará	31, Ataco
4, Tarqui	18, Campoalegre	32, Palestina
5, Saladoblanco	19, Silva	33, Pitalito
6, Isnos	20, Rivera	34, Suaza
7, La Argentina	21, Teruel	35, Timaná
8, Garzón	22, Santa María	36, Elías
9, Pital	23, Páez (Belalcázar)	37, Colombia
10, Agrado	24, Palermo	38, Hobo
11, Paicol	25, Tello	39, Algeciras
12, La Plata	26, Neiva	41, Jambaló
13, Gigante	27, Barayá	42, Acevedo

Source: CAM-SEI

Figure 6. Water supplies for the Upper Magdalena River Basin, in medium climate conditions (up) and dry periods (down) (in millions of meters3/year)[23]



Municipios

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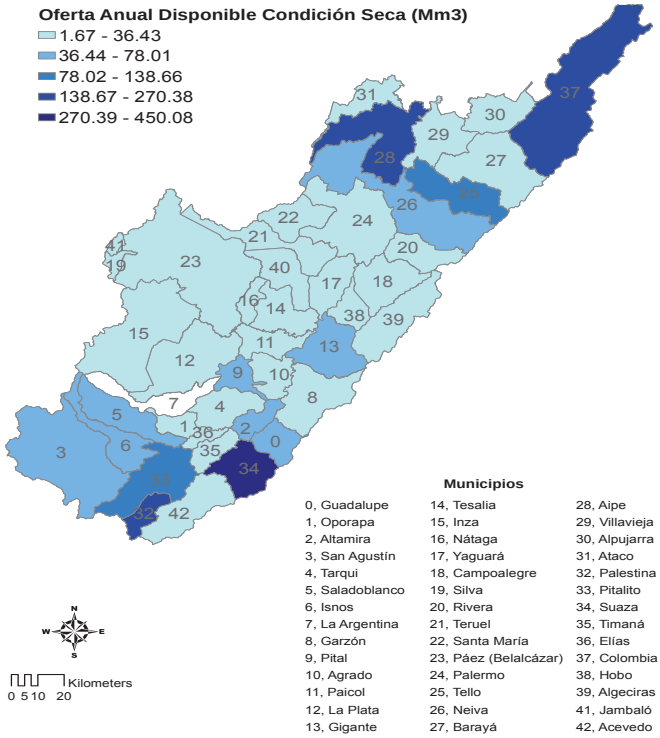

Municipios

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12, La Plata	26, Neiva	41, Jambaló
13, Gigante	27, Barayá	42, Acevedo

Source: CAM-SEI, based on the National Water Study 2010

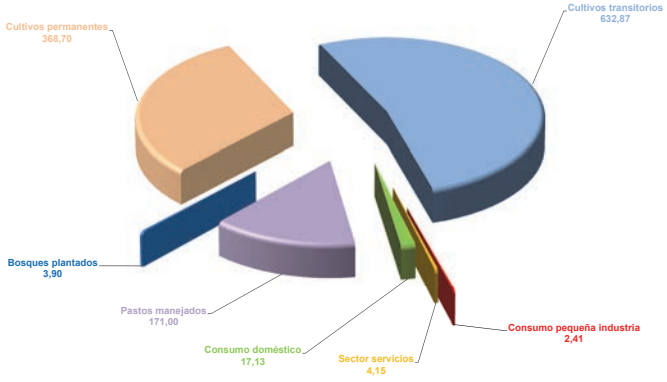
22 Ibid.
23 Ibid.

The Northeastern sector of the Magdalena River basin holds a potential of 9.1 m3 of underground water, used to exploit hydrocarbons for industrial, construction and domestic use. There are 102 deep wells from which 46,000 m3/day are extracted, of which 60% is used for industrial purposes, 26% for domestic use, and 14% for agriculture and recreation. Furthermore, the northern zone of the department has registered 300 tanks used primarily for domestic and agricultural consumption. 31% of deep wells and 35% of tanks are located within the city of Neiva, from which 32,324 m3/day is consumed by public, domestic, industrial and agricultural uses.

In dry seasons, municipalities like Neiva, Garzón and Dolores move from Medium to High water use; municipalities such as Campo Alegre and Palermo shift from Low Use to Medium Use. (See Figure 7).

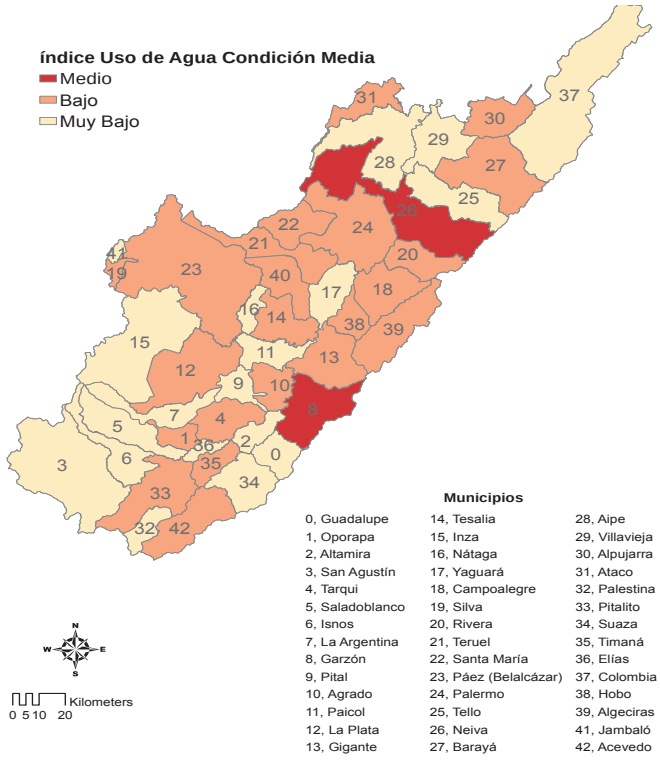
Furthermore, the national Study of Water Use indicates a greater demand, by percentage, for transitory crops, followed by permanent crops and managed pasturelands. (See Figure 8).

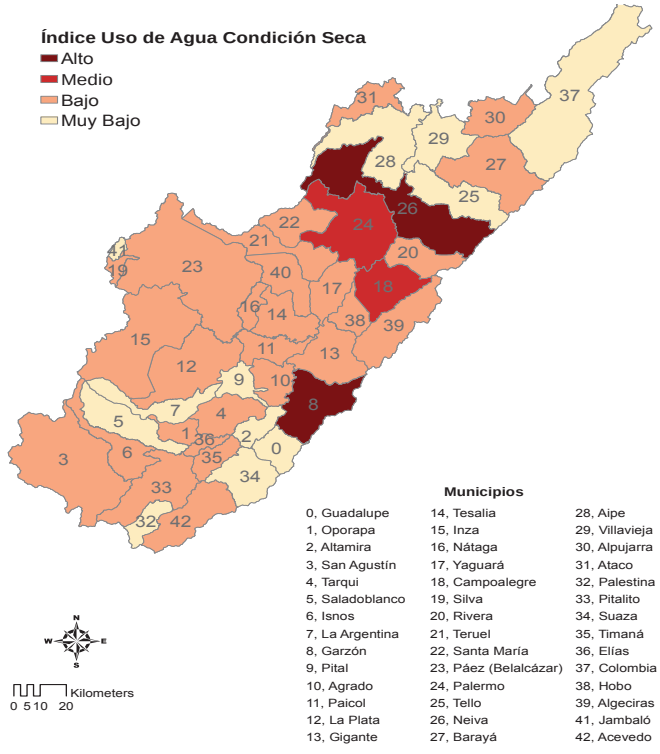
Figure 8. Annual water demand by type of use in the Department of Huila.



Source: CAM-SEI, based on the National Water Study 2010.

Figure 7. Indicator of water use according to average climate conditions (up) and dry climate conditions (down)[25]





Source: CAM-SEI, based on the National Water Study 2010

25 Ibid.

26 Authors' elaboration based on the National Study of Water Usage.

The current water use in the region reflects the challenges posed in its management, namely that urban, agricultural, energy and ecosystem uses compete with each other, generating conditions that require better instruments in planning in order to guarantee the ongoing provision of water in Huila and in Colombia.

Planning instruments promoted by CAM provide concrete guidelines in terms of water resources and include management of protected areas, management of páramos and wetlands, zoning and management of six basins (POMCA for its name in spanish) ,and zoning plans for water resources for the department of Huila. The actions are derived from different stages of implementation and are located in different regions of the department; to date, management plans have been drawn up for six river basins: Las Ceibas, Guarapas, Garzon, Yaguará, Timaná Yaguilga and Páez. The decree from the Ministry of the Environment and Sustainable Development requires that plans be made for the primary basins of the department, including the basin of the Las Ceibas river basin, which provides drinking water to the city of Neiva and constitutes an effective example and model of paying a cost for environmental services, and a model for water services that is specific to the Sauza river, given that both rivers are important to Huila. The expectation is to continue advancing the different Water Basin Management plans (POMCA) that include considerations of climate change for basins that are considered to be priority in the department. Furthermore, there are other strategies, including the Forest Zoning Plan for Huila, (PGOF)[27], the Regional Environmental Management Plan (PGAR) [28], and the Action Plan of the CAM for 2012-2015.[29]

In spite of these planning instruments, there has been a decrease in the water basin, alteration of ecosystems and water pollution, which together have created a pressure on water resources, particularly in the North and Central zones of the department during summer months (dry periods with little precipitation). Combined with a lack of data about the quantity and quality of water, the situation has reduced the capacity for officials to make decisions based on technical information.

Given this situation, the intention is to generate the most reliable information about water resources to make effective decisions about integral resource management. The information produced by CAM and POMCA is fundamental to develop planning instruments. Management plans for basins (climatic POMCA) under the scenario of climate change may be developed in order to prioritize mitigation and adaptation measure that can be put in place in the medium and long term, in particular to ensure the continuous supply of water for different current and future uses of the department, preventing potential conflicts and assuring climate compatible development.

27 The General Plan for Forest Zoning (PGOF) defines types of land use with priority for conservation of water resources, biodiversity and management of agriculture and fishery systems. In terms of water resources, it focuses on defining areas of conservation for basins that are suppliers to municipal aqueducts. This information defines the current situation for areas of conservation and the steps to achieve conservation that guarantee a supply until 2025.

28 The PGAR was designed taking into account the strategy to protect water resources in the department. This document includes sectoral documents such as pollution to benefit coffee and the implementation of wastewater treatment plants. Furthermore, it details strategic areas and projects with indicators and goals to guarantee quantity, quality and access to water resources up until 2020.

29 The Action Plan 2012-2015 defines operations through six programs, each with a specific project to ensure preservation, conservation, recuperation and exploitation of sustainable natural resources. The biodiversity and ecosystem services programs and, in particular, the integral management of water resources, take into account the issue of water in the Huila 2050 Action Plan, with projects in conservation and water use planning through POMCA and the Territorial Plans for Water Use (PORH).

30 Arco, 2008.

ECOSYSTEMS AND BIODIVERSITY: GREAT POTENTIAL UNDER THREAT

The Department of Huila generates important ecosystem services; thus, the 592,062 ha of forests, and the 117,038 ha covered with páramos and wetlands, allow water regulation and provide the conditions for the department to be a major producer of water, while at the same time generating other environmental services and opportunities for sustainable development based on its biodiversity and landscape.[30]

Forests cover nearly one third of the territory of the department (see Figure 9) and are considered a strategic asset for the region. They are estimated to store about 293 million tons of carbon dioxide (CO2), partially contributing to the global regulation of CO2 concentrations. Additionally, these forests are home to a significant amount of wildlife species (many endemic), and are temporary home to migratory species from the Amazon, the Pacific coast and the Andean region. This environment also concentrates nearly 8,000 beehives that produce 291,472 kg of honey, contributing as well to the pollination of 6,500 hectares of fruit.

Huila has been a pioneer in implementing innovative models for the conservation of biodiversity, ever since it declared the first natural national park in 1960. The department currently has six regional natural parks, 27 municipal parks, and 261 private reserves. Together they account for approximately 21% of the territory, and manage to preserve 54% of the 31 ecosystems identified. (See Figure 10) [31] Additionally, the department is part of the biosphere reserve of the Andean Belt — one of five existing in Colombia. Together with other departments, it makes up part of the Amazon forest reserve (one of the largest in the country) and the central forest reserve. [32]

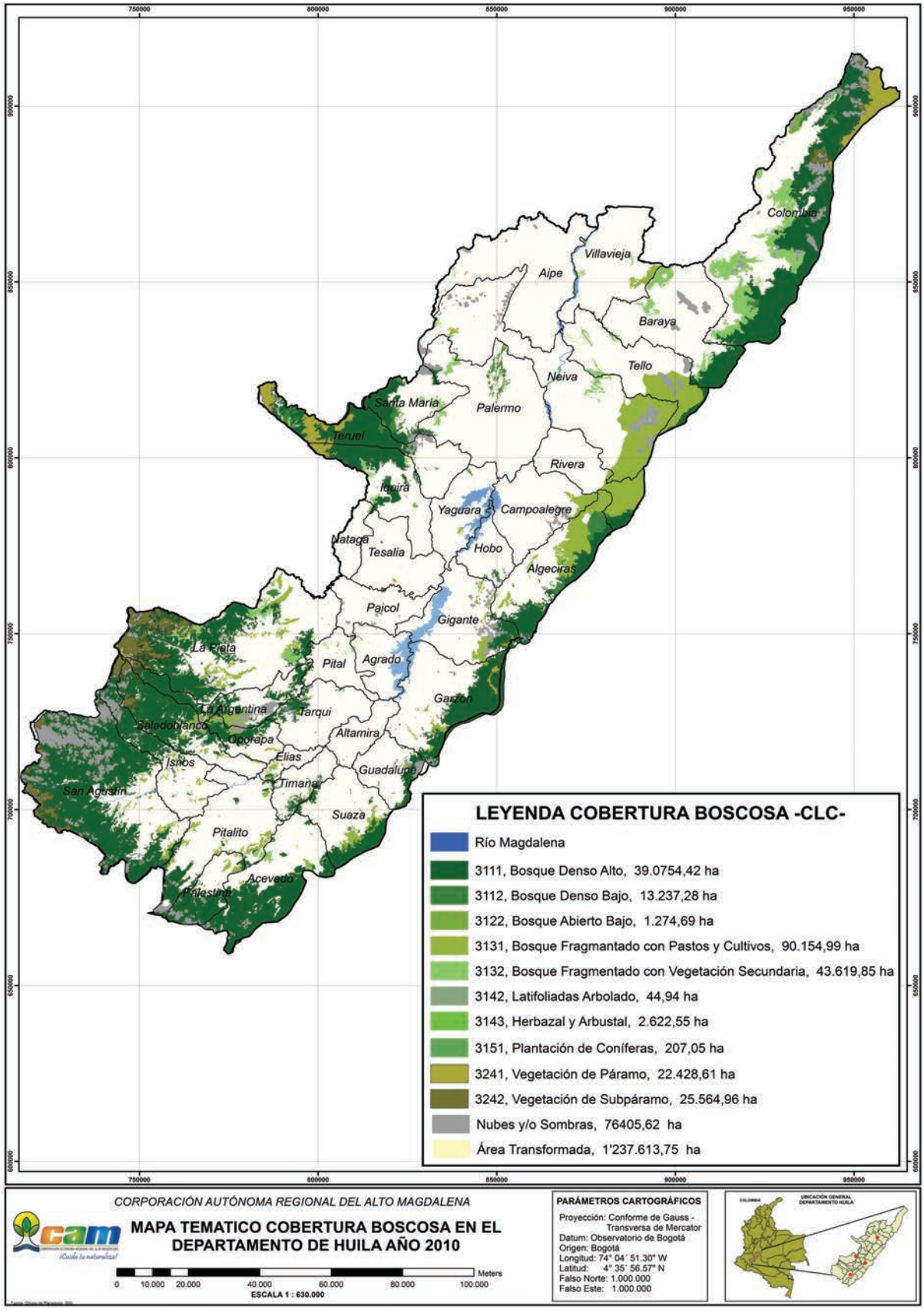
Fifty-nine percent of these reserves coincide with areas covered by páramos, continuous forests and forests ranging from slightly to very fragmented, while 41% correspond to productive sectors, which are transformed by agricultural and livestock activities [33].

Currently there are 120,000 hectares of páramo in the Department[34] and 73 wetlands, which are home to 154 species of birds, claiming the largest number of endemic species including almost 20% of those found in Colombia. One of the biggest páramo regions is the Colombian Massif with 13 biomes and 65 bodies of water. The largest forest areas (cloud forest and high Andean forest) are concentrated there; also, the main water supply for the department and the country has its origin in this area (besides the Amazonia and Chocó) because in these mountains and on their slopes the rivers Magdalena, Cauca, Caquetá and Patía are born. In this area there are also important protected areas such as the Natural National Parks of Puracé, Cueva de Los Guácharos, and Nevado del Huila, as well as protected areas at the regional and local levels[35].

Another important ecosystem in the department due to its landscape and biodiversity is the very dry tropical forest from the eco-region known as La Tatacoa, the second largest arid zone of Colombia, which occupies 33,000 hectares. Paradoxically, this region coincides with the largest groundwater reservoir of the Huila[36].

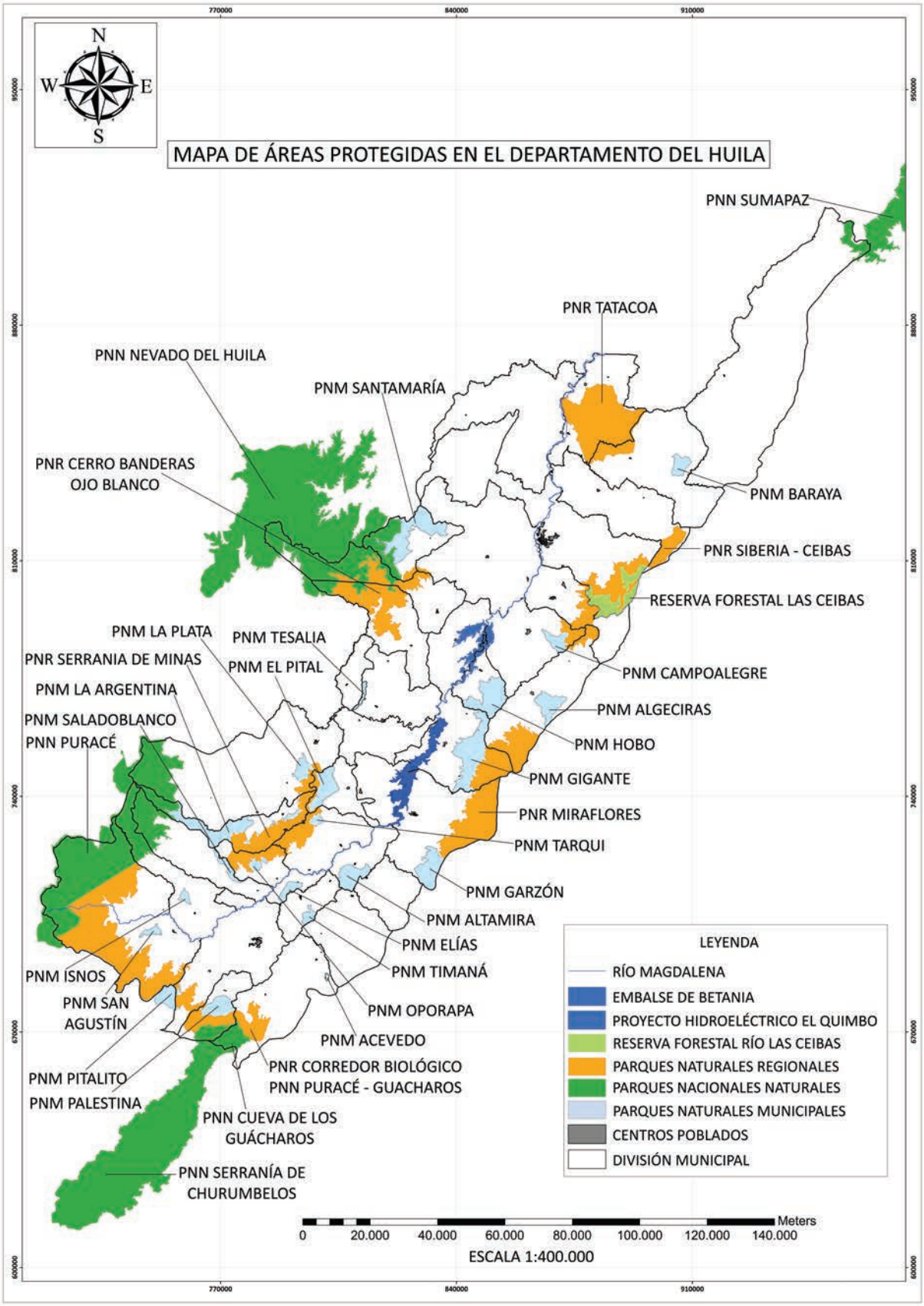
31 CAM. 2013.
32 CAM, 2011.
33 CAM, 2008.
34 Porras and Téllez (2007). Study of Paramos in Huila. 35
35 CAM, 2011.
36 Ibid.

Figure 9. Map of forest cover- Huila.



Source: Arco, 2008

Figure 10. Protected areas of Huila.



Source: Arco, 2008

Pressures on the Forests

The current pressures on biodiversity and the ecosystems of the department are due to the processes of deforestation caused by the expansion of agricultural boundaries, including illicit crops, illegal extraction of biodiversity resources (wood), and high-impact activities (extensive livestock grazing).

Depending on the source of information, deforestation in Huila varies between 5,000 ha/year (IDEAM, 2011) and 10,000 ha/year (PGOF 2008). Farming areas grow at a rate of 6,832 ha/year, of which agriculture contributes 3,066 ha/year, and pasture areas (for extensive livestock) with 3,765 ha; major crops in agricultural areas include coffee, beans, and cold weather fruits (tree tomato, pineapple, blackberry, passion fruit, and pitahaya).[37]

The main direct cause of deforestation is the expansion of the agricultural boundary, which in turn is due to phenomena such as the growth of the rural population, illicit crops, forced displacement, new investments in the agricultural sector, lack of effectiveness of institutions to control cutting and burning of forests, governance failures (at local level), lack of training and education, misguided sector policies, and limitations of sources of income for rural communities.

Wood consumption in the region is considered as one of the main causes of forest degradation, given that the cutting of trees is done illegally in primary and secondary natural forests. The total consumption of wood in the department — mainly for energy (such as household consumption, processing of sugarcane, curing tobacco and brick ovens) and trestles for crops (grenadine, beans and passion fruit) — is estimated at 948,860 m^3/year.[38]

These occupations have generated significant habitat loss and fragmentation, as well as depletion of natural forests, which currently cover only 30% of the department's territory, of which 38% were classified in 2008 as fragmented forest areas.[39] Given the changes in structure, composition and function of ecosystems, desert vegetation in Huila is growing at a rate of 667 ha/year[40] and is part of a process of anthropomorphic desertification that will undoubtedly increase and accelerate with projected climate change.

Additionally, increases in temperature due to climate change may cause an altitudinal shift of the ecosystems, as well as strong pressure on those at higher altitudes (high Andean forest and páramo). Climate change could push coffee crops and extensive livestock activities to higher altitudes, consequently affecting the fragile environments represented by high Andean cloud forests, wetlands and páramo, recognized as some of the largest reservoirs of biodiversity in the planet. Changes in precipitation patterns, combined with increases in temperature (as a consequence of climate change), will push the agricultural boundaries upwards and drive the development of new development areas and the occupation of marginal areas; in turn, these processes will accelerate deforestation and degradation of forest cover, generating an impact on unique ecosystems such as páramo, and other fragile ones such as forests and high Andean wetlands; this will hopelessly fragment the ecosystems and cause significant loss of biodiversity.

38 CAM, 2012.
39 Arco, 2008.
40 IDEAM , 2013.

In general, ecosystems and biodiversity have not yet been fully perceived as an opportunity for the general population. This has prevented the promotion of co responsibility that would lead to conservation measures by all actors involved in the use and conservation of biodiversity, not just exclusively by the environmental sector. Given their strategic importance both for the region and the country, biodiversity and ecosystem services generate opportunities which, through appropriate management, may become engines for sustainable growth with benefits for conservation and development of strategies and models for mitigation and adaptation to climate change.

It is worth emphasizing that mechanisms to prevent and reduce deforestation are needed, which may, at the same time, create viable options for the inhabitants of the region who need to use the forest responsibly. Therefore, it is a priority to develop conservation projects and sustainable uses that combine policy making and control while providing incentives for people from the department to preserve forests.

Similarly, it is necessary to strengthen protection strategies of the Departmental System of Protected Areas, from national to local and regional parks, including private reserves. In fact, protected areas are very effective measures to preserve biodiversity and represent one of the most cost-effective measures to mitigate and adapt to climate change, because they secure the storage of CO_2 (in biomass and soil) and ensure continuous production of environmental goods and services from the ecosystems. It is worth highlighting the urgent need to protect the páramos, glaciers and wetlands as strategic ecosystems to ensure the provision and regulation of water in the department.

Huila must also analyze and understand the climate change vulnerability of its ecosystems , which requires undertaking studies that relate the most vulnerable ecosystems (cloud forests, páramos, lakes, and glaciers) with the current and future capacity to provide critical environmental services, including regulation of rivers and streams, water supply for towns and cities, and recreation in natural areas to generate significant social and economic benefits to the population.

FARMING AND FOOD SECURITY

Food security in the department, closely linked to the stability of ecosystems and the services they provide, is currently threatened by local and regional economic trends, the competitive use of natural resources, and by climate change. In this context, a vision of the Huila 2050 Action Plan for the agricultural sector will inevitably be linked to a more sustainable management of natural resources and agriculture in the context of a changing climate, manifested in the reduction of water availability and temperature increases.

In territorial terms, 53% of the department is devoted to agriculture, with more than a million hectares destined to agricultural activities.[41] According to figures from DANE (2011), the agricultural sector contributes 14.4% of Huila's GDP, of which 46% is from coffee. Coffee is, therefore, the most important segment of the agricultural economy in the department, with 129,152 ha of coffee plantations, the largest area planted in Colombia today. Notably, the coffee industry has been changing its traditional production methods based on shaded crops to other varieties, which, although they do not require coverage, offer greater phytosanitary resistance, are grown in areas of higher density, produce more, and generate a major environmental and biodiversity impact in the coffee area. However, the National Federation of Coffee Growers through its Departmental Committees has currently begun to promote the renewal of traditional crop varieties, returning to a lower production but with better quality to meet the demands of a growing market of gourmet coffee shops, and with better prospects for adapting to climate change in coffee producing areas.

After coffee, livestock is the second most important sector of the agricultural economy of the department, mostly extensive and with dual purpose, with 740,000 ha and 400,000 head of cattle. Both coffee and livestock were largely affected by heavy rains in 2010-2011. Both have proven to be sensitive to variations in climate, either to drought, which weakens them, or to excessive rainfall, creating conditions that are conducive to disease and pests. These two economic sectors occupy about 80% of total agricultural and farming area, so proper management is crucial for sustainable use. Achieving greater sustainability in coffee production and farming practices will:

(i) ensure the long-term productivity of soils, (ii) improve the quality and quantity of water available for domestic and industrial use, and (iii) sustain the continuous flow of ecosystem services for the benefit of Huila. Additionally, through the capture and storage of carbon in the forest covers of the crops, good management will reduce the effects of CO2 emissions for the benefit of the entire planet.

Both coffee and livestock show a substantial annual increase in the area. In the last five years livestock has added 18,228 ha, and coffee 8,590 ha, indicating that they are the main activities directly responsible for deforestation in the department, currently estimated between 5,000 and 10,000 ha/year[42]. In the future, this pressure could increase (see the section on the effects of climate change), unless agricultural practices change to increase production and make it more sustainable by reducing the pressure on forests. Experiences in Central America and Colombia show that forest pasture systems can enhance grassland productivity while reducing emissions by up to 50% as compared to conventional systems, and, at the same time, store a significant amount of carbon in trees. At present, there is a pilot program in the department sponsored by the Livestock Committee of Huila aimed at improving the sustainability of livestock. However, few farms participate in this program.

Table 2. Major agricultural products in the Department of Huila[43]

Item	Hectares or heads ('000)	Volume ('000 t)	Value ('000 million Colombian pesos)
Coffee	129.2	84.5	782
Livestock (head of cattle)	497.6	120.3	197.4
Fish	0.4	33.4	138.3
Fruit	14.9	110.2	163.2
Cocoa	9.8	3.6	17.4
Tobacco	2.0	4.4	23.9

Source: Huila 2050 based on ONF Andina 2014

Beans are another important crop; production in the department is the highest in the country. However, bean crops have had problems during drought and rainy periods, with fungi and pests reducing their productivity and profitability. For this reason, both reliable climate records and accessible early warning methods are needed for farmers to react in a timely manner to problems when they are identified.

Rice is also of great importance, given that the department ranks as the second largest producer in the nation. The main challenge is to reduce the high cost of production to make it more competitive vis-à-vis imported rice. The rice industry consumes a substantial amount of water resources; however, there are currently no reliable figures on quantities consumed, nor is there pressure or sufficient incentive to encourage more efficient use. In times of extreme drought, rice growers have had difficulty accessing enough water to irrigate and maintain economically viable yields.

Fruit crops are also becoming increasingly important, together with horticultural crops, which are considered promising products for the future of Huila's economy. It is worth noting that the production of lulo, passion fruit and grenadine occupy smaller areas of land but have larger ecological footprints, especially due to the use of wood for trestles, the application of agrochemicals and the expansion of production areas (agricultural boundary) in water-generating zones of high-Andean and Andean forests.

The producers mentioned (coffee, rice, beans, fruits) generally have no access to climate information, and respond to climate and climatic variables based on their own experiences and perceptions. The coffee industry is aware of this problem, and is developing

41 ONF, 2014
42 Ibid.
43 Ibid.

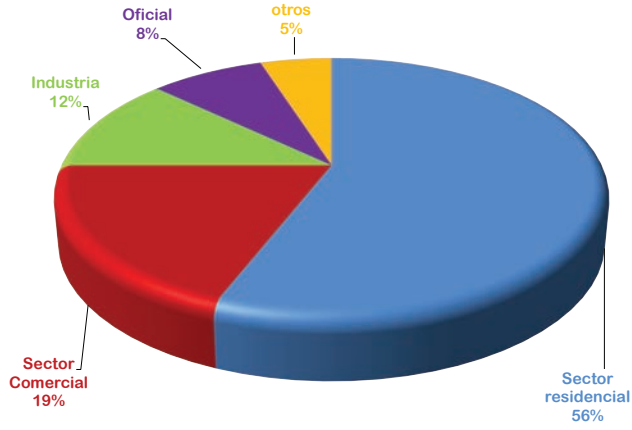
a pilot program to establish a network of weather stations to feed a system of climate information and early warnings addressed to coffee growers. This pilot project is part of this plan. Promoting a climate network and making it accessible to all farmers in Huila (beyond coffee growers) is a priority to ensure an agriculture sector that is resilient to climate change and adapted to the climate of the future.

THE ENERGY POTENTIAL OF HUILA

As previously mentioned, two of the main hydroelectric projects in the country are located in Huila: Betania, with a generating capacity of 540 megawatts, and the new hydroelectric project El Quimbo, which is expected to expand power generation to 940 megawatts. The major rivers that provide the water supply of the department, and the steep slopes of the two Andean ranges, ensure the continuity of power flow to the low lands, with the possibility of generating an estimated 20,000 megawatts of electricity.

Energy consumption is one of the sources of GHG emissions in the department, as can be seen in the chapter dedicated to this issue. The electricity sector currently consumes 599,574 kWh, of which the largest proportion is for domestic consumption[44] (See Figure 11).[44]

Figure 11. Electricity consumption by sector in Huila[45]



Source: Huila 2050 based on ONF Andina

The Energy Development Plan for Huila establishes that energy resource consumption must be optimized. However, there are few strategies at the departmental level that foster an efficient and rational use of resources. Besides some studies and campaigns promoted by the company Electrificadora del Huila, few efforts have been devoted to this subject. For this reason, it is important to develop initiatives aimed at building a culture of sustainable and efficient management of energy resources, which would not only reduce GHG emissions, but also generate savings and efficiencies in the energy sector and increase competitiveness.

A large number of households in the department depend on forest resources as a means to generate energy for cooking, contributing to deforestation. Paradoxically, Huila produces a significant amount of biomass waste from crops such as coffee, rice, and fruit. In this context, the department could be taking advantage of the possibility to develop second or third generation energy options as a pioneering and innovative action.

Additionally, the department has great potential for generation of non-conventional energy sources, especially solar energy[46] and residual biomass from coffee crops (the third largest one in the country[47]) and rice. Accordingly, the Secretary of Highway Infrastructure recognizes the importance of "promoting the development and application of alternative energy production technologies which work with renewable resources, in order to apply them to the solution of the global energy crisis and contribute to a cleaner environment.[48]"

The National Learning Service (SENA), in its regional branch in Huila, has pioneered the appropriation and application of alternative energy sources and has extensive experience in developing prototypes for projects with solar photovoltaic and photo-thermal energy, hydropower and biomass energy. In the future, the implementation of these prototypes is expected to increase, and by 2025 some buildings (e.g., schools and public buildings), as well as a number of structures and agricultural machinery, will function with non-conventional energy sources.

