

Many suburbs of Medellín, Colombia's second-largest city, line the steep slopes of the Aburrá Valley—challenging urban planning. Medellín has built cable cars to make local transportation more efficient.



Report:

Disaster Risk Assessment of Five Colombian Cities



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Abbreviations and Acronyms

AMVA	Área Metropolitana del Valle de Aburrá Metropolitan Area of the Aburrá Valley
ANDI	Asociación Nacional de Industriales National Association of Industries
ARISE	Alliance for Disaster Resilient Societies
BID (IDB)	Banco Interamericano del Desarrollo Inter-American Development Bank
CAF	Corporación Andina de Fomento Andean Development Corporation
CAR	Corporación Autónoma Regional Regional Autonomous Corporation
CARDIQUE	Corporación Autónoma Regional del Canal del Dique
CEPAL	Comisión Económica para América Latina y el Caribe Economic Commission for Latin America and the Caribbean
CNDRG	Consejo Nacional de Gestión del Riesgo de Desastres National Council for Disaster Risk Management
COMBAs	Comités Barriales de Emergencias Neighborhood Emergency Committees
Cormagdalena	Corporación Autónoma Regional del Río Grande de la Magdalena Regional Autonomous Corporation of Río Grande de la Magdalena
Corpocaldas	Corporación Autónoma Regional de Caldas Regional Autonomous Corporation of Caldas
Corponariño	Corporación Autónoma Regional de Nariño Regional Autonomous Corporation of Nariño
CVC	Corporación del Valle del Cauca Cauca Valley Corporation
DAGR	Departamento Administrativo de Gestión del Riesgo de Desastres (de Medellín) Medellín Administrative Department of Disaster Risk Management
DAGMA	Departamento Administrativo de Gestión del Medio Ambiente Administrative Department for Environmental Management
DANE	Departamento Administrativo Nacional de Estadística National Department for Statistics
DFID	U.K. Department for International Development
DGIS	Ministry of Foreign Affairs of the Netherlands
DNP	Departamento Nacional de Planeación National Department for Planning
DRM-	Disaster Risk Management
DRMD	Disaster Risk Management Directorate
EMCALI	Empresas Municipales de Cali
EPA	Establecimiento Público Ambiental Public Entity for the Environment
FASECOLDA	Federación de Aseguradores Colombianos Federation of Colombian Insurance Companies

FENALCO	Federación Nacional de Comerciantes National Trade Federation
FINAGRO	Fondo para el Financiamiento del Sector Agropecuario Fund for Financing the Agriculture and Fishing Sector
FINDETER –	Financiera de Desarrollo Territorial S.A. Financial Corporation for Territorial Development
GDP	Gross domestic product
IDEA	Instituto de Estudios Ambientales Institute for Environmental Studies
IDEAM	Instituto de Hidrología, Meteorología y Estudios Ambientales Institute for Hydrology, Meteorology, and Environmental Studies
IGAC	Instituto Geográfico Agustín Codazzi Agustín Codazzi Geographic Institute
IFI	Instituto de Fomento Industrial Institute for Industrial Development
INVEMAR	Instituto de Investigaciones Marinas y Costeras Institute for Marine and Coastal Studies
INVIPASTO	Instituto Municipal de la Reforma Urbana y Vivienda de Pasto Pasto Municipal Institute for Urban Reform and Housing
ISF	InsuResilience Solutions Fund
MOF	Ministerio de Hacienda y Crédito Público Ministry of Finance
NAMA	Nationally Appropriate Mitigation Actions
NGO	Non-governmental organization
POMCA	Plan de Manejo y Ordenación y Manejo de Cuencas Hidrográficas Watershed Regulation and Management Plan
POT	Plan de Ordenamiento Territorial Land Use Plan
SECO	Secretaría de Estado para Asuntos Económicos de Suiza Secretary of State for Economic Affairs of Switzerland
SIATA	Sistema de Alerta Temprana del Valle de Aburrá Early Warning System of the Aburrá Valley
SISBEN	Sistema de Identificación de Potenciales Beneficiarios de Programas Sociales System for Identification of Potential Social Assistance Beneficiaries
SNGRD	Sistema Nacional de Gestión del Riesgo de Desastres National System for Disaster Risk Management
SPV	Special purpose vehicle
SUMA	Sistema Universitario de Manizales
UNDP	United Nations Development Programme
UNGRD	Unidad Nacional para la Gestión del Riesgo de Desastres National Unit for Disaster Risk Management
USAID/OFDA	United States Agency for International Development/ Office of Foreign Disaster Assistance
WASH	Water, sanitation and hygiene

Executive Summary

To help KfW understand the weather-related and climate change risk exposure of major cities in Colombia, KfW commissioned Global Communities, in partnership with insurance industry partners (DLA Piper, Hannover Re and Willis Towers Watson) to assess the status of DRM in five Colombian cities: Cali, Cartagena, Manizales, Medellín and Pasto. The cities were selected based on the level of their risk exposure and vulnerability, and interest expressed by KfW. The study was conducted through desk research and two field assessments in July-August 2018, during which we met with 50 key Colombian government, community, academia and business stakeholders at the national and sub-national level, and conducted a total of 90 interviews, as is detailed on Annex 1. This report summarizes our findings on the current level of disaster risk management (DRM) and the financing dedicated to DRM by those municipalities, and identifies gaps in awareness and use of DRM tools, such as resilience building and risk transfer tools.

Colombia is widely recognized as one of the most disaster-prone countries in the world. According to the World Bank, at least 85% of its population and its assets are exposed to two or more natural hazards. In addition, not only is climate change already exacerbating flooding and landslides in large parts of the country, but the average rainfall in Colombia is projected to increase over the course of the century, further increasing flood risk.

Colombian leaders have responded with concrete actions to reduce vulnerability. In fact, Colombia is known as a role model in the Americas for its progress in establishing a strong institutional and legal framework for disaster risk management (DRM). However, the implementation of DRM at the sub-national level has proven to be challenging, due to multiple factors such as low level of risk awareness, lack of capacity for DRM, and budget constraints. Furthermore, the value of community engagement in DRM has been underestimated; and there is no sign of consensus among DRM decision-makers at the sub-national level on the need to empower and/or engage communities in disaster management and mitigation.

Act 1523 of 2012 established the National System for Disaster Risk Management and adopted a new national policy on DRM. The National Unit for Disaster Risk Management (UNGRD), which reports directly to the President, leads the implementation of the policy. Despite UNGRD efforts to build capacity at the sub-national level, the municipalities assessed in this study show a diverse level of capacities and advancement in their efforts to implement the institutional guidelines and legal framework for DRM.

In 2016, Colombia issued the National Strategy for Financial Management, which recognizes the need to promote risk transfer tools to reduce the impact of natural hazards on public budgets. Following this guideline, the national government has taken the first steps in implementing the strategy by establishing a DRM fund and adopting risk transfer measures at the national level. However, with a few exceptions, the ability to implement the strategy at the sub-national level is limited.

The importance of protecting public infrastructure with insurance is also recognized by Law 42 of 1993, which assigns public servants with administrative responsibility for taking out adequate insurance policies to protect public assets. Nonetheless, implementing this law has been challenging, since it requires an inventory of public assets, updated information of insurable assets,¹ and an analysis of risk related to those assets at the national² and sub-national level.

Risk transfer has not traditionally been considered part of risk management measures to reduce the economic impact of weather-related risks in Colombia, but there is an enabling environment to promote

¹ Not all public infrastructure would be insurable, as some older buildings and properties do not meet seismic safety standards established by regulation in 1997.

² DNP and other institutions are committed right now to having an inventory of public assets.

financial tools to cope with the effects of climate change. This report identifies the opportunities for tailored disaster risk transfer tools to increase the resilience of individuals, communities and municipalities to external shocks and reduce their future expenditures in case of weather-related disasters.

Efforts by cities such as Manizales Medellín, followed by Cali, whose DRM systems have reached a certain level of sophistication, can be considered a global best practice. These cities show good levels of coordination and community engagement, they have completed -or are in process of conducting- multiple hazard studies and public assets inventories, and have even pioneered risk transfer initiatives, as exemplified by social housing in Manizales (see p.38).

To further enhance DRM efforts at the sub-national level, this report proposes a set of risk mitigation measures, including but not limited to the following:

- *Governance measures.* Enforcing DRM governance schemes, with government roles and responsibilities assigned in engaging communities, academia and the private sector.
- *Infrastructure measures.* Maintaining up-to-date inventories of public assets and studies to understand their exposure, promoting risk awareness and risk mitigation measures, and taking a holistic approach to the relocation and resettlement of informal communities in high-risk zones.
- *Financial measures.* Establishing adequate local DRM funds, designing and implementing tax systems that incentivize the enforcement of risk mitigation measures, and integrating mitigation measures into development loans, to mention a few.

As KfW is re-directing its portfolio in Colombia toward sustainable economic development through investment in urban transportation and infrastructure, and given the interest expressed by municipalities interviewed for this report in protecting public assets and social housing (urban vulnerable communities) from climate-related risks, our assessment suggests the following risk transfer measures as potential solutions to improving DRM in Colombia:

- a. A **parametric insurance solution** for cities that are able to allocate funding for risk transfer solutions, establishing triggers associated with weather-related phenomena, which can provide effective coverage for social housing and main public assets. This kind of insurance solution already exists in the international market and can be developed for any city, and the information is available at national and international levels.
- b. A scheme that combines the **issuance of bonds** to make investments in resilient and climate-smart infrastructure with a **parametric insurance solution** to protect public assets and investments, for cities with limited resources for risk.
- c. A third risk transfer solution, issuance of a **Resilience Bond**, is proposed for a group of municipalities, for insuring resilient infrastructure projects.

The proposed risk transfer solutions could be implemented for i.e. Manizales, Medellín and Cali through KfW's InsuResilience Solutions Fund (ISF), which supports the development of innovative and sustainable climate risk insurance products to improve the resilience of at-risk communities (frequently poor) against extreme weather events. Under the ISF, the proposed insurance measure can be piloted through a participatory approach empowering municipalities and communities in identifying and mitigating risks using qualitative and quantitative tools from the (re)insurance industry. This approach can strengthen the understanding of municipalities and their citizens of the financial impacts of their specific risk exposure, and allow communities to prioritize and implement risk reduction strategies and recovery plans based on accurate information. Municipalities themselves will be able to analyze, develop and strengthen guidelines, mechanisms and public investment in risk management and financing, as well as adaptation to climate change. By building trust, awareness and capacity, municipalities will be able to better formulate their risk tolerance and make decisions on risk transfer solutions.

Table 1 summarizes some key aspects of DRM in the cities of Cartagena, Medellín, Manizales, Pasto and Cali.

Table 1. Key considerations for DRM in five Colombian cities – summary of findings field assessment

City	Articulation within DRM System	Community Integration of DRM	Two Main Hazards	Detailed Studies on Main Hazards	DRM Fund Use	Risks Transfer Solutions in Place
Cartagena	Very Low	None	1. Flood 2. Coastal Erosion	1. Being developed 2. Developed	Response to household affected over last disasters	Insurance policies for public assets
Medellin	High	High	1. Earthquake 2. Floods and Landslides	1. Micro zoning studies finished 2. Being developed	Staff salaries-including the ones for trainers on risk management for schools and communities (50%) and 20% to emergency response.	Insurance policies for public assets (2). An insurance policy for household for earthquake and landslide risk is being discussed with an insurance company.
Pasto	Low	Low	1. Earthquake 2. Volcano	1. Micro zoning studies finished 2. Being updated	Preparation and response activities (54%) and Knowledge activities (30%)	Insurance policies for public assets (2)
Manizales	High	Yes	1. Earthquake 2. Landslides	1. Developed 2. Developed and being updated	Mitigation works and to attend emergencies	Insurance policies for public assets and an insurance scheme for private property owners which subsidized lower-income sector households in the city
Cali	Moderate	Low	1. Flood 2. Earthquake	1. Developed 2. Pending micro-zoning	Respond to emergencies	Insurance policies for public assets (2). An insurance policy for household for flood and earthquake is being discussed.
<p>(1) Only includes the DRM unit budget. It does not consider resources which are usually allocated by the other areas at the Municipality, such as infrastructure budget to reinforce assets, education budget which reinforce schools, etc. It does not consider budget executed on mitigation measures in the city by other institutions such as the Adaption Fund or the National Unit for Disaster Risk Management.</p> <p>(2) The insurance policies in place present similar problems in most of the cities, inventory of assets have not been updated, considering their adequacy to the seism-resistant law from 2010, its current cadastral values.</p>						

1. Introduction

The economic and humanitarian risks associated with catastrophic weather and climate-related hazards are increasing, and represent a major challenge to global resilience, particularly in the increasingly-urban populations of low- and middle-income countries. Overall losses from world-wide natural catastrophes in 2017 totaled \$330 billion, nearly double the \$188 billion lost in 2016. On average, 70% of economic losses from natural disasters remain uninsured, and in low/middle-income countries, this can reach up to 90%, leaving a huge protection gap. Growing evidence indicates that countries with greater penetration of

insurance coverage have faster economic recovery from disasters and rebuild with greater resilience to future disasters. Research has shown that a 1% increase in insurance penetration can reduce the disaster recovery burden on taxpayers by 22%.