44 ONF ANDINA, 2013a.
45 Based on the study on emissions by the ONF, 2013a.
46 See also: Colombia Atlas of Solar Radiation.
47 Atlas of energy potential from residual biomass in Colombia
48 Secretaría de Vías e Infraestructura del Huila, 2014.

3. HUILA AND CLIMATE CHANGE

Preparing for Climate Change

THE CLIMATE OF TODAY AND OF THE FUTURE

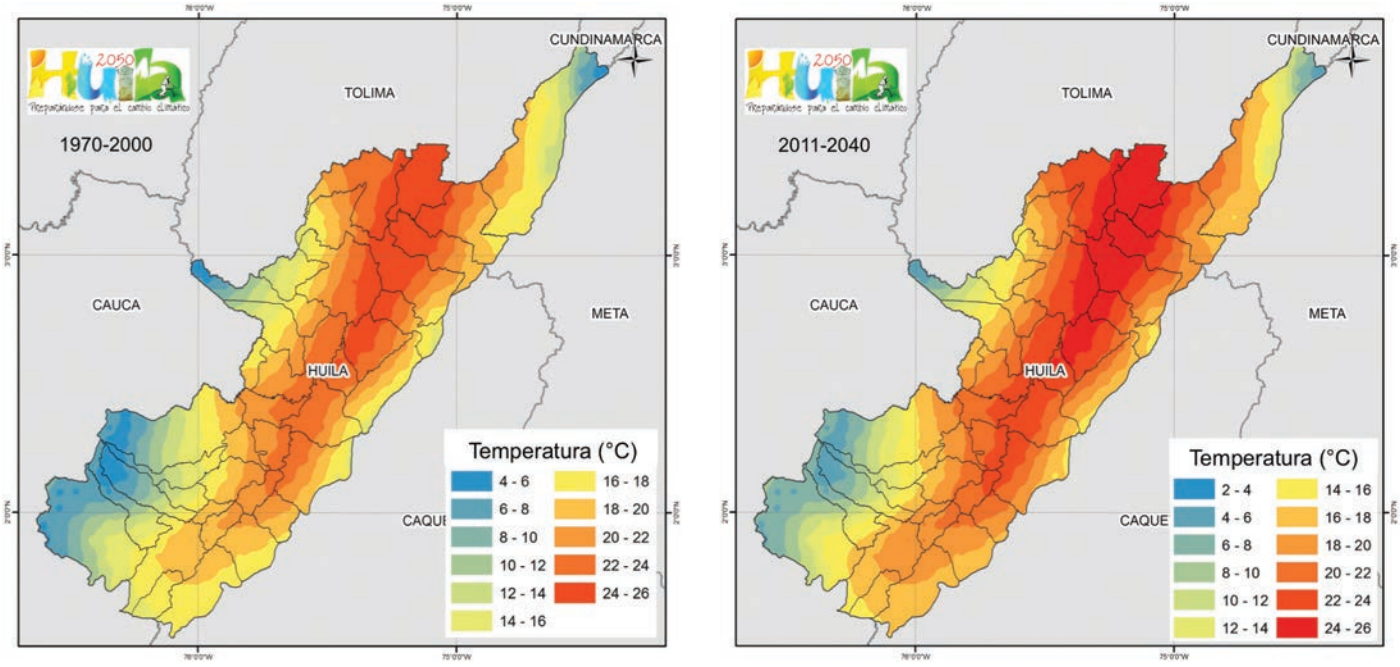
The department of Huila has a widely varied climate due to its diverse thermal latitudes, which in turn lead to interactions of temperatures, sunlight, rainfall, relative humidity and winds. Specifically, 28.3% of the land experiences warm temperatures, 40% experiences moderate climate, 23.2% is cold climate and 8.6% is very cold[49]. Huila, like the rest of the country, has experienced extreme climate events, including the phenomena of El Niño and La Niña that cause increasing concern for the future development of the department and its competitiveness. Temperatures in the warmer latitudes have surpassed historical records. It is worth pointing out that there are very few weather stations available to measure relative humidity, precipitation, temperatures, winds speeds and levels of solar radiation.

Climate variations and projections are by nature uncertain. The most recent Intergovernmental Panel on Climate Change report (IPCC, 2014) states that a target increase not exceeding 2°C of preindustrial levels is possible but very difficult to achieve. IPCC experts point out that only if there are immediate and significant institutional and technological changes, there is 50% likelihood that global warming will not exceed that threshold. Authors of the IPCC decline to give a precise figure beyond what has been provided, but, they warn, "Science has given us a clear message: in order to avoid dangerous interference with climate systems, we must not continue with the status quo."[50]

Projections for Colombia were made by IDEAM (2010) based on the model Providing Regional Climate for Impact Studies (PRECIS), and using global emissions scenarios from the Special Report of Emissions Scenarios (SRES) of the IPCC (SRES A2 and SRES B2) for three periods: 2011-2040, 2041-2070, and 2071-2100.[51] The results of these projections conclude that by 2040 Huila will experience temperature increments of 2°C on average (Figure 12) and a decrease of precipitation of up to 30% (Figure 13). Although it is difficult to perceive the scale, the projections of temperatures for 2040 include a new range of 26-28ºC on average.

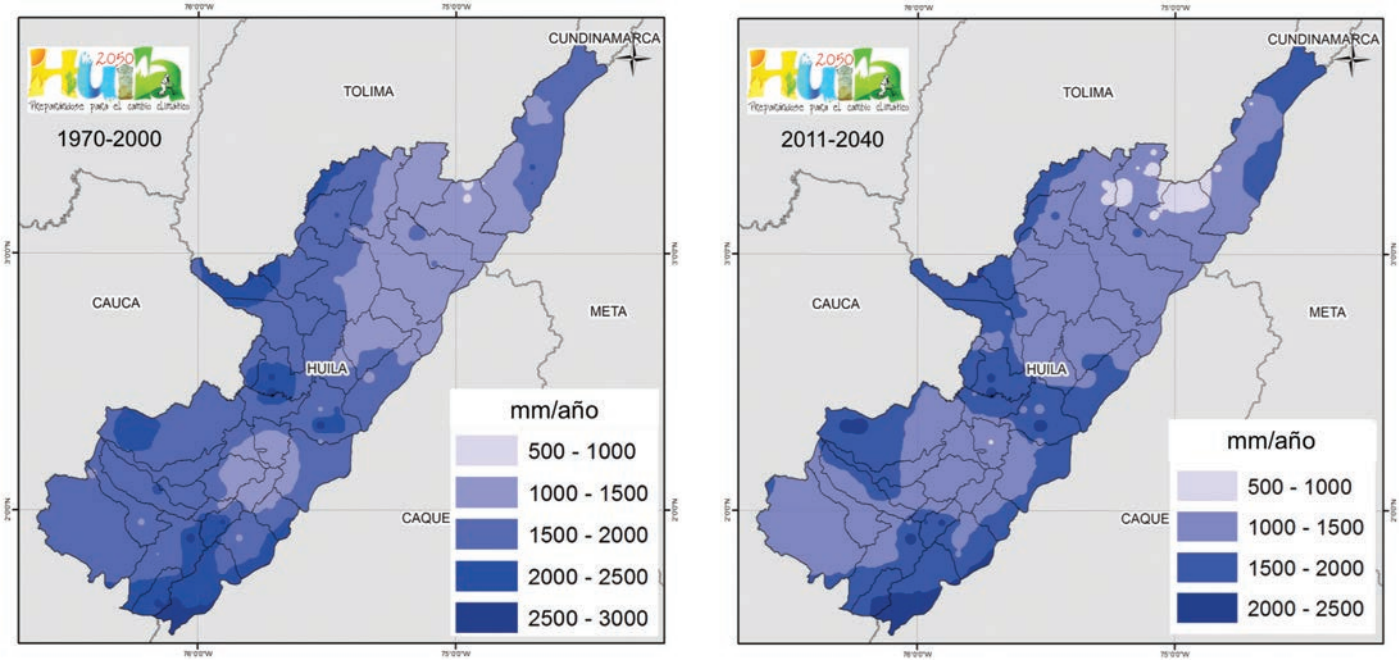
49 CAM, 2011.
50 Endenhofer, 2014.
51 IDEAM is shifting to the new models used in the Fifth Evaluation Report of the IPCC, which demonstrates the results the same magnitude but using a different methodology.

Figure 12. Department of Huila Temperatures 1970-2000 and Projected Temperatures 2011-2040[52]



Source: Huila 2050 Vulnerability Assessment, 2014

Figure 13. Department of Huila Precipitation 1970-2000 and Projected Precipitation 2011-2040[53]



Source: Huila 2050 Vulnerability Assessment, 2014.

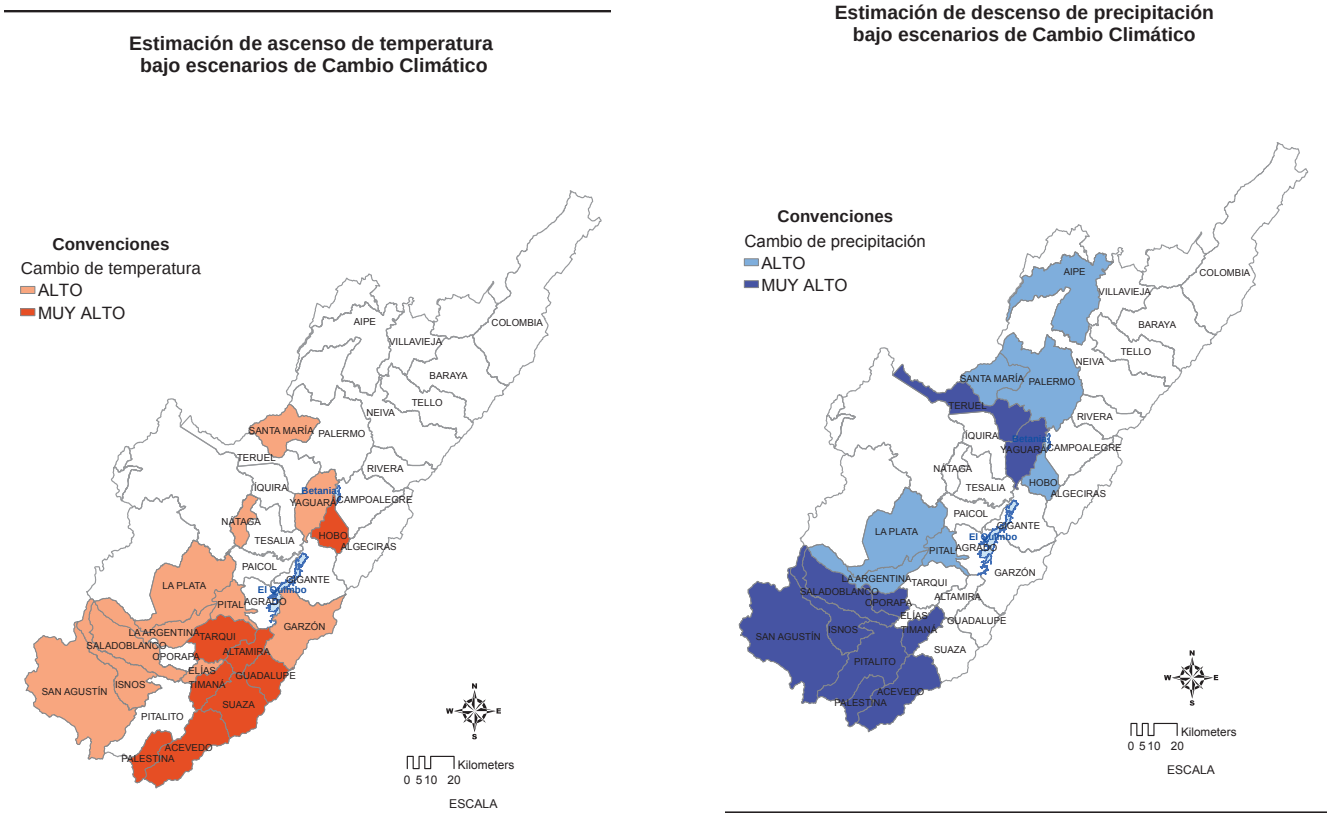
52 Images created by 4D Elements Consultores for the Vulnerability Assessment of Huila.

53 Ibid.

Other variables will be affected due to climate change; some examples are the duration and the intensity of precipitation, more extreme temperature lows during rainy seasons and highs during dry seasons. However, analyses of these variables for the department have not been conducted and it is important to do so in the future in order to predict impacts of climate change on specific sectors. According to these projections, the municipalities that will experience the greatest increases in temperature are Acevedo, Altamira, Guadalupe, Hobo, Palestina, Suaza, Tarquí and Timaná, followed by Elías, Garzón, Isnos, La Argentina, La Plata, Nátaga, Pital, Saladoblanco, San Agustín, Santa María and Yaguará. These municipalities are likely to experience temperature alterations in 30% of their jurisdictions. (See Figure 14) The condition is likely to be critical in the municipalities of Suaza and Timaná, which are in the southern and central zones of Huila with alterations of temperature in about 50% of their jurisdiction.

In terms of annual precipitation, the municipalities that will experience the greatest reductions are Acevedo, Isnos, Oporapa, Palestina, Pitalito, Saladoblanco, San Agustín, Teruel, Timaná and Yaguará, and followed by Aipe, Hobo, La Argentina, La Plata, Palermo, Pital and Santa María, which will see effects in 50-96% of their territory. Equally, the effects will be greater in the municipalities of Isnos, San Agustín Timaná and Yaguará, located in the Colombian Massif, the Central Range and a centrally located area within the Magdalena River valley. Many municipalities that may experience increases in temperatures may also register reductions in precipitation. It is necessary for regional authorities to understand the current and future effects of climate and water demand in order to anticipate future availability .

Figure 14. Municipalities with greater increases in temperatures and precipitation according to IDEAM climate scenarios[54]



Source: CAM-SEI based on Huila 2050 Vulnerability Assessment, 2014

54 Elaborated by SEI based on Vulnerability Fact Sheets, Huila 2050 – 4D.

IMPACTS OF CLIMATE CHANGE

The effects of climate change can put some rural and urban communities in a nearly permanent state of emergency. As mentioned above, greater or lesser access and availability of water tangibly reflect climate. This in turn affects food security and may generate problems with the resilience of agro-ecosystems, public health, energy production and increasing migrations. Nevertheless, the adaptive capacity of societies is enormous. In Huila, measures are already being set in motion to reduce negative impacts of climate change and to take advantage of potential positive impacts. This Plan uses such measures as a point of departure. The objective is, precisely, to serve as a tool for the department to become a climate-smart territory, with low emissions and adapted to the environmental conditions of the future.

The behavior of rivers in their natural cycles and dynamics is a crucial ingredient for agro-ecosystems and for the vital sustenance of rural and urban populations. Regions like Huila will be faced with an increase in stresses on hydro systems for crops and human consumptions generated by increased demand to sustain production and satisfy the productive sectors and communities. According to calculations carried out for this Plan using the WEAP model developed by the Stockholm Environment Institute,[55] which is ongoing for the river basin, climate change could cause a reduction of approximately 10% of the river's flow. On the other hand, it is estimated that by 2025, nearly 22 municipalities will face supply problems.[56] Additionally, hydroelectric energy may also be affected. According to results from WEAP, climate change will affect volumes of water stored in the Betania and El Quimbo (currently under construction) reservoirs, which will affect hydroelectric energy capacity.

The climate of the future also brings about changes in the life cycle of some species, for example in flowering and germination periods, mating and migration seasons, and cycles that may impact the structure and function of ecosystems, affecting productivity and food chains. The vulnerability of ecosystems to climate change, and their capacity to provide environmental services, is a priority for future research because the conservation of vital ecosystems will be fundamental for ecological stability and productivity in the department.

Agriculture and the future climate

According to estimates made by CIAT using 19 General Circulation Models, in combination with the A2 emissions scenarios of the IPCC and the Ecocrop program of the FAO, the physical-ecological environment for agricultural production will be drastically altered by 2030 and 2050 (See Figure 15). Some crops, like cacao, could benefit, while others, such as coffee, will have to adapt to the new conditions in order to remain economically and ecologically viable.

The majority of crops that are apt for such climate conditions will be pushed into higher altitudes; in the case of coffee, for example, this means that about 23.6% of current areas will lose potential over the next 15 years (See Figure 16 and Table 3).

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55 The WEAP model is explained in the section Management of Water Resources as part of the strategy of this document.

56 Arco, 2008.

57 Estimates based on 19 General Circulation Models (GCM) and Type A2 Emissions scenarios. These models project more moderate changes in precipitation and temperatures for Huila than the official model used by IDEAM which are used for the vulnerability studies for this Plan. The CIAT model is used for the agriculture sector because it already exists and is available in Huila. The data about precipitation will vary between the CIAT and IDEAM's model because the former uses an average of 19 models and the latter uses 3. Although the CIAT projects moderate increases in precipitation, the temperature change will lead to increases in precipitation due to evapotranspiration, compensating for the differences and leading to similar impacts in either model.

58 Since September of 2013, the IPCC has used scenarios based on GHG concentrations (RCL) for which scenarios of maximum concentrations (8.5) show similar results to the A2 model used here. It is still early to use this new information for the Huila Action Plan.

While it is possible to compensate for these areas, the change in land use needed to take advantage of such opportunities may cause environmental degradation and conflicts over land.

Other crops that will likely be affected are grenadine and tree tomato fruit, which could lose 76-86% of their area. On the other hand, climate does not seem to affect the cultivation of rice, but it does affect the availability of water, a critical component for this crop. For livestock, it is projected that increased temperatures will affect the animals' energy efficiency[59], decreasing productivity.

It is worth pointing out that the areas that are becoming apt for production when they were not so previously may currently serve different purposes; therefore, it is not recommended to expand agricultural boundaries.

Furthermore, many of these areas are in ecologically fragile areas, including water-producing zones, and their forest coverage should be conserved.

Table 3. Percentage of change in areas that are apt for agriculture between 2010 and 2030 according to CIAT projections.

	NO CHANGE	REDUCTION	INCREASE
Coffee	76,4	23,6	22,2
Cacao	97,9	2,1	49,7
Rice	100,0	0,0	25,6
Grenadine	36,9	63,1	6,0
Lulo	92,8	7,2	20,2
Blackberry	93,9	6,1	11,4
Tree Tomato fruit	40,4	59,6	5,5
Tabaco	79,6	20,4	26,4

Source: Huila 2050 plan based on CIAT

Beyond changes in productivity of land for different crops, agriculture production will also be exposed to indirect effects of climate change:

- The concentration of carbon dioxide in the atmosphere will increase (generating a positive effect in the first few years).

- The combination of changes in temperature and precipitation (Figure 15) will cause a proliferation of infestations of fungi and pests such as rust (coffee) and monilia (cacao), and other related diseases that affect beans, citrus trees and other crops.

- The increase in temperature will effect climate variations, for example the timing, duration and intensity of dry and rainy seasons, making planning of agricultural activities difficult (planting, fertilization, weeding, application of herbicides and fungicides) Prolonged rains and dry periods may also effect grazing patterns.

According to ECLAC (2013), the combination of these effects on agriculture (agriculture industry, forest grazing, livestock and fish farming) will reduce the national GDP by, on average, 2.6% per year for the rest of the century. This implies accumulated losses of up to 24% (agriculture), 16% (fish farming and fishing) and 4.6% (forestry) due to climate change. In addition, ECLAC estimates 16% losses in manufactured food industries. Losses in agriculture and forestry in Huila would likely be similar to national levels, although there is insufficient data to reach definitive conclusions.

59 Measured as Kg of meat or milk produced by kJ of energy consumed.

60 Based on 19 GCM models incorporated in EcoCrop models of agricultural production for CIAT. The blue shaded areas remain productive for the crop, although in practice it may be that only a fraction of these areas are used. The yellow shaded areas show once apt areas that become non productive, and the red shaded areas became unproductive during the period of study.

Recently, however, the main losses in the agriculture sector in the department were caused by extreme climate events. Between 2010 and 2011, for example, more than 8,800 ha were affected by the phenomena of La Niña, of which 2,800 were in coffee plantations, 1,400 in rice, and 1,400 in pasture lands.[61]

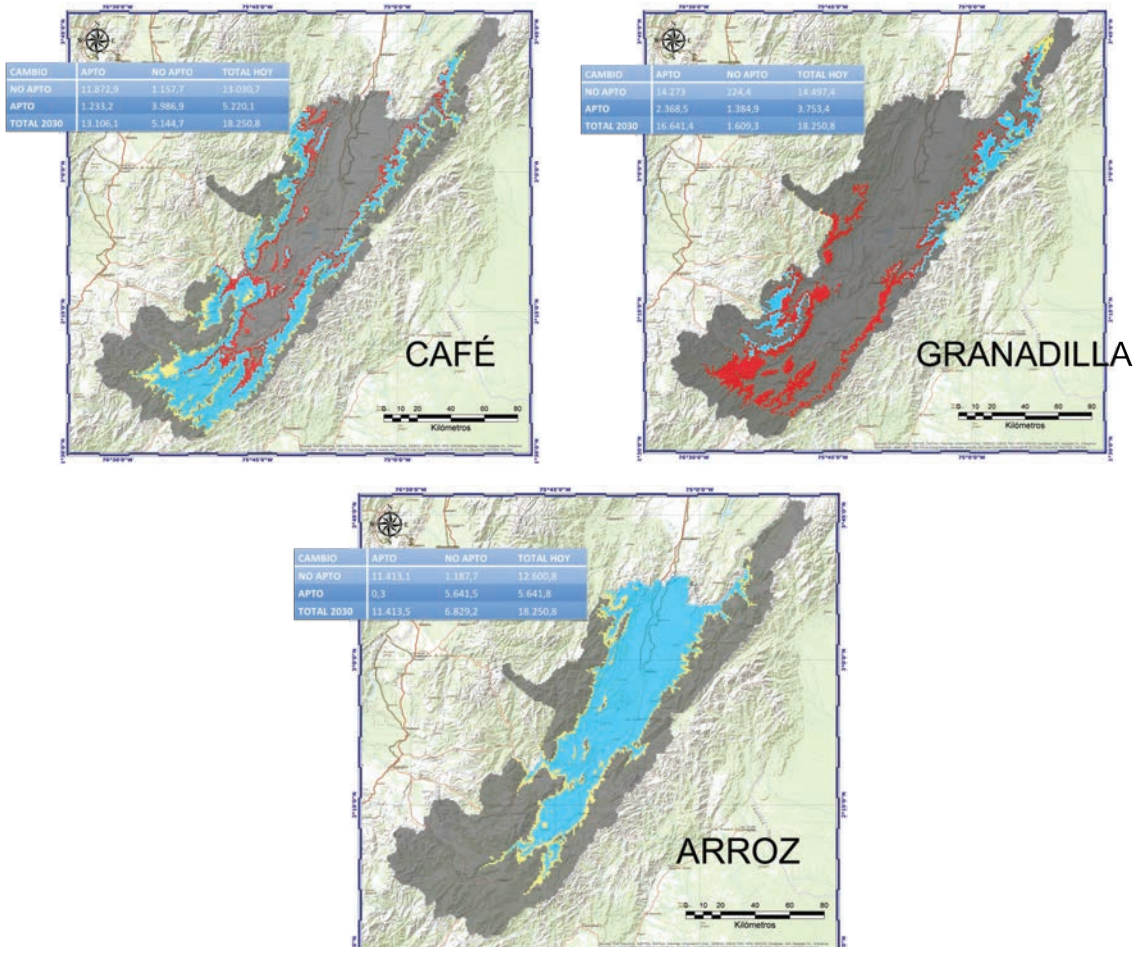
As will be further discussed in the chapter on emissions, the agricultural sector and changes in land use are directly responsible for 58.5% of all GHG emissions in the department.[62] On the other hand, each of these sectors has the capacity to reduce emissions and contribute to the capturing of GHG by introducing trees and carbon into their soils. Agro-forested coffee and cacao plantations, for example, may contain as much carbon per hectare as secondary forests. Nevertheless, the perception is that current varieties of coffee are more productive without shade, so many plantations do not take advantage of their full potential to compensate for emissions and, furthermore, cause losses in soil stability. Likewise, many of these plantations require a conversion of the varieties of plants in order to reduce the exposure to plagues and diseases.

Taking this panorama into account, the department of Huila will need to rethink its agricultural strategies based on climate change predictions, to observe which crops will be appropriate and which ones are inconvenient in the medium and long term. Then appropriate measures may be taken to adapt the sector as a whole and make for climate-smart agricultural strategy.

61 Risk Management Unit for Huila, 2011.

62 Half of these emissions are due to agrochemicals, which leave residues in soil and convert to nitrous oxide (N_20), and to livestock grazing, which produces manure that, as it decomposes converts to methane, a greenhouse gas, (CH_4).

Figure 16. Projections of climate change on soil productivity for coffee (A), grenadine fruit (B) and rice (C), current and projected to 2030[60]



The Human dimension

Climate has a large impact on human beings, and it is human activities that have been the principal cause of environmental degradation, including emissions that affect the climate. The way we live and how we understand climate change must evolve in order to assure climate compatible development in which human well-being and environmental integrity become priority.

In this context, municipalities, cities, towns and neighborhoods must begin to rethink and redesign their habitats, taking into account the challenges presented by a changing climate, especially in terms of housing, efficient transportation, effective management of water and energy, consideration of ecological structures, waste management, and others. Likewise, rural areas must be developed with zoning that is led by environmental considerations, insuring ecosystemic. Adaptation that is based in communities and uses local knowledge becomes an essential tool for the Huila 2050 Action Plan. As argued in the cross-cutting issues of this plan, territorial planning and municipal development plans must include climate considerations in order to position municipalities and their inhabitants on the path of climate compatible development.

Vulnerable populations, women and climate change

Adaptation to climate change requires special consideration of the most vulnerable groups of people. In Huila, about 32% of the population live in conditions in which their basic needs are unmet.[63] A large number of people live in poverty and without economic opportunities to adapt, lacking the means to move to less vulnerable areas or change their crops to become climate compatible.

Women play an important role in caring for and protecting their families from risks, illnesses or calamities that may be caused by climate change. Furthermore, women are educators who help their children understand present and future options to become climate compatible, ensure food security and advocate for future well-being. One of the central aspects of this plan centers around the issues of education and knowledge for women.

A variety of indigenous populations have inhabited the region, including Pijaos, Andaquíes, Yalcones, Paeces, Tamas and Panches; it is calculated that around 1,500 indigenous families exist (1.02% of the department's population, according to DANE, 2005) distributed among the municipalities of Íquira, San Agustín, Isnos, Pitalito, La Argentina, La Plata, Nátaga, Tesalia, Villavieja, Neiva and Rivera. The population has increased due to displacement of the Guambiana ethnic group from the Central Andean range to the town of La Plata in the 1980s, and later, after an avalanche in the Páez River that led the Nasa Kiwe Corporation to purchase land to relocate this population. An estimated 1.34% of the population is afro-Colombian.[64]

These communities pose both opportunities and challenges with regards to climate change. On the one hand, they have ancestral knowledge about climate adaptation in a variety of circumstances that may be very important as communities seek measures based on local and sometimes ancient knowledge. At the same time, these communities tend to be poor and marginalized, and therefore should be treated with special consideration in any municipal development plan.

Health

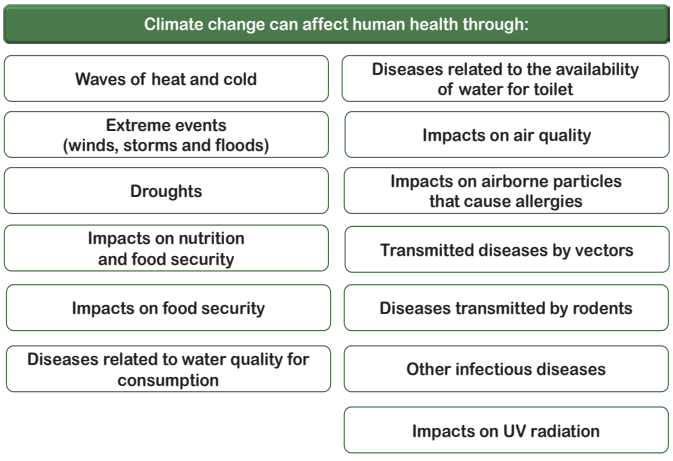
Health is a basic requirement for well-being. To maintain and to improve health of individuals must be an objective of any society that seeks to advocate for the well-being of its citizens. One of the primary causes of mortality and morbidity in Huila are illnesses associated with lifestyles that cause respiratory and other illnesses (heart disease, cardiovascular disease, hypertension, diabetes and others)[65]. There is also a high rate of vector-born diseases (VDBS) including dengue, malaria and leishmaniasis in the department. In 2013, Huila occupied tenth place in the country in cases of dengue (classic and hemorrhagic) with 2,304 cases. país con 2.304 casos[66].

The impact of climate change can have serious health consequences, primarily through the factors that are illustrated in Figure 17.

Information based on Confalonieri, U. et al – IPCC AR4 (2007)

Climate change, therefore, can have a direct impact on human health as a consequence of temperatures rises and variations in precipitation or the frequency or magnitude of extreme climate events. For example, heat waves that are intensified by climate change may cause dehydration and even death among vulnerable groups like small children and the elderly.

Figure 17. Phenomena and factors in which climate change may effect human health.



Information based on Confalonieri, U. et al – IPCC AR4 (2007)

Climate change may also lead to higher rates of VDBS, which is significant in the case of Huila. For example, conditions that facilitate the presence of vectors are likely to spread to higher altitudes as temperatures rise. While it is impossible to predict with certainty without more precise studies, the impact that climate change will have in the rates of dengue and other vector-borne diseases in the department can be seen from important studies that have been carried out in other regions.[67] Strong measures must be taken now to reduce these consequences.

It is also important to look at the impact of climate change on nutrition and food security of populations as well as the safety of different foods. Several diseases may be affected by the availability and quality of water and food goods. Four out of five of the principal causes of mortality in Huila are food related (heart disease, cardiovascular disease, hypertension, diabetes). While reducing the causes and the consequent mortality of such diseases is beyond the scope of this plan, the impact of climate change on the availability and quality of foods is relevant and may have an important impact.

Finally, climate change will require access to information and health services to help understand the phenomenon and to be prepared to respond accordingly. Efforts to improve conditions, both in the health system as well as in environmental and social realms, will have an impact on preparing the department for the climate of the future. This is compatible with the objectives of this plan.

63 DANE, 2005.
64 Ibid.
65 Source: Mortalidad. DANE, INML y Estadísticas Vitales, Huila, 2012. Morbilidad RIPS 2012 –SISPRO. From: Gobernación del Huila (2012). Indicadores básicos en salud. Situación de salud en el Huila. In terms of health coverage, the percentage of the population affiliated with the health system (contributive and subsidized taken together) is 92%.
66 SIVIGILA, 2013.
67 See article about dengue and malaria rates due to climate change in Science, 2014, available in: http://www.sciencemag.org/content/343/6175/1154


COLOMBIA

4. VULNERABILTY

Preparing for Climate Change

The Vulnerability Analysis of Huila, developed in 2013, was carried out to provide inputs for this plan. It was based on a definition of vulnerability from the IPCC in 2001 and resulted in an analysis of potential indicators for Huila that could furthermore be scaled to other regions in Colombia. The full vulnerability analysis can be found in the document "Conceptual and Methodological Framework for the Climate Change Vulnerability Assessment, Huila 2050"[68] which forms one of the bases of the plan.

For this purpose, vulnerability is defined as the degree in which a system (geophysical, biological or socio-economic) is susceptible to and incapable of dealing with the negative impacts of climate change. Vulnerability is a function of degree of exposure, density and adaptive capacity of a system. Exposure of the system is determined by the presence of the phenomena in places that may be adversely or positively affected by factors related to climate change. Exposure and sensitivity together define the potential impact. Finally, the adaptive capacity refers to the ability of the system to face the impact, reducing negative consequences and taking advantage of positive outcomes.

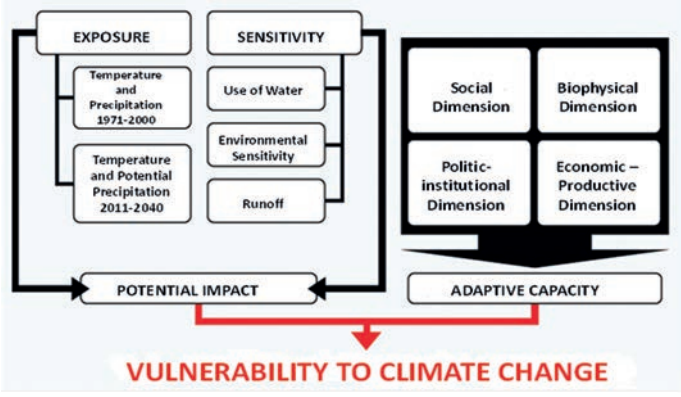
It is notable to point out that in 2014 the Working Group II of the IPCC adjusted its definition of vulnerability to allow the integration of risk management into the analysis of climate change and its impacts, separating the concepts of exposure and vulnerability in the new definition.[69] Looking closely at the possible effect of adjusting the results for the Vulnerability Analysis for Huila to adapt to the new definition, we opted to keep the original conceptual framework since the municipalities differentiate in the indicators about sensitivity and adaptive capacity, which continue to be components in the new definition. However, it is recommended that future studies be based on the new definition. The database of the current study will allow a separation of the two concepts and could be used as reference for future studies.

68 Prepared by 4D Elements consultancy under the coordination of E3 – Ecology, Economy and Ethics.

69 IPCC. Working Group II (IPCC-WGII), 2014.

Using the guidelines of the IPCC, the vulnerability of 37 municipalities in Huila was calculated as a decision-making tool at the municipal and departmental levels. Figure 18 summarizes the framework.

Figure 18. Conceptual Framework to estimate the level of vulnerability of municipalities in Huila to climate change.



Source: Huila 2050 Vulnerability Assessment, 2014

It is worth mentioning that being vulnerable to a greater or lesser degree is not a definitive or unalterable condition; rather it is a condition that is subject to change as strategies to collect more precise data, reduce sensitiveness and increase adaptation capacities are defined and implemented.

Below we analyze the performance of each indicator for each municipality in relation to other municipalities in the department.

The combination of all indicators shows the relative vulnerability of a given municipality. This information is very useful for each municipality to prioritize its actions towards aspects that are weaker and to monitor changes in degrees of vulnerability. It is also useful to prioritize among municipalities according to their degree of vulnerability. Each municipality may analyze the indicators that show vulnerability and take measures to improve these indicators and adapt to the future climate. Additionally, the results of the multivariable statistical analysis are represented, which identify the lines of action for the department to reduce the variation in vulnerability among municipalities more effectively.

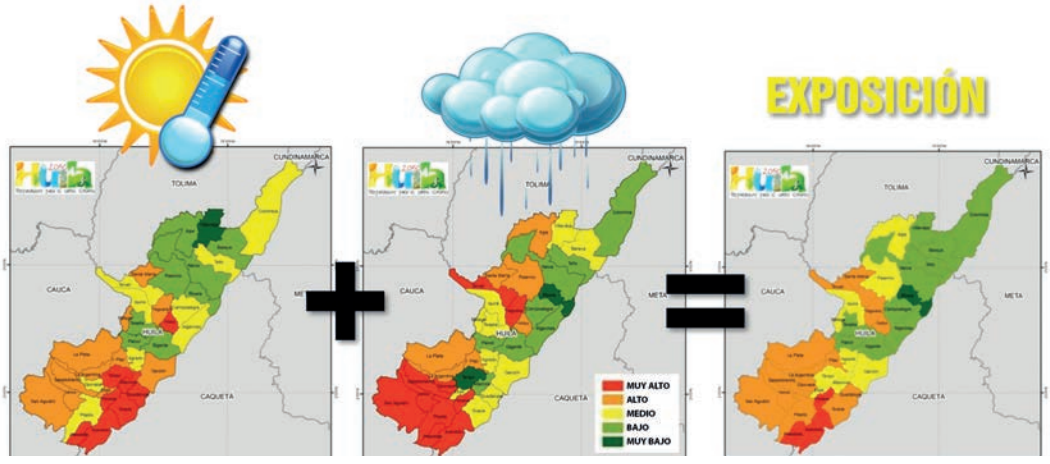
POTENTIAL IMPACT

Exposure

Current climate conditions were identified by baseline reference points that correspond to multiple year averages of precipitation and temperature from 1971-2000, as well as from scenarios calculated using baselines from 2011-2040 by IDEAM.

According to these projections, the department of Huila will be hotter and drier in the future. On average, the medium temperature will increase 2°C and precipitation will decrease by up to 30%. The differential degrees of change are presented at the municipal level, as seen in Figure 19, in which the greater the change indicates more exposure (shown in red) and the least change indicates less exposure (shown in green). The northern part of the department shows lower levels of exposure, while the southern region show higher levels.

Figure 19. Exposure to climate change in municipalities in Huila.



Source: Huila 2050 Vulnerability Assessment, 2014

Sensitivity

Sensitivity was determined based on three indicators:

- Rates of water use. This indicator represents a balance between supply and demand of water resources. It is useful to identify, for example, potential problems in supplying drinking water, reservoir deficit ,and the decline in electrical energy.

- Index of environmental sensitivity. This indicator considers the susceptibility of the environment when its function is affected by intrinsic climate conditions. This indicator helps in the identification of erosion, aridness and vegetation coverage, among others.

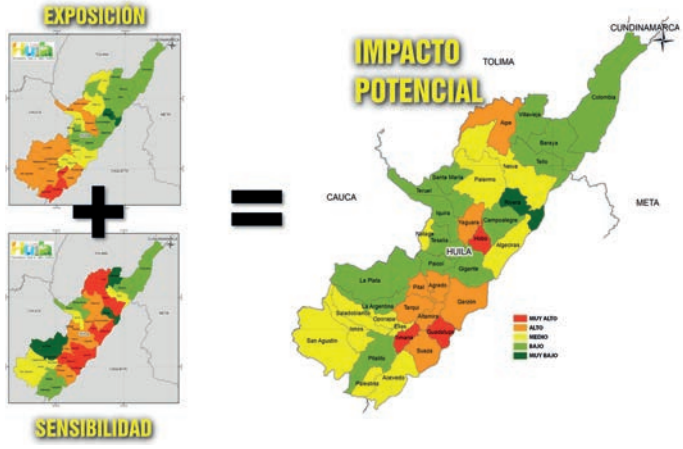
- Runoff. This indicator measures precipitation that does not filter into the ground and that turns to runoff or which freely flows over a surface of land, becoming irregularly concentrated or overburdening streams in the water system. When runoff increases it can cause movements or displacement of land; when it decreases it may affect water supplies.

The three indicators are directly related to sensitivity. That is to say, as values increase, so do levels of sensitivity. As shown in Figure 20, the municipalities that are more sensitive to climate change are located primarily in the central part of the department (shown in orange and red), while those located in the northern and southern extremes are less sensitive.

Potential impact

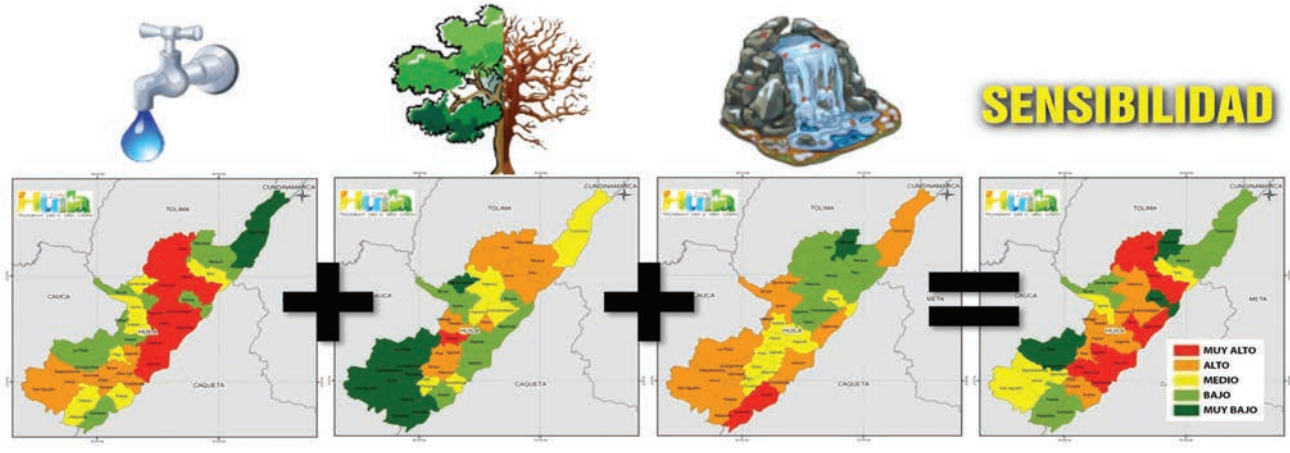
Bases for these indicators of exposure and sensitivity and the potential impact from climate change were calculated for the 37 municipalities (Figure 21). One can see that the municipalities in the center and the southern zones have a very high potential impact, as does the city of Aipe, located in the Northeast of the department. On the other hand, the municipalities in the southern and some located in the northern areas of the department show a medium potential impact, and those in the extreme northern and central western zones show less potential impact.

Figure 21. Potential impact of climate change on municipalities in Huila



Source: Huila 2050 Vulnerability Assessment, 2014

Figure 20. Sensitivity to climate change in municipalities in Huila

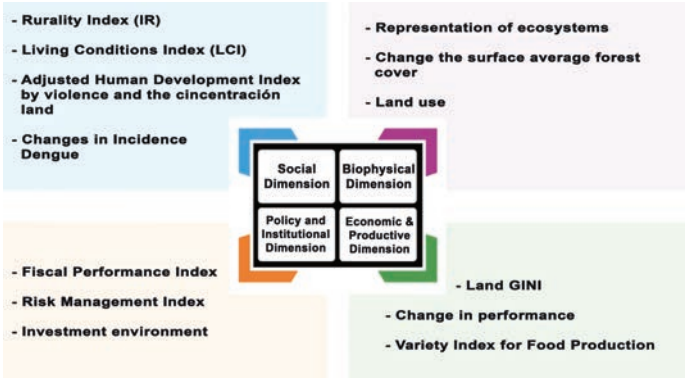


Source: Huila 2050 Vulnerability Assessment, 2014

ADAPTIVE CAPACITY

Municipalities' adaptive capacity to climate change was estimated from the indicators using four dimensions: social, biophysical, political-institutional and economic-productive. These are presented in (Figure 22).

Figure 22. Indicators of municipalities' adaptive capacity

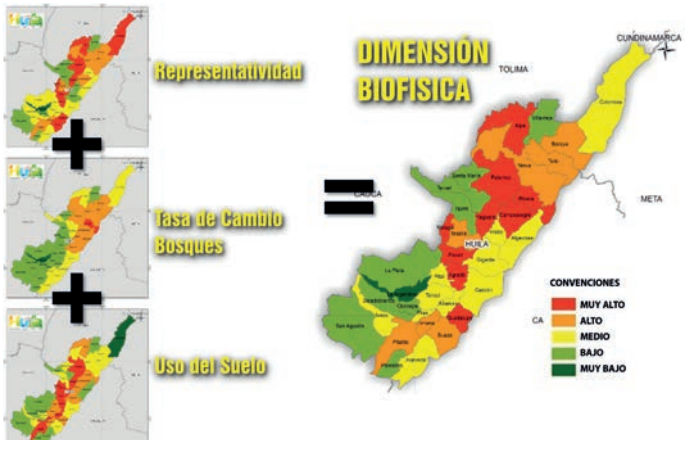


Source: Huila 2050 Vulnerability Assessment, 2014

Biophysical dimension

Indicators of the adaptive capacity that corresponds to the biophysical dimension demonstrate existing natural coverage of vegetation in each municipality, the representative proportion of ecosystems in the National Registry of Protected Areas (RUNAP for its Spanish acronym), and variations in land uses (See Figure 23). Municipalities with a low level of adaptive capacity in this dimension are located in the northern part of the department, while those with higher levels or much higher levels are located in the southern and western parts.

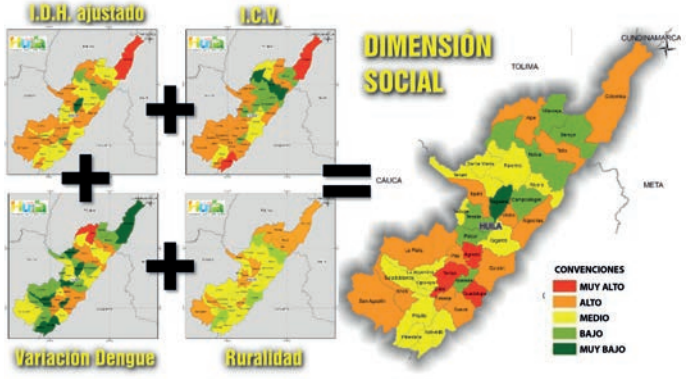
Figure 23. Adaptive capacity of municipalities of Huila in the biophysical dimension



Social dimension

The adaptive capacity of the social dimension was calculated using indicators that look at social conditions, based on the relationship between territories and quality of life. To this end, the vulnerability analysis showed that the higher the ratio of rural to urban and the variation of the rates of dengue, the lower the adaptive capacity. Likewise, the greater values of adjusted Life Conditions Index (LCI) and Human Development Index (HDI) indicated a better adaptive capacity. The majority of municipalities showed a low level adaptive capacity (shown in orange) and medium level (shown in yellow) in this dimension, which shows no geographical pattern (See Figure 24).

Figure 24. Adaptive capacity of municipalities in Huila for the social dimension



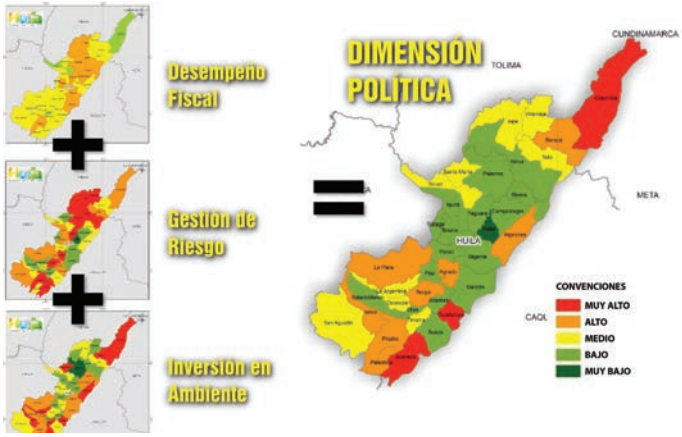
Source: Huila 2050 Vulnerability Assessment, 2014

Political-institutional Dimension

The indicators for adaptive capacity in the political-institutional dimension refer to investments in risk management and in the environment per 1,000 inhabitants, and fiscal performance. The higher the value, the greater the adaptability of the municipality. Municipalities with low and very low adaptive capacity in the political-institutional dimension are located in the northern and southern zones of the department (shown in orange and red), while those with higher levels (shown in green) are located in the central part of the department (See Figure 25).

◄Source: Huila 2050 Vulnerability Assessment, 2014

Figure 25. Adaptive Capacity of municipalities in Huila in the political-institutional dimension

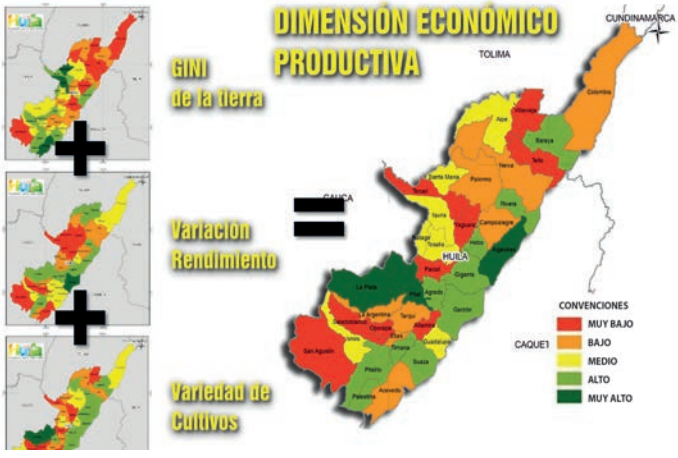


Source: Huila 2050 Vulnerability Assessment, 2014

Economic-productive dimension

The indicators of adaptive capacity in the economic-productive dimension show the concentrations of land and the resilience of agricultural models through performance and variety of crops in municipalities in Huila (See Figure 26). Municipalities with a higher adaptive capacity are located, generally, in the south and center-east of the department. On the other hand, many municipalities with a low adaptive capacity in this dimension are located in the center and south-west.

Figure 26. Adaptive capacity of municipalities of Huila in the economic-productive dimension

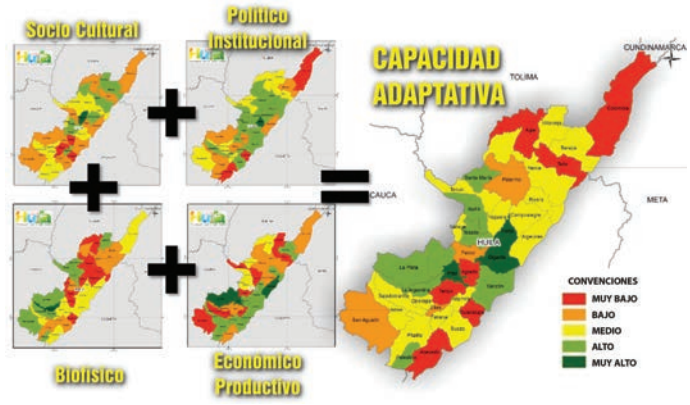


Source: Huila 2050 Vulnerability Assessment, 2014

Adaptive capacity

From the indicators in the four dimensions, the adaptive capacity to climate change was calculated for each of the 37 municipalities (Figure 27).

Figure 27. Adaptive capacity to climate change for the 37 municipalities in Huila

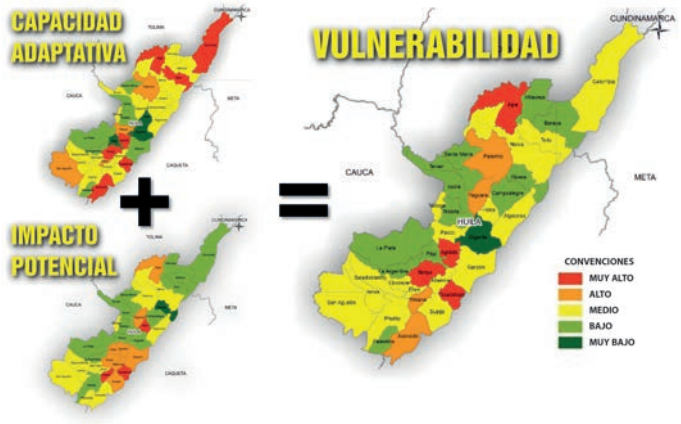


Source: Huila 2050 Vulnerability Assessment, 2014

VULNERABILITY

The degree of vulnerability to climate change was calculated as a function of the levels of potential impact and adaptive capacity (Figure 28). Additionally, municipalities were classified according to a contingency matrix that related the indicator of potential impact with the adaptive capacity, showing 17 out of 25 possible types (Table 4). It should be mentioned that the analysis for each municipality is detailed in the Municipal Vulnerability Fact Sheets that have been provided to each city in the department.

Figure 28. Vulnerability to climate change of municipalities in Huila



Source: Huila 2050 Vulnerability Assessment, 2014

Table 4. Classification of municipalities of Huila according to the degree of vulnerability, as a function of potential impact and adaptive capacity

ADAPTIVE CAPACITY	POTENTIAL IMPACT 2	3	4	5
1		Gigante		Pital
2		Íquira La Argentina La Plata Santa Maria Tesalia	Palestina	Garzón
3	Rivera	Baraya Campoalegre Pitalito Teruel Villavieja	Algeciras Isnos Nátaga Neiva Oporapa Saladoblanco	Altamira Suaza Yaguará
4		Paicol	Elias Palermo San Agustín	
5		Colombia Tello	Acevedo	Agrado Aipe Tarqui

ADAPTIVE CAPACITY	1
1	Hobo
2	
3	Timaná
4	
5	Guadalupe

Source: Huila 2050 Vulnerability Assessment, 2014

In general, it was found that increases in temperatures, reductions in precipitation and increments in demand for water, among other circumstances, are demonstrations that the department of Huila is not exempt from the effects of global climate change. According to predictions made by IDEAM for 2040, there will be an overall increase of 2°C in 75% of the territory and precipitation will decline in 67% of the department; ranges of precipitation at altitudes above 2,500 meters will likely even disappear. These changes, added to loss of vegetation coverage and the reduction of biodiversity, have already generated considerable environmental impact that puts the department on alert. An increase in productive activities and political and socio-economic conflicts put Huila's adaptive capacity to confront climate change to test.

Municipal Cluster Analysis

In order to identify similarities among municipalities in terms of performance in the 18 indicators, a cluster analysis[70] was carried out, organizing municipalities into four groups:

- Group one, conformed by the municipalities Palestine, Santa Maria, Saladoblanco, Isnos, Oporapa, Acevedo, San Augustín, Íquira, Teruel, La Argentina, La Plata and Pitalito. Although these municipalities have varied levels of potential impact and vulnerability, they are characterized by presenting a greater threat of reduced precipitation; higher environmental sensitivity; a larger forest cover with less changes and better ecosystem representativeness; and lower runoff than municipalities in the other groups. With regards to indicators of adaptive capacity, this group has, on average, a relatively lower performance in land distribution, crop yields, fiscal performance, environmental investment, the Human Development Index, and the Life Conditions Index.

- Group two, which includes the municipalities Guadalupe, Suaza, Timaná, Agrado, Elías, Tarqui, Pital, Tesalia, Altamira, Nátaga, Paico, and Aipe. The four most vulnerable municipalities are in this group. Municipalities in the group are

70 This analysis is a multivariable statistical technique that groups together certain elements (in this case variables) in order to observe homogeneity and differences among groups. This method is primarily used as an exploratory technique; it is descriptive but does not explain detail; it is used to identify which municipalities share general characteristics. To apply this technique, the numerical gap between variables was determined and later, pairing closest values, a group of municipalities that share characteristics were identified. The value closest to 0 indicated the greater shared variables while the farthest (25) shows little similarities.

characterized, generally, by having a greater threat of temperature change, less representativeness in their protected areas, more of their land with conflicts of use, and a greater increase in the occurrence of dengue during the last five years. For the other indicators municipalities in this group show an intermediate performance, except for investment in risk management, which is relatively low compared to other municipalities.

- Group three conformed by Neiva, Rivera, Baraya, Tello, Campoalegre, Gigante, Algeciras and Garzón. It is characterized by a better performance, in general, in almost all indicators of adaptive capacity, except for investment in risk management, investment in environment, and the Rurality Index.

- Group four, which includes the municipalities of Hobo, Villavieja, Palermo, Yaguará and Colombia, shows a varied performance in all the indicators, though it differs from other groups by showing a better performance in terms of investment in risk management and environment, and having a higher Rurality Index. It also shows less variety in crops.

Additionally, from the principal components anaylsis done, six variables that have the greatest impact on climate variability in municipalities were identified. These are: Living Standards Index (LSI); Runoff; Environmental Sensitivity Index (ESI); Land Use; Fiscal Performance Index (FPI) and Representation.

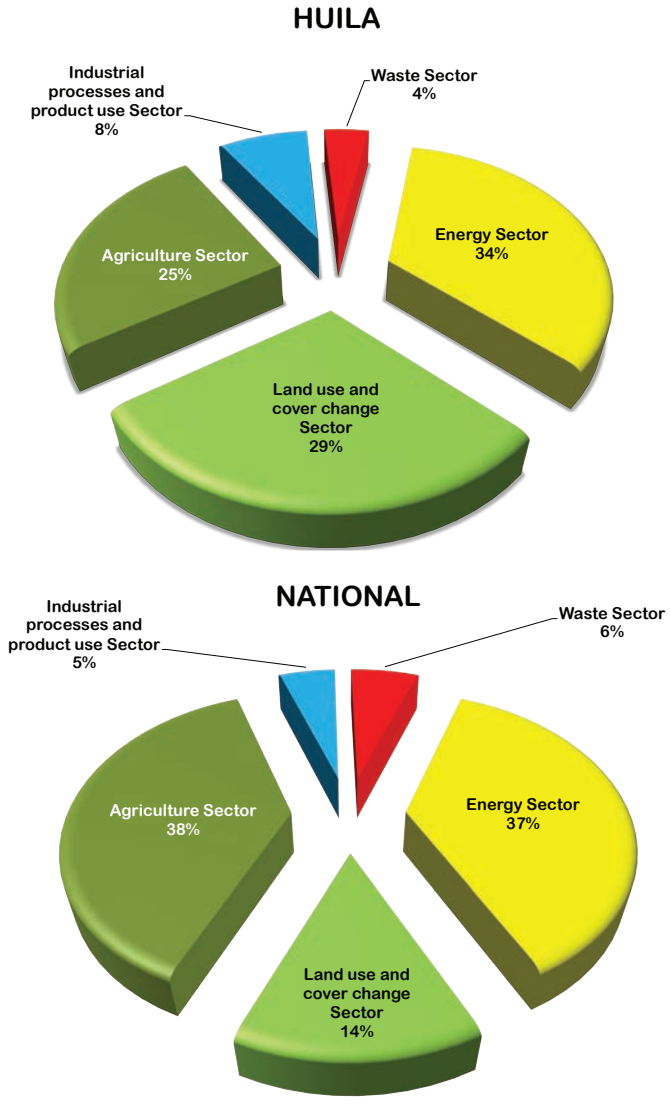
These results indicate that municipalities do not vary by factors such as exposure (temperature and precipitation) but they have different levels of vulnerability due to factors such as sensitivity and adaptive capacity in the social-cultural, political-institutional and biophysical dimensions. Therefore, climate change adaptation and mitigation strategies, both at the Departmental Government and municipal levels, should promote strategies aimed at improving SLI, Fiscal Performance and representation of ecosystems in protected areas and land use change. Furthermore, they should develop strategies to diminish runoff and improve the Environmental Sensitivity Index.

If these measures are applied they will have outcomes on other variables and will contribute to a holistic reduction of potential impact due to sensitivity factors and a better capacity to adapt, both at the municipal and departmental levels.

5. GREENHOUSE GAS (GHG) EMISSIONS

Preparing for Climate Change

Figure 29. Distribution of GHG emissions – Huila and national [72]



Fuente: ONF Andina, 2014.

An integral part of the studies developed for this plan was the identification of GHG emission sources. This information informs what actions are required to reduce emissions in the department, across the territory and by sector. The study was conducted using the guidelines of the Methodological Guides for National Inventories of the IPCC (IPCC, Version 2006), applying methods for Levels 1 and 2. With these methods, an initial estimation of emissions was made for Huila.[71]

The principal productive activities of the department were identified in order to characterize GHG emissions for five sectors or categories: i) energy and fossil fuel consumption; ii) industrial processes and use of materials; iii) agriculture; iv) land use and changes in vegetation coverage; and v) waste generation and disposal.

Results are expressed as a quantification of emissions for each of the sectors and were calculated for the GHG identified in the territory, expressed in tons (t) of CO_2 equivalent (CO_2eq). This allows a comparative analysis of the importance and the contribution of different sectors at a regional level as well as the contribution to emissions of the department at the national level.

Total GHG emissions for the department were 5,317 gigagrams of CO_2eq, which represents 2.95% of levels of emissions nationally reported in the National Inventory of Greenhouse Gas Effect (See Figure 29). Total emissions are considered high when taking into account that the department represents only 1.74% of Colombia's GDP.

Results for the department show that the sector that produces the greatest amount of emissions is the energy sector, with a total of 1,834 Gg of CO_2eq., representing 34.51% of total emissions. Following is the sector of land use and change in vegetation coverage with 29%, and agriculture with 24.5%. Finally, in fourth and fifth places are industrial processes and wastes, with 8 and 4% of total emissions, respectively (See Figure 29). The methodology and analysis of results of emissions estimates may be seen in further

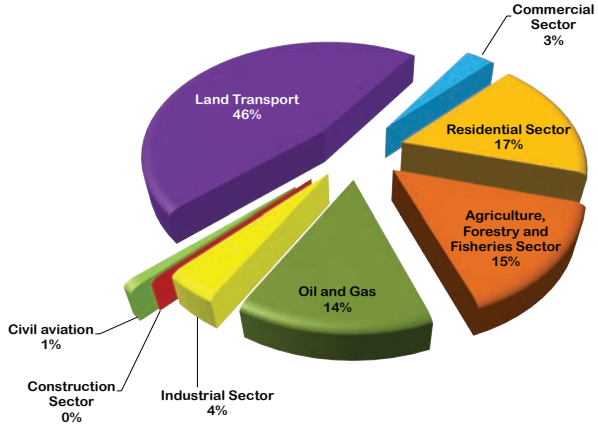
71 ONF ANDINA, 2014.

detail in the document Greenhouse Gas Emissions in Huila, cited in the bibliography of this plan. Below we summarize the analysis by sector.

Energy Sector

Activities or subsectors within this category that contribute the greatest amount of GHG are, in order of importance, ground transportation (46%), residential (17%), agriculture, forest pasture and fish farming (15%) and hydrocarbons (14%) (See Figure 30). In terms of these values, it is worth pointing out the significant increase of fuel consumption for transportation that has occurred, from 33,500,000 gallons in 2001 to 61,500,000 in 2011 (an increase of 83%). [73]

Figure 30. Emissions by sub-sector; energy sector



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According to statistics provided by the Institute for Transportation and Traffic for Huila (2010) the department has 92,151 vehicles registered, of which 93% are privately owned and 7% are for public transport (6,210 vehicles). In terms of automobile sales, according to the Colombian Automotive Committee, from 2009 to 2011 the cities of Neiva and Florencia have experienced an increase of 89% in car sales.[74] In recent years there has also been significant increase in heavy transport by intercity highway, especially carrying crude oil. During 2012 monthly circulation averaged 35,896 trucks per toll station in El Patá (the highway that leads from Neiva to the center of the country); by 2013 heavy load traffic increased to an average of 36,766 vehicles per month.

According to the results from CAM's monitoring system, in 2011, 90% of vehicles sampled did not comply with emissions standards that are obligatory under Resolution 910 of 2008,[75] even when 93% of vehicles had the required technical-mechanical and emissions certificates.

Other subsectors in the energy category that represented high levels of emissions were electric energy consumption, natural gas, firewood and wood for domestic uses (contributing 17%) and agriculture, with 15%. Consumption of electrical energy in the department is 599,574,324 kWh, of which the greatest portion is for residential use (56%), followed by the commercial sector (19%) and industrial and public sectors (12% and 8% respectively). Consumption in the public sector of 47,595,316 kWh is notable.

The World Bank estimates that per capita consumption of energy in Colombia is 1,123 kWh, while in the department of Huila, per capita consumption is 546 kWh.[76] On the other hand, natural gas consumption in the department is 40,624,762 m^3 per year, 50% of which is for domestic use and 27% for the transport sector (natural gas powered vehicles).

72 Ibíd.
73 Ibid.
74 Comité Automotor Colombiano, 2011.
75 CAM, 2011.
76 Information obtained from the database of the company Electrificadora del Huila for 2011.

Average consumption per capita of gas is 192 m^3/ inhabitant/year, while in the department of Huila it is 41 m^3 /inhabitant/year.

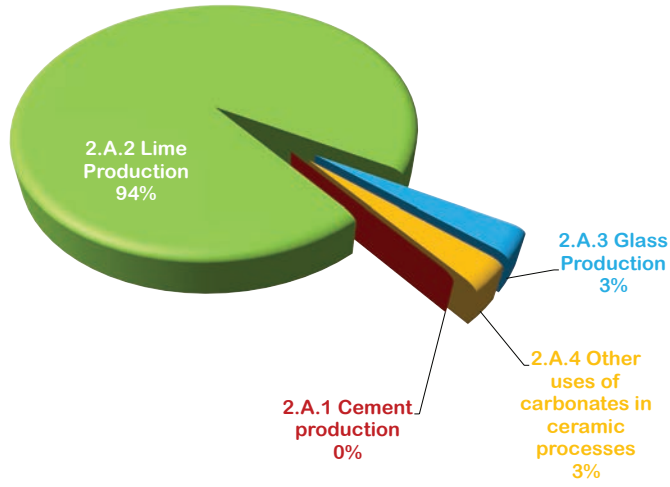
In the subsector of agriculture there is a relatively significant use of firewood. It is estimated that in the department, 423,742 t/year is consumed in homes, 14,000 t/year for curing of tobacco, 18,5000 t/year in the traditional processing of sugar cane and 16,848 t/year for brickmaking. In terms of using wood for crops and fencing, it is estimated that 2,529 m^3 is used for tree tomato fruit, 16,760 m^3 for passion fruit, 19,831 m^3 for beans and 32,750 m^3 for grenadine.[77]

Finally, emissions stemming from the hydrocarbons subsector occupy fourth place in overall emission in the energy sector (14%), as a consequence of exploitation of oil and gas, activities that generate an estimated 261.49 Gg CO_2eq/year. Although exploitation of crude oil has declined in Huila (in 2004 it represented 50,798 barrels daily and in 2011 only 41,911), exploitation of gas reached a total of 9.5 billion cubic feet (BCF), of which only 10% was re-injected, while only 25% was commercialized, 36% was consumed, and 27% was burned. Of emissions in this subsector, 74% were caused by transference, venting, burning and loss during transfer.

SECTOR OF INDUSTRIAL PROCESSES AND USE OF MATERIALS

Emissions in this sector correspond to those generated in industrial activities in exploitation of lime, carbonates and ceramics, which are estimated at 434 Gg of CO_2eq, corresponding to 8% of total emissions in the department (See Figure 31). Huila produces 30,027 tons monthly of carbonates and 15,062 tons monthly of dolomites.[78]

Figure 31. Emission by subsector: industrial processes and uses of materials



Source: ONF Andina, 2014

SECTOR OF LAND USE AND CHANGE IN VEGETATION COVERAGE

The Department of Huila underwent an expansion of area dedicated to farming of 34,161 ha between 2005 and 2010, of which agriculture contributed to the transformation of 15,333 ha. Principal among these areas was land dedicated to coffee (8,590 ha increase), followed by corn (2,243 ha) and grenadine (1,162 ha). The livestock sector contributed with an increase of 18,828 ha in pasture lands. The analysis of this information, together with statistics for the General Plan for Forest Zoning and IDEAM, led to an estimated rate of deforestation between 5,000 and 10,000 hectares per year.