Colombia features weak insurance penetration and density—measures of premiums compared to the size of the economy and the population, respectively—compared to other large markets in the region. For the Latin America and Caribbean region as a whole, insurance penetration stood at 3.09% in 2015; the penetration rate in Colombia was estimated at 2.64 % of GDP.

The aim of the study commissioned by KfW and undertaken by Global Communities, in partnership with insurance partners, in July-August 2018 was to understand the national landscape of DRM and related financing in Colombia, for which we conducted an in-depth review of the current status of DRM in five municipalities—Cartagena, Medellín, Manizales, Pasto and Cali—then analyzed the results in order to identify gaps in awareness and use of DRM tools such as resilience building and risk transfer tools.

This report summarizes our findings on the current state of DRM and financing at the national and municipal levels. We also identify measures that could increase natural disaster risk resilience, and suggest ways these measures can strengthen the impact of KfW’s engagement with vulnerable communities in Colombia. Section 3 presents proposed mitigation measures and potential risk transfer solutions, while Sections 4 through 8 report city-specific findings.

2. National Level Disaster Risk Management

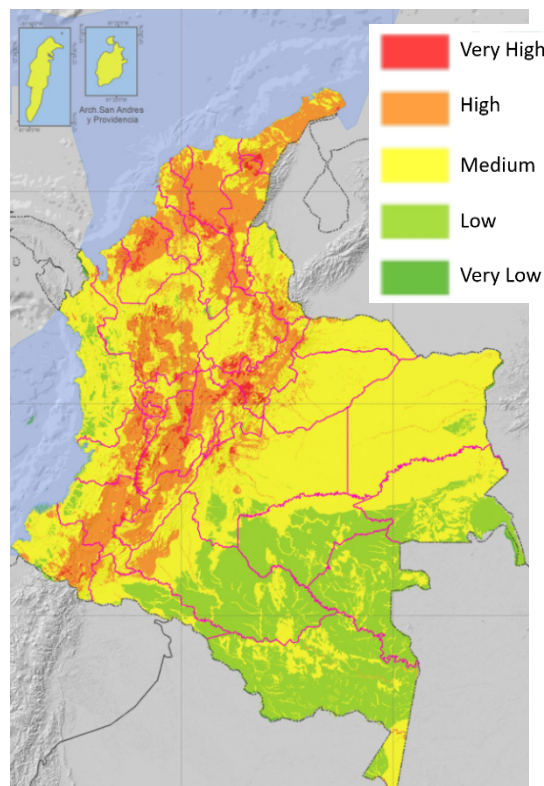


Figure 1. Potential level of impact of climate change in Colombia from 2011 to 2040 (Source: IDEAM)

National-level DRM Summary

Location	Population	DRM Plan	Principal Risks
Northwest South America	49,879,897 (DANE projection as of July 31, 2018)	Approved in 2015, for the period 2015-2025.	<ol style="list-style-type: none"> 1. Earthquakes 2. Floods 3. Landslides 4. Volcano eruption

2.1 Current state of national DRM, including current and past government initiatives

2.1.1 DRM Governance Framework pertaining to local DRM: Main actors and their responsibilities

The leadership of the Colombian National System for DRM consists of the National Council for DRM, which is responsible for setting policy and the National Unit for Disaster Risk Management (UNGRD), which is responsible for providing guidance on implementation of those policies at national and sub-national levels. The alignment around DRM of all institutions at different government levels (national, departmental and local), as well as the participation of Colombian private, non-governmental and academic sectors throughout the DRM system allows for an integrated approach throughout the country.

Act 1523 of 2012 provides the framework for the national and sub-national DRM system in Colombia. It established the Policy and the National System for Disaster Risk Management (SNGRD, acronym in Spanish), and details the responsible institutions, their corresponding functions and responsibilities, as well as the planning, information, and public financial tools available to achieve objectives. It also established a special process to alert the public to disasters and calamities. The law furthermore established the structure of the DRM system at the sub-national level to mirror the national-level structure, and requires every department and municipality to have a DRM Plan and an emergency action Plan.

SNGRD is comprised of public, private, academic, NGO and community institutions as illustrated in Figure 2, and elaborated on in Annex 1: Methodology and list of institution interviewed

Data and Information Collection Methods

Data and information were collected through:

- Desk research of current DRM and climate change adaptation plans, related laws at the national and municipal level, studies about risks and previous disasters and risk maps.
- Information collected during the UN Conference for DRM for the Americas, which took place from June 20th to June 22nd in Cartagena de Indias.
- Interviews made with relevant officials and institution representatives, in Cartagena, Bogotá, and Medellín, as well as community leaders in Medellín, during the field trip from June 20th to June 29th.
- Phone interviews made during the weeks of July 2nd to July 13th.
- Interviews made with relevant officials and institution representatives, in Bogotá, Pasto, Manizales, and Cali, during the field trip from July 16th to July 31th.
- Interview with officials from KfW, National government institutions and partners at Bogota from June 25th to 26th, as well as on July 31th

Interviews at the national level were limited because officials from the main national institutions were dedicated to transferring Government portfolio to recently new elected Government.

There was no opportunity to interview all relevant high- level officials from the Cartagena municipality and Bolivar Department—to which Cartagena belongs—as there were assigned to the organization of the global Cartagena Climate Conference or attending to a recent emergency in the Department.

List of institutions interviewed

During the visits, we interviewed a whole range of stakeholders from the national to the community level to understand first-hand the status quo of the DRM system from knowledge to the operational and financial aspects of it. There were nearly 50 meetings and approximately 90 people interviewed.

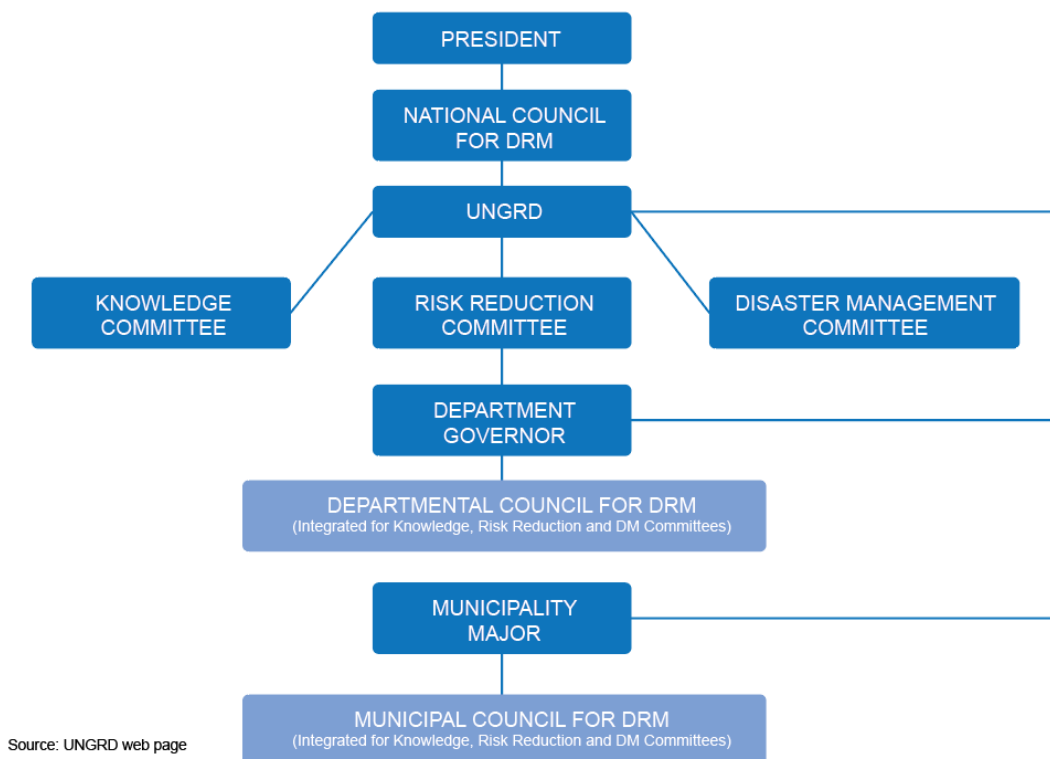
Below is a list of institutions interviewed:

#	Institution	Area or authority Interviewed
FIRST VISIT		
BOGOTA		
1	Willis Towers Watson	Head of Facultative Reinsurance for Colombia and for selected cities
2	National Unit for Disaster Risk Management -UNGRD-	Advisor Responsible for Financial Protection Strategy
		Advisor for Financial Protection strategy
		Responsible at UNGRD to formulate project to prevent coastal erosion in Cartagena
3	DLA Piper	Senior Insurance Associate
4	FIDUPREVISORA	National Fund for Disaster Risk Management Coordinator
5	KfW	Regional coordinator for Colombia and local coordinator for transport and urban development in Colombia
CARTAGENA		
6	Cartagena Municipality	RDM Management Unit, advisor
		Infrastructure Secretary, advisor
		Planning secretary, advisor
7	Marine and Coastal research Institute -INVEMAR-Colombia	Responsible of data development for planning and development plan for Cartagena
8	Cartagena Chamber of Commerce	Executive President
MEDELLIN		
9	Antioquia Department	Coordinator for DRM Department (DAPARD)
		Sustainable Development Secretary
10	Medellin Municipality	DRM Department - DAGRED- Chief - Vice Director of Knowledge
11	Metropolitan Authority for Aburra Valley	DRM Department and responsible for POT planning
12	Local Development Enterprise Association	Environmental Management and Strategic Planning representatives
13	Local Community Boards	

14	University EAFIT	Information, research and development for Medellin DRM Plan
15	100 resilient cities Office at Medellin	Chief Resilience Officer for Colombia
SECOND VISIT		
BOGOTA		
16	Ministry of Finance	Subdirector of Risk
		Advisor at Risk Sub direction
17	Adaptation Fund	Advisor at Sub-direction of Risk Management
18	Environment and Sustainable Development Ministry	Climate Change Direction and Risk Management
19	National Department Planning	Environment and Climate Change Adaptation Sub-Direction
20	Hanover Re	Chief for Colombia
PASTO		
21	Pasto Municipality	Environment Management Secretary
22	ALCALDIA MUNICIPAL DE PASTO	Treasury Secretary
23	Nariño Governorate	DRM Direction
24	Pasto Municipality	DRM Department
25	Pasto Municipality	Planning Department
26	CORPONARIÑO	Advisor of Risk Assessment Direction
27	Pasto Municipality	Community Development Secretary
MANIZALES		
28	Instituto de Estudios Ambientales (IDEA) Universidad Nacional de Colombia (sede Manizales)	Prof. Omar Dario Cardona- Risk transfer and earthquake modeling expert
29	Instituto de Estudios Ambientales (IDEA) Universidad Nacional de Colombia	Director
30	Regional Autonomous Corporation- Corpocaldas	Environmental Planning Sub- Direction
31	Manizales Municipality	RDM Unit- Chief
32	Manizales Municipality	Planning Secretary
33	Manizales Municipality	Treasury Secretary
34	Universidad Católica de Manizales	Research are on DRM
35	Manizales Municipality	Environment Secretary

36	Universidad de Manizales	Environment and Development Research Center - Cimad
CALI		
37	Valle del Cauca Governorate	DRM Secretary
38	Cali Municipality	DRM Secretary
39	Cali Municipality	Land- Use Planning - Planning Department
40	Regional Autonomous Corporation – CVC	Environmental Management and Climate Change
41	Universidad del Valle	Environmental Urban conflict Observatory- OCAU
42	Cali Municipality	Department for Environmental Risk Management (DAGMA)
43	Cali Municipality	Resilient Office (100 resilient Cities)

Figure 2. Structure of the National System for Disaster Risk Management (SNGRD)



The effects of La Niña in 2010-2011 created a greater level of government awareness about the effects of natural disaster and the need to become better prepared. Colombia's 2015-2025 National Plan for Disaster Risk Management was approved in November 2015. It contains a detailed description of the action items that the SNGRD will execute, along with the timeline and indicators for each action around risk awareness, reduction and response activities. Among the activities listed is the development and implementation of a financial strategy for DRM.

Law 29137, just approved on July 27, 2018, relates to Climate Change Management and describes the need for complementarity among planning and financing for climate change and DRM.

2.1.2 Level of risk awareness and the state of development and implementation of DRM plan

A key part of the national strategy on DRM is to strengthen awareness at the sub-national level. In addition to regulations established to promote DRM at the sub-national level (see [Annex 3](#)), the UNGRD has worked intensively to build capacities at the sub-national level to promote knowledge about risk, and to support and implement mitigation projects around the country. Nonetheless, sub-national implementation of the policies, roles, responsibilities and dedicated funds has proven difficult. There are two main reasons for these difficulties, according to officials interviewed during this study:

- The need for continuous capacity building activities aimed at sub-national authorities. Capacity varies from municipality to municipality and is affected by factors such as staff turnover, the funding available for studies to quantify risk, the time and funding available for training and other activities and the level of commitment of the local authorities.

- At the sub-national level, DRM competes for funding with other pressing needs. There is no financial planning for response to future events. The existing local funds are mainly dedicated to responding to emergencies when those occur, and most of the time the funds have proven to be insufficient. In these events, most municipalities ask for support from the department or national level in order to recover from emergencies.