Annual statistics for the year 2011 show the greatest concentration of coffee plantations located in the southern region of the department (47,677 ha), primarily around the municipalities of Pitalito and Acevedo. Next is the central region, with 29,457 ha around the jurisdictions of Garzón and Gigante. Corn crops are concentrated, on the other hand, in lower altitudes, such as in the northern region, in particular in the jurisdictions of Neiva and Colombia. Grenadine is grown in higher altitude regions near Palestina and Pitalito. Pastureland and fodder are primarily located in northern and central regions, with 408,453 ha and 140,959 ha respectively.

Between 2005 and 2010, deforestation was focused primarily in the northern and southern regions of the

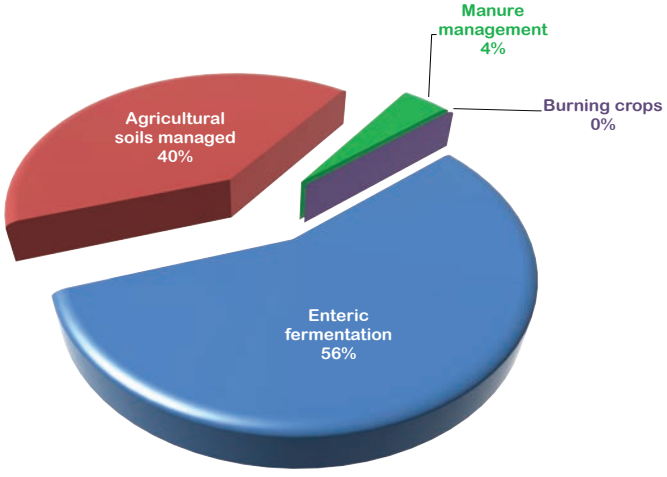
77 CAM, 2011.
78 Ibid.

department. In order of relevance, from greatest to least loss of forest within municipal jurisdictions are La Plata, Colombia, Íquira, San Agustín, Pitalito and Rivera; paradoxically, important municipalities such as Yaguará, Altamira and Nátaga that have less wooded areas, are those that experienced the highest rates of deforestation.[79]

AGRICULTURE SECTOR

Agriculture represents third place in terms of sectors that generate GHG emissions, with 1,304 Gg CO_2eq (See Figure 32). Among the causes are enteric fermentation, contributing 56%, since the department

Figure 32. Emission by subsector: agriculutre sector.



Source: ONF Andina, 2014

was home to a total of 479,306 head of cattle in 2011, with an annual rate of increase of 4,260 heads (between 2003-2011). Extensive livestock is developed through dual purpose productive systems and is concentrated in the areas of jurisdictions of Neiva, Palermo, Gigante, Garzón and Pitalito.

On the other hand, agricultural soils that use fertilizers, in particular rice and coffee crops, represented 40% of emissions in this sector in 2011. Coffee required an average between 295 - 405 kg of fertilizers (simple and compounded) and three liters of agrochemicals per hectare, translating to a total of 117,224 ha that required 82,056,800 kg of fertilizers and 351,672 liters of agrochemicals.

In rice crops, 450 kg of urea and 29.5 liters of a variety of fungicides and insecticides were applied. Consequently, in 2011,32,611 hectares that were planted with rice required approximately 14,674.950 kg of urea and 962,024 liters of agrochemicals. It is important to point out that the greatest extensions of land that are appropriated for rice cultivation in the department are centralized in the northern regions, in particular in the jurisdictions of Campoalegre, Palermo and Villavieja.

WASTE SECTOR

Emissions from waste are in last place among sectors in the department with a total of 4%, equivalent to 201.4 Gg CO_2eq (54% of which corresponds to residuals from water treatment, primarily for domestic use, and 46% to solid wastes deposited in landfills, integral plants and incineration).

While Wastewater Treatment Plants are available in about 51% of the department's territory, current infrastructure is only able to remove less than 15% of contaminated water generated in urban areas, which means that principal urban centers such as Neiva, Garzón, Pitalito and La Plata do not have full sewage treatment service. Added to this is sewage pollution in rural areas that do not have basic sanitation services. Within the agriculture sector, coffee crops represent both the predominant crop (with more than 100,000 ha and nearly 76,000 producers) and the principal generators of water pollution as well. Furthermore, crops such as rice, tobacco and lulo, grenadine and tomato fruits are intensive users of highly toxic agrochemicals, which also contribute to groundwater contamination. Finally, it is estimated that the industrial sector contributes nearly 5% of all water pollution.

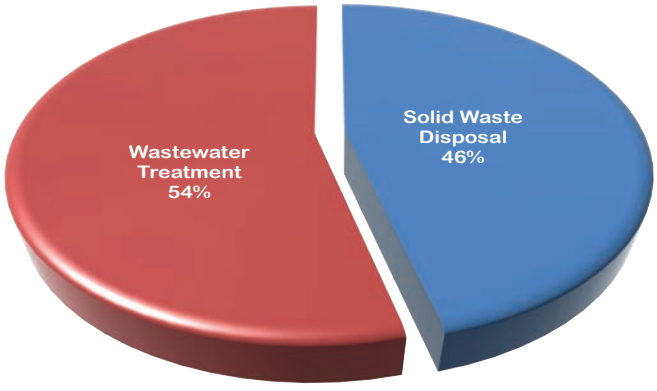
According the National Final Disposition Report of 2012, Huila produces an estimated 458 tons daily of garbage for a population of 1,083,000 people. Of this, 70% ends up in landfills, 27.9% in recycling plants and 1.8% is disposed of inappropriately. The CAM has issued suspension notices to recycling plants for poor management and overcapacity of their facilities.

The city of Neiva has 83,123 subscribers to the garbage collection and disposal service. The city represents 60% (270 tons/day) of the total production

79 Ibid.

of waste in the department, which ends up ultimately in the Los Angeles Landfill. The second place in this realm is the city of Pitalito, which produces 41 tons/day; in third place and fourth places are the cities of Garzon and Campoalegre with 19 and 12 tons/day respectively.

Figure 33. Emissions by subsector: waste



Source: ONF Andina, 2014

PRIORITIES IN MITIGATION

Mitigation strategies geared to reduce deforestation and forest degradation, good agricultural practices and efficient and sustainable transportation are especially relevant for Huila since they are related to activities that contribute to more than half of total emissions in the department.
In the energy sector, it is important to research and promote biofuels, mass transport, renewable energy and energy efficiency strategies for residents throughout the region.

In the sector of industrial production and materials, the priority should be to promote the modernization of technology, improve productive practices, and create incentives for clean, low coal-burning production and the utilization of energy alternatives and financial mechanisms that promote such changes. In general there is a need for greater participation of the industrial sector to mitigate and measure emissions and to implement more efficient industrial practices in the long term.

In the sector of land use and vegetation coverage, mitigation priorities include the definition of regulatory policies aimed at optimal uses of land, erosion control, crop rotation and policies that take into account the value of forest areas and the ecosystems they provide.

Among the combined strategies of mitigation and adaptation, it is necessary to promote actions capture and conserve carbon deposits , including protected areas in the department. For this, it is important to increase the size and connectivity of existing woodlands and protect watersheds, restore degraded land, reforest, and establish agro-forestry systems and substitution for biological products.

Equally, it is important to perfect baseline information of forest inventories and changes in land use at the local, regional and national levels in order to reduce uncertainties of estimations. This can be achieved through special small-scale mapping of vegetation coverage that have enough detail as to show differences in natural stratification.

To reduce emissions in the livestock sector, it is important to develop strategies that on the one hand improve efficiency of livestock productivity through genetic techniques and, on the other hand, alter the digestion and nutrition through adapting agroforestry systems and improving pastures.

Finally, in the waste sector, the recommendations are to evaluate the viability of reducing the quantity of organic waste, introducing new technologies for the end of the line in order to replace landfills and to consider taking advantage of gas that waste generates.

6. THE STRATEGY: MAKE HUILA A CLIMATE-SMART TERRITORY

Preparing for Climate Change

CLIMATE-SMART TERRITORIES

The vulnerability analysis for the department of Huila gives evidence that climate change is indeed occurring and that it affects people everywhere, in every sector. The specific impacts vary from place to place and affect different numbers of people in different municipalities and in different sectors. Therefore, adaptation strategies should be appropriate to local conditions and should consider the interaction among different social groups and sectors.

Adaptation is not only a priority for Huila. International agreements require precise contributions towards the proposed goal to manage GHG concentrations in the atmosphere so that average global temperatures do not increase beyond 2°C by the end of the century (the international threshold) and thereby avoid disastrous consequences. Furthermore, adaptation in Huila will also contribute to efficiency in the industrial sector, as pointed out in the previous chapter.

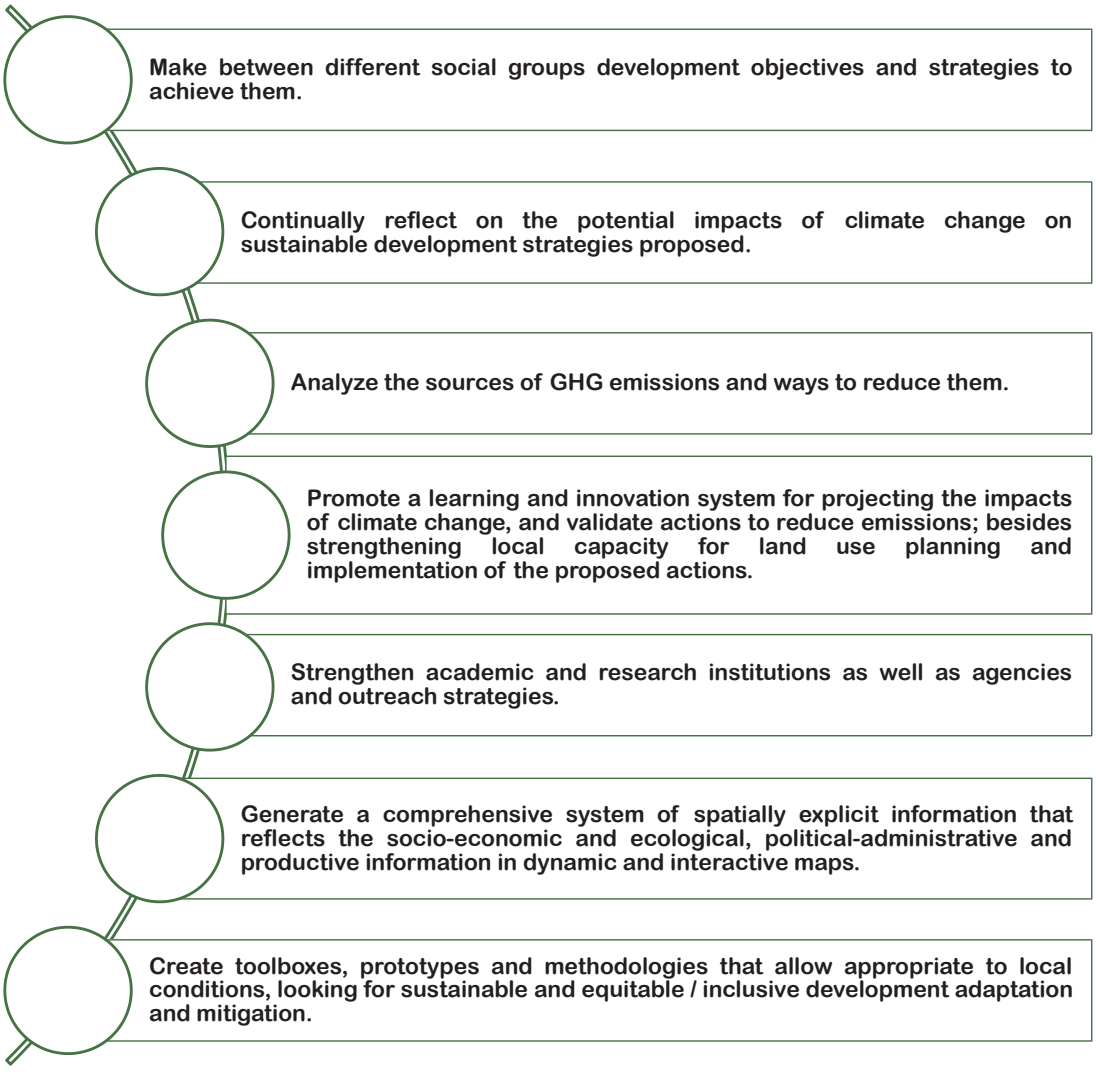
To this end, the proposal is to lead the department to become climate-smart through a focus on Climate-smart Territories (CST). According to CATIE , this focus integrates collective actions within a territory to increase productive capacity, reduce GHG emissions and increase adaptation potential, both in the territory, among people, and within industry and ecosystems.

CST are characterized by establishing an interface between science and decision-making processes that promotes the application of scientific advances for the well-being of society and provides information and knowledge to decision makers so that they can develop climate-compatible policies and strategies and include these in municipal and regional development plans. In this way, knowledge becomes a central axis in society, which simultaneously requires strengthening education and training in issues related to climate change.

Territories foster different sectoral policies according to the objectives of different segments of the population. Coalitions, conflict management and a multidisciplinary focus are essential aspects to make CST work.

This plan helps the department become a CST, in which climate-compatible actions are integrated both with sectoral planning policies at the national level and projected towards Huila, in municipal and department development plans, sectoral actions and in the action plan of CAM.

Figure 34. Characteristics of a collaborative CIT platform



Source: Author's diagram

OUR STARTING POINT

In order for Huila to become a CST, the concept of development must be reconceived. To face climate change, we must focus on integrated responses that limit the department's contribution to the magnitude and speed of climate change. At the same time, we must confront impacts and take advantage of opportunities to adapt early. This plan contemplates some actions that are directed at reducing the sources, or increasing filters of GHG emissions (mitigation) and others that contribute to reducing the vulnerability of the territory (adaptation), and, finally seeking ways to create synergies between these two realms.

As a starting point, we look at the guidelines and measures that have been given priority at the national level as part of the Colombian Strategy of Low Carbon Development and by the National Plan for Adaptation to Climate Change. To this end we take into account measures included in sectoral plans for mitigation that may be relevant for the department, given its profile of emissions and considering that adaptation measures should be part of a planning strategy that guarantees competitiveness in the long run. Proposals, therefore, should be incorporated in development plans as well as in territorial zoning and management of water resources.

The plan begins with a recognition that both responses (mitigation and adaptation) and the synergy between them are specific in a given context and should be aligned with the development standards of the department of Huila. To propose actions that have a regional vision in a way that is compatible with climate change, it is fundamental to take planning instruments into account. Furthermore, priorities must be identified and used as criteria in the definition of strategic sectors for mitigation and adaptation. Similarly, it is necessary to highlight what is being done in terms of facing the challenges of climate change; some of the responses proposed should be extensions of good development practices and climate-smart actions that have already taken place.

On the other hand, the Huila 2050 Action Plan rests on a long-term vision applying departmental management instruments. Some of the actions of the Plan have been put into place, by the Department, by CAM and by the city of Neiva in a transversal manner and as part of the management instruments generated by the Departmental Government as well as the territorial and municipal zoning and development plans, with a long-term vision.

Finally, we also begin with mitigation and adaptation actions that have been taken in the department for the six watershed systems that have been identified as priority in zoning plans (POMCH), including the mapping and zoning of basins, the plan for the management of páramos and wetlands, the advance in the system of protected areas (one of the most complex in the country), the Payment for Environmental Systems project related to the Las Ceibas River, the REDD Project for the Guaharos-Puracee corridor, and the advances in climate change strategies in the coffee and livestock sectors. These action are already an integral part of this plan and continuous reference is made to them in the respective proposals of lines of actions in this chapter.

DEVELOPMENT PRIORITIES FOR HUILA

The Department of Huila has traced a vision of development through a variety of instruments. Table 5 presents a summary of these, highlighting the priorities.

Table 5. Instruments for Development Priorities

PLANNING INSTRUMENT	PRIORITIES
Huila Vision 2020	Oriented to "consolidate Huila as the Green center of Colombia by 2020, making the department peaceful, unified and entrepreneurial-minded; to become a dynamic leader where everyone can realize their dreams." Based on five pillars: i. Equality and respect for life as an essential condition for peace in the region. ii. Raising living standards, education in ethics and commitment to development of the population. iii. Create regional and global integration to take advantage of the added values that offer improvements in quality of life. iv. Create a diversified entrepreneurial foundation that applies high-tech innovations to sustain the tourism and forestry industries. v. Restoration, protection and enjoyment in harmony with cultural and natural patrimony.
Regional Plan for Competitiveness 2010-2032	This plan is founded on 5 objectives, 14 strategies and 49 initiatives which lead to a global vision based on the goal: "Huila will have highly qualified human-talent base, higher incomes, integration with international and national markets, all of which are supported by regional, business and institutional strength, infrastructure, innovation, science and technology, creation of a culture of productivity that respects the environment and leads to sustainable and diversified development with the added value of the potential of the department by 2032." • Objectives • Sectoral development on scale with global and national objectives in which the department demonstrates its potential. • Convert to sustainable development based on the formation and affirmation of new capacities and abilities. • Support the development and formalization of business. • Incorporate and apply science, technology and innovation. • Promote strategies to create connectivity, infrastructure, equipment and environmental sustainability and to attract investments.
Internal Agenda for Competitiveness and Productivity for Huila	Huila is a region with a wealth of opportunities, natural, cultural and human resources that lead to a great productive potential and which can be transformed to a competitive advantage. For these reasons, the internal agenda for competitiveness and productivity is launched from a working group promoting 5 fundamental ambitions: 1. Agroindustry based on technology for producers in sectors such as tobacco, cacao, specialized coffee and fruits such as Cholupa, grenadine, lulo, blackberry, passion fruit, tree tomato fruit and table grapes. 2. Fisheries and fish farming (and its production chain). 3. Eco and cultural tourism. 4. Mining (phosphorus rocks, clay and marble). 5. Electric energy (generation and commercialization).

PLANNING INSTRUMENT	PRIORITIES
Regional Environmental Management Plan 2011-2023	"By 2033, the Department of Huila will become, both at the national and international levels, a model of environmentally sustainable development, with economic growth that is in harmony and maintains conservation of environmental goods and services, thereby contributing to improvements of the natural environment and the quality of life of the population." Areas of interest Use and coverage of soils, basins that are supplies of water, biological diversity, natural threats and risks, productive systems. Strategic areas 1. Strengthen institutions as a basis for environmental planning and territorial management. 2. Integrate management of strategic areas and biodiversity, with an emphasis on consolidation of SIRAP. 3. Integrate management of water, soils, air quality and forest resources. 4. Use and adequately appropriate the natural supply chain for sustainable development in the productive sectors.
Departmental Development Plan "Huila is competitive"	Priorities are to reduce poverty, increase social inclusion and create improved access to health, education and housing. The promotion of the rural sector, taking advantage of comparative advantage and/or competitiveness, providing assistance in the countryside and increasing irrigation infrastructure. The strengthening of sectors that are identified in the internal agenda of competitiveness through the promotion of mining activities, reinforcing tourism in four clusters and guaranteeing the interconnectedness among centers of production and consumption. Expose the need to guarantee that science and technology and innovation contribute to the productive sector. Suggest the integrated management of natural resources associated with protected areas, water resources and other ecosystems that allow sustainable environmental development of the department, including climate change challenges. Recommend increasing coverage of supplies of potable water and sewage systems, as well as wastewater treatment and improve the end of the line of solid waste in urban areas.

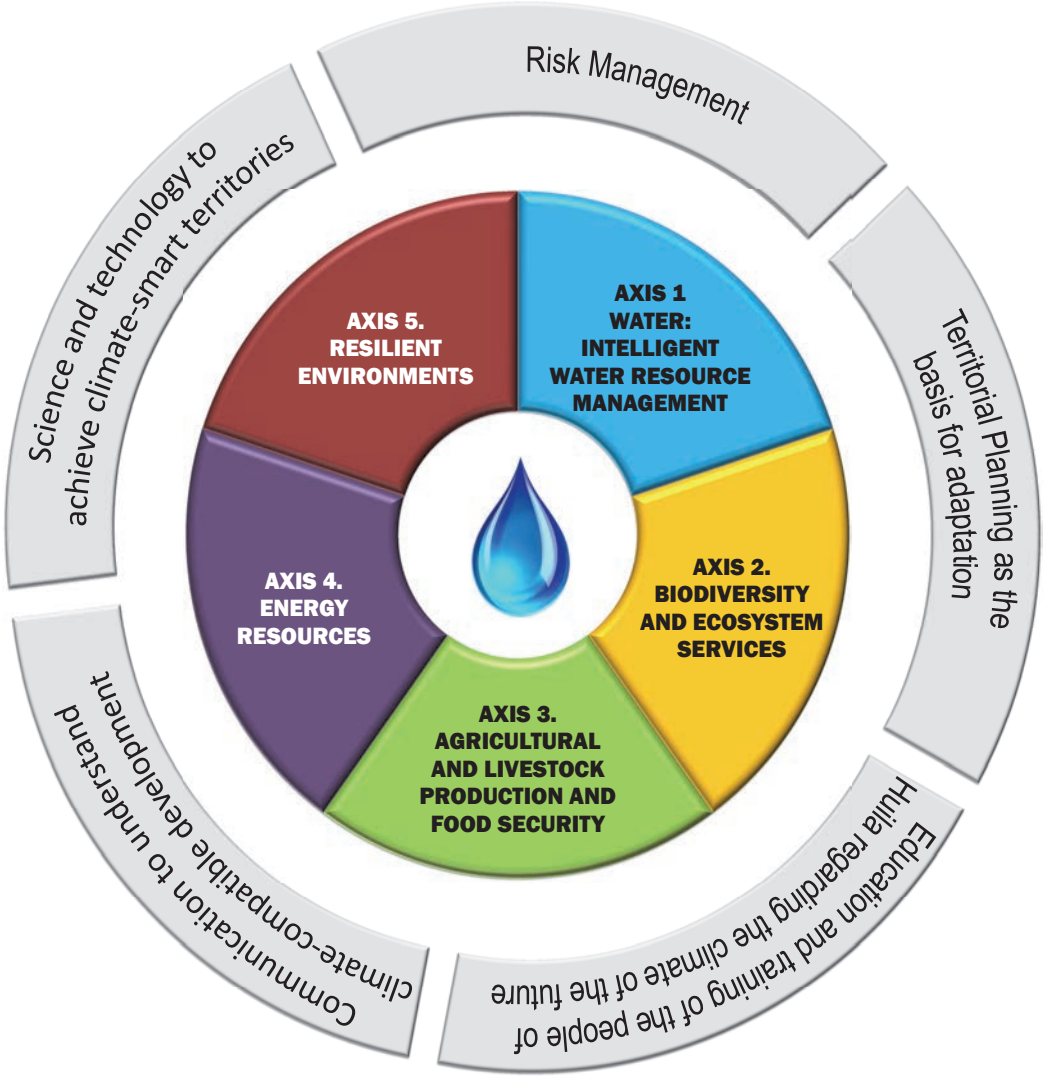
The Huila Action Plan does not pretend to cover the entire department, but rather to permeate the different existing plans. Furthermore, it seeks to achieve a vision in the long term, in which the urgency to counteract the future climate leads Huila to concerted early actions that position the department to become climate compatible.

THE AXES OF ACTION: TOWARDS A CLIMATE-SMART HUILA

The axes of action for this plan stem from a vulnerability and emissions analysis and from different dialogues with diverse stakeholders in the department between 2013 and 2014. The central axis revolves around water as a vital resource for Huila and the rest of the country. Around this axis revolves those of biodiversity and ecosystem services, agriculture and food security, energy and the human axis; each one is interrelated with the others.

The plan also has five transversal topics that are fundamental to the concept of climate change in political, educational, communications and management realms of the department. These are: territorial zoning, education and training, communication, science and technology, and risk management.

Figure 35. Axes of Action for Huila Plan 2050



Below, we describe each of the axes with their respective areas of action.

AXIS 1. WATER: INTELLIGENT WATER RESOURCES MANAGEMENT

The axis of water is an integral element to prepare the department of Huila for climate change, since its adequate availability is crucial to protect biodiversity, contribute to social development and provide ecosystem services, agricultural production, food security and energy. Planning for water consumption has become an unavoidable reality for Colombia. For these reasons, it is particularly important to focus on this issue at the departmental level, and regionally in the Upper Magdalena Basin, both because of its provision of water for the country as well as for its multiple uses in Huila. The issue of water use is divided initially by what is consumed and what dissipates into the system (e.g. vegetation cover, irrigation and municipal consumption) and what is used but does not dissipate into the system (e.g., hydroelectric energy demand and ecology of rivers and streams).

> Huila will have water in sufficient quantity and quality to achieve sustainable development and provide water to the rest of the Magdalena River basin, through the efficient management of its basins, in a participatory manner among stakeholders, ensuring the protection of its sources, equity in its use, efficiency in consumption, and financial schemes to achieve this.
>
> **VISION 2050**

The intention of this axis is to promote the use of water resources in a smart way while creating synergies among the other axes of the Plan. In this way, it attempts to:

- Identify conservation and protection measures of basins through reforestation, afforestation and other conservation measures for natural habitats (linking to the biodiversity and ecosystems axis), with the goal of assuring water ecosystem services.

- Evaluate good agricultural practices in which the efficient use of water is contemplated (linking to the axis of agriculture and food security)

- Foster information about potential hydroelectric energy generation in the region (linking to the axis about energy) assuring environmental ends and the establishment of requirements of water use, both for humans and for agriculture.

To achieve this objective of water conservation and to guarantee its future availability in a climate change scenario, the following lines of action are proposed:
In the first instance, promote modeling that leads to an understanding of the potential water in the future under different climate scenarios and, gradually, develop plans for water basins that integrate the climate dimension. This will require financing of plans with climate ends and innovative schemes to evaluate the potential of hydroelectricity under climate change scenarios.

In terms of hydro modeling, the water axis is based on the development of participatory and analytic models using tools applied with climate scenarios known as WEAP. The WEAP[81] model is software that elaborates a projection about how changes in precipitation and temperature may affect the availability of water for different uses in a given watershed. In spite of the lack of data and of limitations of information, the WEAP model provides the best information available to orient providers and users in decision making in order to guarantee the availability of this resource and to prioritize adaptive measure to climate change in the short, medium and long range.

Each water basin is different; for each one, specific actions must be identified that include climate adaption in accordance with the other axes of biodiversity, agriculture, energy and the human component. For example, among the adaptation measures to be evaluated are conservation of areas with vegetation coverage, management and control of urban growth, changes in agriculture and crop

81 The Water Evaluation and Planning System (WEAP) is a unique a free model developed by the Stockholm Environmental Institute (SEI), which evaluates of the prospects of climate change on hydroelectric systems' performance. There are more than 13,000 users of this software worldwide and it has been successfully applied in diverse areas, including the Andean Region and the State of California. The heart of WEAP is analysis of scenarios that represent possible future outcomes based on historical information. This allows one to evaluate the consequences of unintended changes in the system, and to evaluate how they may be mitigated through policies and/or technical interventions. In the Upper Magdalena, SEI is supporting WEAP with data on climate, hydrological, demand requirements, operations systems, reservoirs and ecological wetlands in order to create possible future scenarios. With the help of WEAP, it will be possible to respond to questions such as how much surface area should be protected in order to satisfy water demand. Given that currently resources are being delegated for conservation in a sporadic and isolated manner, this type of analysis allows important areas to be identified and to concentrate investments in water system areas.

patterns, irrigation maintenance , implementation of technologies to generate electricity, improvements in quality of surface water, implementation of ecological corridors and construction of new dams. Such actions are not necessarily different from those determined in planning instruments, but they should be conceived of and focus on their effects as mitigation and adaptation to climate change measures.

The third area of action seeks that the POMCA include innovative financing schemes that allow funds to be managed for mitigation, adaptation and community involvement in development.

Finally, the fourth area of action leads to an understanding of the hydroelectric potential of the watersheds in such a way that appropriate decisions for future projects, smaller than or greater than 20,000 megawatts, may be made. While information about the use of watersheds is part of this axis, political decisions in this respect are part of the energy axis.

Area of Action 1.1 Hydro modeling in Huila

PROBLEM	ACTIONS IN PLACE
Increasing demand for water for consumption in agriculture, urban centers, energy, mining and hydrocarbon exploitation and climate change impose a threat to ecosystems. Adaptation strategies must be identified to counter the negative effects of climate change. Beyond climate change, there are uncertainties about development processes associated with growing populations, expansion of agriculture, changes in vegetation coverage, priorities in providing water and infrastructure. Nevertheless, it is impossible to intuitively deduce the effect of mitigation and adaptation measures (neither those planned nor those being carried out) in combination with development processes and climate change. The participatory and analytic focus based on the WEAP model opens the opportunity to identify actors and the roles they play in water resource management, considering climate change in the evaluation of measures. Furthermore, information can be collected about how external agents exert pressure that is manifested in watersheds.	• XLRM[82] analysis through the USAID-SEI project. • WEAP Beta Model • The modeling process has been advancing since 2013, identifying a baseline for analysis: on the one hand, a team in CAM has been identified to lead the analysis of adaptation measures; on the other hand, a contextualization of the watershed has been made that considers existing planning instruments. This contextualization has characterized in detail the pressures that are exerted on hydro resources – the uncertainty of climate change and population changes being two examples - and about opportunities to adapt, such as conservation strategies and water regulation.

Objective

Develop a participatory and analytic model of water in Huila based on the WEAP modeling tool under climate change scenarios, with the objective of projecting how changes in precipitation and temperatures will affect the availability of water for the different uses of the watersheds.

Actors

WEAP – CAM team, SEI

Description

- Develop a WEAP model of the Upper Magdalena River Basin that determines the supply and demand of water for different uses under current climate conditions.
- Characterize climate uncertainties of the watershed is an important step in the implementation of this focus. For this reason, the proposed strategy for the axis on water requires the elaboration of climate scenarios that can be used for adaptation measures as defined by planning instruments. This step will be executed in collaboration with IDEAM.
- To run the WEAP model, including the contribution of water basins that are under conservation or protection (páramos, prioritized forests or protected areas, wooded areas in basins that supply water, areas that are protected to supply the agricultural sector) in different seasons of the year historically and with climate projections for the future. Include other adaptation measures associated with improvements of infrastructure (e.g., management of urban demand, changes in agricultural patterns, maintenance of irrigation areas, implementation of other technologies to produce electricity, etc.) institutional improvements (e.g., improve the quality of water) to the implementation of ecological water corridors and hydro regulation (e.g., construction of new dams).
- Finally, an analysis of the additional effects and benefits of mitigation efforts for water resources will be carried out.

Timeframe for implementation	Financing
One year	Estimated cost: COP 118,000,000 Possible sources of finance: USAID-SEI

Barriers to implementation

Availability of personnel from CAM to define scenarios.

Indicators

The model becomes appropriated by the functionaries of CAM and is put into action.9

Area of action 1.2 Participation and integration. Climate POMCAS

PROBLEM	ACTIONS IN PLACE
The current POMCA do not consider climate change. On the other hand, conservation of páramos, forests and protected areas is necessary to regulate water resources in zones where water basins supply municipal aqueducts and agricultural areas. It is estimated that to have an effect on water planning, the participation and feedback of stakeholders is needed, not only under current development conditions, but under future conditions as well.	• Management plans for the water basins of the Las Ceibas, Guarapas, Garzón, Yaguara, Timana and Yaguilga rivers are in place. • In the Las Ceibas River basin a Watershed Council was formed, made up of public enterprises, mayors, governors, urban and rural communities and the CAM. This entity has been carrying out reforestation and isolation activities, as well as land purchases, with resources from a fund projected for 20 years. • In the Guarapas River basin a pre-consultation is being carried out with the indigenous community. Land purchases have been made in Pitalito and work has been carried out to isolate, reforest, build eco-efficient ovens and train people. • In the Garzón River basin land purchases have been made. • The adaptation fund is supporting the development of POMCA in the Las Ceibas River basin, in a sector of the Juncal River basin and in the Paez River basin. Additionally, there is currently an agreement to formulate a plan for the Suaza River basin. • An XLRM analysis is being carried out through the USAID-SEI project.

Objective

Develop river basin management plans including climate change scenarios, using the WEAP model in a participatory process to prioritize adaptation and mitigation measures to assure a well-managed basin.

To estimate the conditions of supply and demand in the river basins of Las Ceibas and Suaza rivers historically, current conditions based on climate change and the water supply for conservation zones in different periods of time historically and with future climate projections. From these results, an additional analysis that focuses on river basin committees and municipalities can be done and it will be possible to present the information that refers to the effects of climate change with stakeholders.