Colombia has a national strategy for financial risk management at a nascent stage of implementation. A National Strategy on Public Financial Management of Risks associated with Natural Disasters was issued in 2016 with the support of the World Bank, the Secretary of State for Economic Affairs of Switzerland (SECO) and the Global Facility for Disaster Reduction and Recovery. The Strategy includes policy objectives and promotes risk transfer and retention solutions in order to reduce fiscal vulnerability to natural disaster and promote macroeconomic stability. Specifically, the strategy promotes the design of financial and insurance tools, and supports the development of similar tools at the sub-national level.

Furthermore, the National Financial Strategy for Climate Change Adaptation recognizes the need to promote financial tools to cope with climate change effects, including the development of an insurance market for climate change-related risks, and the development of a proposal for climate-related risk insurance in the agricultural sector.

2.1.3 DRM measures in place (including funding, mitigation/infrastructure measures, fiscal measures and risk transfer)

Funding

There are two main sources of funding for DRM at the national level:

1. **The National Fund for DRM:** The law that created the SNGRD also renamed and repurposed the National Fund for Disasters (1989) into the National Fund for DRM, extending its objectives to fund not only disaster management activities but also risk prevention and reduction. The Fund is administered as an autonomous trust, which can be financed through public and non-public donations. This law also requires municipalities and departments to create funds with a similar purpose, called Territorial DRM funds.
2. **The Adaptation Fund:** The Adaptation Fund was originally created to fund reconstruction after the devastation caused by La Niña in 2010-2011, with a total budget of 9.3 billion pesos funded by the National Government. Departments, municipalities and ministries can request Adaptation Fund resources for specific projects. In total, 29 projects have been selected, including four mega projects working to mitigate the effects of future disasters in some of the main river basins of the country: the Canal del Dique, Gramalote, La Mojana and Jarillón de Cali. The objectives of these mega projects are to restore the river basin ecosystem, and to reinforce and/or build infrastructure resilient to natural disaster and climate change effects. The Fund's total budget was recently amended based on changes in budget assumptions, and the final budget to be executed will be 7.9 billion pesos. The Adaptation Fund's mandate also authorizes work with international cooperation funds and the Fund working on elaborating projects to be submitted to the Green Climate Fund.

REDUCED GROWTH BECAUSE OF LA NIÑA

The National Department for Planning has recently published an article which collected information on the costs associated with the 2015 El Niño. It estimates that El Niño cost the country approximately 0.6% of GDP.

The study, prepared by the IDB and CEPAL, estimates the economic effects from La Niña of 2010-2011 at -0.12% GDP growth, with the agriculture, cattle and mining sectors most affected.

Risk Transfer solutions implemented in Colombia

The importance of protecting public infrastructure with insurance is recognized by law, which also assigns public servants administrative responsibility for taking out adequate insurance policies to protect public assets (Law 42 of 1993). Nonetheless, implementing this law has

been challenging, since it requires an inventory of public assets, updated information on insurable assets,³ and an analysis of risks related to those assets at the national⁴ and sub-national levels.

There have been efforts by the National Association of Insurance Companies (FASECOLDA) as well as the Financial Supervisor of Colombia to extend the use of catastrophic insurance, which is detailed in Section 3.2.1.

At the national level, Colombia has been a pioneer in risk transfer measures dealing with natural hazards, including:

- A contingent credit with the World Bank for US\$150 million, which was used during La Niña events and which will soon be renewed and increased to US\$ 250 million.
- The Pacific Alliance catastrophe bond (the largest sovereign insurance risk transaction in the region), which Colombia subscribed to this year, assured US\$400 million in coverage upon declaration of a national disaster caused by an earthquake. This risk transfer solution is being explored by the National Government, with a similar scheme being discussing with the Andean Development Corporation (CAF) and Inter-American Development Bank (IDB).

At the municipal level, Manizales, in cooperation with the World Bank and the Universidad de Manizales have jointly developed a model to transfer earthquake risk to the capital markets for housing in the city since 1999, a global innovation. See p.37 for a description of this model. In Cali, the municipality is in discussions with insurers on an excess rainfall policy.

FASECOLDA, in cooperation with the Ministry of Finance (MOF) and the Fund for the Agri-culture and Fishing Sector (FINAGRO) is also championing an initiative to develop a parametric insurance solution for the agriculture sector to cope with floods, heavy rain, and drought.

2.1.4 Existing data sources (open and commercial) and available data about risk exposure and vulnerability to natural hazards - including projections of future risks and costs associated with these risks

The main sources of detailed data and information about risk exposure and vulnerability to natural hazards are the Colombian scientific research institutes: Instituto Geográfico Agustín Codazzi (IGAC), Colombian Geological Service, Institute for Geology and Mining, the Institute for Hydrology, Meteorology, and Environmental Studies (IDEAM) and the Maritime Directorate.

IDEAM has a database of major meteorological events that have occurred in Colombia over the last 30 years, although the level of analysis varies. IDEAM has a major role in the national system for DRM, as it is responsible for issuing meteorological warnings that are shared with the UNGRD. IDEAM can also provide historical analysis and projections of risk scenarios on demand. Recently, they have developed a methodology to analyze historical data for a specific region—Amazonia—to allow them to forecast future events.

FASECOLDA has been working for many years on a project to develop insurance for disaster risk. They have built datasets for Bogotá and Medellín land registry information, for any type of risk. FASECOLDA already has more than 120 layers of information accumulated from various public and private sources. This database allows insurance companies to more accurately estimate risk at the household level.

The web page DESINVENTAR from Corporación OSSO has an inventory of disasters that occurred in

³ Not all public infrastructure would be insurable, as some older buildings and properties do not meet seismic safety standards established by regulation in 1997.

⁴ DNP and other institutions are committed right now to having an inventory of public assets.

Colombia since 1914⁵ and specific inventories for some Departments such as Valle del Cauca, Antioquia, Caldas, Risaralda and the Medellín metropolitan area. The registry contains basic information reported from disaster events. Municipalities voluntarily send information including key data such as the numbers of deaths and households affected by a disaster event; partial information is available on crop damage, public infrastructure, number of people evacuated and estimates of financial losses for some of these events.

However, there is no comprehensive registry of costs and economic impacts of disasters at the national or sub-national levels, and studies about specific disasters are available for only the most recent events. When a disaster event occurs, departments and municipalities use budgets from different sectors (infrastructure, education, health, etc.) to respond to emergencies, making it difficult to estimate total costs incurred by the government, private sector, non-governmental organizations (NGOs) and inhabitants. There is no estimate of how disaster events have affected the growth or development of cities and the country, with the exception of a study by the IDB and Economic Commission for Latin America and the Caribbean (CEPAL) undertaken after the last La Niña event in 2010-2011.⁶ It is estimated that the La Niña Phenomena produced losses up to USD 1.8 billion in losses for transportation infrastructure, as is showed in Table 2 below.

Table 2. Damage and losses on transportation infrastructure, generated by La Nina Phenomena 2010-2011 (millions of Colombian Pesos-2011) ⁷

Assets	Losses in millions of Colombian Pesos
Roads	3,236,619
Railway	68,133
Airports	60,140
Ports	2,873
Total	3,391,154
US\$	1,836,063
Source	Banco Mundial (2012). Análisis de la gestión del riesgo de desastres en Colombia un aporte para la construcción de políticas públicas. 436 pp. Chart based on <i>Information from Ministry of Transport and BID-CEPAL, 2011</i>

2.1.5 DRM projects currently being implemented

The Ministry of Finance is currently implementing the following projects:

- Within the framework of the Pacific Alliance, the MOF is implementing a technical analysis of a Catastrophe (Cat) Bond associated with climate-related risks. In Colombia, this tool would be focused on the proportionate protection of the country in case of a severe flood.
- There is a plan to develop another Cat Bond for some departments that can contribute to the protection of their territories.

⁵ <https://www.desinventar.org/> This web page was the basis for a similar one developed by the UN International Strategy for Disaster Reduction as an effort to collect information from disasters worldwide, which can be found in www.desinventar.net

⁶ <https://www.cepal.org/publicaciones/xml/0/47330/OlainvernalColombia2010-2011.pdf>

⁷ 2011 Exchange rate 1USD=1846.97

- Jointly with UNGRD, and with SECO's, support, the MOF would like to support big cities in developing their own financial strategy for DRM, as they are doing with the Department of Cundinamarca, to which the capital Bogotá belongs. The next city would be Medellín.

The National Department for Planning (DNP) is building a database of government investment in DRM, gathering information about all DRM investments at the national (since 2002), departmental (since 2006), and municipal (since 2004) levels, project by project, to have a tool to monitor investment in DRM. The DNP is also responsible for the process of monitoring for adaptation and mitigation efforts in Colombia, and tracks the national and sub-national progress toward fulfillment of the Nationally Appropriate Mitigation Actions (NAMA).

MUNICIPAL INDEX OF DISASTER RISK

For 3 specific hazards (landslides, floods and flash floods) the Index shows that at least 75% of Departments are exposed to all three hazards, with Antioquia, Casanare and Chocó being the most affected. 61% of the exposed population live in the urban areas of Bogotá, Medellín and Putumayo. 6.7 million Colombians (13%) are more exposed to the three hazards and have vulnerable social conditions.

With the aim of making DRM evaluations part of every investment by government in the country, the DNP has also recently developed a Municipal Index of Disaster Risk.⁸

2.1.6 Other city-level DRM stakeholders, particularly non-traditional stakeholder (NGOs, business associations, etc) and other donors acting in the field

Table 3. Stakeholders in national-level DRM

Stakeholder name	Relevance/ areas of work
State Secretariat for Economic Affairs of Switzerland (SECO)	SECO has been the main technical assistance provider for the development of DRM guidelines in the country over the last years.
The World Bank	Jointly with SECO, the World Bank has provided technical assistance for the development of DRM policies and for the CAT Bond structure development.
United Nations Development Programme (UNDP)	UNDP has been a technical and funding source for different DRM and environmental management studies at the national level.
German Corporation for International Cooperation (GIZ)	GIZ has a project related with the peace process and environmental risk in specific territories within the country.
National Business Association of Colombia (ANDI)	ANDI represents ARISE—a private sector alliance for disaster resilient societies—in Colombia. They have started their DRM management efforts since their involvement of Continuity plans and security at work location for the Colombian main industries.
National Association of Insurance Companies (FASECOLDA)	FASECOLDA participates as private sector representative on the Risk Reduction Committee at the national level. As an association of insurance companies FASECOLDA is keenly interested in promoting insurance as a financial tool for DRM. It also owns a land registry database for Bogotá and Pasto with more than 130 layers of information from 120 institutions, for use by its members.

⁸ <http://repositorio.gestiondelriesgo.gov.co/handle/20.500.11762/26622>

3. Proposed Mitigation Measures and Potential Risk Transfer Solutions

For many decades, DRM in Colombia has been focused on responding to disasters as they occur, although there has been some focus on mitigation of earthquake risk through measures such as infrastructure reinforcement.

However, La Niña events, which affected most of the country in 2010-11 and 2015-2016, showed that other hazards could be equally destructive. Floods and landslides had an increased impact due to a combination of factors, such as urbanization and the existence of informal settlements impacting mitigation areas and sewage routes, the destruction of natural barriers that prevent landslides and floods because of change of soil use, deforestation, forest fires, the accumulation of garbage on river basin, etc.

3.1 High-level reflections and suggestions for risk mitigation measures

KfW is looking at shifting its portfolio in Colombia to be more focused on sustainable economic development, through investment in transportation and infrastructure for cities. Possible projects could be the Medellín Metro expansion, an enhanced massive transport system and green corridor for Cali, the cable metro for Manizales, the project to prevent coastal erosion in Cartagena, and water, sanitation and hygiene (WASH) programs in other cities. Below, we propose several risk mitigation measures that KfW can consider for its portfolio.

Understanding risk and its economic impact is the basis for action to reduce the impact of the risk. Without a clear understanding of public assets exposed and vulnerable to natural hazards, it is impossible to estimate the investment needed to cope with future disasters.

a. Governance measures

A clearly-defined governance structure for DRM, with assigned roles, responsibilities and institutional accountability will allow not only for an adequate level of coordination but also better implementation.

Considering the structure of the DRM system at the sub-national level, a look at the integration of the following stakeholders in DRM discussion and decision platforms is suggested:

Community-level representatives. Community participation ensures not only the appropriateness of the projects being executed but also provides a way for representatives to contribute to the early warning system, execution of mitigation measures, and the maintenance of “cement” and “green” infrastructure, as well as to organized response. The level of community participation achieved to date in each municipality is explained in Annex 5.

Academia: Academia makes an important contribution to research and analysis of the information gathered by the early warning systems, and helps interpret and summarize that information for policymaking, regulation, and early warning.

The private sector: Businesses that provide public services are participating on some Municipal Councils already, however, the further inclusion of the private sector into the municipal DRM system will give municipalities access to economic support for DRM; promote integration of private sector efforts and services on DRM, and make it easier for municipalities to work with the private sector on mitigation projects that benefit their industries and to coordinate disaster response efforts.

b. Mitigation/Infrastructure measures

There have been efforts to update the inventory of public assets at the municipal level, however assets for public use (green public areas as parks, bike paths, etc.) have not been consistently included in

inventories. Understanding the exposure and level of vulnerability of those public assets will allow the city to take mitigation measures in advance, which could include:

- reinforcing structures for seismic-resistance;
- solutions around informal settlements;
- gauging the suitability of existing areas for potential use in disaster response (such as using open green spaces as shelter areas, building containers for storage of water and basic survival kits, etc).