To evaluate the water availability in the river basins of Las Ceibas and Suaza rivers so that the information will contribute to the objectives of PGAR and the Action Plan in terms of water regulation in dry periods. This, together with the socialization and feedback about mitigation and adaptation measures regarding climate change and water resources, will allow actions to be prioritized so that the conservation, availability and efficient use of water in climate change scenarios is guaranteed.

Finally, the climate POMCAS will be developed with concrete actions for each river basin.

Actors

WEAP-CAM team and SEI; River basin water councils councils; CAM team in change of POMCAS.

Description

The WEAP model and the climate scenarios will be used to detail relevant aspects of supply and demand, starting with the watersheds of the Las Ceibas and Suaza rivers, with the objective of creating estimates to support the end-use in dry periods primarily in municipal seats and in irrigated agriculture areas and estimated projections under climate change scenarios.
The watershed councils will generate POMCAs under climate change scenarios from the analysis of results from the participatory method; the councils can prioritize mitigation and adaptation measures as part of the integral management plans under climate change scenarios. These processes will be applied for the watershed of the Las Ceibas and Suaza rivers and will lead to the implementation of climate POMCA in various other watersheds by 2050.

Timeframe	Financing
One year	Estimated cost: COP 175,000,000 for each POMCA. Possible sources: USAID-SEI, CAM.

Barriers to implementation

Agreements in each river basin council to develop climate change POMCAS. Availability of personnel from CAM to define scenarios, coordination of actors to participate in workshops and availability of financial resources.

Indicators

Number of watershed with WEAP models and , of POMCAS with climate change scenarios, number of watershed councils consulted and involved and adaptation measure identified, prioritized and implemented.

Area of action 1.3 Financing Payment for Environmental Services (PES) schemes

PROBLEM	ACTIONS IN PLACE
Well-managed watersheds provide water. Watersheds are an option to generate PES schemes that contribute to maintenance and actions that appropriate the watershed by those who care for them and use the water. Therefore, it is necessary to create PES options that are able to generate these processes in the long term and that lead to the implementation of mitigation and adaptation measures that can be incorporated into planning instruments.	The Las Ceibas River basin is the starting point for PES schemes and can be replicated to other watersheds. This scheme already has financing secured for the next 20 years, with the participation of the Governor's Office, the Neiva mayor's office, the CAM and the Public Service Company. The financial scheme generates resources to buy land in the basin and to work with the peasants to develop more sustainable production and conservation models.

Objective

Promote financial schemes including payment for ecosystem services for each of the basins with POMCAS, in a participatory process with the actors that use and protect the water in each basin assuring its long term management.

Actors

CAM; mayor's offices' public service companies; Governor's Office of Huila and river basin councils.

Description

Each basin has different actors and options to finance its climate POMCAS. In each of the watershed basins financial schemes will be analyzed including PES schemes, including those who protect and use the water of the basin.

These schemes should have at least some of the following conditions:

Think of the long-term management of the basin; (ii) equitable distribution amongst the ones who protect the basin and the ones that use it; (iii) have efficient administrative entities, (iv) a participatory scheme to define the investments in the basin.

Timeframe	Financing
One year for the analysis. Indefinite time for 5-year revisions for the implementation of schemes.	Estimated cost: COP 80,000,000 (preparation of financial scheme for each basin) Possible sources of financing: CAM and various municipalities involved-water service companies; Governor's Office and private users of watersheds. International companies like USAID and TNC.

Barriers to implementation

Entities in each basin with sufficient financial resources as to support the financial schemes. Will of the entities to create a financial scheme. Lack of organized water councils able to manage the financial schemes.

Indicators

Number of financial schemes identified and implemented in watersheds

Area of action 1.4. Hydrogenation. Evaluation of the low potential of hydroelectricity in climate change scenarios

PROBLEM	ACTIONS IN PLACE
There is pressure on the development of hydroelectric power in the watershed that requires: revising the water available to generate energy (greater than or less than 10MV) in order to made energy decisions based on water supplies; assure ecological stability of the watershed and guarantee availability of the resource for the diverse activities in the department, taking into account climate scenarios and analyze the hydroelectric scenarios to supply the country and the international market.	Energy projects are planned at the national level. In Huila, the hidrolectric project of Betania has been in operation for 30 years and the Quimbo hydroelectric development is being developed. There are also hydroelectric projects of less than 20MV, that need the water permits from the CAM.

Objective

To understand and utilize the hydro modeling produced by WEAP (action area 1) to make decisions based on the feasibility of developing new hydroelectric projects in Huila.

Actors

CAM, ANLA, UPME, CREG

Description

The WEAP model should be comprehensible to the different regional stakeholders and should continue to model the watershed in order to make appropriate hydroelectric decisions.

Based on the model, CAM should be able to create a process to socialize the information with energy and environmental authorities in order to reach consensus for future national scale projects in Huila.

Timeframe	Financing
The WEAP model will be ready in 2015, as a decision planning tool thereafter.	Estimated cost: COP 30,000,000/year[83] Possible sources of financing: USAID-SEI (for scenarios and approval), CAM (for use and continuation of the model and to socialize results with decision-makers)

Barriers to implementation

Availability of personnel from CAM to understand and continue WEAP model.

Indicators

Guidelines carried out by CAM to give concessions, agreements with national authorities about hydro energy potential.

83 Equipment and personnel to maintain the WEAP system and a counterpart from the CAM.

AXIS 2. BIODIVERSITY AND ECOSYSTEM SERVICES

Current pressures on the department in terms of biodiversity and ecosystems lie in processes of deforestation, the expansion of agricultural boundaries, illegal extraction of biodiversity resources and systems of production with high impacts, as can be seen in the diagnosis of these systems. Furthermore, climate change will in turn alter the physical-ecological effects of species and their habitats, affecting their capacity to generate ecosystem services. Such changes lead one to consider strategies that guarantee the ecological stability of the department.

This axis seeks to develop actions that ensure the resilience of natural ecosystems in the face of human impact and climate change. The objective is to guarantee future goods and services that require sustainable development and human well-being in the region. Two encompassing groups of actions will be developed: those related to adaptation to protect ecosystems and biodiversity and their related services' and those that relate to mitigation of climate change impacts for conservation and to increase carbon capture of forests and woodlands.

The strategic ecosystems in Huila will be protected and will serve as providers of ecosystem services for the department and the rest of the country, while increasing the area of forests and biodiversity applying innovative systems and incentives so that communities can be their guardians.

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Activities to protect ecosystems are focused on vulnerability analyses, redesigning departmental strategies for biodiversity protection with an emphasis on adaptation, and developing priority actions for the most vulnerable ecosystems, particularly páramos and wetlands. Conservation activities for carbon reserves of wooded areas include the implementation of a department-wide system of carbon monitoring, the development of a strategy for REDD+ jurisdiction and the consolidation of voluntary conservation activities (CO2 Bank of community environmental services) and private natural reserves.

Area of action 2.1. Formulation and activation of a REDD+ jurisdictional strategy for the Department of Huila

PROBLEM	ACTIONS IN PLACE
Deforestation in the department has led to significant loss and fragmentation of habitats as well as substantial GHG emissions from land use change. Natural forests in the department currently encompass only 30% of the territory; of these 38% are catalogued as fragmented forests.	• The REDD+ pilot project in the Natural Regional Park of the "Puracé-Cueva de los Guácharos" corridor. • Evaluation of the potential implementation of a REDD+ program for the jurisdiction of the department (pre-feasibility) and advance of feasibility studies for its implementation. • Current actions in place by CAM to control deforestation. • System of protected areas in the department.

Objective
Reduction of the rates of deforestation and ecosystem fragmentation in the department of Huila as a strategy to protect ecosystem goods and services that they generate, through departmental political incentives and control schemes while guaranteeing priority mitigation of GHG emissions.

Actors
Directly responsible: CAM, CORMAGDALENA, ONF Andina, departmental government.
Other actors: local government, productive associations, FINAGRO, Ministry of Agriculture and Rural Development, Ministry of the Environment and Sustainable Development, Ministry of Mining and Energy, international cooperation agencies, private investors.

Description
The strategy is based on strengthening institutional and inter-sectoral relationships to manage the struggle against deforestation, relying on the participation and co-responsibility of public and private stakeholders in conservation efforts, with the goal that the protection of forests is perceived and assumed as a social obligation that benefits everyone.

Specific management actions of a department-wide REDD+

- Formulate the department-wide REDD+ project with participation of various actors.[84]
- Validate the department-wide REDD+ scheme with appropriate national authorities: MADS and IDEAM.
- Validate the project design document (PDD) with a certifiable international agency.
- Design and implement an institutional and community strategy required for the execution of the project.
- Secure sources of finance from cooperation agencies and through commercial channels of carbon credits.[85]
- Implementation of the project

Timeframe
Formulation: 1 year
Implementation: 20 years

Financing
Estimated cost of feasibility study: COP 270,000,000
Estimated cost of REDD+ project: to be determined
Possible source of financing: CAM Action Plan, CORMAGDALENA, French Fund for the Environment, international cooperation agencies, instruments to foster agricultural development of the Colombian State (technical assistance), ICR, credit, departmental governments, private investors, commercialization of carbon credits.

Barriers to implementation
- Limitations of financing the studies required for the design of the project (projection of deforestation models, design of REDD+ activities, monitoring of carbon reserves, elaboration and validation of project documents).
- Deficiencies in mechanisms of action and inter-institutional articulation in terms of interests in forest conservation.
- Lack of clarity about methodology of commercialization and value of carbon credits.
- Lack of clarity in the definition of the REDD+ Colombia strategy.

Indicators
- Approval of voluntary market formulation or national REDD+ mechanism.
- Baseline of forests and biodiversity.
- Five year monitor of forest coverage, evaluation of control of adverse social and economic impacts, adverse economic management indicators about investments and social activities developed, management indicators of investments and activities

84 Includes monitoring of carbon reserves in densities and methods required by the Voluntary Carbon Standard (VCS) and the design of REDD+ activities, which include: generating base lines and scenarios of deforestation in the department; analyzing the causes of deforestation and forest degradation, improving control and follow-up mechanisms; implementing PES mechanisms; direct technical rural assistance; promoting productive activities that do not use wood resources; strengthening departmental policies on environmental education; improving knowledge about land holdings; purchasing lands; natural or assisted means of restoring and regenerating natural habitats; improving forest management and reforestation efforts, taking into account the possible impacts of climate change on different types of forests.

85 This source of finance helps to control and supervise illegal deforestation and will serve as PES instrument, fostering sustainable agricultural development, investments in recuperation and protection of forests, activities that generate value for forests instead of producing wood, and gives credibility to institutions and communities in management of protected areas.

Area of action 2.2 Vulnerability studies of ecosystems under climate change scenarios

PROBLEM	ACTIONS IN PLACE
To date, the design and management of strategic ecosystems in the department have not been considered vulnerable to climate change. It is necessary, therefore, to evaluate ecosystem vulnerability, biodiversity and ecosystem services to ensure protection and to guarantee that the means to manage them are the best possible, given future climate scenarios. It may be possible to contribute to adaptation based on fundamental ecosystems for the well-being of people and to contribute to the competitiveness of the department. It is worth pointing out that at the national level, policies regarding biodiversity are being brought up to date and that regional plans for integrated management are needed. This means making Huila a pilot project and integrating proposed actions into the Plan.	• Management plans for protected areas. • Inventories of existing biologically diverse areas. • Bringing national policy on biodiversity up to date, including regional components.

Objective

To generate vulnerability studies of ecosystems and their services, under climate change scenarios, which serve to generate management recommendations.

Actors

Directly responsible: Instituto Humbolt, CAM, other research institutes
Other actors: UAESPNN, SIRAP, SIDAP, Ministry of the Environment and Sustainable Development.

Description

This strategy consists of analyzing the climate change vulnerability of ecosystems, as well as ecosystem services of Huila and to prioritize the places and areas of action for the implementation of effective adaptation responses.

This takes into consideration the following activities:

- Model the current and future distribution of the primary ecosystems of the department, incorporating climate change scenarios for 2050.
- Model the current and future distribution of priority species for the department, incorporating climate change scenarios for 2050.
- Model changes in ecosystem services (water and carbon).
- Analyze the adaptive capacity of institutions in charge of management and conservation in these realms.

Timeframe
18 months.

Financing

Estimated cost: COP 500,000,000
Possible sources of financing: CAM, Department, possible royalties, adaptation fund, USAID.

Barriers to implementation

- Deficit of information in the development of studies.
- Difficulty in estimating the scale in order to advance the analysis.

Indicators

- Models of change in distribution of ecosystems due to climate change.
- Areas prioritized to implement conservation and adaptation measures based on ecosystems.
- Ecosystems, species and ecosystem services evaluated in terms of sustainability in climate change.
- Evaluation of adaptive capacity of institutions.
- Integration of sensitivity analysis and adaptive capacity that lead to vulnerability and recommendations to increase resilience.

Area of action 2.3 Strengthening of departmental system of protected areas

PROBLEM	ACTIONS IN PLACE
The current system of protected areas does not encompass the existing variety of ecosystems in the department, nor does it adequately cover the extension of area. 45% of ecosystems continue to be unprotected and only 29% include sufficient areas declared under conservation to maintain viability of different forms of life. Furthermore, they are not appropriately grouped together to offer complete habitats. This reduces the effectiveness of areas of conservation to protect ecosystems and the services they provide. Additionally, as posed in area of action 2, these protected areas have not been selected based on an analysis of the vulnerability of their ecosystems with climate change projections. Therefore, they require strengthening the SIDAP based on a selection criteria for conservation. Furthermore, it is necessary to motivate the department, municipalities and private stakeholders to assure representation in the SIDAP, its adequate management and a vision based on the climate of the future.	• Inter Corporate Agreement for the Eco Region of the Colombian Massif. • PROMACISZO Project. • BIOMACIZO Project. • ECOANDINO Project for Sustainable Development. • Project for the Biological Corridor between the National Natural Park Puracé and the Guácharos Caves • SIRAP-MACIZO Agreement • Project for the Consolidation of the a regional development vision for the municipalities of the Massif subscribed to ASOMAC. • Subprogram of Integration of ecosystems and adaptation to climate change of the Colombian Massif. • Program for Forest Ranger Families. • GEF Project Mosaic Conservation. • REDD+ Project Biological Corridor of Guácharos-Puracé. • Program for legalizing rural property.

Objective

To consolidate the Departmental System of Protected Areas (SIDAP) based on future climate scenarios in such a way as to assure the design and management to maintain ecosystem services and to guarantee quality of life of people of Huila until the year 2050.

Actors

Directly responsible: PNN, SIDAP, Network of private natural reserves, CAM, Departmental Committee of Protected Areas.
Other actors: private enterprises, SIRAP Massif, department of Huila, municipalities, local committees of protected areas, productive associations.

Description

From the results of vulnerability analyses of ecosystems carried out to date:

- Revise the proficiency of the system of protected areas to respond to climate change
- Redesign the system of protected areas
- Obtain legal figures for the adequate protection of strategic ecosystems that are vulnerable to climate change
- Strengthen administrative and management schemes for areas acquired by the State in these ecosystems
- Strengthen the organizational development processes in strategic areas and reinforce and increase human capital to advance protective actions
- Revise management plans for current Protected Areas
- Design and implement a monitoring system for the implementation of management plans

Timeframe

Indefinite with five-year revisions.

Financing

Estimated cost: COP 200,000,000 per protected area.

Possible sources of financing: CAM, department, municipal aqueduct companies, Water company of Huila “Aguas del Huila”, municipalities through a 1% investment; Colombian National Natural Parks Unit, international cooperation agencies, regional science and technology funds.

Barriers to implementation

- High costs of the actions needed to guarantee representation of ecosystems.
- High percentage of territory in private holdings.
- Failures in acquisition schemes and administration of property under conservation.
- Low value of biodiversity as an environmental service.
- Increase in desertification process.

Indicators

- New areas declared for management.
- Mitigation and/or adaptation actions implemented in Natural Parks in the Department of Huila.
- Design of biological corridors taking into account impacts of climate change.

Area of action 2.4. Management of páramos and wetlands

PROBLEM	ACTIONS IN PLACE
The páramos are considered sources of water and only exist in five countries of the world (Peru, Ecuador, Colombia, Venezuela and Costa Rica); they are highly threatened due to climate change projections. Huila has 120,000 ha of páramo that must be delineated and protected; however, a large percent of wetlands (strategic ecosystems that regulate part of the water cycle and contribute to the ecological stability of the region) are not included in the System of Protected Areas. Furthermore, there is pressure on these ecosystems that require special attention, such as, for example, protection against invasions of páramos for agricultural expansion, or the increase in urban and rural zones that threaten strategic wetlands. Additionally, Huila has been subject to pressure from the armed conflict, in particular in high risk areas of the mountain corridor that form the boundary to the foothills leading into the Amazon basin. In a potential post-conflict context, the sustainable management of these areas becomes a strategic factor and requires commitment from the political leaders and from the general population of Huila The vision is to ensure water resources for Huila and consider the climate scenarios of the future and management of páramos and wetlands.	• Vulnerability and impact studies of climate change on páramo and wetland ecosystems in the Andean highlands of Colombia. • Execution of management and zoning plans for 120,000 ha of páramo ecosystems. • Implementation of the management and zoning plans for 4,145 ha of wetland ecosystems. • Inter-institutional Agreement between the Instituto Humbolt and CAM for the delineation of the Miraflores páramo. • IDEAM program for glaciers.

Objective

To guarantee the delineation, planning, management of adaptation of páramos and wetlands, maintaining the supply of ecosystem services that support the development of the department of Huila and the country.

Actors

Directly responsible: Instituto Humbolt, CAM, Governor's Office of Huila, municipalities, Ministry of the Environment and Sustainable Development, Colombian National Natural Parks Unit.
Other actors: Owners of private reserves, Municipal Aqueduct Companies.

Description

The strategy is oriented to consolidate mechanisms of implementation to maintain resilience and reduce vulnerability of páramos and wetlands through the development of knowledg, for conservation, restoration and sustainable use.

The strategy contemplates the following activities:

- Delimit existing páramos and wetlands in the Department of Huila
- Bring management plans for páramos and wetlands up to date according to these delimitations and make new plans where necessary
- Guarantee the implementation of strategies and measures for management plans.
- Generate a program to raise consciousness about the importance of páramos and wetlands for Huila

Timeframe

Delimitation of páramos and wetlands: 2 years
Bring management plans up to date and develop new plans: 4 years
Implementation: 5 years with 5-year revision

Financing

Estimated cost: To be determined
Possible sources of financing: Instituto Humbolt with resources from royalties, CAM, Department, municipal aqueduct companies, Aguas del Huila, municipalities from a 1% investment, Colombian National Natural Parks Unit, international cooperation agencies, regional funds.

Barriers to implementation

- Conflicts for soil use.
- High costs of actions deemed necessary to guarantee conservation of páramos and wetlands.
- High percentage of the territory in private holdings.
- Failures in acquisition schemes and administration of properties under conservation.
- Lack of control mechanisms for the protection for ecosystems.
- Lack of clarity of responsibility of management plans for these areas.

Indicators

- Number of páramos and wetlands delimited.
- Number of páramos and wetlands with management plans.
- Management plans for páramos and wetlands in execution and incorporated into other planning and zoning instruments in the territory.

Area of action 2.5. CO2 Bank for community environmental services

PROBLEM	ACTIONS IN PLACE
The region of Huila has approximately 592,062 hectares of forest coverage that stores nearly 293 million tons of CO_2. The increased pressure on natural forests leads, in many cases, to greater profit to cut down forests and expand agricultural boundaries than to conserve them. For this reason, the challenge is to make significant investments that conserve forest ecosystems and thereby preserve environmental services such as the storage of CO_2 in the region. Actions have already been set in motion with the goal of controlling deforestation and conserving forest ecosystems in Huila. A REDD+ scheme is being proposed for the department. Nevertheless, while this scheme is advancing and as results are becoming evident, it is necessary to take early and cost-effective actions that conserve and restore forest ecosystems and improve the quality of life of local communities.	• REDD+ Guácharos-Puracé Project • PES scheme in the Las Ceibas River basin

Objective

To develop a compensation system for rural populations to conserve and restore natural forests in the regions through a special environmental fund (local and regional), financed voluntarily by companies and individuals that are willing to compensate for the generation of GHG emissions in their daily activities and in their productive processes.

Actors

Directly responsible: CAM, Bancolombia, companies, civil society and rural people.

Description

- Creation of an environmental fund that facilitates and fosters a voluntary compensation mechanism for GHG emissions for companies and citizens.
- Quantification of carbon footprints for companies and citizens and willingness to participate in the compensation fund.
- Financial resources from the fund for rural people who are beneficiaries and who have natural forest on their property.
- Monitoring of vegetation coverage that allows for the purchase of areas with low rates of conservation, from a baseline to a "current status" with the aim of detecting and preventing decreases of original coverage through the implementation of timely corrective and protective actions.
- Corroborate conservation and protection activities where property owners have committed to participate through sight visits to verify and validate.

Timeframe	Financing
Design and creation of a fund: 1 year Implementation: On-going	Estimated cost: COP 500,000,000 for the initial creation of the fund. Possible sources of financing: Ecopetrol and voluntary support from other businesses and individuals.

Barriers to implementation

Depends on the number of companies and individuals who believe in this mechanism and give it value, as well as generation of a cultural shift among rural people and business owners to create the will and confidence to develop this mechanism.

Indicators

- Number of companies associated, individuals who participate, number of hectares and families compensated and benefitting.

AXIS 3. AGRICULTURAL PRODUCTION AND FOOD SECURITY

The areas of action proposed for the axis of Agriculture and Food Security are focused on information systems that help in decision making in the overall sector and in the two most important sub-sectors in the department, which are coffee and livestock. The goal is to generate adaptation and mitigation measures that stimulate the productive sector to transform into a climate-smart one.

> The inhabitants of Huila will have farming systems adapted to the climate of the future, ensuring their food security; 100% of their farms will have implemented agroforestry and silvopastoral systems, ranking Huila as the department with the highest sustainable agriculture GDP of Colombia.
>
> **VISION 2050**

An important element in the preparation for climate change is access to climate information to support decision-making processes in agriculture. While efforts exist to expand the network of weather stations in the department, the Secretary of Agriculture of the Governor's Office, with the support of CAM, is analyzing information gaps for priority crops and development activities in order to overcome them (Area of action 1). Another important element in preparing the sector for climate change is to understand its vulnerability. During the next few years relevant entities will be trained, strengthening their vulnerability analysis, monitoring and management capacity for different agricultural commodities (area of action 2).

Climate change strategies for agriculture and food security seek to promote good practices in climate-smart agriculture, beginning with coffee and livestock (area of action 3), including development of agro forest and forest pasture systems and the promotion of crops (and varieties) that are more resilient to climate change variations. The potential of agriculture is recognized for mitigating climate change through carbon capturing in agroforestry and in soils, for reducing greenhouse gas emissions such as nitrous oxide (due to overuse of agrochemicals) and methane (primarily in livestock production). To optimize mitigation efforts in the agriculture and food security sector, ecological cycles, agro forestry systems for coffee crops, forest pastures for livestock, improved measures for livestock feeding and more effective and efficient agrochemical uses will be promoted.

A system of incentives is needed to foster changes in production that are climate smart and to overcome initial costs of transforming the sector (area of action 4). It is worth mentioning that some incentives are proposed in the axis about water use, where it is suggested to analyze the feasibility of establishing novel systems of financial transfers that recognize the value of hydro services provided by forests, as well as good practices in agriculture and the conservation and restoration of priority ecosystems.

The agricultural sector is influenced in the public sphere by the departmental Secretary of Agriculture, and depends on other stakeholders such as the Federation of Coffee Growers, the Society of Cattle Producers and other trade associations and private stakeholders. Therefore, the success of this area of action will depend on the positions that these organizations take.

Area of action 3.1. Climate information

PROBLEM	ACTIONS IN PLACE
Huila lacks an integrated information system of climatology for the agro sector to support decisions that producers make as they manage their crops in the face of climate change.	The starting point for this strategy is the Plan for climate-smart coffee production of the Federation of Coffee Growers that includes improvements in the meteorological network and new weather stations in different regions of the department.

Objective

To develop a weather network to generate information relevant to decision making in the sector, increasing efficiency in production and foreseeing climate events in order to plan the agricultural calendar, to plant greater varieties of crops and to direct action to efficiently control plagues and diseases.

Actors

Directly responsible: Secretary of Agriculture of the Governor's Office, Federation of Coffee Growers and CEICAFE, RICCLISA network, IDEAM and private sector weather networks already in place.
Other actors: CAM, universities.

Description

Activities in this area of action are based on expanding the network of existing weather stations (IDEAM and recognized sectors) and complementing research about the relationship between crops and climate in selected farms. For this action, a network of at least one weather station per municipality will be set up with sets of climate sensors in particular fields of important annual crops (rice, beans, horticulture crops, etc.). Furthermore, a digital network linked to cellular telephone networks will be established to alert farmers about abnormal climate situations, with recommendations of possible corrective action for agro systems.

Specific actions:

- Form an inter-institutional committee to prepare a proposal for implementation and analyze the type of information required by producers who are most exposed to climate (initially, it is suggested to work with coffee, rice and bean producers).
- Analyze the kind of information that producers require to improve their decision-making processes, including the way in which they would prefer to receive information.
- Develop a technical and financial proposal, including existing models, such as the IDEAM climate APP.
- Validate the proposal of the Governor's Office in terms of financial feasibility through existing external sources as well as projects that already are financed with resources, such as the weather station network for coffee growers that is financed through royalties.
- Determine which institution will develop and manage weather stations in the department, including the necessary human resources.
- Assure that the network is used appropriately by all users.

Timeframe	Financing
Installation of systems: three years Indefinite application with five year revisions	Estimated cost: COP 5,000,000,000 Possible sources of financing: Royalties, adaptation fund, private (sectorial) funds and funds from bilateral agreements for adaptation to climate change.

Barriers to implementation

- Financial limitations
- Initially, local data is insufficient to make precise projections and there is a risk of making incorrect recommendations, resulting in loss of confidence among farmers.

Indicators

- Number of weather stations set up in the department
- Central system functioning
- Number of users who apply APP

Area of action 3.2. Vulnerability analysis of crops

PROBLEM	ACTIONS IN PLACE
Each agricultural species present its own sensitivities and adaptive capacities to climate change; these require better understanding to effectively manage crops.	The CIAT developed an initial analysis that was briefly interpreted in the first part of this plan, and which was presented in greater detail by CIAT to the Ministry of Agriculture. Likewise, agriculture sectors like coffee have done more specific vulnerability analyses for their own crops.

Objective

To develop a vulnerability analysis of the primary crops for Huila to increase resilience and resistance and the potential response of producers to climate change, and thereby improve their capacity to take advantage of positive impacts.

Actors

Directly responsible: Secretary of Agriculture of the Governor's Office, RICLICSA and productive sectors.
Other actors: Universities, Ministry of Agriculture and research centers like CIAT, ICA, CORPOICA and CATIE.

Description

Taking into account the sensitivities of crop and species selection, an analysis of the possible impacts of climate change will be made. An analysis of the adaptive capacity of families involved in cultivation or management based on surveys and secondary sources of information (e.g., agriculture census, registers in health centers, etc.) will be conducted. Once a baseline and methodology for data collection are established a monitoring system will be set up to revise the state of vulnerability every five years and recommend adjustments in existing strategies.

Specific actions:

- Identify crops subject to analysis.
- Analyze potential impacts, among them, aptitude of lands.
- Survey producers and extension workers at the municipal level.
- Identify primary factors of sensitivity and adaptive capacity where the department may have an impact.
- Propose department wide strategies with the goal of improving conditions that foster adaptive capacities of producers and reduce the sensitivity of crops, species and agriculture systems.

Timeframe	Financing
One year with five year updates.	Estimated cost: COP 300,000,000 Possible sources of financing: royalties, adaptation fund, private (sectorial) funds and funds from bilateral agreements for climate change adaptation.

Barriers to implementation

Limitation of financing and consensus about priority of crops and species.

Indicators

Vulnerability studies implemented, number of surveys carried out, number of trade associations that use results of the analyses in their strategic planning.

Area of action 3.3. Good practices in climate-smart livestock

PROBLEM	ACTIONS IN PLACE
Forest pasturing has proven to be very important for increasing efficiency while generating better environmental and social conditions. The World Bank estimates that increasing forest pasturing is one of the most important adaptation and mitigation strategies for climate change. While the Huila Society of Cattle Farmers has made advances in sustainable livestock, it has only converted a small portion of total livestock area in Huila. The goal is to expand this practice to the entire department beginning with arid and semi-arid regions. Such practices help cattle adapt to higher temperatures by giving them shade and improving their feed, while improving soil management, ecosystems, the availability of water and erosion.	Prototypes of forest pasture farms belonging to the Huila Committee of Cattle Farmers.

Objective

To develop a large program for sustainable livestock, increasing the application of good practices for livestock management in the department, beginning in arid and semi-arid regions.

Actors

Directly responsible: Governor's Office, producers, The cattle Ranging Committee of Huila, SENA, FEDEGAN.
Other actors: universities, CIPAV, CIAT, CAM, mayors, CATIE.

Description

This action will begin with a systematization of experiences and lessons from livestock farmers in areas of dry tropical forests in the municipalities of Baraya, Neiva, Palermo, Yaguará and Villavieja. Through this area of action the producers with positive experiences will be identified and will constitute a basis of the formation of Field Schools (Escuelas de Campo – ECA) that will disseminate lessons learned.
Simultaneously, a vulnerability study for livestock will be carried out to identify the areas, systems and families that are most vulnerable and the factors that could contribute to reducing vulnerability. Based on this analysis, indicators will be defined to monitor and evaluate the benefits of good practices in terms of production, adaptation and mitigation.

Specific actions:

- Analyze the vulnerability of livestock and families of livestock.
- Identify the primary factors of sensitivity and adaptive capacity.
- Establish, in a participatory manner, existing practices that help reduce vulnerability.
- Systematize the experiences of best practices, including strengths and weaknesses
- Form ECAs, implemented on farms that have good practices and coordination them through the SENA.
- Prepare reference materials for ECAs.
- Select, in a participatory manner, the indicators to monitor the effectiveness and efficiency of good practices; elaborate and validate protocol for their measurement.
- Train people in technical and supervisory roles to monitor progress.
- It will be necessary to begin one of the following actions in order to formulate and implement this project:
- Approve a proposal with the Governor's Office for its financing with funds from royalties.
- Contract a consortium for implementation.
- Define the area of intervention and socialize the proposal with livestock farmers.

Timeframe

Five years for 10% of livestock farms
Indefinite with five year revisions
Increment in proportion to following years

Financing

Estimated cost: COP 3,000,000,000 in addition to counterpart from producers.
Possible sources of financing: royalties, with the possibility of generating additional funds through special international programs, such as certification of best practices and carbon capture funds. Likewise, foster the entry of GEF forest pastures for Huila if additional financing is obtained by the Colombian government.

Barriers to implementation

- Financial limitations
- Consensus about best practices, in cases where these differ from conventional practices and require an initial investment
- Cultural barriers to change

Indicators

- Number of hectares converted, production per hectare, measurement of Carbon Footprint

Area of action 3.4. Good practices for climate-smart coffee production

PROBLEM	ACTIONS IN PLACE
The coffee sector has changed practices over time from shade grown coffee varieties to open areas. This change has affected ecosystem management and water generation and has led to new problems with rust (a fungus) and plagues. Most recently, and given the consequences of climate change, the Federation for Coffee Growers, together with CENICAFE, have developed a project at the national level, and specifically for Huila as a major producer of coffee beans, to reverse this tendency and return to shade grown coffee, a variety that is more adaptable to the climate of the future. Coffee cultivation requires a holistic focus to become strong in the face of climate change and to seek opportunities to mitigate climate change. The proposal is to use best practices to reduce the primary problems that coffee crops face: susceptibility to plagues and diseases, quality of the plants, contamination of water and contributions to emissions from deforestation.	The coffee sector has ample knowledge about the performance of its crops in the face of climate change and about possible actions to reduce negative effects or take advantage of opportunities posed by mitigation efforts. CENICAFE is developing a project directed at the Fund for Royalties which projects adequate changes for the type of crops and the manners of production and management.

Objective

To increase resilience and resistance of coffee production in the face of impacts of climate change, and to improve farmer's capacity to take advantage of positive impacts.

Actors

Directly responsible: Federation of Coffee Growers through the Departmental Committee, CENICAFE and private producers.
Other actors: Secretary of Agriculture of the Governor's Office, CAM.

Description

The project suggests a variety of specific actions that strengthen the competitiveness of climate-smart coffee production. Specifically for Huila, the project proposes generating a change, monitoring it and taking advantage of best practices of CENICAFE to bring about transformations and ensure that coffee cultivations are climate compatible. In the future, being able to measure the carbon footprint will give a competitive advantage to coffee growers who export, for whom mitigation measures for the sector will be based on supporting different producers of a low emissions crop.
Specific actions

- Implement a network of climate information for coffee growers, such as conditions that bring about outbreaks of fungi and insects, but that can be controlled through management (fertilization, planning of harvest, etc.).
- Renew plans with the goal of incorporating varieties that are more resilient against fungi and more climate tolerant.
- Implement ECAs for coffee growers.
- Improve coffee producing systems by incorporating shade trees in optimal densities that provide services of carbon capture and lower average temperatures among plants, but that do not host outbreaks of disease and plagues (managed shade).
- Optimize the management of water waste.
- Generate corridors of conservation between farms, in accordance with the axis on biodiversity and ecosystem services.
- Begin to measure the carbon footprint using baseline information.

Timeframe	Financing
Five years for 90% conversion of coffee farms	Estimated cost: to be determined. Possible sources of financing: Resources from the coffee sector, royalties, adaptation and mitigation fund, private (sectorial) investors and funds from bilateral agreement for climate change.

Barriers to implementation

- Financial limitation.
- Cost of implementation of new practices for producers.

Indicators

- Number of hectares cultivated in shade coffee.
- Measurement and reduction of carbon footprint.
- Number of ecological beneficiaries.

Area of action 3.5. Tools to provide incentives to use best practices

PROBLEM	ACTIONS IN PLACE
For best practices to be applied in agriculture, incentives are needed in terms of technology, economics, legal and financial and other areas. Currently, the sector has a limited number of incentives in place to convert conventional practices into more efficient and climate compatible practices. Both the CAM and the Governor's Office are willing to create conditions that lead to good agricultural practices. Furthermore, they are currently in a position to exercise control mechanisms and provide incentives for converting. There are many sectors in which producers would like to learn about better practices that are aligned with climate impacts.	• Extension services of each agricultural sector exist. • There are also technology parks established by the SENA.

Objective

To create plans, programs and tools for the different agricultural and fish sectors of Huila, to promote incentives that foster the private sector to implement best practices in agriculture and fisheries that are considered to have possible impacts on climate change.

Actors

Directly responsible: agriculture and fishing sectors, Governor's Office, CAM, municipalities.
Other actors: universities, SENA.

Description

CAM applies an environmental norm that attends to the regulation of water concession, the control of deforestation and sound environmental management of land, norms that are developed with the goal of protecting the environment. However, they also help reduce environmental and human sensitivity against potential climate change impacts. It is important to motivate producers to recognize these functions or regulations and to stimulate them to comply with norms and regulations.
Among the proposed incentives are those that create low cost financing, certifications, economic stimuli, benefits from the CO2 Bank (area 25) and payment for environmental services.

Regulatory actions:

- Determine the primary barriers for the sector with the goal of changing current behaviors.
- Propose pragmatic regulatory schemes.
- Foster actions that have technical assistance.
- Generate schemes of technical assistance from trade associations to incentivize good practices.
- Create a fund for good climate-smart practices.
- Establish a fund with mechanisms (fiduciary type) and rules of adjudication that include monitoring and follow-up. Such funds may include financial transfers that recognize the value of water services provided by forests, both in terms of good practices, as well as conservation and restoration of priority ecosystems.

Timeframe

Indefinite with five year revisions.

Financing

Cost: to be determined.
Possible sources of financing: a climate-smart fund will be created with initial resources from the interested sectors; the fund will be expanded with resources from CAM, royalties, the fund for adaptation and mitigation, private (sectorial) investors, and funds from bilateral climate change agreements.

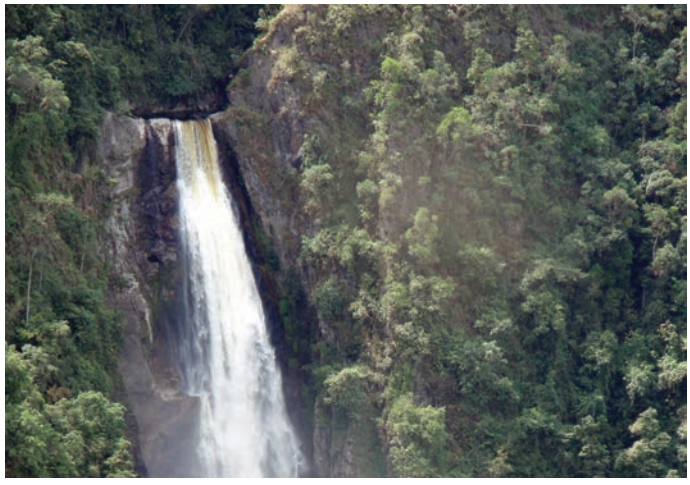
Barriers to implementation

- Financial limitations.
- Knowledge about good practices (technology transfer).
- Cost of implementation of new practices for producers.

Indicators

- Indirectly, by monitoring the factors of vulnerability.

AXIS 4. ENERGY RESOURCES



Efficient use of energy is a key factor to reduce GHG emissions and to improve economic efficiency. In climate change scenarios, efficient energy use and unconventional sources of energy are necessary to assure the diversification of the department-wide energy matrix, to have energy reach remote unconnected areas and to respond to the challenges of the future.

Furthermore, there are a large number of homes in Huila that depend on firewood for cooking, increasing deforestation. Paradoxically, the department produces an important quantity of biomass from the waste from coffee, rice and fruit crops, which could be used as second and third generation energy options, becoming a pioneer and innovative source for energy.

This strategic area seeks to promote the rational and efficient use of energy and unconventional sources of energy, including biomass, in such a that contributes to guaranteed energy supplies, competitiveness of the department and the promotion of sustainable energy.

Likewise, it seeks to analyze the information generated in the axis of water through the WEAP model so that it may contribute to decision-making on hydroelectric dams in the department.

Huila will have an appropriate balance between hydropower and alternative energy sources, including biomass, which will make it an efficient and competitive department, pioneer in energy savings and efficient energy use, based on educational programs with its inhabitants.

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Area of action 4.1. Promotion of energy efficiency

PROBLEM	ACTIONS IN PLACE
The cost of industrial and domestic energy in the department is another factor that has implications for competitiveness and speed of economic growth. Therefore, assuring energy efficiency is one of the biggest challenges for the department as well as for the global economy. Programs that reduce energy consumption contribute to meeting economic and environmental goals in three ways: through economic savings, energy reserves and limiting GHG emissions.	• National Action Plan PROURE 2010-2015. • Commercial options for lighting, refrigeration and alternative energy.

Objective

To reduce energy demand and improve energy efficiency among consumers, including in public buildings, commercial installations and industries.

Actors

Directly responsible: regional and local governments (Secretary of Roads and Infrastructure of Huila, municipal mayors),Electric Company of Huila, energy producers.
Other actors: CAM, UPME, CAEM and civil society.

Description

The measures planned for this area have the goal of fostering efficient energy as established in the Action Plan PROURE 2010-2015.

- Improve energy efficiency for the residential sector:
  - Substitution of light bulb to incandescent lighting.
  - Renewal of household appliances such as refrigerators, air conditioners and others (urban areas).
  - Replace inefficient electric burners with more efficient ones and substitute wood or carbon burning sources with cleaner sources (rural areas).
- Improve energy efficiency in the commercial, industrial and public sector:
  - Inform users about technologies and good practices in lighting systems, refrigeration and air conditioning in the commercial sector through communication and diffusion of activities.
  - Develop a pilot project that applies the concept of energy efficiency in commercial, industrial and public buildings.
- Convert public lighting to efficient technology.

Timeframe

Two years to raise awareness about the PROURE program in the department
Ongoing with five year revisions

Financing

Estimated cost: COP 200,000,000 to raise awareness and generate a baseline to measure efficiency and emissions for energy consumption.
Possible sources of financing: co-financing with resources from the nation (UPME), municipalities and the private sector.
Potential donors such as IDB and USAID through energy efficiency programs.

Barriers to implementation

- Lack of regulatory policies.
- Difficulties in financing.
- Cultural barriers.

Indicators

- Decrease in consumption of electric energy in the industrial, residential and public sectors.
- Reduced emissions: GHG inventory.
- Generation of economic savings.

Area of action 4.2. Promotion of sources of renewable energy in unconnected urban and rural areas

PROBLEM	ACTIONS IN PLACE
Huila has great potential to generate alternative energy that is currently being wasted, because a significant number of homes are not connected to the energy network and many use firewood for cooking. Energy options that are cost-effective are needed that create opportunities for these communities and which, at the same time, generate efficiencies for populations that can take advantage of options like solar power, hydroelectricity and biomass, which is abundant if the department transforms bioenergy.	• Energy Action Plan for the department • Techno parks of the SENA

Objective

To promote the appropriation and application of alternative energy sources in Huila's municipalities, reducing emissions, diversifying the matrix of energy and preparing for climate-compatible energy development.

Actors

Directly responsible: regional and local governments (Secretary of Highways and Infrastructure of Huila) municipal mayors, SENA, UPME.
Other actors: Institute of Planning and Promotion of Energy Solutions for Interconnected areas (IPSE), international programs for alternative energy (USAID, IDB, Dutch international cooperation and others), federations and agricultural trade association in general, alternative energy companies, CAM.

Description

Elaborate municipal plans for alternative energy:
• Research in the field with the goal of gaining information about potential alternative energy sources for each of the 37 municipalities.
• Create a map of potential renewable energy in the territory.
• Construct a map of potential biomass energy sources in the territory.
• Define Alternative Municipal Energy Plans and determine goals for production of different types of alternative energy.
• Create an integral management plan for alternative energy for the department.

Capture financial resources:
• Create business plans for pilot projects.
• Assist municipalities in the search for sources of funding.

Training, awareness building and dissemination:
- Train and qualify experts in alternative energy (together with the transversal axis on training).
- Develop activities to disseminate information with regional agencies and communications media.
- Carry out educational campaigns about alternative energy options in conjunction with educational institutions (high schools, technical and professional schools).

Timeframe

- Design of municipal plans and departmental strategies: 3 years
- Implementation: ongoing, with five year revisions

Financing

Estimated cost for design of plans COP 500,000,000.
Implementation: to be determined.
Possible sources of financing: national, departmental, and local government, private sector, international sources.

Barriers to implementation

- National Regulatory Framework.
- Costs of technologies are superior to conventional technologies.
- Cultural resistance.

Indicators

- Number of municipal plans designed.
- Pilot projects implemented.
- Savings in energy bills.

Area of action 4.3. Regulation of hydro electric energy based on information of potential

PROBLEM	ACTIONS IN PLACE
Huila has been the subject of studies and home to the construction of large hydroelectric projects such as Quimbo and Betania, due to its water supply and relation to the Magdalena River. These national-scale projects have generated controversy because of their environmental impact, including ecological impacts and impact on the water systems of Huila. At the same time, there is growing pressure to construct small central stations of 20,000 MV that may have impacts on smaller water basins. In this context, the water axis of this plan proposes developing information on the water potential of the department to gauge potential hydroelectric energy supplies. With such information, national authorities should be able to develop policies around the future hydropower of the department.	• The WEAP Model in construction to determine potential hydroelectric energy • National Energy Plan • Environmental Licenses for Quimbo and Betania • Environmental License for projects smaller than 20,000 MV

Objective

To generate inputs for guidelines of potential hydroelectric energy for the department that support decision making about proposed projects in Huila.

Actors

Directly responsible: CAM and ANLA of MADS, UPME, CREG.
Other actors: Civil society.

Description

- Understand the results of the WEAP model to generate hydroelectric energy for the department, including the potential of generating scenarios.
- Revise current and future real potential of developing new hydroelectric dams.
- Revise approved concessions and their impact on water resources in light of climate change.
- Provide input for the guidelines on potential hydroelectric energy that inform decisions about concessions.

Timeframe	Financing
UOne year after the delivery of the WEAP model for hydroelectric energy (axis 1). Use of the model and guidelines: ongoing with five year revisions.	Estimated cost: COP 200,000,000 to generate guidelines. Possible sources of financing: co-financing with resources form the nation, CAM. Potential donors: IDB and USAID.

Barriers to implementation

- Regulatory policies that do not take into account regional studies and a scheme of decision making to expand electrical energy nationally.

Indicators

- WEAP Hydro Model incorporated in CAM for decision making.
- Guidelines for potential hydroelectric energy for Huila developed and functioning for decision making in terms of new generation of energy.

AXIS 5. RESILIENT ENVIRONMENTS

The Huila 2050 Action Plan is centered around people. The population of Huila must adapt to confront the challenges of climate change and to take advantage of future opportunities, using planning beginning today in a participatory manner to foster competitive and sustainable development in their department.

Understanding people and the circumstances in which they live requires planning at the municipal, town, city, neighborhood and rural levels. To contribute to this process, the Plan has undertaken vulnerability analyses of each of the municipalities of the department to create a vision for adapting and developing in a climate-smart manner, from the national, departmental and municipal levels. The analysis presents relevant information so that mayors and the populations they represent can be informed and can create their own development plans, thereby improving quality of life. In this context, the human axis is centered on understanding how to become resilient, lower emissions in cities and help municipalities understand their degree of vulnerability, so that people can choose to develop climate-compatible models and so that rural people be considered as the basis of any effort. Such efforts at the local level are scalable to the rest of the department through innovative and concrete actions that improve the quality of life of the people of Huila today and in the future.

All municipalities of Huila will have implemented climate compatible development plans, generating innovative examples of cities, towns, neighborhoods and “veredas” adapted to the future climate, with healthy people who will have adapted their lifestyle to the changing climate.

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In each of these territorial dimensions there are different challenges: construction of adapted and resistant housing; development of efficient, low emissions transportation; respect for the ecological structure of surrounding areas to ensure water supplies, clean air and land for the future; assurance that there are green areas and corridors to generate quality of life and opportunities to promote tourism, and define these areas in Territorial Zoning Plans and development plans in order to foster such guidelines in the Huila Action Plan.

Furthermore, this axis proposes actions in the area of health with two priorities: prevention of vector-borne diseases and safeguarding against increasing heat waves. Both aspects will be compounded by temperature rise and must be addressed to ensure to quality of life for the inhabitants of the department.

The human axis is inherent in the Plan because the survival of people depends on water, ecosystems (and the biodiversity they provide), agriculture, food security and energy to drive industries. Furthermore, this axis includes a temporal dimension that begins with the work carried out in pioneering cities in terms of intelligent climate planning, and seeks to reach all cities within the next 10 years. Finally, for the implementation of actions that are proposed, it is important to understand that this axis demonstrates the inter-connected nature of the transversal elements, such as territorial zoning and planning and the inclusion of climate change instruments, education and training, science and technology and financing.

Area of action 5.1. Convert Neiva into a climate-smart city that is resilient to climate change

PROBLEM	ACTIONS IN PLACE
Neiva is a city with approximately 382,000 inhabitants, and experiences continuous economic and urban growth. It is located on the western bank of the Magdalena River and has an average peak temperature of 37° C. Las Ceibas river is the only source of fresh water for the urban center, and for this reason, its viability as a water source depends on protection of this ecosystem. In the vulnerability analysis for Huila, Neiva has a medium level of vulnerability; nevertheless, an analysis of the variation of vulnerability shows indicators with higher risks, such as use of water, unequal land distribution, low investment in risk management and low levels of representation of ecosystems and wooded areas. Additionally, an analysis of emissions in the department shows two important issues: land-use change and transportation. Given the relative importance of Neiva in the context of the department, it is assumed that these two sources of emissions will be subject to mitigation programs in the city. Neiva aspires to apply the necessary measures to adapt to the future climate and to continue to be competitive, sustainable and to lower emissions. In this context, the city hopes to become resilient with an integral vision on transportation, energy and ecological structure, with stable sources of water, climate compatible housing and healthy surroundings.	• Implementation of the Territorial Zoning Plan for the Las Ceibas river. • Strategic System of Public Transportation of Neiva SETP. • Ten Year Plan for Public Health. • Micro Acclimatization Proposal for the urban POT. • Study of Threats, Vulnerability and Risks (AVR for its Spanish acronym). • Las Ceibas Ronda River Park project.

Objective

Promote Neiva as a city with low emissions that is climate resilient and competitive

Actors

Governor's Office of Huila, Mayor's Office of Neiva, Corporation of Regional Autonomy of the Upper Magdalena, Chamber of Commerce, civil society.

Description

The municipality of Neiva should promote an AVR study and understand the dimensions of municipal vulnerability analysis that are generated as part of the Huila 2050 framework. According to this combined analysis, Neiva should begin a plan to confront climate change with concrete mitigation and adaptation measures that lead it to become a climate-smart city. This means thinking about resilience, climate compatible development and the prospect of future competitiveness, with investments that are cost-effective and begin immediately.

In this context, Neiva should formulate a climate plan that includes the following actions:

- Carry out a study in 2014 that includes current risks, threats and vulnerabilities as part of a vision for responding to the climate of the future.
- Present the vulnerability study that was done for the Action Plan for Neiva and adhere to adaptation and mitigation measures.
- Measure GHG emissions for the city and define a baseline.
- Integrate issues such as housing, transportation, waste management, water management, and healthy environments.
- Implement early action that can be integrated into the SETP initiatives and the guidelines of the POT for micro-acclimatization of the urban area, which in turn should be included in the design of the plan to guarantee continuity.
- Formulate and implement a public environmental policy that assures development of the program and gradual implementation.

Timeframe	Financing
Development of vulnerability and study of carbon emissions: one year Development of climate plan: one year Implementation of plan: ongoing with five year revisions	Development of plan: COP 1,200,000,000 Implementation of early actions: to be determined Implementation: to be determined Possible sources of financing: municipal resources, government, possible donors (USAID and others)

Barriers to implementation

- Lack of continuity with change of mayors.
- Scarce resources for implementation.
- Lack of inter-sectoral and institutional articulation.

PROBLEM	ACTIONS IN PLACE

Indicators

- Municipal agreements for development of climate plan.
- Development and analysis of vulnerability with future scenarios.
- Climate change plan for Neiva fully developed.
- Number of early actions implemented.
- Number of measures that are financed and being carried out.

Area of action 5.2. Foster a municipal climate smart model with small towns and settlements

PROBLEM	ACTIONS IN PLACE
There is little analysis of climate change at the municipal level in vulnerable departments. In the case of the Huila 2050 Action Plan, a vulnerability analysis has been done for 37 municipalities based on indicators of different components of vulnerability and on four dimension of adaptive capacity. The results of this analysis indicate that the challenges are different for each municipality; some experience greater degrees of vulnerability and show critical values in some criteria. However, municipal majors do not have climate change as part of their priorities. The objective of these analyses is to provide support to municipal development plans, a novel new topic for mayors and one that becomes a challenge to their own management, assuring their competitiveness and quality of life.	• Vulnerability analysis of 37 municipalities in Huila.

Objective

Generate a climate-smart municipal model that integrates issues of planning, both in the urban (towns and cities) and rural contexts.

Actors

Municipality selected, Governor's Office, CAM and other actors.

Description

The vulnerability study of the municipality will give a better appreciation of the different aspects of life within a municipality that are each subject to climate changes in the future.

One of the key aspects in the process of adaptation and reducing risks from climate events is the degree of political will and technical support, from mayors. city councils and relevant actors from the public and private spheres. For these reasons, a municipal committee for climate change will be formed that will develop actions for a climate-smart municipality.

Once the committee is formed, an analysis of vulnerability variables of the municipality and areas of action in three dimensions will be proposed. The political dimension, to ensure the incorporation of climate change in municipal development plans, as well as the Territorial zoning plan (POT), and municipal zoning as needed.

The city/town dimension, through which the climate plan for the capital city will be generated, linking it to the rest of the city jurisdiction. Climate adaptability criteria will be identified for six proposed issues:

- *Urbanisms and mobility*
- *Planning of natural, green spaces*
- *Sustainable and bio-climatic construction*
- *Energy efficiency and savings*
- *Waste management*
- *Citizen participation*

PROBLEM	ACTIONS IN PLACE

This plan will be developed in a participatory manner with a variety of stakeholders.

The rural dimension, which will be developed at the pilot project level with some of the vulnerable settlements on the outskirts of the urban center with populations that are open to understanding climate and sustainability and generating climate-smart models for their community. This dimension will take into account the ecological structure and landscape, food security, water management, conservation, waste management, energy uses, housing and adaptive and healthy surroundings, among other factors. The model will be generated in a participatory manner with different stakeholders; it is therefore important that representatives of the Community Action Boards take interest in the projects.

Timeframe	Financing
Five Municipalities in the first three years. More municipalities in the following years.	Cost: to be determined. Possible sources of financing: municipal resources, CAM, and possible the Governor's Office. Potential donors: USAID, FINDETER and others

Barriers to implementation

- Achieve true processes of social and cultural change to understand the dimensions of vulnerability and risks of climate change events
- Political will
- Timely financing

Indicators

- Municipal agreements for climate development plan
- Municipal Council for Climate Change formed
- Design adapted to town/capital
- Design of rural community climate plan

Area of action 5.3. Prevention and control of vector borne diseases - VBD

PROBLEM	ACTIONS IN PLACE
Climate change can affect the presence of mosquitos that transmit certain diseases (dengue, Chagas disease, leishmaniasis and malaria) thereby increasing rates of illness. Currently, Huila has one of the highest rates of dengue in Colombia and the impacts of climate change (particularly the increase of temperatures at certain altitudes) could increase the propensity of vector-bearing insects. Colombia has important policy instruments that stem from the health sector that encourage inter-sectoral work to confront Vector-Borne Diseases (VBD). However, these instruments are only beginning to be implemented and their further development requires commitments from different entities and levels so that their actions may be articulated. On the other hand, there is no detailed information that allows authorities to better identify the most susceptible areas of increased incidence of VBD and to focus prevention efforts on areas where climate change affects the presence of vectors.	• Initial development and actions of the Integrated Management Strategy for the promotion, prevention and control of Vector-Borne Diseases in Colombian, 2012-2021. • Inclusion of strategies related to prevention and control of VBD in Ten Year Public Health Plan. • Resolution 4278 and 4485 of 2012 of the Ministry of Health and Social Protection. • Advances in the framework of the Sectorial Plan for Adaptation for the Health sector. • Component D of the Integral Project of National Adaptation (INAP): response to the increase of exposure to tropical vector diseases (malaria and dengue) induced by climate change. • Actions under way in the department and municipalities of Huila for prevention and control of VBD (which include a number of educational materials).

Objective

Support the implementation of the Ten Year Public Health Plan in its strategies related to prevention and control of VBD, to reduce the impacts of climate change on the incidence of disease.

Actors

Public service companies (waste collection and aqueduct), departmental and municipal education secretaries, day-care workers, Red Unidos, APS, Ministry of Health and Social Protection, Health Secretary of Huila, Municipal Health Secretaries, Health Provider Agencies (IPS for its Spanish acronym), Hospital Networks, CAM, Ministry of the Environment and Sustainable Development (Office of Climate Change), IDEAM, governor's office and mayor's offices.
Other: social networks, schools and universities, police departments, military forces, fire departments, Aguas del Huila, Secretary of the Interior, Secretary of Transportation and Traffic (water trucks), Secretary of Agriculture, senators and House representatives.

PROBLEM	ACTIONS IN PLACE

Description

To support the necessary actions with the goal of implementing a variety of components related to VBD of the Ten Year Public Health Plan and the ECI-VBD, and the Integrated Management Strategy for the promotion, prevention and control of VBD in Colombian (EGI-VBD), 2012-2020, including:

- Workshops led by the Ministry of Health and Social Protection, and by the Health Secretary of Huila, in which all key stakeholders participate in the implementation of preventive and VBD control measures as contemplated by the Ten Year Public Health Plan and the Integrated Management Strategy.
- Carry out studies that estimate future incidence and impacts of climate change on the presence of vectors and the scope of VBD, to focus preventive and control efforts in highest risk areas.
- Training programs to strengthen capacity of functionaries involved in administration and health services in the department related to VBD.
- Promote high impact preventive measures against VBD in high-risk areas.

Timeframe	Financing
One year to carry out workshops and studies Annual programs for training, implementation of preventive measures and strategies to change habits and for early alert.	Estimated cost: COP 200,000,000 for studies. COP 700,000,000 annually for workshops and training programs and strategies to change habits

Barriers to implementation

- Ineffective coordination among actors, in particular municipal health secretaries and health service providers (IPS).
- Low capacity of management of scarce resources, in particular in municipal health secretaries and health service providers (IPS).
- Cultural barriers to adapt preventive measures.

Indicators

Follow-up mechanisms for the implementation of the Ten Year Plan and the Integrated Management Strategy will be used. There will also be follow-up for the following indicators:

- Resources designated for prevention and control of VBD
- Number of studies that have been advanced
- Number of people trained
- Cases of VBD
- BVD morbidity and mortality rates

Area of action 5.4. Management of heat waves

PROBLEM	ACTIONS IN PLACE
Worldwide heat waves have become more frequent and extreme in the past few years (IPCC, 2013). In the case of Huila, as previously mentioned, projections made by IDEAM indicate that by 2040 the average temperature will increase by 2° C and with the new IPCC projections they could rise to 4 to 6° C . This will affect the municipalities with current high temperatures with stronger incidences in vulnerable population such as elder people and babies.	Through its web page, IDEAM offers "information related to alarms about hydro meteorological or climate phenomena and their levels of threat through bulletins and alerts published daily and through special communications directed at the National System of Prevention and Attention to Disasters (SNPAD) and the National Environment System (SINA), in accordance to its national reference network."[87] The National Unit for the Management and Prevention of Disaster Risks (UNGRD) has developed protocols to respond to drought periods that include, among others, climate predictions, risk scenarios, areas of intervention, recommendations and service response by sector, and estimated budgets. Additionally, the UNGRD releases communications to authorities such as governors and mayors with recommendations that are relevant to prepare for such phenomena. The UNGRD also develops educational fliers and airs radio spots directed at communities and sectors.

Objective

To reduce morbidity and mortality from diseases associated with exposure to extreme heat and high solar radiation in the department.

87 See: http://www.pronosticosyalertas.gov.co/jsp/107.

PROBLEM	ACTIONS IN PLACE

Actors

Secretary of Health of Huila, Municipal Health Secretaries, IPS, Ministry of the Environment and Sustainable Development (Climate Change Office), IDEAM, regional entities of the National System for Management of Disaster Risks (among them, Departmental Committees, District and Municipal Disaster and Risk Management Committees).

Description

To evaluate the vulnerability of populations in the face of health problems generated by extreme heat, focusing on municipalities that will be affected by high temperatures as a consequence of climate change (those that lie in the Magdalena River basin), and that will take into account differences in vulnerability for different groups of populations.

An agreement within the public health system with hospitals and health centers about management protocol during heat waves.

Awareness raising in communities so that people may take preventive measures against adverse health effects caused by extreme heat and prolonged exposure to high levels of solar radiation. Such action will be focused on the most exposed areas, primarily those located in the Magdalena River valley. The following actions will be contemplated:

- Increase the distribution of educational material relevant to the development of UNGRD and other institutions (leaflets, fliers, radio spots and television announcements).
- Develop additional educational material especially designed for the conditions in Huila, as the case requires.
- Strengthen communications systems and alerts issued by IDEAM throughout the region.
- Educational campaigns should be focused on populations that are most vulnerable. It is especially important to design campaigns for people who work outdoors (farmers) so that they may take measures to adjust their work routines to avoid extreme heat and excessive solar radiation.

Such actions should be carried out hand in hand with relevant institutions such as IDEAM, the UNGRD and other entities of the National System of Management of Disaster Risks

Timeframe	Financing
Two years	Costs: To be determined Possible sources of financing: channeling of resources for risk and disaster management Support from Departmental Government, and Municipal Mayor's Offices of the more vulnerable and exposed municipalities.

Barriers to implementation

- Difficulties in effectively coordinating stakeholders.
- Difficulty in channeling resources.
- Difficulties in achieving changes in habits required for people to take preventive measures necessary to reduce the rates of illness from exposure to extreme heat and solar radiation.

Indicators

- Resources designated to the implementation in this area of action
- Awareness campaigns developed
- Number of functionaries of the health system trained
- Mortality rates from illnesses related to exposure to extreme heat and solar radiation
- Mortality rates from illnesses related to exposure to extreme heat and solar radiation

7. TRANSVERSAL AXES

Preparing for Climate Change

The transversal axes are strategies to ensure that the people of Huila understand the risks and opportunities of climate compatible development, and that they become engaged in the Huila 2050 Action Plan. To achieve this requires understanding the current and future climate, and encouraging both public and private entities and urban and rural citizens to develop concrete actions in collective efforts that add to the Plan, making Huila a landscape that adapts to and is compatible with the future climate.

AXIS 1T. TERRITORIAL ZONING AS A BASIS FOR ADAPTATION

In the face of the certainty that climate patterns will be altered in the future in the department of Huila, two important tools have been identified that aid planners and local authorities to seek adaptive and preventive strategies against negative impacts and generate opportunities for climate compatible development. They are: i) territorial zoning and use of natural resources, and ii) peasants' and indigenous people's ancestral knowledge.

Zoning plans at the municipal level began in Colombia in the year 2000 and must be revised and updated by 2014. Territorial zoning and use of natural resources represents the combination of very efficient tools in terms of adaptation to climate change and risk and disaster prevention. In fact, they allow a "bird's eye view" of integrating different elements of the territory that cannot be visualized from a sectoral or single dimension viewpoint into one perspective.

The Huila 2050 Action Plan seeks to optimize the use of this planning and decision making tool, through concrete actions to incorporate climate into zoning plans, sectoral and trade association plans, conservation strategies and municipal development plans. Specifically, the Plan provides support to municipalities in the department of Huila to: i) understand how to integrate climate variables and manage risks with territorial zoning with an emphasis on the areas most vulnerable to climate events; and ii) collect and use information about municipal vulnerability, hydrology and geo-morphology of significant changes of vegetation coverage and land use, and exceptional hydro and geological events, with the goal of making appropriate zoning decisions. The information collected and processed

by Municipal Climate Information Banks (MCIB) will eliminate bottle-necks in territorial zoning while supporting decision makers in planning, mapping, baseline creation, early alert systems about climate events and eventually establishing climate-smart territories (See Areas of action 1 and 2).

An intrinsic characteristic of climate is precisely its variability. While there have been patterns throughout time that are apparently constant, at the local level climate variations have always been a fundamental determinant of subsistence and survival and, consequently, a critical ingredient of cultural patrimony and ancestral accumulation of knowledge among indigenous and self-sufficient populations. Adaptations of these populations to climate variability is reflected in traditional agricultural practices, settlement patterns, architecture and technology and can be seen in legends, belief systems and taboos that have the implicit purpose of restricting people from occupying certain spaces, regulating the appropriation of certain natural resources or avoiding the destruction of areas and ecosystems to reduce risks of disaster or avoid greater impacts. Many of these aspects of “community-based climate adaptation” are very useful and can easily be transferred to the current situation in planning and zoning, creating settlement patterns, productive processes of communities and the current situation of Huila in the 21st century. The cultural patrimony and accumulation of ancestral knowledge deserves to be recuperated included in the articulation of strategies to adapt to climate change in the long term. For these reasons they should be considered in the Municipal Climate information Bank -BMICs.

Area of Action 1T.1. Training for municipal authorities in territorial zoning and climate change

Objective

Support the revision of the municipal POT through training to municipalities to use practical tools for strategic participatory planning, designed to integrate multiple climate variables and develop zoning leading to climate-smart municipalities and territories.

Description

Training courses in planning and zoning for territories that include didactic and practical tools to:

- Systematize and optimize the effectiveness of planning oriented to adaptation to climate change.
- Facilitate the visualization and articulation of territorial-climatic issues from a holistic perspective .
- Foster knowledge transfer (geographic information) to decision-making levels in terms of zoning and delimiting areas to become climate smart.
- Empower the active participation of members and minority populations or marginal segments of society in processes of climate adaptation.
- Maximize the appropriation of results (plans, strategies, actions) among decision makers and key participants.

For this proposal:

- Agreements with educational entities or private companies dedicated to training specialized professionals in participatory strategic planning will be made, with emphasis on integrating multiple variables to achieve results that are appropriate for all participants.
- A package of methodological materials will be put together, as well as manuals and didactic tools to carry out strategic planning workshops that lead to climate-smart territories.
- A work plan will be prepared and agreement reached among executing agencies and participant municipal authorities.
- Training workshops will be held in the 15 priority municipalities in Huila.
- Results will be evaluated in terms of effectiveness in methodological knowledge transfer and empowerment.
- A second phase will be designed about the base results of the evaluation, with the goal of involving and training the other 22 municipalities.

Actors

Directors/units of municipal planning, zoning, risk management offices of the municipalities in Huila

- Training actions will be coordinated with programs for planners for other entities such as the Governor's Office, CAM, the Ministry of the Environment and Sustainable Development, Office of Risks of the Ministry of Housing, among others, in terms of management of risks and climate adaptation.
- Agreements will be signed or drawn up with entities such as universities, and specialized agencies in planning and development to develop the methodological packet, learning materials and to organize equipment for training.

Timeframe

Twelve months to develop the methodological packet (and learning materials) and to carry out the 'course' on strategic planning starting with 15 municipalities.

Financing

Cost: COP 600,000,000
Possible sources: royalties, Governor's Office and municipalities, donations and international cooperation.

Indicators

- Number of municipalities trained to develop POTs applying a vision of climate-smart territory.
- Number of participants in training courses.
- Number of POTs that integrate climate variables and considerations.

Area of action 1T.2. Develop the Municipal Climate Information Banks (MCIB)

Objective

To develop and maintain a database about climate that provides information for decision making in terms of territorial zoning and municipal planning in 15 municipalities in Huila.

Description

Currently, municipalities are fed secondary information generated by the department government and by CAM to make decisions about territorial zoning. Every municipality must be capable of analyzing its own mapping information and maintain and actualize climate data in order to plan for zoning with a projection into the future.