Households do not fully understand the risk exposure and vulnerability of their neighborhood. It is important to expand their knowledge through regular communication at the city level. Homeowners should be informed of the location of their property on the city risk map in order to create risk awareness and promote risk mitigation actions.

Households in high-risk areas are often part of the lowest-income sector of society. Sometimes, inhabitants are aware of the risk to which they are exposed, but prefer to stay in high-risk locations because they don't have the means to move or a place to move to, and they have built an entire livelihood tied to the area where they live: fishing in the river, collecting garbage from the hill, etc. Municipalities need to take a holistic approach to resettlement, support knowledge and behavior change programs, and promote integration into new communities, among other actions.

c. Financial measures

Understanding the financial impact of hazards such as La Niña is critical to promoting investment in mitigation measures. A pilot study undertaken by Corpocaldas, for instance (see text box on p.39), shows that the return on investment in mitigation measures is four times the investment amount. Investment in mitigation measures is not only needed, but has also proven to be more efficient than spending on disaster response.

The national government will need to play an active role in supporting the development of financial strategies at the city level to better manage DRM. Some financial measures that can be taken by sub-national governments/municipalities include, for instance:

- Establish permanent and consistent funding for DRM. The current fluctuation in funding amounts for DRM in some municipalities forces ad hoc planning, and most funds are allocated to other purposes even before a disaster strikes.
- Impose taxes to fund specific mitigation measures. Since most municipal mitigation measures are for public benefit, they could be funded by a portion of general taxes as property tax or tax on industry and commerce activities, as has been done by some municipalities visited for this study. Benefits that certain industries would reap from the reinforcement of specific infrastructure at the city level—savings, appreciation of property value or quicker recovery after a disaster, resulting in less downtime—are reasons that can be used to gain the support of businesses, or at least reduce their resistance to taxes.
- Provide financial incentives, such as tax deductions, for private sector investment in mitigation measures such as public access to early warning systems used by specific industries for public benefit, and resilient infrastructure.
- Credit with a future income guarantee. Some of the municipalities included in this report—Medellín and Cali—are among the more industrialized cities in Colombia. Others, like Manizales, are increasingly involved in the coffee sector. It is expected that those economic activities will bring increasing income to municipalities in future years. A portion of the expected future incomes could be used as a guarantee for getting credit lines today to invest in building more resilient infrastructure, and in this way, the municipalities can implement DRM measures without compromising budget

priorities. Investments for building resilient infrastructure to ensure industry needs—a reliable water supply, alternative sources of energy or means of transport, reinforced roads, bridges, airports and other public infrastructure—will make livelihoods more secure, bolster other critical services such as health services and education, and thus will strengthen the economic sustainability of those cities.

- Calculate estimates of future benefits from current investment in mitigation of natural risk and climate change effects, which can be used to develop financial schemes such as bond issuance (green, resilient).
- Credit for public development projects should include investments in DRM. To date, disaster risk levels have not been fully considered by banks in the evaluation of loans. The law that created the DRM system in Colombia states that all public investment shall consider DRM as a cross-cutting topic. Requiring that a portion of all public investment be allocated to risk mitigation measures would promote mitigation works at the sub-national level.
- The use of contingent credit by municipalities for managing the impact of risk is an important way to mitigate the economic consequences of the disaster, instead of relying on access to loans after a disaster event at usually higher rates and opportunity costs.

3.2 Linking risk assessment and risk mitigation with potential risk transfer solutions

The National Association of Insurance Companies (FASECOLDA) has been working to build a database that insurance companies could use to model new and refine past insurance products for catastrophe risk. The database includes information at the land registry level for Bogotá and Medellín, and will include other cities over time. FASECOLDA has also been very active in promoting education about insurance among Colombian population.

3.2.1 Risk Transfer Efforts in Colombia to Date

In an effort to increase insurance penetration for catastrophe risk, the Financial Superintendent of Colombia has also issued regulations in the last years:

- Changes to modeling for loss estimation or catastrophic models for earthquake risk, giving the industry two years—until January 2019—to apply the new modelling system (detailed loss model instead of aggregate loss model) to establish the estimation of technical reserves, according the reserve regime for the insurance sector established by the MOF by decrees 4865 of 2011 and 2973 of 2013.
- Allowing Foreign Insurance companies to sell insurance in the country through the banking system and using *contratos de uso de red* (network use contracts), and allowing Colombian citizens to buy insurance coverage abroad, only for non-compulsory insurance.
- Recently issued (April 2018) regulation for earthquake insurance, establishing that companies that have these products in their portfolio, shall have an “Integral Plan” for earthquake management, which includes a detailed list of information that insurance companies need to have and report on in relation to property insured, to show how they have created the model for earthquake risk, and keep records of changes in any relevant variable of the model updated.

In the case of parametric insurance products, commonly used as a product to cope with catastrophe risk, there is debate in Colombia about its applicability in the country considering the “principle of indemnity” established by the Commerce Code. According to the Code, the compensation provided by the insurance company shall be correlated to the damage suffered. A parametric product, however, provides compensation in relation to a trigger, without a direct correlation to the damage suffered. The Financial Superintendence has not made an official statement about its position on this topic.

Catastrophe risk products have been developed and sold in Colombia, but have low penetration because of the lack of awareness about insurance. As many insurance industry representatives recognized, insurance is usually bought only when the coverage is mandatory, as it is for common property in condominiums and for public infrastructure.

To date, risk transfer measures have not been fully considered as mitigation measures to reduce the economic impact of weather-related risk.

The five cities studied identified two areas—social housing for vulnerable people in the city, and public assets— as likely to be most impacted by natural disaster and therefore of greatest concern. Most of the cities mentioned weather related-risks as the ones for which they need specific protection, considering their high potential impact, as in the case of flood risk, their frequency, as in the case of landslides, as well as the limited or non-existent protection offered for those risks. Concern about landslides also included those provoked by earthquakes.

The lack of existing flood models has had a significant impact in the ability of insurance carriers to cover flood risks around the world. Nonetheless, our partnership has access to a flood models for Colombia, which could be used for modelling this risk for specific cities working with the local risk industry. Table 4 below summarizes these needs for the cities of Manizales, Medellin and Cali.

Table 4. Protection needs from some municipalities

MUNICIPALITIES	NEED SPECIFIC PROTECTION FOR	PERILS (*)	STATUS OF PROTECTION UP TODAY
MANIZALES	Public infrastructure	Landslides	Under multiperil policy
	Social Housing	Landslides	Under multiperil policy
MEDELLIN	Public infrastructure	Landslides and flash floods	Under multiperil policy
	Social Housing	Earthquake	No protection
		Flood, Landslides and flash floods	No protection
CALI	Public infrastructure	Flood and landslides	Under multiperil policy
	Social Housing	Earthquake	No protection
		Flood and landslides	No protection

(*) Landslides excluding those provoked by seism or excess of rain. There are no parametric models for landslides, but related models such as those for excess of rain could be used as a proxy or an indemnity model could be used.

3.2.2 Proposed Risk Transfer Solutions:

Previous experiences in the cities studied show that in the absence of financial strategies for risk management, municipalities respond to disasters with the transfer of funds from the National Fund for DRM, with redirected funds from their own budget, and high cost credit lines they get at the time of the disaster. Risk transfer solutions allow municipalities – and national government – to not only plan for future events, avoiding the high opportunity and indebtedness costs of the current response mechanisms, but also transfer those costs from municipalities and national budget to the insurance industry and securities market. Moreover, it allows a more rapid and appropriate response to the emergencies and recovery process, as compensations go directly to provide funding to the needs and recovery of assets protected, avoiding the long-lasting budgetary and procurement processes that getting and allocate public funding for emergencies and recovery could take.

Based on our desk research and field assessments, KfW could consider the following potential risk transfer solutions:

- a. A **parametric insurance** solution for cities that are able to allocate funding for risk transfer solutions, establishing triggers associated with weather-related phenomena, which can provide effective coverage for social housing and main public assets. Parametric insurance offers a broad range of protection to public assets and social housing where there is not enough data past loss, especially for events related to weather variability. It also allows a quick response when a natural disaster occurs, since there is no need for loss assessment, which can involve considerable time and cost, because the payout is due if the parameter exceeds the pre-determined threshold, and thus contributes to a shorter recovery process. This kind of insurance solution already exists in the international market and can be developed for any city, and the information is available at national and international levels.⁹ As it was mentioned before, there is debate in Colombia around whether parametric products could be considered insurance products, since parametric products do not apply the “principle of indemnity” established by the Commerce Code. Therefore, the implementation of a parametric insurance solution will require clarity about its applicability by the insurance regulator.
- b. The issuance of **bonds for investments in resilient and climate-smart infrastructure, combined with a parametric insurance solution** to protect public assets and investments, for cities with limited resources for risk management. Since this scheme has not been applied in Colombia, it will require a national level commitment to articulate its implementation. This scheme requires:
 - the Colombian government to structure and issue bonds with a certain level of guarantee (sovereign guarantee) or to grant the authorization to the municipality to issue them;¹⁰
 - a commitment by the municipality to use funds for resilient infrastructure or to integrate measures to make infrastructure resilient;
 - local and international insurance industry to work on developing a parametric insurance for existing and future infrastructure, as well as agreement on how premiums will be paid (possible sources: could be initially subsidized, a loan guarantee with the revenues of those climate-smart infrastructure, among others).
- c. A third risk transfer solution, issuance of a **Resilience Bond**, is proposed for a group of municipalities, considering the complexity of the scheme, which includes structuring, legal and management costs. Resilience bonds generally follow the mechanism implemented by catastrophe bonds, where the issuing group (usually a development bank, a reinsurance company, a risk modelling company and a special purpose vehicle—SPV), work jointly to issue bonds based on a catastrophe risk estimation scheme, providing insurance¹¹ to a sponsor and profits to bond investors during the life of the bond, while the SPV invests bond proceeds to guarantee those payments. If a catastrophe occurs, the sponsor will receive an indemnity, while the investor receives a discounted amount of their investments or no reimbursement (100% deduction), according the bond's terms. The scheme includes an estimate of losses in case a catastrophe occurs, using parametric modelling for catastrophe scenarios with and without the resilient infrastructure project. The estimated savings on losses realized from the implementation of the resilient infrastructure project in case a catastrophe occurs will mean a lower risk for bond investors and for the insurance companies. The resilience bond will include estimates of savings when the resilient project is implemented, generating a reduction in coupon paid to investors. Savings on coupon payments, at the same time, could be allocated to fund a series of additional measures: investing in other resilient project infrastructure, extending insurance to other assets, paying insurance premiums, etc.

⁹ Detailed information for modeling risks is obtained from satellite sources, which is combined with local sources information.

¹⁰ According to fiscal laws, municipalities and departments can issue bonds with certain restrictions (Law 358 from 1997). Interest on debts when a new debt operation is agreed shall not exceed the 40% of operational savings (current income minus operating costs). If the interest on debts exceeds 40% of operational savings, the municipality will need a review by the Ministry of Finance and a performance plan agreement, and if debts exceed 60% of operational savings, Ministry of Finance authorization is required.

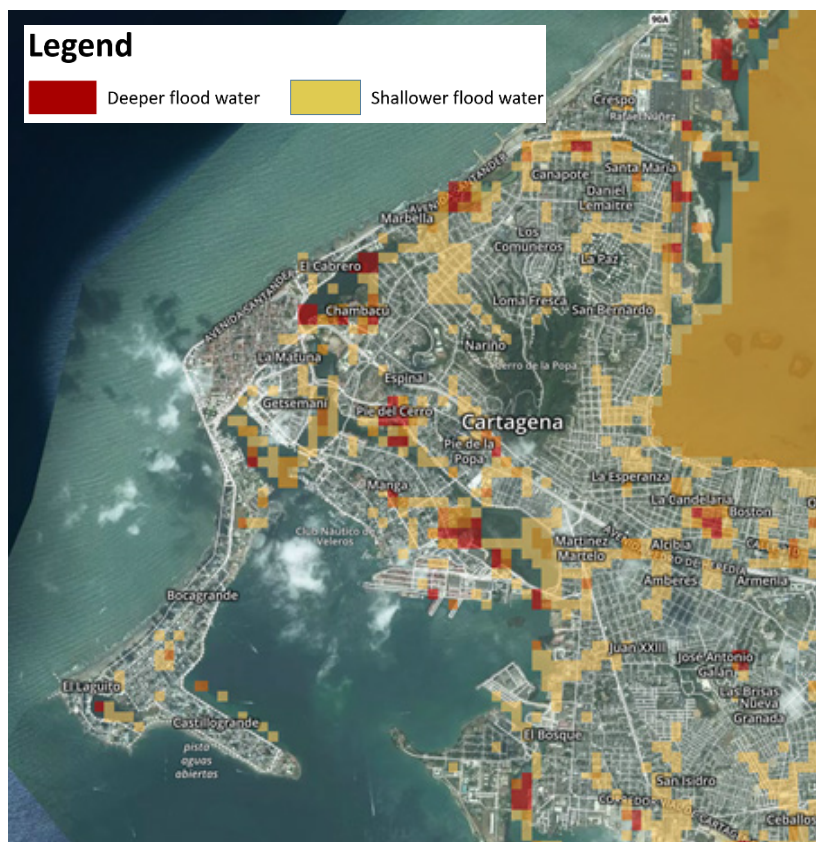
¹¹ The type of Insurance included in those schemes used to be parametric.

In this scheme the municipalities will be the sponsors, so they will need to allocate funds for insurance premiums in their budgets, and will also be responsible for implementing resilient infrastructure project on time. The issuing group would be responsible for structuring, issuing and guaranteeing insurance and bond payments.

The proposed parametric risk transfer solution for social housing and public infrastructure could be implemented in Medellin, Manizales and Cali through KfW's InsuResilience Solutions Fund (ISF), which supports the development of innovative and sustainable climate risk insurance products to improve the resilience of at-risk communities (frequently poor) against extreme weather events. Under the ISF, the proposed insurance measure can be piloted through a participatory approach empowering municipalities and communities in identifying and mitigating risks using qualitative and quantitative tools from the (re)insurance industry. This approach can strengthen the understanding of municipalities and their citizens of the financial impacts of their specific risk exposure, and allow communities to prioritize and implement risk reduction strategies and recovery plans based on accurate information. Municipalities themselves will be able to analyze, develop and strengthen guidelines, mechanisms and public investment in risk management and financing, as well as adaptation to climate change. By building trust, awareness and capacity, municipalities will be able to better formulate their risk tolerance and make decisions on risk transfer solutions. This joint initiative would allow the (re)insurance industry to develop models for weather-related risks specific to each municipality's needs, as well as enhance local industry capabilities.

4. Cartagena Report

Figure 3. Cartagena 100 year fluvial and pluvial flood map (Source: KatRisk with data set licenses by Willis Towers Watson)



Cartagena DRM Summary

Location	Population	DRM Plan	Principal Risks
Northern (Caribbean) coast of Colombia	1,013,375 (DANE, 2017)	2013, includes only a limited section of recommendations and not a detailed plan of action.	<ol style="list-style-type: none"> 1. Floods 2. Coastal erosion 3. Landslides 4. Tropical storms 5. Sea swells

Cartagena's DRM governance, planning and preparedness is at a nascent stage, with limited implementation capacity and risk awareness. Cartagena has received support from international institutions (e.g. UNDP, the Climate and Development Knowledge Network, the UK Department for International Development (DFID), and the Ministry of Foreign Affairs of the Netherlands (DGIS) for the development of its DRM plan and climate change adaptation strategies. Nonetheless, Cartagena's capacity to implement the plans and increase awareness of risks among officials remains limited. Reasons for the current stage of development include:

- Political instability: Cartagena has had 14 mayors in 7 years, which affects planning and capacity to implement proposed plans;

- Budget constraints: Most of Cartagena's DRM budget is dedicated to providing rent subsidies for victims of past natural disaster and DRM staff salaries; and
- Staff turnover: A high turnover rate hinders the development of local capacity in risk management and planning, so the central government has intervened to support the local authorities.

4.1 Current state of municipal DRM, including current and past local government initiatives

4.1.1 DRM Governance: Framework for local DRM: Main actors and their responsibilities

As defined by SNGRD illustrated in Figure 2, the local DRM local system of the municipality of Cartagena de Indias consists of:

- The local Council for DRM, which is responsible for the coordination, planning, support and monitoring in the municipality. It is comprised of the main municipal authorities, as well as stakeholders for DRM in the region, including the local environmental authority (the Public Entity for the Environment (EPA) of Cartagena, Civil Defense, Red Cross, fire department, local police, the regional autonomous corporations for social housing and urban reform as well as for the Canal del Dique); and
- The mayor, who is responsible for leading the implementation of DRM policies and plans.

There are two principal institutions designated by law to manage the environmental risk in the region:

1. EPA Cartagena, a public entity; and
2. CARDIQUE, the regional corporation for the environmental management of the main canal of the Bolívar region, the Canal del Dique.

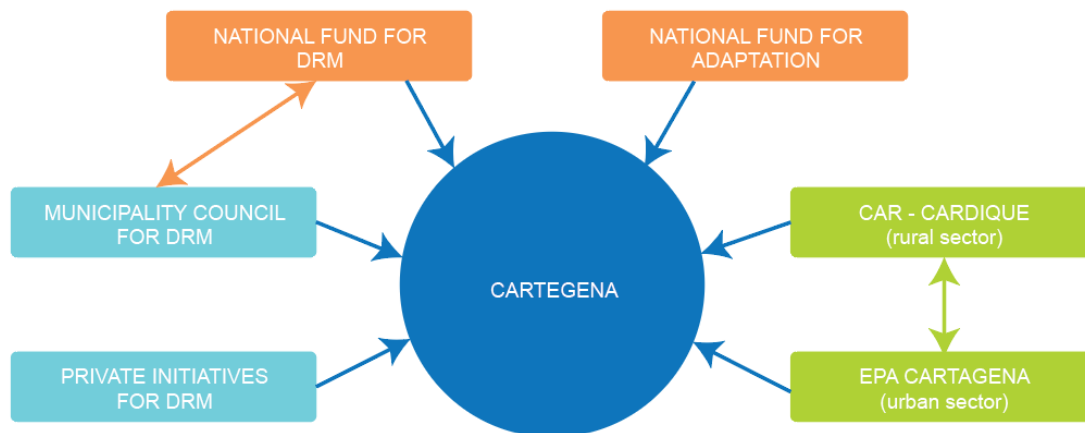
These two institutions provide environmental license for activities in the urban and rural area of Cartagena, respectively.

Although institutions within the DRM system recognize the municipality as leading DRM efforts and projects, all institutions seems to work in isolation with minimum or no coordination with the municipality, as is reflected in Figure 4.

CARTAGENA'S INDEX OF DISASTER RISK

Among municipalities in Colombia, Cartagena is ranked third, with major risk and limited capacity to manage those risks, according to the DNP's Index of Municipal Disaster Risk.

Figure 4. DRM structure in Cartagena



4.1.2 Level of risk awareness and state of development and implementation of DRM plans at city level

The DRM plans approved by the municipality of Cartagena identify the principal risks to which the city is exposed, but do not include a planning section with activities to implement recommendations to reduce the risk exposure. The Municipal Council of Cartagena approved the following plans:

- The 2013 local DRM plan was developed with support of the UNDP and the European Union, and approved by the city in 2014. The plan follows the main structure proposed by the UNGRD and evaluated the main disasters to which Cartagena is exposed: flooding and landslides. However, it does not make projections of the possible effects of those hazards and has only a generic reference to past events, collected from different sources such as Desinventar. Moreover, the shortest section of the plan is the one that proposes recommendations and activities, which were identified without analyzing needs, resources and risk scenarios.
- The strategy for responding to local emergencies, created with the support of UNDP and the UNGRD and approved in 2015, establishes the roles and responsibilities of local institutions in case of emergency and provides a road-map of activities to undertake in case of a disaster.

Cartagena has not developed a financial strategy for implementing DRM activities. Every new administration has included DRM activities in the city's development plan, but it is dedicated mainly to disaster response. Budget allocations for DRM are limited, and funds that are set aside are mainly dedicated to providing rent subsidies for victims of past natural disaster events and DRM staff salaries.

Risk studies for the city are not complete. Municipal officials recognize the need to update the DRM plan with new studies, which are needed to estimate risks besides coastal erosion and floods, but due to lack of funds, the municipality is waiting for the studies being done as part of the Land Use Plan¹² (POT), to feed into their plans. The studies for the POT will be ready this year and are being developed by the Cartagena University.

A plan called Plan 4C, "Competitive and Compatible with Change from Cartagena," funded by DFID and DGIS, was developed by institutions, including Invemar, with the support of the Chamber of Commerce from Cartagena, the Climate and Development Knowledge Network, as well as the National Ministry for Environment. Plan 4C analyzes the risks to which Cartagena's coastal zones are subject from an environmental point of view. It names coastal erosion as the main factor for exacerbating possible risks scenarios. The pessimistic scenario showed that one of every five inhabitants could be affected by high tides, 28% of the local industry could be at risk of flooding, and 86% of Cartagena's historical heritage could be affected by flooding. Despite these scenarios, risk awareness is almost non-existent among business leaders and most of Cartagena's population.

4.1.3 DRM measures in place (including funding, mitigation/infrastructure measures, fiscal measures and risk transfer)

Funding and risk transfer

Local funding for DRM was allocated by Act 1523 in 2012, but the new fund actually received only monies transferred from previous emergency accounts; no new funding was allocated. The local fund for DRM has had the following expenditures to date:

- Around 80% is dedicated to providing subsidies for rent to victims of previous disasters, some households having received subsidies for almost eight years in a row, due to the absence of a local program for building social housing.

¹² A Land-Use Plan (known as POT or Plan de Ordenamiento Territorial in Spanish) is a tool for physical, social, and economic municipal planning, proposed by Law 388 (1997). Its formulation offers an opportunity for any municipality to identify its potential and to propose the priority actions needed for its development based on a regulated use of its territory.

- The rest is dedicated to paying the local DRM unit expenses, including salaries of its personnel (around 30 people).

Municipal officials mentioned that the main problem for the efficacy of the local DRM fund is the absence of additional funds dedicated to areas of work such as promoting risk knowledge and ensuring financial protection.

Municipal officials mentioned that they have taken out insurance to protect their main buildings and infrastructure, as required by national law, but Global Communities' assessment did not find authorities or data that could confirm that statement, nor were details about the level of protection discovered.

4.1.4 Existing data sources (open and commercial) and available data about risk exposure and vulnerability to natural hazards, including projections of future risks and costs associated with these risks

Plan 4C includes a series of maps of Cartagena's exposure to coastal erosion and flooding, available through a digital database called Midas. This database aims to include all information relevant to the city's land use planning via a geographic information system. It also includes the risk maps and risk scenarios for flood and coastal erosion up to 2040. The database was developed by the Institute for Marine and Coastal Studies (INVEMAR) and consolidates information from the IGAC database, IDEAM and the Institute for Cultural Heritage of Cartagena in order to estimate the socio-economic and physical exposure and vulnerability of Cartagena. They made some rough estimates of future costs and losses associated with those risks for the city, cited as losses per square meter, which were the basis for Plan 4C.

4.1.5 DRM projects currently being implemented

Of the three main projects to mitigate natural disaster and climate change effects, only one is managed by the municipality; the other two are implemented by National Government institutions. The projects currently being implemented are:

- Reinforcement and reconstruction of major canals in the city's historic area, with the aim of reducing the city's vulnerability to excess rain, and providing a good sewage system for those flows. This project is managed by the municipality through the mayor's office approved by the central government.
- Canal del Dique Project. This project is implemented through the Adaptation Fund (see p. 11). The project was submitted on behalf of Cormagdalena, the autonomous environmental authority for the Magdalena River, but it will have a clear impact in Cartagena and its port and transport services. This project aims to clean, channel and reinforce the Magdalena river basin, which comes from the Cauca to the Bolívar region—the main route from the port of Cartagena to other provinces in Colombia. The reinforcement of dikes and restoration of the river's ecosystem will also mitigate the possibility of further inundations for the ten towns located along the river. The project has a total budget of 1.09 billion pesos, and it was projected that by the end of 2017 up to 89% of that budget would have been spent, benefitting 217,000 people.
- A project to prevent coastal erosion in Cartagena was designed by the municipality and directly support by UNGRD, which considered the project a priority for the municipality. The total project budget is 160,000 million pesos, of which the national government allocated 62.5%, while the municipality contributed 37.5%. The project will most likely be directly executed and managed by UNGRD, but a specific agreement on who is responsible for execution is still pending.¹³

¹³ <http://www.minambiente.gov.co/index.php/noticias/3821-gobierno-nacional-y-alcaldia-de-cartagena-firman-convenio-para-prevenir-la-erosion-costera>

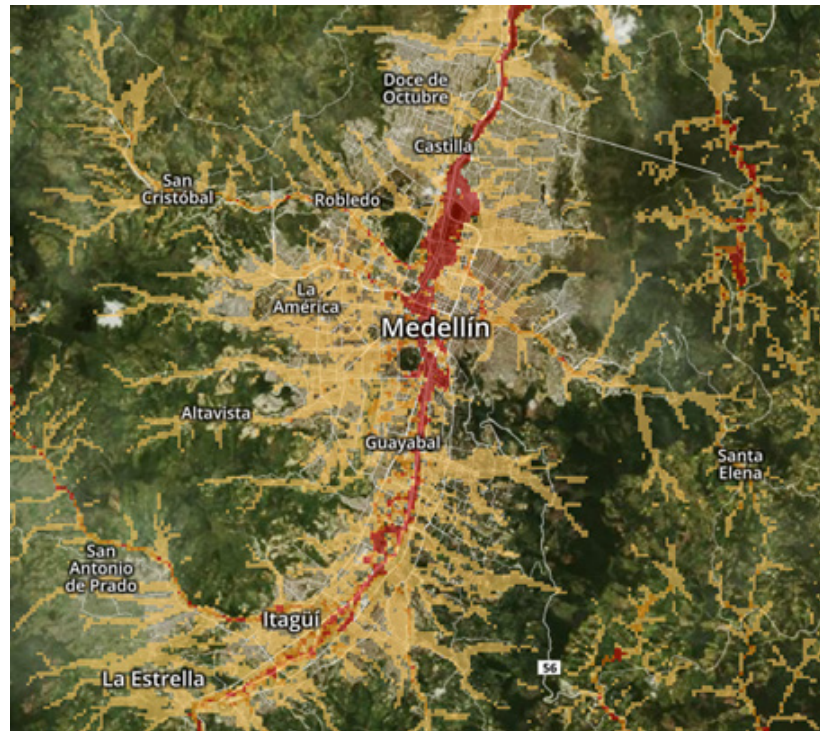
4.1.6 Other city-level DRM stakeholders, particularly non-traditional stakeholder (NGOs, business associations, etc) - especially other donors acting in the field-