In each municipality, a MCIB will be generated by the planning department. To do so, municipalities must be able understand and use the information registered in the vulnerability fact sheets, risk maps, the hydrological information generated by the WEAP model and the climate information disseminated by IDEAM and other institutions to utilize the weather stations (at least one per municipality). This information is essential to actualize municipal climate vulnerability and to ensure that the network of weather stations is increasingly rigorous in providing data for decision-making and in climate-compatible development and zoning.

Furthermore, a technical team at the municipal level will be conformed to compile, interpret and use information for zoning, planning, early alerts, resettlement plans, designating territory, declaring protected areas, managing watershed and creating climate-smart zoning.

Actors

Direction, municipal planning units, territorial zoning, risk management and similar offices in the 15 priority municipalities in Huila.

- Actions will be coordinated for training and information with climate observatories in Huila.
- An agreement will be made with IDEAM to ensure a network of weather stations in Huila, with access by municipalities.

Timeframe

Eighteen months for implementation of MCIB

Financing

Cost: To be determined
Possible source of financing: To be determined

Indicators

- Number of MCIBs created.

AXIS 2T. EDUCATE AND TRAIN HUILA'S POPULATION ABOUT FUTURE CLIMATE

Education and training are key elements to respond to climate change challenges. Through them, it is possible to help society to better understand and take action against possible impacts. These actions help provide incentive for people to change their habits and help to adapt and mitigate. Through this strategic axis, the Action Plan seeks to make education and training a central and visible aspect of climate responses for the region. By promoting formal, and non-formal education, these can drive cultural change to make Huila a climate-smart territory.

The proposal is to take advantage of education and knowledge as a platform offered by SENA to integrate the topic of climate change in its technical and technological programs, as well as in training programs offered in high schools and to productive associations in the department.

In this respect, it is proposed that SENA's training centers incorporate modules that emphasize climate change into their curricula. Topics such as climate-smart agriculture, alternative energy, and adaptation based on ecosystems, among others, should become routine topics in curricula. Additionally, it is suggested that agreements and contracts with trade federations and associations be made so that training programs and technical assistance about adapting crops and climate-smart methodologies like ECA (Escuelas de campo-Field Schools) be taught to farmers and offered in schools.

The ECAs are based on managing information that can be transformed into knowledge and is used by farmers to improve their circumstances independently. Beyond this, ECAs provide an alternative to generate sustainable rural development in the poorest areas, since they not only create knowledge but also improve local organization. In the learning process, farmers play an important role; they are not simply subjects that adopt plans that have been designed by technicians, but they actively participate in the development, implementation and evaluation of plans.

It is hoped that climate change be a transversal strategy of the Inter Institutional Committee for Environmental Education in Huila (CIDEA for its Spanish acronym), fostering learning with a long-term vision.

In this context, it is vital to promote innovative teaching to integrate the topic of climate change in schools. To this end, modules will be designed for environmental education and climate change, to strengthen teachers' capacity to impart knowledge about climate change, and at the same time to promote favorable attitudes among student towards adaptation and mitigation. In alliance with the CIDEA, the same thematic axes will be promoted in environmental education for Huila.

As a complement to education modules for teachers, a climate kit will be designed for schools that includes a compilation of didactic materials about climate change (developed by UNESCO, FAO, IDEAM and CATIE, among others), including practical tools to apply concepts about adaptation and lower emissions in daily activities and among communities, including school gardens as a teaching mechanism about adaptation to climate change, adoption of forests by schools or fostering recreational activities around these issues.

The final proposal is to create experiences to raise awareness of the public using a variety of artistic tools. In this respect, an itinerant module will be designed to be taken to different municipalities and which will be shown to diverse audiences, using activities such as theater, films and others around the central topic of climate change.

Area of action 2T.1. Development of field schools – "Escuelas de campo-ECA"

Objective

Recreate Field Schools -ECAs for productive sectors whose members wish to introduce improved agricultural practices that are climate compatible.

Description

Existing experiences with crops or resilient systems will be systematized, validated and improved through ECAs. For this to take place:

- At least two sectors will be chosen to apply ECA methodology (coffee and livestock).
- Agreements will be made with educational institutions or with people who are able to generate ECA methodology.
- An initial plan and methodology will be implemented.
- The first field visits will be developed with associations.
- The methodology will be developed in other sectors and with other actors.

Actors

The ECAs will be implemented in coordination with the Secretary of Agriculture and Mining of the department, municipalities and private trade associations (coffee or livestock).
An important actor is the SENA, with which an agreement will be signed to introduce climate change in its different field courses.

Timeframe

Two years to install the methodology in at least two productive sectors in two regions in Huila.
On-going to reach full extension with continual improvements.

Financing

Cost: COP 300,000,000 for two years.
Possible sources of financing: resources from associations, GEF sustainable livestock, donations.

Indicators

- Number of farms that have participated in the Escuelas de Campo.

Area of action 2T.2. Climate change as a transversal axis of the Inter Institutional Committee of Environmental Education of Huila (CIDEA for its Spanish acronym)

Objective

To make climate change a transversal axis for the Inter Institutional Committee of Environmental Education of Huila (CIDEA), with the goal of generating knowledge, education and awareness in the school age population in the department.

Description

The CIDEA will take the axes of the Huila 2050 Action Plan as the transversal axis for learning.

- Innovative programs will be developed in each axis to make them part of a learning strategy
- Experiential education will be incorporated in topics; for example, every school adopts a forest or uses alternative energy.
- Recreational themes will also be developed that can be represented in settlements and populations of the department around climate change issues.
- A climate observatory will be used as the center of CIDEA in climate issues and efforts will be combined to promote teaching and learning.

Actors
Secretary of Education of Huila, CIDEA, private entities and foundations with experience in education.Tiempo de implementación

Timeframe

One year to generate the Plan for Climate Education of CIDEA.
Ongoing to advance different actions.

Financing

Cost: COP 200,000,000 for two years.
Possible sources: CAM, Governor's Office, private donors.

Indicators

- Number of educational entities participating in climate change activities.

Area of action 2T.3. Development of a "climate kit' for schools in Huila

Objective

Compile and develop didactic climate change materials that can be reproduced and that is used in high schools and grade schools in Huila.

Description

- Compile existing material in Colombia regarding climate change, including materials provided by IDEAM, Gustavo Wilches and others.
- Compile materials available in Spanish from international sources that can be adapted to primary schools (videos, booklets, etc.).
- Select material that is appropriate for Huila and develop a climate kit at low cost and with substantial content that can be easily reproduced.
- Generate agreements with the Secretary of Education and the CIDEA for distribution.
- Develop a course for professors around methods for using and understanding the material.
- Deliver a series of courses for teachers that initiate a sequence of entertainment around climate change.

Actors

Secretary of Education of Huila, CAM, schools, education foundations, entities that wish to support by donating materials.

Timeframe

One year with five year renovation of the climate kit.

Financing

Estimated cost: COP 100,000,000 for 50,000 kits, each one at COP 20,000 a piece.
COP 1,000,000,000 for teacher training.
Possible sources: Education foundations, Bank of the Republic, donations from private entities.

Indicators

- Number of climate kits produced and distributed
- Number of teachers trained

AXIS T3. COMMUNICATION FOR UNDERSTANDING CLIAMTE COMPATIBLE DEVELOPMENT

Besides identifying climate change risks for Huila, and the measures to counteract them, it is fundamental to inform citizens, not just for the sake of informing them, but to create awareness and sensitivity. To do so, this transversal axis proposes to communicate and disseminate general knowledge about climate change as well as the knowledge generated in the elaboration of this Action Plan.

Through entertainment directed at communications media and journalists in the department, the proposal is to consolidate a team of people who are able to generate a common understanding about climate change and construct and reorient social concepts with which people perceive the problems and solutions. In this way, the axis seeks to motivate the population to alter actions on a daily basis that directly or indirectly contribute to the problem, or to adapt through a variety of practices.

Once a communications team is selected and trained, the proposal is to generate agreements that articulate strategies with different communications media, collectives and individuals (newspapers, community radio, magazines, etc.) with the goal of creating a process of communication in which the content is derived in conjunction with the climate observatory of the department.

The communications plan will be coordinated with the office of communications of the Governor's Office, the CAM, mayors, and associations as primary actors, guaranteeing that the communications process be aligned with the strategic axes of the climate change Plan and support the objectives and goals of actions that will be implemented in the region.

In this context, the climate change portal of CAM will be buttressed, creating a virtual library with current resources and publications that are relevant to the topic.

Area of action 3T.1. Training in climate change for journalists

Objective

Objective
To develop innovative communications strategies about climate change that lead to better understanding about the challenges and opportunities for the department and that motivate the population to adapt climate-smart practices in their daily lives.

Description

- Agreements will be generated with educational or specialized businesses to train communications professionals in scientific journalism about climate change and innovative strategies to communicate about them.
- Workshops will be held with trained communicators with the goal of designing a communication strategy about climate change that includes the following:
    - Management priorities about climate change .
    - Formulation of objectives and goals in communication.
    - Structure and orientation of strategic units of action (campaigns, small campaigns, ongoing communications systems, activities, etc.).
    - Evaluation of effectiveness of strategic units according to the objectives and goals of communications.

Together with the climate observatory, some communication prototypes will be chosen and implemented in the department.

Actors

Educational entities, social communicators, media in Huila, Departmental Secretary of Education, CAM, municipal mayors, Governor's Office, CIDEA.

Timeframe

Twelve months

Financing

Estimated cost: COP 200,000,000
Possible sources of financing: To be determined.

Indicators

- Number of communicators trained.
- Number of communications strategies designed.

Area of action 3T.2. Agreements with communications media in Huila

Objective

To support the department in communication and distribution of information about climate change, including communications strategies that articulate existing media and communications platforms in the department.

Description

- Agreements will be generated with media in Huila (newspapers, magazines, radio stations, etc.) to implement and disseminate the communications strategies designed in the previous area of action.
- A work plan will be prepared to bring communications media in the department together with the climate change observatory in the department.
- Result will be evaluated in terms of effectiveness of the communications strategies.

Actors

Social communicators, media in Huila, Departmental Secretary of Education, CAM, mayors, Governor's Office, Secretary of Government and Community Development.

Timeframe

Ongoing

Financing

Financing
Estimated cost: COP 100,000,000 annually.
Possible source of financing: to be determined.

Indicators

- Number of agreements with communications media.
- Number of communications strategies implemented.

AXIS T4. SCIENCE AND TECHNOLOGY THAT LEAD TO CLIMATE-SMART TERRITORIES

The construction of climate-smart territories requires an important catalyst from applied scientific research and the appropriate technological support in the environmental, social and economic contexts of the territory in processes of adaptation. Ongoing articulation and dialogue among scientists and technicians in the biophysics field, the regional economy and communities throughout the territory constitute crucial elements. This is imperative to: i) articulate research programs and applied sciences that are of highest priority in the process of adaptation; ii) promote the development of appropriate technology that is relevant to sustainable development in Huila; and iii) influence municipal and departmental policy regarding climate-smart territories.

In this effort, the Huila 2050 Action Plan will develop two areas: the first will promote the study of climate adaptation in a single context through scholarships and subsidies for research; and the second will approach the needs of industry in different geographical areas with creative local talent in small industries and crafts to produce appropriate technology that is compatible with the goals of sustainable and climate-adapted development, in this case through events, incentives and prizes.

Area of action 4T.1. Scholarships for a climate-smart territory

Objective

Administer ten scholarships per year for graduate or post-graduate studies in climate change related fields in the Department of Huila with the goal of improving resilience and competitiveness.

Description

- Agreements will be implemented with education institutes and universities and research institutions with the objective of administering scholarships for graduate or post-graduate study in topics related to climate change in Huila.
- Agreements will be fostered with private industries to sponsor studies and research through corporate social responsible programs – mostly in the mining and hydrocarbon sectors – that are relevant and related to climate and community adaptation.
- An appropriate entity (foundation or fiduciary) will be selected to coordinate scholarship programs in order to assure quality of studies and results, as well as to orient research to solve local problems and to develop appropriate technology.

Actors for these goals, will be responsible for the following actions:

- A study and research program will be prepared in agreement with executing entities and participating educational authorities
- The administration of graduate and undergraduate scholarships and subsidies for research according to the goals agreed upon among participating educational authorities
- Results will be evaluated in terms of relevance, innovation and, above all, applicability in the mitigation of impacts, adaptation to climate change, reduction of disaster risk, resilience of productive sectors, improvements in patterns of settlement, and capacity to generate employment and ensure quality and value of local products.
- A second program of scholarships and subsidies will be designed to investigate the base of evaluation, with the objective of involving more students and generating more results towards the construction of climate-smart territories.

Actors

Departmental Secretaries of science and technology, education, academic entities and research, private sector business, multilateral international organizations (World Bank, IDB, CAF), foundations) Ford Foundation, and international NGOs.
Coordination of the programs require involvement of the Ministry of Education, national and international academic entities, business foundation and SRE programs.

Timeframe

24 months to administer ten annual scholarships (total of twenty) for study and subsidy of research in the field of climate change adaptation and creation of climate-smart territories.

Financing

Cost: COP 400,000,000 for 24 months
Possible sources of financing: royalties, governor's Office, donations, (foundations and NGOs) and international cooperation.

Indicators

- Number of scholarships granted, graduate and post-graduate studies, theses and research papers published.

Area of action 4T.2. Fairs and promotional events for appropriate technology

Objective

To organize and administer fairs, events, workshops and working groups to promote the development of appropriate and local technology, to promote the construction of climate smart territories.

Description

- Agreements will be made with public and private entities to administer events, fairs, workshops and working groups to promote the development and dissemination of appropriate technology towards the creation of climate-smart territories in Huila.
- Agreements will be promoted with private industry, primarily in the mining and hydrocarbon sectors, to promote events, fairs and pre-funding programs (through SRI programs) towards the development of appropriate technology designed to reduce emissions and carbon footprints, to adapt productive systems and patterns of human settlement.
- The departmental secretaries in science and technology,

chambers of commerce and trade organization, among other private entities, will coordinate the promotion of local appropriate technology through different kinds of events (fairs, workshops and joint work groups) that will take place among small industries, crafts people, trade associations and business organizations.

Actors for these goals will be responsible for the following actions:

- Prepare events, business fairs with pre-funding, and prizes to promote the development and marketing of specific technology to confront the challenges of climate change and guarantee the sustainability of productive systems and human settlements (small towns and cities) in the department of Huila.
- Administer those events in coordination with departmental and municipal authorities, trade associations, small industry organizations and groups of electrical and metallic workshops to highlight the creative and productive capacity of the department.
- Evaluate results in terms of effectiveness of and participation in events, alliances and capital from pre-funding for the development and marketing of technology to mitigate impacts and adapt to climate change, improve patterns of human settlement, generate employment and add value and quality to local products.

On the basis of this evaluation a second program will be designed to support local technology for the construction of climate-smart territories.

Actors

Departmental secretaries of science and technology, private businesses (SRE), academic and research entities, trade organizations, foundations (Ford and MacArthur Foundations), international multilateral agencies and pre-funders (World Bank, IDB, CAF) and international NGOs.
Coordination of the program to promote appropriate technology is required with actions from the Ministry of Science and Technology, PROEXPORT, national and international businesses, business foundations and SRE programs.
Departmental Inter Institutional Committee for follow up and control.

Timeframe

24 months to administer events, fairs, workshops for two years with the objective of reducing vulnerability and diminishing risk of disasters during climate events.

Financing

Cost: COP 360,000,000 for 24 months
Possible sources of financing: royalties, Governor's Office, donations (foundations and NGOs) and international cooperation

Indicators

- Number of events, fairs, workshops and programs of prefunding held.
- Amounts of capital invested in innovative businesses to produce appropriate technology.
- Number of publicity and marketing events promoting appropriate technology.
- Number of businesses producing or committed to developing appropriate technology to adapt to climate change, increasing resilience of productive systems, creating sources of jobs and improving the competitiveness of municipalities and cities.

AXIS T5. RISKS MANAGEMENTS

There is a correlation between climate change and geological and hydro-meteorological natural disasters. Law 1523 together with the huge advances in risk management (understood as the combination of actions to reduce risk, diminish vulnerability and attention to emergencies and disasters) represent a context that is favorable to confronting the effects of climate change in Colombia. This is the case, in particular, where i) territorial and environmental entities have taken their role of reducing vulnerabilities seriously; ii) there are conditions that foster mitigation of reduction of impacts of disaster; and, iii) proper management of the recuperation of territory and populations following catastrophes occurs. In these conditions, the fact sheets that are described below contain two parts: the first is of an institutional and political character, for which no additional investment nor special bureaucratic efforts are required – only a flow of more effective information that is shared, political will that supersedes the limits of territories and institutional and a communications strategies without barriers to effective decisions and adjusting realities of the territory. The second has an operational character and is focused on concrete actions to diminish risk, reduce vulnerability and prevent disasters with reduced loss to human life and economic resources.

Through this activity the Plan will contribute to: i) making disaster prevention actions more effective; ii) responding in a timely manner to disaster events and in this way; and iii) assuring that local strategies towards climate-smart territories in the department be more viable.

Area of action 5T.1. Coordination of inter-institutional actions on risk management for a climate-smart territory

Objective

Establish institutional mechanisms to coordinate and share information with risk management institutions, in order to make joint decisions and exercise authority effectively to reduce vulnerabilities, diminish disaster risk, and improve the resilience of the department.

Description

First part:

- Agreements and/or contracts will be established with entities in charge of information and risk management so that it may flow effectively – to facilitate early alert – towards the entities and work groups who are responsible for reducing vulnerability of the territory and diminishing disaster risk.
- Joint working groups will be established to analyze hydro-meteorological information, interpret it adequately and channel it in a more efficient way to territorial authorities for decision-making and corresponding action.
- Territorial and environmental authorities will form joint working groups to plan and organize relevant actions about extreme climate events with the goal of reducing negative or catastrophic impacts.

Second part

- Departmental and municipal committee of risk management will form joint working groups with the "Huila Climate Observatory" (see proposal below) to define hydro-meteorological threats and take preventive actions in a systematic manner and reduce pertinent risks.
- Environmental authorities – within their realms of capacities – will support territorial authorities in the identification of areas that are most vulnerable, beginning with the watersheds that supply water and the population centers that are exposed to avalanches and flooding, among other risks.
- Environmental authorities, in coordination with risk management entities, will support the execution of prevention plans for disasters in critical watersheds, in areas where there are vulnerable populations or infrastructure that is susceptible to prevent hydro-meteorological disasters.
- The environmental authorities, in coordination with other entities at the departmental and national levels, will support the execution of preventive infrastructure construction, such as, for example, i) redirection of streams or creeks; ii) adaptation of channels; iii) reforestation and recuperation of deforested or degraded areas; iv) stabilization of slopes that are susceptible to landslides; and iv) relocation of crops and people threatened by catastrophic events, among others.

Actors responsible for this area of action will:

First part::

- Prepare a scheme or plan of inter-institutional "coordination" assigning each entity or institution the corresponding responsibilities, the financial obligations and the personnel necessary to make decisions, as well as the structural hierarchies that control the flow of information (early alert) and effective decision making.
- Share the preparation of contingency plans corresponding to probable hydro-meteorological events or events that are profiled as imminent, with disastrous effects on the territory or human settlements.

Second part:

- Execute concrete actions to diminish vulnerability of territories in priority watersheds, correcting and improving streams or creeks, reforesting degraded areas, restoring wetlands and flooded areas, among other concrete actions.
- Evaluate the results of joint action and coordinated efforts in terms of cost-effectiveness, efficiency, mitigation of impacts, adaptation to change, reduction of risk of disasters, and also in terms of resilience of productive systems, improvements for human settlement patterns and recuperation of territories after disasters have occurred.

Actors

Territorial (municipal) and environmental authorities that are present in the department (CAM, Cormagdalena), municipal and departmental committees of disaster risk management.
National Unit of Management of Risks of Disasters, Ministry of the Environment and Sustainable Development, Ministry of Housing, City and Territory.
Community organizations and base organizations, local and national NGOs, and entities responsible for attention to disasters, control and recuperation of territories (Red Cross, National Police, health secretaries, etc.).

Timeframe

Twenty four months to organize plans and schemes of coordination, reach agreements and contracts to coordinate work jointly to implement concrete measure that guarantee the flow of adequate information, significantly reduce risk of disaster towards the construction of climate-smart territories.

Financing

Cost: COP 100,000,000 for the first part and up to COP 1,000,000,000 for the second part during 24 months.
Possible sources of financing: royalties, Governor's Office, UNGRD, donations (foundations and NGOs) and international cooperation.

Indicators

Number of committees (joint working groups) working effectively and efficiently on sites to improve streams, creeks, reforested areas and restored wetlands to reduce vulnerability, prevent disaster and manage more effective response.


REPÚBLICA DE COLOMBIA
1000
PESOS
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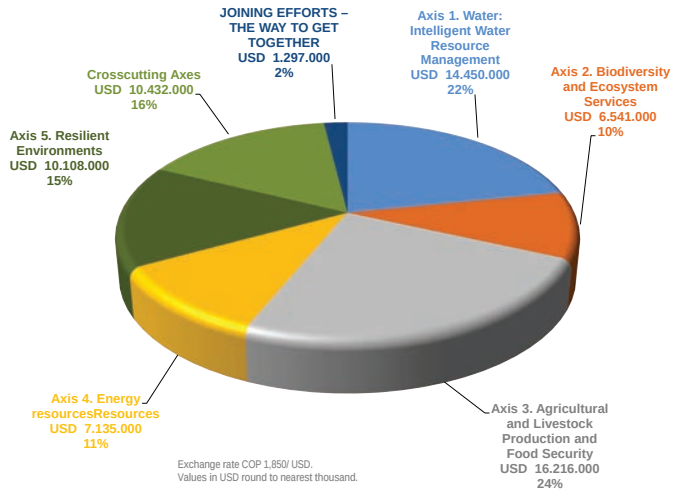
8. INNOVATIVE FINANCIAL OPTIONS TO ADDRESS CLIMATE

The adequate implementation of the actions proposed in this Plan require crucial resources to back them up. With this in mind, the fact sheets that describe each of the areas of action include possible sources of financing their implementation. This information has been compiled in a table that is presented as an annex to this plan and in which the estimated costs are included for each action. Additionally, below is a description of the sources of financing that could be channeled towards the implementation of each proposed measure, both within the department and at the national and international levels.

DEPARTMENT RESOURCES

As part of this plan, a study was carried out for the "identification of public and private resources that may be channeled to mitigation and adaptation of climate change in the Department of Huila,"[88] which analyzes Huila's economy, public sector financing at the regional and local levels (CAM, mayor's and Governor's offices), resources from royalties, CAM's environmental investments, territorial entities and private investment projects (such as the Quimbo dam). Based on this analysis, an estimation of resources that could be allocated to climate change mitigation and adaptation in the department was made. For this process, the following categories were taken into consideration:

Figure 35. Costs of Huila 2050 Plan, 2014-2050.



• Historical expenditure in environmental and related investments;
• Obligatory investments in watersheds (according to Article 111 of Law 99 of 1993); and
• Resources from royalties.

Estimation of these resources was made for three different scenarios: pessimistic, moderate and optimistic. The results indicate that it would be possible to channel between $19,149 million and $17,248 million Colombian pesos per year to climate change actions (See Table 6).

88 The complete report may be consulted in the climate change library of CAM. "Identification of public and private resources that may be channeled to mitigation and adaptation of climate change in the Department of Huila," developed by Guillermo Rudas for E3 – Ecology, Economy and Ethics, 2013.

Table 6. Estimations of annual designated resources for adaptation to climate change in three scenarios ($ millions of pesos in 2011 prices)

CONCEPT	TOTAL VALUE	% ALLOCATED ACCORDING TO SCENARIO			RESOURCES AVAILABLE ACCORDING TO SCENARIO		
		PESSIMISTIC	MODERATE	OPTIMISTIC	PESSIMISTIC	MODERATE	OPTIMISTIC
Historical expenditure in environmental and related investments	59.950				7.198	14.395	21.593
CAM	12.027	20%	40%	60%	2.405	4.811	7.216
Department of Huila	16.420	10%	20%	30%	1.642	3.284	4.926
Municipality of Neiva	9.976	10%	20%	30%	998	1.995	2.993
Remaining municipalities	21.527	10%	20%	30%	2.153	4.305	6.458
Obligatory investment in watersheds (Art. 111 Law 99 of 1993)	7.753				1.551	3.101	4.652
Department of Huila	4.888	20%	40%	60%	978	1.955	2.933
Municipality of Neiva	1.604	20%	40%	60%	321	642	962
Remaining municipalities	1.261	20%	40%	60%	252	504	757
Royalties	208.013				10.401	20.801	52.003
Department of Huila	152.255	5%	10%	25%	7.613	15.226	38.064
Municipality of Neiva	10.845	5%	10%	25%	542	1.085	2.711
Remaining municipalities	44.912	5%	10%	25%	2.246	4.491	11.228
Total	**275.715**	**7%**	**14%**	**28%**	**19.149**	**8.298**	**78.248**

Source: Rudas, 2013

To make this estimation, it was assumed that a determined percentage of available resources in each of the categories mentioned above are allocated to mitigation or adaptation measures for climate change (percentage that depends on a given scenario). Nevertheless, it is worth mentioning that barriers to achieve these allocations may exist, including lack of will on the part of entities that hold resources, or difficulties in cases where investments have already been planned for activities that are not part of the climate change actions. Nevertheless, given that mitigation and adaptation to climate change is in line with many of the environmental actions that these entities carry out, channeling resources to climate change actions seems to be a feasible option.

It is also important to note that transfers by the federal government to territorial entities are given priority in areas of education (60%), health (25%) and clean water (5%). Remaining resources are allocated without appropriation to a specific issue, although they are conditioned on investments in sectors such as sports and recreation, and cultural activities and, therefore, are not directed to environmental topics per se.

Therefore, it is worth pointing out that few municipalities in the department comply with the obligatory 1% in acquisition of areas of interest for municipal aqueducts, according to article 111 of Law 99 of 1993. In terms of acquisition of lands for conservation of watersheds, municipalities have met 45% of their obligation in investments as stated by law. Therefore, increasing the rate of compliance with this norm could increase in good measure the resources available for climate change mitigation and adaptation.

The new scheme of royalties reduced the portion that flows to the departmental level and encourages the flow of royalties to municipalities; however, between 2012 and 2014, municipalities have received only 40% of what was transferred to the department in the two previous years. Income to the department will decline at a lower proportion, receiving 80% per year of what was received on average in the three previous years. Furthermore, it is worth pointing out that resources from royalties should be channeled in good measure though projects presented to the General System of Royalties, to be approved by the Collegial Organs of

PAYMENT FOR ENVIRONMENTAL SERVICES SCHEME OF THE ZONING AND WATERSHED MANAGEMENT PLAN (POMCA) OF THE LAS CEIBAS RIVER

The Las Ceibas River provides water for the city of Neiva, with a population of over 335,000 inhabitants. Taking into account the importance of this river, the Governor's Office of Huila, the CAM, the Mayor of Neiva and municipal public services companies decided to create a common fund to invest resources from their respective budgets in planning, zoning and management activities.

The plan has investments allotted for the next 20 years, at a cost of nearly $87 billion pesos, of which the majority are fixed sources from the entities that are a part of the consortium. The scheme is a great example to be replicated to other watersheds as foreseen in the Huila Plan 2050.

Administration and Decision (OCAD for its Spanish acronym), for which efforts related to the formulation of projects are fundamentally important.

CAM is the primary actor using investments that are likely to be articulated with climate change strategies. The destination of resources has been concentrated in the past few years in water resource management, which is very important for climate change. Furthermore, a very high percentage (around 20%) is allotted to protected areas, another fundamental part of the Huila Action Plan. CAM has ample experience in leading programs with the participation of territorial entities in the department. The most emblematic project is the PES scheme described in the box above.

The Huila 2050 Action Plan will enter a focalization stage and will channel local, regional, national and international resources to the development of its strategies. It must furthermore integrate efforts with the private sector to advance a collective strategy to address climate change.
Within these efforts is the channeling of obligatory investments through projects with private investment backing (such as the construction of the Quimbo dam). Although they are temporary, they may generate resources for funds to implement actions of the Plan. Both compensations to CAM, like those that come from licensing in areas of influence of the projects, could be significant sources if they are articulated into the Plan.

Additionally, as part of the proposals for this plan, a variety of compensation mechanisms for conservation were proposed. While each modality will be carried out in different axes of the Plan, it is important that their implementation be integrated at the regional level so that they are more cost effective.

OTHER NATIONAL SOURCES OF FINANCING

In Colombia there are financing options to address climate change that are being created by banks such as FINDETER or BANCOLDEX. The first case is led by an initiative to foster resilient cities, with resources allocated to developing studies and credits assigned to the developing actions. Some private companies like ARGOS, or public companies like ECOPETROL, are beginning to create programs to foster climate initiatives in Colombia. It is hoped that each day, new resources will be allotted by private and public enterprises to generate cities and regions that are prepared to face the climate of the future.

INTERNATIONAL SOURCES OF FINANCING

There is enormous diversity in the kinds of resources available for mitigation and adaptation to climate change for developing countries like Colombia. It is estimated that the total annual flow of climate financing reaches nearly $100,000 million dollars.[89] While it is possible to channel a good quantity of resources from the department to finance measures that are proposed in this Plan, it is also worth considering international sources that may be available, including the UNFCCC, Official Assistance for Development (OAD) and multilateral and public-private funds.

The mechanism of UNFCCC and the Kyoto Protocol

Taking into account contributions of different countries around the world to climate change, and given that the capacity to adapt varies, the UNFCCC and the Kyoto Protocol have foreseen financial assistance from the wealthier countries to poorer and more vulnerable ones. To this end, financial mechanisms have been established that are currently administered by the Global Environment Fund (GEF); four special funds have been established: the Special Climate Change Fund (SCCF), the Fund for Least Developed Countries (FLAC) administered by the GEF, the Green Climate Fund (GCF) under the UNFCCC, and the Adaptation Fund (AF) under the Kyoto Protocol.[90]

Other Sources of Finance

Sources of finance for mitigation and adaptation, beyond those mentioned above created by the UNFCC and the Kyoto Protocol, include other resources from ODA which can be channeled primarily through national agencies with the support of multilateral and development organizations.

Some countries have special programs that provide resources to projects on climate change mitigation or adaptation that could finance the actions proposed in the Plan, as well as the support from USAID and its development program FCMC.

A range of multilateral entities offer resources to finance measures related to climate change, the largest of which are the United Nations and The World Bank. The UN does so primarily through the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP), as well as through UN-REDD, which articulates the work of UNDP, UNEP and the Food and Agriculture Organization (FAO) to support countries in their REDD+ efforts.

For its part, The World Bank finances primarily through the GEF. In 2010, twenty-one countries contributed $889 million dollars for the fifth GEF gathering. The World Bank also contributed funds to finance environmental protection measures, that, in turn may become measures of mitigation or adaptation.

Additionally, in 2008, a Climate Investment Fund was established, administered by The World Bank, but in this case jointly with regional development banks (in the case of Latin America and the Caribbean, the InterAmerican Development Bank – IDB). Regional development banks like the IDB also allocate funds for mitigation and adaptation measures to combat climate change, as do sub-regional institutions such as the CAF.

Carbon Markets

Beyond sources of finance mentioned above that may include donations or loans, there is also the option of carbon markets. These are schemes to purchase and sell determined quantities of carbon shares to offset GHG emissions. In such markets, there are three kinds of shares that can be traded:

- Emissions permits;
- Certificates to reduce emissions that originate in projects (including those that are generated through Clean Development Mechanisms projects called CER;[91] and
- Voluntary certified emission reductions (those that are sold on voluntary markets)

The Clean Development Mechanism

The CDM is one of three mechanisms included in the Kyoto Protocol and it allows developing countries to issue emissions reduction certificates for projects for which reduction is certified, and which can be purchased by countries that need to reduce emissions. The principle demand for ERCs issued by Least Developed Countries (LDCs) is the European market. For an LDC to undertake projects, they must agree to three conditions: i) to contribute to the goals of sustainable development where the projects take place; ii) to generate a reduction of emissions in addition to those that would have occurred without the project; and, iii) that the reduction of emissions be certified by an "Operational Entity" accredited by the Executive Committee of the CER. It is worth pointing out that this mechanism was created by the Convection for the period of 2012, which was proposed until 2015, while countries came to agreement about new financial mechanisms. While the CER served a purpose and prices of tons of carbon were as high as $15 dollars, its future is now uncertain. Colombia was one of the developing countries with the greatest number of CERs, including the mass transit system of Transmilenio, the wind generated energy project of Jepirachi and the Doña Juana landfill projects, to cite only a few. In general, more than 65% of projects worldwide are being carried out with renewable energy.

The Voluntary Market

The voluntary market refers to carbon credit transactions that are not ruled by obligatory regulations and that are aimed at complying with emissions reduction goals. Among these are the sale and purchase of Verified Emissions Reductions (VERs) created especially for this market, as well as the sale of credit on regulated markets for those who seek to voluntarily reduce emissions. It is estimated that in 2011, transactions in the voluntary market for carbon reached $576 million dollars Additionally,[92] the

91 Certified Emission Reduction

92 "Developing Dimension: State of the Voluntary Carbon Markets 2012". Ecosystem Market Place y Bloomberg New Energy Finance, 2012.

market demonstrated resilience to global economic problems at the end of the 2000-2010 decade.