Table 5. Stakeholders in Cartagena DRM

Stakeholder name	Relevance/Areas of work
Mamonal Foundation	Comprised of more than 25 major companies from the industrial area of Cartagena, the Foundation has been working to support the development of capacity of communities in Cartagena to participate in the neighborhood emergency committees (COMBAs). This project has been run by the Foundation for the past 10 years in 48 communities in the city
ANDI Bolívar	ANDI is working with communities to build an early warning system.
Petrochemical industry	One of the main industries in Cartagena, the petrochemical industry has its own DRM plans, and is working on DRM with the population in areas closest to facilities, in particular on evacuation plans in case of a disaster.
GIZ	GIZ is working on an adaptation strategy based on ecosystems, with the principal aim of restoring mangroves along the coast

5. Medellín Report

Figure 5. Medellín 100 year fluvial and pluvial flood map (Source: KatRisk with data set licenses by Willis Towers Watson)



Legend



Medellín DRM Summary

Location	Population	DRM Plan	Principal Risks
Central Andes region	2,464,322 (DANE-2015)	For the period 2015-2030, published on Dec. 2017. Includes vulnerability plans and a detailed plan of action.	1. Earthquake 2. Landslides 3. Flooding, including flash floods 4. Forest Fires

The municipality of Medellín has a well-developed DRM system, which includes participation of all key stakeholders: government institutions, universities, community representatives and -soon- by private sector representatives. Micro-zoning maps for the city have already been developed and will soon be approved. The public infrastructure inventory is being updated, and studies for floods and landslides patterns are being developed.

5.1 Current state of municipal DRM, including current and past local government initiatives

5.1.1 DRM Governance Framework for local DRM: Main actors and their responsibilities

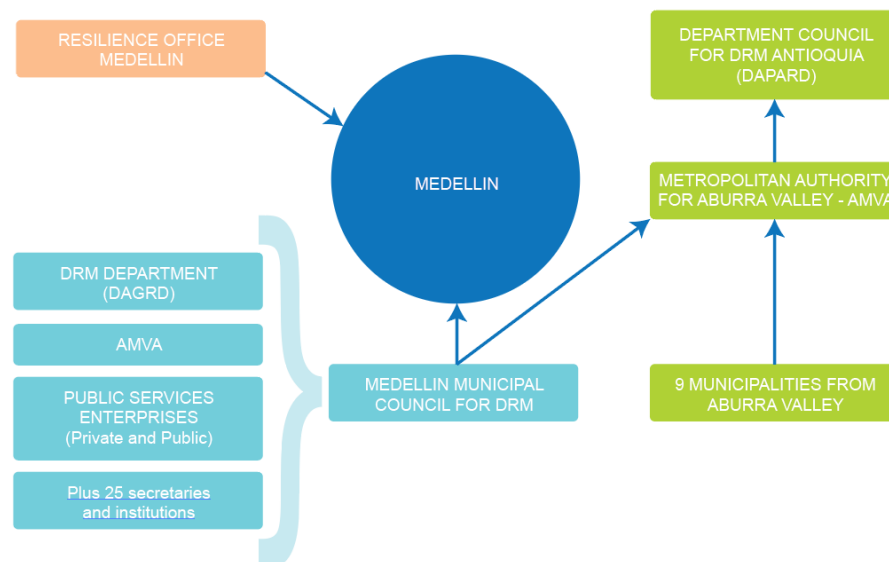
The structure of the local DRM system for Medellín is described in Figure 6 below and additional details are in Annex 4. Primary responsibility for DRM in Medellín is shared among three entities:

The DRM Municipal Council is responsible for developing DRM policies and provides the main platform for discussion and coordination on DRM. It includes 29 secretaries and institutions from the city, metropolitan and department levels, as well as public services enterprises, allowing for coordination at the city level.

The Medellín Department for DRM (DAGR) is responsible for the implementation of DRM at the municipal level. Since its creation, it has contributed to the elaboration of the Local Plan for DRM, implemented projects to promote knowledge about risk among communities, and supported many DRM projects and efforts in the municipality.

The DRM office at the Metropolitan Authority, which represents Medellín on the Departmental Council, is accountable for major infrastructure which connects the ten municipalities of Aburrá Valley, such as the river basin infrastructure and the Metro transit system.

Figure 6. DRM structure in Medellín



The DRM Unit from the Antioquia Department has a subsidiary role in Medellín. The Unit represents the Department on the National Council for DRM Committees and acts in case of disaster under the subsidiary principle,—that is, when the respective municipality has exhausted its response resources—to protect the inhabitants' life and properties.

Medellín's Resilience Office is an independent office established as part of the 100 Resilient Cities project, an initiative of the Rockefeller Foundation.

5.1.2 Level of risk awareness and state of development and implementation of DRM plans at the city level

According to the Municipal Plan, Medellín is at significant risk of landslides, floods, forest fires, and earthquakes. While the first two occur more frequently, the latter two would have a more widespread impact on lives and households.

The Municipal Plan for DRM contains a series of risk maps developed by Universidad EAFIT based on an assessment of more than 25,000 buildings in Medellín, which analyze exposure and vulnerability to various risks across the city. With regard to seismic risk, the mapping highlights two major concerns: 1) Most structures were built before the 2010 law on seismic-resistance and are not compliant; and 2) Informal settlements, especially in the low-income sectors of the city, do not meet seismic standards and are at major risk. The main source of local-level data on various risks comes from the Early Warning System of the Aburrá Valley (SIATA), which is managed by Universidad EAFIT and is owned by the Metropolitan Authority. The metropolitan area invested in the installation of 54 measurement stations, a satellite radar and new tools for measuring water flow to be implemented along the river basin. Because of this investment, the SIATA was transferred to the Metropolitan Area administration in 2010, although its technical management is still with EAFIT. Today, its automated information is one of the leading warning systems in the country, and feeds into the IDEAM system as a source of data from the subregion.

5.1.3 DRM measures in place (including funding, mitigation/infrastructure measures, fiscal measures and risk transfer)

Funding

Medellín does not have a financial strategy for DRM. Financial protection for DRM is generically stated as a set of principles within the DRM Plan, which recognizes the importance of insurance as a financial risk transfer tool but has not defined specific activities to promote it. The local unit for DRM mentioned that they have not received any training on how to develop and implement a financial strategy for DRM from the National Unit or any other institution.

The Territorial Fund for DRM has been operational since 2012 and is dedicated mainly to emergency response. It has not yet been revised to meet the new regulation for territorial funds, however city-level officials are expecting designation of its board to be made soon by the Municipal Council. They plan to include representatives of the private sector on the board.

Most of the mitigation measures are implemented by the departments responsible for certain municipal assets, i.e., the education department is responsible for schools and all educational infrastructure, the health department is responsible for hospitals and other health facilities, etc.

The local DRM fund receives funding from the municipal budget annually, which is set at 1% of income from property taxes and 1% of income from commerce and industry taxes. For 2018, the total budget for the DRM Department (including staff salaries) was estimated in US\$9.7 million, which represents 0.048% of the municipal total budget. Of that amount, 50% is dedicated to management expenses and staff salaries, while 47% is dedicated to three strategic areas: 14% to knowledge of risks, 13% to risk reduction and mitigation, and 20% to emergency response—of which half is dedicated to reinforcing the fire department.¹⁴

¹⁴ Annual Budget from Medellín Municipality 2018. Municipal Council Agreement No. 68 de 2017. Published in the Gaceta Oficial from Medellín Municipality on December 15th, 2017.

Mitigation & Infrastructure measures

According to the local DRM unit, all public infrastructure in the city is insured against major risks. Nonetheless, insurance industry representatives said that most of the insurance coverage has been issued based on generic information the municipality has about public infrastructure, without updated information on commercial values and specific risks associated with location and vulnerability conditions. The update to the public infrastructure inventory that the Municipality of Medellín with the Metropolitan Area of the Aburrá Valley (AMVA) are conducting will help to identify the need for reinforcement.

The main project dealing with disasters in Medellín is the insurance scheme to protect social housing against seismic which is being developed by Swiss Re. Since last year, the Medellín municipality has been working with Swiss Re on a proposal for a catastrophic insurance solution, which can cover social housing against earthquake risk. The idea is to generate a scheme which can be paid through property taxes at the city level, a similar model to that adopted many years ago in Manizales. In that model, higher income property owners in the city pay an additional amount to contribute voluntarily to the protection of the social housing in the city. Recently, the municipality is seeking to add a coverage against landslides to the proposal, considering the high frequency of that peril.

5.1.4 Existing data sources (open and commercial) and available data about risk exposure and vulnerability to natural hazards- including projections of future risks and costs associated with these risks

As noted in Section 5.1.2, the Municipal Plan for DRM includes a series of risk maps based on detailed work done by EAFIT University, with an analysis of exposure and vulnerability to different risks. FASECOLDA used the information on land registry in Medellín and created a separate database with 120 added layers of information on various risks from different sources. The FASECOLDA database is available for use by insurance companies in developing and defining insurance policies.

There is no registry of costs and economic impact of disasters in Medellín or Antioquia Department. In Medellín, every department (health, transport, education, etc.) has assumed responsibility for recovery of the costs of damaged infrastructure in case of disaster, and there is no centralized registry of those costs, not even for the La Niña event. The DAGRD only has records of expenses made by itself (for basic survival kits, machinery, equipment, etc.) for each event. Neither the Department of Antioquia nor the municipality of Medellín has information on the economic impact of those disasters on municipal or departmental GDP.

5.1.5 DRM projects currently being implemented

The seismic micro-zoning project implemented by the Metropolitan Area is a major dataset for the Metropolitan Plan for Seismic Risk and Urban Rescue and for Medellín. The micro-zoning project has been completed and is expecting approval from central government authorities, and subsequently by all municipalities in the project. It will be the basis for developing regional risks maps, including for Medellín. Based on the project, AMVA is planning a program to strengthen basic infrastructure in ten municipalities, including Medellín.

A general inventory of public infrastructure has been done by the Secretariat of Supplies and Services. The municipality is aware that some public infrastructure does not meet the seismic resistance standard set forth in the 2010 law. For example, only two firefighter stations in the city comply with the law.

Another project from the Aburrá Valley is a complete study of the exposure and vulnerability of the ten municipalities to the more frequent risk of floods, landslides and flash floods.

DAGRDR is also implementing the following projects in Medellín:

- A complete training program on DRM directed at community associations and the creation of a network of community leaders in direct contact with the DRM authorities in the city, in order to promote engagement in DRM;
- A program to be implemented through the schools to educate children and to develop a series of tools and materials to build the capacity the larger community;
- A pilot project is being implemented with Build Change, to bring low-income housing in Medellín up to the standards as defined by the 2010 law on seismic-resistance.

5.1.6 Other city-level DRM stakeholders, particularly non-traditional stakeholder (NGOs, business associations, etc) and other donors acting in the field.

Table 6. Stakeholders in Medellín DRM

Stakeholder name	Relevance/Areas of work
The World Bank	The World Bank has provided technical assistance in the development of the insurance policy by Swiss re.
FENALCO	The Medellín chapter of this association of merchants is currently implementing a DRM project for micro and small enterprises with the support of USAID. A continuation of a project developed with Global Communities, FENALCO received a grant from USAID to strengthen resilience against natural and man-made hazards among micro and small entrepreneurs through a program that includes training about risk, adoption of mitigation measures and a multi-risk insurance policy developed by the main company in the city (SURAMERICANA)
Build Change	Build Change is an NGO currently working with the 100 Resilient Cities office to implement a pilot project to reinforce informal built houses to make them earthquake resistant.
Universidad EAFIT	EAFIT is a private university which could be a good ally as the main source of information and detailed studies for DRM in Medellín. They inventoried buildings and produced an analysis of vulnerability and risk, with georeferences to propose risk and vulnerability scenarios for different events. They also did a pilot project that analyzed landslide risk including the expected route for landslides, as part of the DRM Plan

6. Pasto Report

Figure 7. Pasto 100 year fluvial and pluvial flood map (Source: KatRisk with data set licenses by Willis Towers Watson)



Legend



Pasto DRM Summary

Location	Population	DRM Plan	Principal Risks
Southern Colombia, in the Andes at the foot of Galeras Volcano.	455,863 (DANE 2017)	It has a DRM from 2012 and a development plan published in 2016 (Plan for the period 2016-2019), which includes a short section for DRM -3 pages-.	<ol style="list-style-type: none"> 1. Volcanic eruption 2. Seismic 3. Landslides 4. Flooding

Local DRM is not well developed or coordinated among institutions, and there is limited awareness of risks. Geological studies for seismic risk have been developed. Climate-related risk information is being developed for the land-use planning law. There are limited resources for DRM.

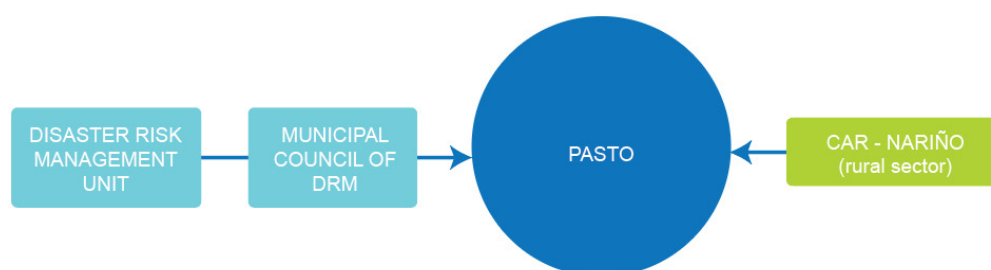
6.1 Current state of municipal DRM, including current and past local government initiatives

6.1.1 DRM Governance Framework for local DRM: Main actors and their responsibilities

Pasto has a long tradition in disaster response, due to its exposure to the Galeras Volcano. Pasto has implemented a DRM system focused on prevention and response to emergencies, and has a well-known urban rescue unit within its fire department. After the increase in Galeras Volcano activity in 2004, the Municipality of Pasto created a Municipal Council for DRM and a DRM Directorate (DRMD). In accordance with Act 1523, the Municipal Council consists of representatives of all relevant departments from the municipality: Corponariño, public services enterprises, the fire department, and police force.

The mayor has primary authority and responsibility for DRM in the city, and the local DRM unit is in charge of implementing DRM activities. Nonetheless, according to interviews undertaken in Pasto there is a low level of coordination among the DRMD and other departments and institution in Pasto. There currently is no coordination with the private sector in DRM activities in Pasto and the integration of community participation is run by another department.

Figure 8. DRM structure in Pasto



6.1.2 Level of risk awareness and state of development and implementation of DRM plans at city level

Risk awareness at the sub-national government exists but activities are mainly focused on response preparation and there is no plan to confront high exposure to risk. The city developed the first emergency plan in 2004. The most recent DRM Plan issued in 2012 describes major natural hazard events that occurred in the past in the city, and defines the level of exposure of Pasto to future earthquakes, volcano activity, landslides and floods.

Inhabitants are not fully aware of their vulnerability. The city is located 9 kilometers from the active Volcán Galeras, so most of the population is aware of their exposure to volcano risk, but not the degree of their vulnerability. Studies indicate that until a few years ago, only 18.5% of Pasto territory would be affected by an eruption,¹⁵ but recent studies by the Colombian Geological Service¹⁶ indicate that 60% of Pasto could potentially be affected by a volcanic eruption. This last study, undertaken by Miyamoto Engineers, showed that 60% of the city is also at a high or intermediate level of risk of earthquake damage. Pasto's population is particularly vulnerable due to high levels of poverty and non-seismic resistant houses. According to local officials, the Colombian Geological Service has recommended relocating some communities (such as the Community of Mapachico). Nonetheless, there are barriers for relocation, chiefly: 1) the municipality does not have enough resources to undertake this activity; and 2) despite the central government willingness to provide the needed resources, people from affected areas do not want to be relocated.

¹⁵ Alcaldía Municipal de Pasto (2013). Cuaderno diagnóstico de gestión de riesgo para el POT. Pasto 2012-2015.

¹⁶ There is also an Observatory from the Colombian Geological Service located in Pasto, to monitor changes on Galera Volcano activity.

The Plan for Climate Change Adaptation for the Department was developed in collaboration with the World Wildlife Fund. Main concerns are related to land erosion, agriculture expansion, cyclical droughts, and encroachment on the riparian buffer zone. The plan also provides information to Pasto's agricultural sector on how to substitute crops adapted to changes in climate. Specific studies on Pasto's vulnerability to climate change are being developed.

6.1.3 DRM measures in place (including funding, mitigation/infrastructure measures, fiscal measures and risk transfer)

Funding

Funding for DRM is limited. The bulk of the available funding is allocated for responding to emergencies. The Municipality of Pasto dedicates 4% of the industries and commerce tax to DRM which is funded through the municipality's territorial fund for DRM. In 2017, this budget reached 2.162 million pesos and in 2018 will probably reach 2.953 million pesos. According to the DRMD, that amount is allocated as follows: 30% for knowledge-strengthening activities, 5% for risk reduction activities and 65% for emergency preparation, response, and recovery; this amount includes the budget for the DRMD. The DRM Fund budget is frequently insufficient, as many events occur each year that cause damage and affect houses. During the seismic events of April 2018, Municipality of Pasto received support from UNGRD for a basic kit for 3 months for affected households plus construction materials to build new houses. INVIPASTO, the local institute for housing, is responsible for building new homes for those affected (INVIPASTO is funded by 8% of property tax at the municipality).

Mitigation measures

The municipality is currently implementing the following measures:

- An early warning system for hydrological events;
- Some risk reduction work on the river basin;
- Increasing number of drills in schools and development of a volunteer network;
- A training program for the Community Action Association in DRM, offered jointly by the Secretary of Health and the Universidad de Nariño.

For the communities, Pasto has a well developed web page and a mobile phone app, so people from Pasto can get up-to-date information about the climate forecast, and learn more about risks at the city. The information provided includes mitigation actions people can take by themselves, with guidelines for disaster management plans in schools and households.¹⁷ It also provides a way to communicate with support committees at the community level, through radio and social networks.

Risk transfer

The municipality is interested in implementing a policy similar to the one in Manizales. While the municipality was discussing that possibility with the public insurance company "La Previsora", two issues arose: 1) a lawsuit by an ex-worker of La Previsora prohibiting the company to use the risk model, and 2) a rough estimate of a number of property owners with high incomes (SISBEN 1, 2 and 3) showed that there would be too few property owners able to purchase insurance at rates that would also allow companies to provide coverage to Pasto residents with low incomes.

¹⁷ <http://www.gestiondelriesgopasto.gov.co>

6.1.4 Existing data sources (open and commercial) and available data about risk exposure and vulnerability to natural hazards- including projections of future risks and costs associated with these risks

In recent years Pasto has conducted some important studies that provide details about various risks:

- A 2013-2014 study of the physical and functional vulnerability of public basic infrastructure, which showed a very bad prognosis for the city. The municipality delivered the information to every department in order to develop an action plan.
- A seismic micro-zoning evaluation done by Miyamoto Engineers under the Prepare Program funded by USAID/OFDA, which closed in 2016. The report shows that 60% of buildings and houses in urban areas of Pasto would be seriously affected (destroyed) or moderately affected by an earthquake, because a great many buildings were made with sun-dried bricks and/or concrete blocks without proper structural reinforcement.
- A study of flood and flash flood risk, as part of the detailed studies for the new Land-Use Plan (POT).

The DRMD reports the numbers of victims and houses affected to the UNGRD, but there is no registry of costs of past events, nor are projections done of the costs of future risks, so there is little information available on costs. The DRMD records only the expenses paid from its budget, since municipal departments must cover reconstruction costs from their own budgets.

6.1.5 DRM projects currently being implemented.

Additional studies about different risks are being developed, including two important ones: 1) an update of the volcanic risk study, requested by the Colombian Geological Service, and 2) a study of lahar (violent mudflow) risk.

The main mitigation projects to be executed by the municipality are maintenance of rural and urban roads to facilitate evacuation in case of a seismic event, and recovery of the Pasto River, the city's main source of water. The Municipality received a loan from Bancolombia to execute the Pasto River project estimated at 13,400 million pesos.

Other projects planned include:

A training center and an operational base for disasters. The DRMD has prepared a project for the implementation of an Integral center for DRM and Operation Base, which will be located in the area of the Galeras Volcano. Currently, they are looking for funds to build the Center. The Center will serve as an emergency headquarter and facilitate the removal of the estimated huge amount of debris that a seismic event will produce. In the meantime, it would operate as a training center for emergencies and rescue operations. The investment needed is estimated at US\$1.5 million.

Mitigation of air pollution. A project with an important impact for the future will be the strategic transport system for the city, which is estimated at 60,000 million pesos and will contribute to improving the quality of air in the city. It has been submitted to FINDETER under the CIUDAT credit line but will require additional fund from other banks, but it requires the Ministry of Transport guarantee, which will take time.

At the Department level, the Watershed Regulation and Management Plan (POMCA) for *Guátara River Basin Management* is expected to be approved soon. It will include detailed studies of rural areas in Pasto and information about flood risk to be considered in formulating the new POT. The Nariño Department received funding from the Ministry of Finance to develop these studies, which have been approved by the Ministry of Environment.

A city based on sustainable energy. With regard to environmental risk, Pasto has applied for a loan from KfW and the UK Government, through FINDETER, to pilot the “superblocks” project which aims to create

a transportation corridor, combining clean transport with regular transport in the city, around the superblocks. There is another project with the Swiss Government to promote Pasto as “a city based on sustainable energy”, which combines the use of electric bikes for transport, improved energy efficiency (by improving of the city's electrical network) and promotion of solar energy for houses and business.

Hillside stabilization. The Secretary of the Environment of Pasto operates a project to stabilize hillsides and rehabilitate water sources. One million trees will be planted within the municipality; 318,000 are already in the ground.

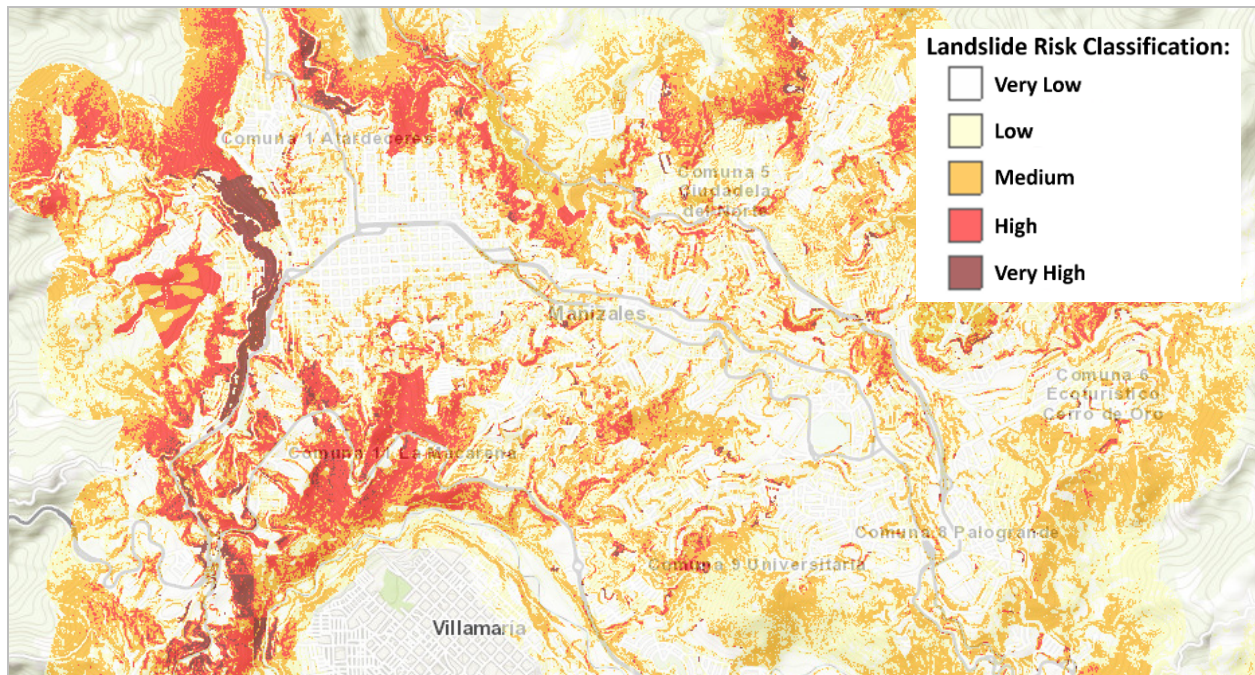
6.1.6 Other city-level DRM stakeholders, particularly non-traditional stakeholder (NGOs, business associations, etc) and other donors acting in the field.

Table 7. Stakeholders in Pasto DRM

Stakeholder Name	Relevance/Areas of work
USAID/OFDA	There is a good relationship and continuous collaboration between the Municipality and USAID/OFDA -South Force- since they have funded many studies to better understand the risk exposure and vulnerability from Pasto to seismic and volcano activity.
French Agency for Cooperation	The French Agency for Cooperation is currently helping to design strategic projects that can generate value for the city, due to its lack of big industries.