In Colombia there is an incipient voluntary market for carbon trade. Zero Carbon is an initiative of the Foundation Natura Colombia that seeks to participate in the growing voluntary market to mitigate carbon emissions with the goal of taking advantage of opportunities presented by increased concern about global climate change and its consequences. Zero Carbon is a simple scheme that allows people, private companies or public institutions that are aware of their roles in the problem of climate change and are interested in solutions to channel resources to finance projects to reduce emissions (mitigation) or capture carbon. There are other private initiatives that choose this option, such as Acción Verde (Green Action) and other companies that give support through compensation. For Huila, these could be interesting for afforestation through private voluntary financing. Various options for international voluntary markets also function in Colombia, offering innovative schemes. Companies, such as Argos, ISAGEN and Emgesa, among others, have procured markets to compensate for their emissions.

REDD+

REDD was proposed in 2007 in the 13th Conference of Parties (COP13) of the UNFCC, recognizing that forests have a critical role in storing carbon. The objective is to remove incentives to deforest and degrade forest lands, thereby reducing GHG emissions. The mechanism has evolved to REDD+ which takes into account other activities such as the management of sustainable forests and the increase of forest reserves. Likewise, there are proposals to take into account co-benefits (related to other ecosystems or social beneficiaries) within its mechanisms.

The idea of REDD+ projects is to allow resource transfers to places that are avoiding deforestation by stakeholders' interested in reducing emissions (e.g., industrialized countries that have signed on to the UNFCCC). However, the method to finance REDD+ activities has not yet been discovered, nor has a regulated market been created by the UNFCCC. Nevertheless, voluntary market transactions are taking place. Nonetheless, REDD+ activities can be developed at the project level, as is the case with the REDD Massif developed by ONF in four municipalities for this Plan. The idea is to generate policies and schemes that jointly reduce deforestation rates. These types of actions are being developed in other countries (e.g., Acre, Brazil or Chiapas, Mexico), and buyers are appearing, including the State of California in the United States. Other forms of creating REDD+ projects locally are proposed in Area of action 2.5, with the idea of developing a CO2 Bank for Huila as another way of fostering voluntary REDD+.

Figure 36. International entities that have allotted resources to finance climate change action in Colombia

World Mundial	BID	CAF	CDKN	Center for Cleaned Air Policy	Climate and Clean Air Coalition
CMNICC	International Finance Corporation	FFEM	Climate Investment Funds	GEF/FMAN	GIZ
Global Methane Initiative	Government of Germany	Government of Canada	Government of Spain	Government of USA	Government of Suiza
Government of United Kingdom / Embassy British	LEDS Global Partnership	Mitigation Action Plan and Scenarios	OIM	ONF Andina	Partnership for Market Readiness
PNUD	World Food Programme	Quebec	Sustainable Energy for All	The NAMA Facility	European Union
USAID					

Source: Presented at the Work Group of Cooperation, February 2014, MADS


TEMAS MAS IMPORTANTE

9. UNITED EFFORTS - HOW WE WILL BE ORGANIZED

The success of the Action Plan is directly related to the participation and political will of actors from the department. The commitment of all relevant stakeholders, articulated though local and national alliances, will be fundamental to achieve the goal of Huila as a climate-smart territory. In this context, the plan foresees two fundamental instances to assure cohesion and institutional coordination around its implementation: The Departmental Council for Climate Change of Huila as a guiding pillar of the Plan, and the Climate Observatory where the plan will be coordinated, implemented and monitored.

THE DEPARTMENTAL COUNCIL FOR CLIMATE CHANGE

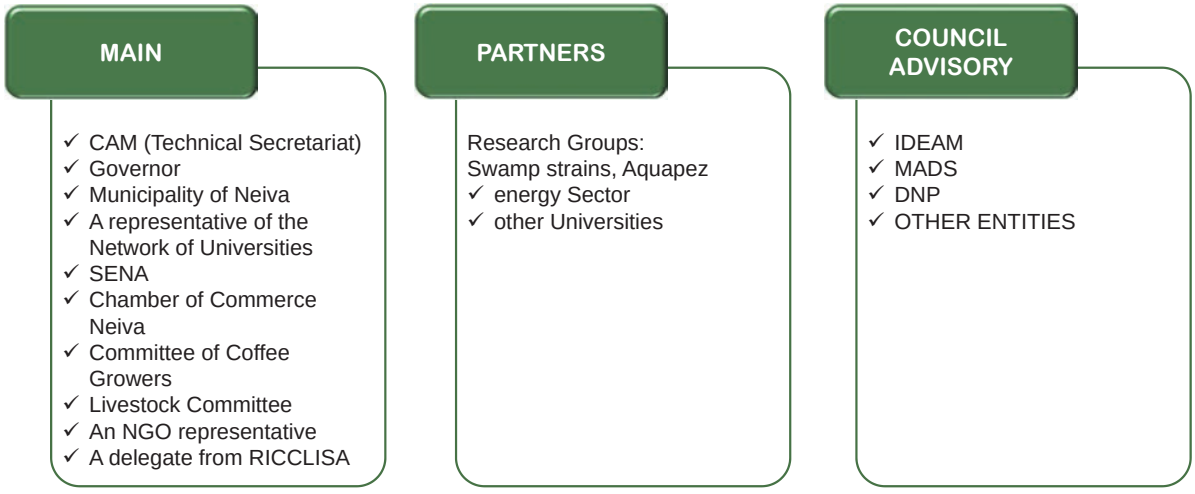
Through the leadership of CAM and the constitution and functioning of the Departmental Councils for Climate Change, there is already a coordination mechanism set in place at the regional level. This mechanism involves key entities in the department and requires that new entities be brought into the circle so that joint concrete actions are set in motion. The members of the council will foster the procurement of funds for each area of action. To this end, they will maintain communication of information about current and ongoing financing and they will meet to identify strategies to obtain funds from specific sources for prioritized areas of action.

The Council has been supported by the participation of national entities such as MADS, IDEAM and DNP, and this support will continue to be part of the Plan's execution. At the same time, as different sectors generate mitigation and adaptation projects at the national level, the Council may also apply such measures for Huila as a pioneer department in climate and development. Huila is also part of a Central-Andean node for climate change, which should be bolstered, as well as the inter-departmental relations to take joint actions.

The mapping of stakeholders that was done as part of the framework of this plan shows that for each action that corresponds to a principal axis, there are a total of 51 relevant stakeholders. Each plays a different role and has different degrees of influence and power to positively affect the implementation of the Plan. The CAM stands out as a fundamental role in various principle axes of the Plan. Nevertheless, other regional agencies, including the Governor's Office and municipalities, entities such as SENA, trade associations and education and health entities, to name only a few, play important roles in diverse areas.

In this sense, it will be necessary to establish objectives of association and coordination among the different stakeholder of each principal axis, and to look for strategies to maintain momentum and ensure proper execution.

Figure 37. Members of the Departmental Council for Climate Change



Source: Authors' elaboration

THE CLIMATE OBSERVATORY

The Climate Observatory of Huila will be the first created in Colombia and has the goal of coordinating actions within the Huila 2050 Action Plan, generating a platform of climate information and monitoring, and will serve as a base of coordination among stakeholders.

The headquarters of the Climate Observatory will be in CAM, and it will have a basic staff to lead and coordinate actions within the framework of climate compatible development. The Observatory will generate agreements with different entities related to the plan, acting as a driver of actions and as an inter-sectoral and regional coordinator. Furthermore, it will be the depository of information in terms of climate and development, which will be made available to the different stakeholders in the department for timely decision making. The Observatory will house the information from the hydrologic modeling, climate scenarios, departmental and municipal vulnerability analyses, financial information and forest and deforestation monitoring.

The Observatory will respond to the guidance of the Departmental Council for Climate Change. Furthermore, although it is housed in CAM, it may have independent legal representation so that it may receive donations from different sources and may efficiently and effectively coordinate the different axes proposed in the Plan. The Observatory will integrate climate and development within the department, including public and private agencies.

The Observatory already has a coordinator and should contract various climate change specialists to support implementation of databases and the development of a monitoring system. The first task of the Observatory will be to write a proposal to finance its establishment in the short and medium term (equipment, methodologies, human resources).

The Observatory will define protocols to share data among different public and private stakeholder as one of its first tasks.

As described in more detail below (section The Monitoring and Evaluation Strategy-How we measure our progress), the Observatory will be responsible for verifying and/or managing monitoring and evaluation activities. Based on the information generated through these actions the Plan will be revised at least every five years. The Climate Observatory will lead this process and any modifications will be discussed and agreed with relevant stakeholders and the Departmental Council on Climate Change. The latter will have to approve any changes made.

10. THE MONITORING AND EVALUATION STRATEGY

Preparing for Climate Change

INFORMATION: FROM TODAY UNTIL 2050

As an integral part of this plan, an information platform was created for Huila in the National Agency for Environmental Licensing. This system integrates all the spatial information brought together from IDEAM, CAM and the IGAC.

Currently, the system shows the layers of abiotic material (geomorphology, geology, hydrography and soil), the socio-economic level (indigenous territories, settlements, municipalities, private reserves and national, regional and municipal parks), the biotic level (ecosystems, vegetation coverage for 2000, 2007, 2010) and environmental zoning.

Furthermore, the specific information of zoning for the watershed (POMCH) is organized into 20 variables, including conflicting land uses and climatic zoning. It also has a significant quantity of information about natural reserves.

Likewise, there is a plan to set up a vulnerability analysis in a special model of climate change in the same platform, which will be implemented by the MADS climate change office, with the goal of clarifying and looking at other departments at the national level so that comparative indicators may be obtained.

The idea is to continue updating the information system for Huila towards 2050, for the time-being from the ANLA platform. In an agreement between CAM and ANLA, the latter houses the platform but other entities are responsible for updating it, with rigorous parameters about metadata. All generated information should include metadata based on the template proposed by ANLA; this is to facilitate the traceability of the quality of data, sources that served to generate the data, and identify responsible parties in its generation. The metadata will allow easy exchange of geographic information between CAM and other State organizations, and between CAM and the stakeholders that may develop projects under the framework of the agreement. In the future, the SIG may also be managed from Huila as an important strategy for decision makers in the department.

The information system for Huila is crucial to monitor changes in vegetation coverage and other variables

that have been added to the system. The intention is to upload more relevant and comparable information in order to measure changes in variables and indicators. It will be crucial, in this platform, to combine climate variables with other variables that are already in the system in order to measure changes.

The information alone will not guarantee the success of the plan if it is not interpreted and used to make decisions. For this reason, the Climate Observatory of Huila will be in charge of keeping the information up to date and sharing the information among diverse departmental stakeholders. It will also oversee why the measurements are used and the progress of Huila in becoming climate smart.

HOW WE MEASURE OUR PROGRESS: INDICATORS OF WHERE WE WANT TO BE

Follow-up and evaluation of the actions undertaken is fundamental to the success of the implementation of this Plan and to better understand its achievements. Monitoring and evaluation allows actors to know if actions are appropriate, whether they are being carried out, or if objectives are being reached. Furthermore, climate change increases the uncertainty of future environmental conditions, so it is necessary to carry out ongoing evaluation if actions are to continue to be effective in a given moment. Therefore, follow-up and evaluation are fundamental aspects to effectively convert Huila into a climate-smart territory, with low GHG emissions and resilient to the impacts of climate change. Additionally, follow-up allows practitioners to adjust actions as necessary and efficiently use resources in cases where actions are unsuitable, where objectives are not being met or where proposals need to be altered.

For the monitoring of the Plan, the flowing actions are proposed:

- Follow-up on specific indicators proposed for each area of action (see factsheets) and evaluate results of their implementation.
- Follow-up on GHG emissions in the department, using baseline emissions estimations developed as an input for this Plan and improving methodologies as more precise information and technical and conceptual advances become available.
- Follow-up on the vulnerability of the department in the face of climate change, using as a the level of vulnerability developed as an input for this plan, as well as the more detailed sectoral analyses proposed in various areas of action, improving methodologies as more precise information and technical and conceptual advances become available.
- Follow-up on climate change and its effects on the principle axes of this Plan, in particular the availability of water, soil health for crops, distribution and health of species, occurrence of extreme events and their impacts and life conditions in urban areas (heat waves and dengue rates) (See Table 8).

The monitoring system will be based on information that normally is taken from surveys and census by different State entities (e.g., agricultural census, register in DNP). Furthermore, the Observatory will carry out studies to identify indicators and protocols

for collecting information that are representative of climate change impacts.

While follow-up of specific indicators for each area of action and evaluation of their implementation will provide specific information, the monitoring of GHG emissions in the department and the vulnerability of Huila in the face of climate change will give a broad picture of the impact of this Plan. In the end, this is the ultimate goal: to reduce emissions (or avoid the substantial increase of emission as the population grows and prospers) and to make the region less vulnerable to the adverse impact of climate change.

The Climate Observatory, as explained in the section "How we are organized", will be in charge of managing the follow-up and evaluation of the implementation of the Plan. This means ascertaining who will be directly in charge of: putting each of the areas of action into practice; conducting follow-up on the indicators and other relevant estimates as they develop; managing new GHG emission estimates in no more than five years and every five years hence; managing new vulnerability analyses in no more than five years and every five years hence; strengthening the network of weather stations in the department for continual monitoring of weather conditions; and measuring specific indicators about the state of resources and the environment, susceptible to climate changes, with the frequency that is stipulated by the needs of each indicator.

This information will be used to revise the actions included in the Plan. The revision process will be led by the Climate Observatory and discussed with the Departmental Council on Climate Change and other relevant stakeholders. Finally, the Council will be responsible for approving the modifications that will be made, as it initially approved the actions included in this Plan. Such review should be conducted every 5 years, using the results of the GHG emissions studies and vulnerability assessments performed. If necessary, the actions in the Plan may be reviewed more frequently but any changes should always be discussed with the relevant stakeholders and the Departmental Council on Climate Change, and approved by the latter.

Table 7. Indicators proposed to do follow-up on climate and its effects on the axes of this plan

Expected change	Indicator	Means of verification
Increase in temperatures	Current tendency vs. 1970-2000 period	Weather stations
Reduction in precipitation	Current tendency vs. 1970-2000 period	Weather stations
Increase in evaporation	Current tendency vs. 1970-2000 period	Weather stations
Major effects of extreme events	Tendencies in damages by extreme events ($$, deaths, victims)	Reports of damage from extreme events
Reduction in yields of non- intervened crops	Tendencies of yields of principle crops as classified by the system	Registries (municipal and trade associations)
Increase in plagues and disease among crops	Incidence and scale of plagues and diseases	Registries (municipal and trade associations
Changes in phenology	Periods of flowering of main perennial crops and key species	Ongoing observation of plots in the field and in different ecosystems
Changes in regeneration	Tendencies in number of sprouts per plant of a given species	Ongoing observation of plots in the field and in different ecosystems
Reduction in water supply	Tendency in water supplies in different annual seasons	Ongoing measurement of water supplies, at minimum once a month in two important rivers.
Quality of life in urban centers	Cases of dengue	See area of action
	Number of people affected by heat waves	See area of action

11. CONCLUSIONS

Creating the Huila 2050: Preparing for Climate Change Plan has been an opportunity for the department of Huila and its institutions to act in a timely manner to address one of the most important challenges that we face on this planet.

The message of a group of scientist that analyzed the 1,200 possible scenarios to avoid a temperature increase of more than 20C during this century is clear: "To avoid dangerous interferences in the climate system we cannot continue with business as usual…only a significant institutional and technological change will avoid the 50% probability that global warming will not surpass this threshold." In summary, the global economic structure must change drastically and soon.

The Huila 2050 Action Plan integrates elements of both mitigation and adaptation. While every corner of the planet must take measures to reduce emissions, in the case of Huila and the rest of Colombia, it will be particularly important to prepare for the challenges of living on a planet that is 20C hotter and has less water than today.

The structural axes presented in this Plan also represent the structural axes of development and competitiveness of Huila. The difference lies in that the Plan projects a vision for the year 2050, generating a challenge so that the department may have a vision of the State rather than of government, and that it begin to immediately think about climate-compatible development.

The plan depends on institutional unity in the department, a vision that is shared among all stakeholders (public, private and civil society). It is notable that although the plan depends on the Departmental Council for Climate Change, for which the CAM serves as Technical Secretary, the department must not be mistaken in thinking that this is only an environmental issue. On the contrary, as indicated in the IPCC, it is an economic issue that can quickly lead to recession of the global economy and, more immediately, that of the department. For this reason, the plan should continue to lie in the hands of all the institutions that shape the economy and the course of development of the department.
The Climate Observatory of Huila will be fundamental for coordinating the different areas of action, generating information for decision-making and monitoring change. In this context, the Observatory should be formed quickly and should be financed from diverse sources that can guarantee its stability and longevity.

Success of the plan will depend on each person and institution understanding it and incorporating it into their vision of development. It also requires financing to foster the areas of action that have been proposed in order to demonstrate early victories that show the benefits of the plan.

The study on financing climate change in the department shows that resources to support a new model of climate-compatible development already exist. Implementation is simply a matter of enforcing regulations that are already in place by law, such as the designation of 1% of municipal resources to manage watersheds, or using resources from royalties and compensations effectively and efficiently. As stated in the introduction, acting now will be much more cost effective than mending situations tomorrow.

A special call is made to mayors and to municipal authorities to study and understand the dimension of vulnerability presented here to benefit municipal development. The challenge of the plan will be to generate climate-smart cities that plant the seeds of competitiveness that will be reaped by 2050.

Communication and diffusion of the plan, and educational material in the department will be fundamental. The climate has changed more in the past 50 years than in the entire history of the planet, yet educational systems continue to teach about changes of the planet in conventional ways. The people of Huila must understand the challenges of the future climate and they must be willing to act in favor of their own futures and that of generations to come.

Finally, a call is made to national entities to understand that investing in a climate-smart Huila is likewise an investment in a country that is better adapted and resilient to the climate of the future.

Huila 2050

Preparándose para el cambio climático

IDENTIFICACIÓN DE RECURSOS PÚBLICOS Y PRIVADOS SUSCEPTIBLES DE SER CANALIZADOS HACIA LA MITIGACIÓN Y ADAPTACIÓN AL CAMBIO CLIMÁTICO EN EL DEPARTAMENTO DEL HUILA

GOBERNACIÓN DEL HUILA

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FROM THE AMERICAN PEOPLE

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12. BIBLIOGRAPHY

- Comstock M., Santelices I., Vanamali A. (2012). Caso de Estudio: Proceso Nacional de Cambio Climático Colombia. Center for Clean Air Policy, Washington DC.

- CEPAL (2012). Valoración de daños y pérdidas. Ola Invernal de Colombia, 2010-2011, Bogotá: Misión BID-CEPAL.

- Calderón, S. (2013). Plan Nacional de Adaptación al Cambio Climático (presentación). Bogotá: DNP.

- Plan Nacional de Adaptación. (n.f.). Recuperado septiembre 15, 2013, de

- Ministerio de Ambiente y Desarrollo Sostenible (MADS). (2013). Estrategia Colombiana de Desarrollo Bajo en Carbono. [en línea]. Bogotá- Colombia: Julio de 2013. fecha de consulta: 15 septiembre 2013]. Disponible en: http://www.minambiente.gov.co/documentos/DocumentosGestion/cambio_climatico/estrategia_bajo_carbono/100713_cartilla_ecdbd.pdf

- Ministerio de Ambiente y Desarrollo Sostenible (MADS). (2012). Preparación de la Estrategia Nacional de Reducción de Emisiones por Deforestación y Degradación Forestal - REDD+. [en línea]. Bogotá- Colombia: Junio de 2012. [fecha de consulta: 15 septiembre 2013]. Disponible en: http://www.minambiente.gov.co/documentos/DocumentosGestion/cambio_climatico/reed/documentos_interes/250712_folleto_02_redd.pdf

- Ortega-P., S.C., A. García-Guerrero, C-A. Ruíz, J. Sabogal. & J.D. Vargas (eds.). (2010). Deforestación Evitada. Una Guía REDD+ Colombia. Ministerio de Ambiente Vivienda y Desarrollo Territorial; Conservación Internacional Colombia; Fondo Mundial para la Naturaleza (WWF); The Nature Conservancy; Corporación Ecoversa; Fundación Natura; Agencia de Cooperación Americana (USAID); Patrimonio Natural- Fondo para la Biodiversidad y Areas Protegidas y Fondo para la Acción Ambiental.Bogotá. 72p.

- IDEAM-CORMAGDALENA. (2012). Plan de Ordenamiento y manejo integral de la cuenca del Río grande de la Magdalena.

- Corporación Autónoma Regional del Alto Magdalena (CAM). 2011. Plan de Gestión Ambiental Regional del departamento del Huila 2011 - 2023. Huila, Neiva.

- Gobernación del Huila. (2012). Plan de Desarrollo departamental 2012- 2015 “Haciendo el Cambio” Huila. P 118-244.

- ASOCIACIÓN COLOMBIANA PETROLEO .Informe Estadístico Petrolero2013 [en línea]: Informe automatizado de la Asociación Colombiana de Petróleo. [fecha de consulta: 16 Febrero 2014]. Disponible en: http://www.acp.com.co/index.php/es/informe-estadistico-petrolero-iep

- GOBERNACIÓN DEL HUILA. (2007) Agenda interna para la productividad y competitividad. Departamento de Huila. 1 ed. Neiva: Editora Surcolombiana S.A. 2007. 399 p.

- Secretaría de Agricultura y Minería. (2012). Observatorio de Territorios Rurales. Evaluaciones Agropecuarias Municipales.

- Olaya Alfredo y Sánchez Mario (eds.). (2005). Del Macizo Colombiano al desierto La Tatacoa, la ruta del río Magdalena en el Huila. Neiva: Universidad Surcolombiana, Corporación Autónoma del Alto Magdalena CAM.524p.

- IDEAM. (2010) Estudio Nacional del Agua. Instituto de Hidrología, Meteorología y Estudios Ambientales. Bogotá D.C. 409 p.

- ASOCIACIÓN GRUPO ARCO. (2008). Plan General de Ordenamiento Forestal del Huila. Informe final del Convenio 191 de 2007. 1 ed. Bogotá D.C. Asociación Grupo Arco. 139 p.
- Corporación Autónoma Regional del Alto Magdalena (CAM). 2013. Informe de Gestión 2012 - 2013. Huila, Neiva.

- ONF Andina, (2014 a). Evolución de la Cobertura Vegetal en el departamento del Huila para el período 2005- 2010 y Análisis de las causas de la deforestación. Neiva. P.

- Corporación Autónoma Regional del Alto Magdalena (CAM). (2012). Plan de acción 2012-2015 CAM- Alto Magdalena: territorio verde y climáticamente inteligente. Neiva.

- Plan de Desarrollo del Energía. (n.f.). Recuperado enero 13, 2014, de: http://www.huila.gov.co/index.php?option=com_content&view=article&id=8087&Itemid=3827

- Edenhofer Ottmar (2014). Comunicado de prensa del IPCC: Las emisiones de Gases de Efecto Invernadero se aceleran a pesar de las medidas para reducirlas. Oficina de prensa del IPCC. Suiza. Disponible en: http://www.ipcc.ch/pdf/ar5/pr_wg3/20140413_pr_pc_wg3_es.pdf

- Gobernación del Huila (2012). Indicadores básicos en salud. Situación de salud en el Huila.

- Confalonieri, U. et al. (2007). Human health. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on ClimateChange.

- SIVIGILA- Sistema de Vigilancia en Salud Pública; Instituto Nacional de Salud. (2014). Casos confirmados por departamento. Recuperado noviembre 15 de 2013, de: http://www.ins.gov.co/lineas-de-accion/Subdireccion-Vigilancia/sivigila/Estadsticas%20SIVIGILA/CASOS%20CONFIRMADOS%20POR%20DEPARTAMENTO%20sem%2045.xlsx

- ONF Andina, (2014 b). Cuantificación y análisis de las emisiones de GEI por sector y subsector en el departamento del Huila, Neiva. P.
- Artículo revista science

- Finanzas Carbono (BID, et. al). Disponible en http://finanzascarbono.org/financiamiento-climatico/

- UNFCC. Finance. Disponible en https://unfccc.int/cooperation_and_support/financial_mechanism/items/2807.php

- “Developing Dimension: State of the Voluntary Carbon Markets 2012”. Ecosystem Market Place y Bloomberg New Energy Finance, 2012.

ATTACHMENTS

Preparing for Climate Change

TABLE OF THE COMPONENTS AND LINES OF ACTION OF THE PLAN

COMPONENT	LINE OF ACTION	EXPLANATION AND RESOURCES ALREADY COMMITTED	APPROXIMATE COST
1- WATER: INTELLIGENT WATER RESOURCES MANAGEMENT	1.1 - Hydro modeling in Huila	WEAP Model funded by USAID with SEI. Resources already committed: COP 500 million (USAID-SEI).	COP 500,000,000 USD 270,000
	1.2 - Climate POMCAS	COP 100 million to integrate climate change in each POMCA. Six climate POMCA in total (estimated). Resources already committed: COP 75 million (USAID-SEI).	COP 600,000,000 USD 324,000
	1.3 - Payment for Environmental Services (PES) schemes	Designing the scheme per basin: COP 80 million. Five basins in total. COP 5 billion to manage the basin during 10 years. Resources for Las Ceibas River basin (COP 87 billion) already committed for 20 years. The scheme includes purchase of land.	COP 25,250,000,000 USD 13,649,000
	1.4 - Evaluation of the hydroelectric potential under climate change scenarios	Part of the results of the WEAP model funded by USAID. Resources already committed: COP 12 million (USAID- SEI).	COP 100,000,000 USD 54,000
			COP 26,450,000,000 USD 14,297,000
2- BIODIVERSITY AND ECOSYSTEM SERVICES	2.1 - Jurisdictional REDD+ strategy for Huila	There is already an agreement between Cormagdalena and CAM to finance the first study carried out by ONF (COP 270 million). However, more depth is needed. Resources already committed: COP 270 million (paid to ONF).	COP 800,000,000 USD 432,000
	2.2 - Vulnerability assessments of ecosystems under climate change scenarios	This study has overall progress by the Alexander von Humboldt Institute. Resources already committed: COP 50 million (CAM).	COP 600,000,000 USD 324,000
	2.3 - Strengthening the departmental system of protected areas	COP 200 million estimated to develop the management plan for each regional park. Additional resources of COP 1 billion per protected area to implement the plans are required. We estimate that six parks will be strengthened and that civil society reserves will be supported with COP 1 billion. Resources already committed: The following resources have been assigned to strengthen protected areas: COP 2.3 billion (General Royalties System-Fund for Science and Technology); COP 200 million (CAM); COP 200 million (ONF); COP 100 million (CUCHIYUYO).	COP 8,200,000,000 USD 4,432,000
	2.4 - Management of páramos and wetlands	We estimate that it is possible to delineate and develop management plans for at least 5 páramos and wetlands at a cost of COP 300 million per area.	COP 1,500,000,000 USD 811,000
	2.4 - Huila CO_2 Bank	COP 200 million to design the program, plus an additional COP 800 million as seed capital.	COP 1,000,000,000 USD 541,000
			COP 12,100,000,000 USD 6,541,000
3- AGRICULTURAL PRODUCTION AND FOOD SECURITY	3.1 - Climate information	Information systems can be very expensive. The starting point is the information system of the coffee sector for COP 3 billion. It will be strengthened with additional resources.	COP 8,000,000,000 USD 4, 324,000
	3.2 - Vulnerability assessments of crops	The Ministry of Agriculture and Rural Development has an agreement with CIAT to develop these assessments. There exists the possibility to carry out specific assessments for Huila under this agreement if some resources are added. Additionally, the Adaptation Fund will finance, through Corpoica, a project to carry out vulnerability assessments and identify adaptation measures for some crops and pilot municipalities in Huila. Resources already committed: to assess the vulnerability of a few crops in Huila and implement adaptation measures in the agricultural sector- COP 3.6 billion (General Royalties System – Fund for Science and Technology).	COP 10,000,000,000 USD 5,405,000
	3.3 - Good practices for climate-smart livestock	We expect to start under the same financial scheme of the silvopastoral GEF project with initial resources and counterparts from farmers.	COP 3,000,000,000 USD 1,622,000
	3.4 - Good practices for climate-smart coffee production	Resources would come from the Colombian Coffee Growers Federation for the conversion of farms, and some additional resources for producers that are not part of the Federation. Resources already committed: The following resources have been allocated for research and to strengthen the production model for coffee according to the specificities of Huila, taking into consideration climate variability and change: COP 11,527,655,000* (General Royalties System - Fund for Science and Technology, Fedecafé and Cenicafé). Additionally, there are resources allocated to determine environmental footprints, including the carbon footprint totaling COP 3,116,796,500.	COP 5,000,000,000 USD 2,703,000
	3.5 - Tools to provide incentives to use good practices	Better estimates are still required per new sector. The amount proposed should be enough to generate seed capital to start good practices programs.	COP 4,000,000,000 USD 2,162,000
			COP 30,000,000,000 USD 16,216,000

COMPONENT	LINE OF ACTION	EXPLANATION AND RESOURCES ALREADY COMMITTED	APPROXIMATE COST
4- ENERGY RESOURCES	4.1 - Promotion of energy efficiency	This program would have the support of UPME and ElectroHuila and require a basic energy efficiency study for Huila.	COP 5,000,000,000 USD 2,703,000
	4.2 - Promotion of renewable energy sources	This program would include pilot programs in areas that are not connected to the national electricity network and a biofuel pilot.	COP 8,000,000,000 USD 4,324,000
	4.3 - Regulation of hydropower based on information about its potential	Based on the results obtained using WEAP to generate information for decision-making.	COP 200,000,000 USD 108,000
			COP 13,200,000,000 USD 7,135,000
5- RESILIENT ENVIRONMENTS	5.1 - Climate-smart Neiva	Neiva begins with programs that have already secured resources.	COP 1,200,000,000 USD 649,000
	5.2 - Climate-smart municipality	We expect to have plans implemented for at least 5 municipalities in the next 10 years at a cost of: To design the plans COP 200 million, plus COP 2 billion to implement them (per municipality).	COP 11,000,000,000 USD 5,946,000
	5.3 - Prevention and control of vector-borne diseases	This line of action is aligned with the programs already put in place by the regional Secretary of Health. We expect to support these programs with COP 500 million annually.	COP 5,000,000,000 USD 2,703,000
	5.4 - Management of heat waves	It is a new topic in Colombia so the regional Secretary of Health hasn't even handled it. We expect for the Secretary to begin handling it.	COP 1,500,000,000 COP 811,000
			COP 18,700,000,000 USD 10,108,000
		SUBTOTAL	COP 100,450,000,000 USD 54,297,000
CROSS-CUTTING 1- Land use zoning	1T.1- Training in land use zoning and climate change	Since the POTs are done every 10 years, two rounds of training will be carried out each at a cost of COP 600 million.	COP 1,200,000,000 USD 649,000
	1T.2 - Municipal Bank of Climate Information (MBCI)	In the next 10 years at least 7 MBCI should be created at a cost of COP 300 million each.	COP 2,100,000,000 USD 1,135,000
CROSS-CUTTING 2- Education and training	2T.1 - Field schools about better agricultural practices	An annual cost of COP 400 million is estimated to develop field schools in at least two sectors.	COP 4,000,000,000 USD 2,162,000
	2T.2 – Climate change as a cross-cutting axis of CIDEA	COP 100 million per year.	COP 1,000,000,000 USD 541,000
	2T.3 - "Climate kit" for schools	COP 150 million U.S. dollars every 5 years.	COP 300,000,000 USD 162,000
CROSS-CUTTING 3- Communication to understand climate compatible development	3T.1 - Training for journalists about climate change	Trainings will be carried out every 2 years at a cost of COP 100 million each time.	COP 500,000,000 USD 270,000
	3T.2 - Agreements with media organizations in Huila	COP 50 million per year.	COP 500,000,000 USD 270,000
CROSS-CUTTING 4- Science and technology	4T.1 - Scholarships for a climate-smart territory	COP 400 million every two years for 10 scholarships.	COP 2,000,000,000 USD 1,081,000
	4T.2 - Events to promote appropriate technology	COP 50 million per year.	COP 500,000,000 USD 270,000
CROSS-CUTTING 5- Risk Management	5T.1 - Coordination and inter-agency actions for risk management	The cost of the coordination scheme is estimated at COP 50 million annually. The implementation of preventive measures is estimated at COP 1 billion annually plus what municipalities provide.	COP 10,500,000,000 USD 5,676,000
		SUBTOTAL	COP 19,300,000,000 USD 10,432,000
HOW TO GET ORGANIZED	Climate Observatory	The cost of a coordination scheme including a head of the Climate Observatory and 3 other professionals is estimated in COP 240 million annually.	COP 2,400,000,000 USD 1,297,000
		TOTAL	**COP 122,150,000,000 USD 66,027,000**

* Not all financial resources are allocated to include climate change considerations in the coffee sector.