7. Manizales Report

Figure 9. Landslide risk levels in Manizales in 2017 (Source: Mayoralty of Manizales)



Manizales DRM Summary

Location	Population	DRM Plan	Principal Risks
Central-west region, in the Andes near the Nevado del Ruiz Volcano	397,466 (DANE, 2016)	Yes. Published in 2016, with activities projected for 12 years. It mentioned the need to promote insurance schemes for public infrastructure, housing and small and medium enterprises.	<ol style="list-style-type: none"> 1. Earthquake 2. Volcano eruption 3. Landslides 4. Forest fires

Manizales has the most well-developed DRM system in the country, with good coordination among actors, including universities, and a high level of awareness about natural hazards risks. Locally-developed risk transfer solutions have been in place since 2006, providing detailed information to the insurance industry for public infrastructure and social housing. Mitigation measures have included considerable investments to reinforce basic public infrastructure against seismic risk. Studies of climate-related hazards are being updated. Guidelines for a local DRM fund are in the process to be implemented.

FIRST REGULATION ON SEISMIC-RESISTANCE

As early as 1979, Manizales had a regulation on seismic resistance, established in collaboration with the Inter-American Development Bank.

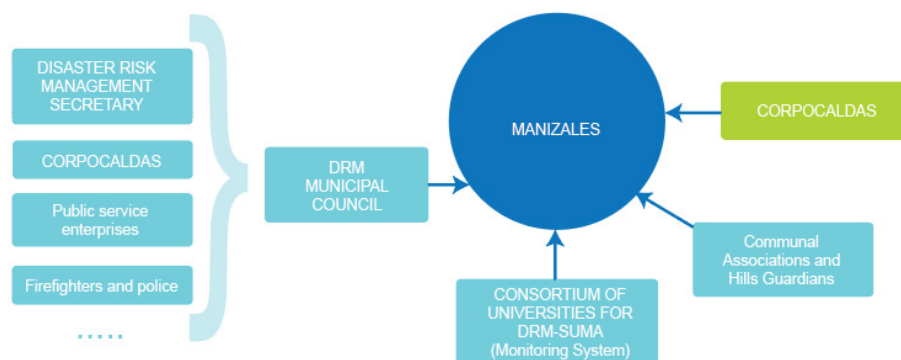
7.1 Current state of municipal DRM, including current and past local government initiatives

7.1.1 DRM Governance Framework for local DRM: Main actors and their responsibilities

The current DRM system follows the organization established by Act 1523, allowing active participation of all institutions involved in DRM in the city. The DRM system is illustrated in Figure 10 below.

There is a good level of coordination among municipal, environmental and department authorities. The DRM Council is responsible for policy development and approving measures at the city level. The council works closely with Corpocaldas, which is responsible for transferring the main fund to Manizales for DRM. Corpocaldas, besides being the regional environmental authority, is the owner of the monitoring system for seismic and hydro-meteorological events. It also supports all municipalities in integrating DRM into the POT, supporting knowledge generation and proving municipalities with funding for studies.

Figure 10. DRM structure in Manizales



All universities with DRM programs participate in the SUMA alliance¹⁸, to coordinate academic and extra-curricular efforts to support resiliency in the city. Some projects include updating studies for micro-zoning for specific risks, working with displaced people after a disaster, providing psychosocial support, reducing the anthropogenic effects on disasters, etc.

The Universidad Nacional de Colombia in Manizales fulfills an important role in monitoring the early warning system for hydro-meteorological and seismic events, which is part of Corpocaldas' environment management responsibility.

7.1.2 Level of risk awareness and state of development and implementation of DRM plans at city level

Manizales has been a leader in disaster risk management in the country. Manizales has a long history dealing with disasters that destroy the city and surrounding areas (earthquake, fire, landslides). That history inspired the city to implement a DRM system even before the national system was created.

The Plan for DRM is a roadmap for the city that clearly identifies Manizales' exposure and vulnerability. Elaborated in 2016, the plan establishes a series of activities to be implemented in the short, medium and long-terms, through 2024. The local DRM unit is currently updating studies at a micro-zoning level for floods and landslides. It is also working with the University of Manizales to provide train community leaders in DRM and to promote the development of community DRM plans. They are also working on a proposal to modify their DRM fund, and a new board for the Fund will be designated soon.

¹⁸ All universities in Manizales that have DRM programs participate in this alliance to improve research, share knowledge and strengthen their programs.

There is high level of awareness among the local population about risk. Most public and private organizations are aware of the risks the city faces and have been working on the implementation of mitigation measures. Most construction meets standards, and there is a registry of master builders in the municipality. The main challenge for the city is the invasion of hillsides by people from other regions who are not aware of the high risks. The process of relocating that population requires the effort of many institutions plus significant funding to provide an alternative place to live.

7.1.3 DRM measures in place (including funding, mitigation/infrastructure measures, fiscal measures and risk transfer)

Funding

A Municipal Council agreement established funding for DRM from the following sources:

- The main source is the environment surcharge: This tax paid to Corpocaldas is equivalent to 2.5% of property taxes (the maximum allowed by law). Of that amount at least 1.0 % is assigned to DRM in Manizales. The funds received from environment surcharge and contribution from other decentralized offices are cumulative, that means that funds are kept from one year to the next and not combined with the main budget of the municipality.
- From the municipality income, a variable amount, which is not cumulative, is allocated. Additionally, the Fund can receive extraordinary funds when needed in the event of an emergency or for a special project. The municipality received 13 million pesos in 2018 for a total loan from commercial Spanish bank BBVA of up to 21 million pesos for road reinforcement.
- A contribution from all decentralized institutions. Institutions owned by the municipality are IFI Manizales, Aguas de Manizales, the Instituto de Valorizacion de Manizales, Caja de Vida de Manizales, and others give 1% of their budget for DRM. These funds are not cumulative.

Most of the budget is dedicated to mitigation works and emergency response.

Mitigation

Manizales has 48 hydro-meteorological stations and 12 accelerometers (for earthquakes) as part of the monitoring system managed by the Institute for Environmental Studies (IDEA) at the Universidad Nacional de Colombia. It also has an air quality monitor for the region and soon will have a system for monitoring underground water, which is in the process of implementation.

Manizales supports a community-led initiative to clean its hillsides. The “Hillside women guard” is a program implemented by Corpocaldas and the Manizales municipality. The Foundation FESCO, funded by Corpocaldas, manages the program, providing a payment to a selected group of women of the hillside communities who oversee hillside maintenance.

MANIZALES HOUSING INSURANCE SCHEME

The original scheme prescribed that only if 30% of people in the highest income level (SISBEN 3,4,5 and 6) pay the voluntary insurance, those at the lowest income level would be covered by the insurance. The program was called Munipredios. During the first 5 years, the 30% was not reached, so Manizales municipality with the support of the World Bank, decided to revise the scheme to propose adjustments to the insurance company. Since those adjustments in 2005, it provides insurance to low-income sectors up to 39 legal minimum salaries, no matter the level of insurance purchases by high-income property owners in the city. From 2010 to 2015, the municipality did studies to update risk estimates, adjusting for the investments made to reinforce structures throughout the city. Based on those studies, the municipality proposed adjustments to the insurance policy and got a reduction in the premiums on behalf of households. The municipality issued a tender in 2016 for a new coverage and a consortium of AXA and Colpatria (a local insurance company) was awarded permission to issue insurance policies at lower premium rates.

Risk transfer

Manizales has an insurance multiperil policy for its public infrastructure. Public assets from the city have a separate insurance policy, which has been adjusted over time to reflect the investment made to reinforce all public infrastructure structures in the last years. The policy is being updated with information about the most recent construction and work done to reinforce buildings. Currently the insurance is provided by a consortium of La Previsora and Liberty. However, there is an interest to develop a warning system and model specifically for landslide risk, which will serve as a source of information to adjust insurance policies.

Furthermore, Manizales has a risk transfer solution for housing—the oldest such scheme in Colombia. Since 1999, it has a program of collective insurance, which allows owners from the highest-income level (SISBEN) to voluntarily pay for a multi-risk insurance, and with a percentage of that premium, the municipality paid for insurance for lower-income households. The value insured by the policy is the cadastral value in all cases. The local DRM unit informed us that the number of insured properties has increased over time.

IFIMANIZALES is the financial institution of the municipality, which provides funding for city projects. It is a public (51%)-private (49%) institution that can provide loans to the city as needed.

7.1.4 Existing data sources (open and commercial) and available data about risk exposure and vulnerability to natural hazards- including projections of future risks and costs associated with these risks

Detailed studies and historical information about hazards are available at IDEA. IDEA has the maps of micro-zoning for earthquake and hydro-meteorological risks with historical information. Manizales has a very detailed micro-zoning study for earthquakes linked to information on the seismic-resistance of buildings and houses, which allows the municipality to negotiate a reduction in premiums for the insurance policies that cover houses and public assets in the city. Previously, the municipality undertook an evaluation of integral risk to public assets, which allowed them to implement a program to reinforce all public infrastructure. It also has a study from 2007 about seismic-resistance of public assets.

Now the municipality is working to adapt this micro-zoning study to the detailed study for landslide information.

The new POT or Land Use-Plan, with all basic studies, was completed and approved in August 2017. It includes detailed studies of seismic risk. The information about new POT, which includes geo-referenced information, is open to the public and available on the municipality web page.¹⁹ It includes many layers of information to identify areas of hazard and risk.

¹⁹ <http://geodata-manizales-sigalcmz1.opendata.arcgis.com/>

7.1.5 DRM projects currently being implemented

Manizales municipality is currently working on the following projects:

- Updating the public infrastructure inventory and including an inventory of assets for public use such as squares, bridges, parks, etc. The idea is to include some basic public assets under the insurance policy and do a program to reinforce those goods.
- Detailed studies for landslides are currently being undertaken. This is a pending matter for the POT, which will allow them to ask for a proposal to the insurance companies.
- Development of school plans for DRM, with the collaboration and technical support of the Catholic University of Manizales.
- The local DRM unit is supporting the private sector in developing their own Plan for DRM, through training and information sharing.
- The Department of Environment has a program to stabilize hillsides, sowing 120,000 trees in identified areas at risk, working with children and community leaders. The program has reached 16% of its goal.
- The city plans for a new cable car line and routes for electric bikes, which will reduce the pollution by cars in the city.

STUDY OF THE BENEFITS OF MITIGATION WORKS

Corpocaldas commissioned a study to estimate how much a city can save for investment in mitigations works.

Working in a community classified as SISBEN 3, where a plant cover recovery program was implemented, the mitigation program estimated that the value of benefits of the mitigation program were four times the investment made, considering the recovery or increase of commercial value of houses, recovery of plant cover, and costs avoided in case of a disaster (for response, outplacement, health assistance, among others).

Projects being implemented by other entities include:

- The Department of Caldas is working with USAID/OFDA to establish a communication network among the communities and municipalities around Nevado del Ruiz volcano.
- The Catholic University of Manizales has the first spin-off from the Colombian coffee region for innovation funding by Colciencias. Jointly with other biotech institutions, they have made advances to create cheaper multipurpose monitoring stations for landslides, to measure clean air, etc. to be integrated into the early warning system.

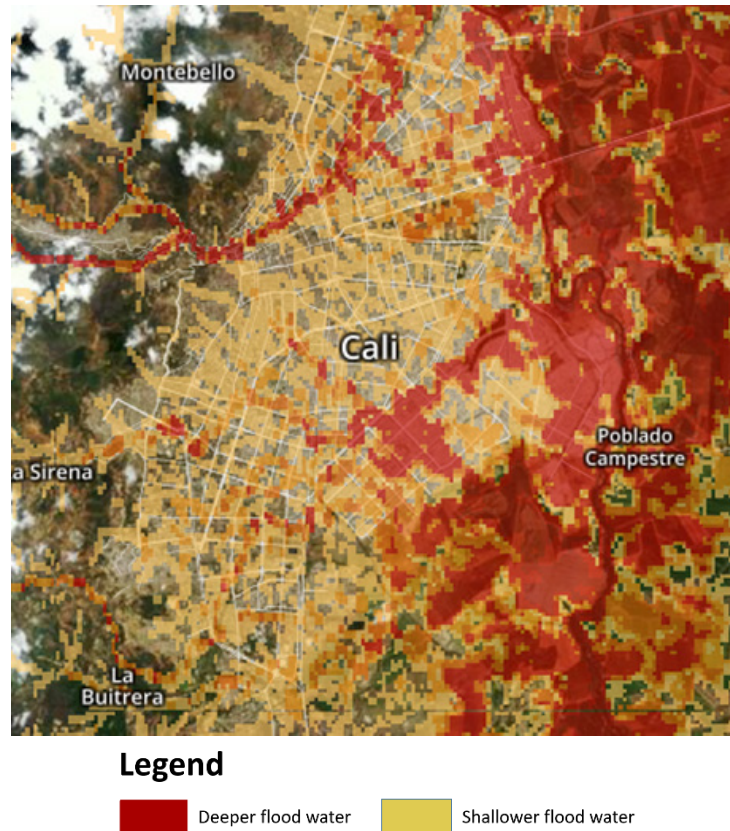
7.1.6 Other city-level DRM stakeholders, particularly non-traditional stakeholder (NGOs, business associations, etc) - especially other donors acting in the field-

Table 8. Stakeholders in Manizales DRM

Stakeholder name	Relevance/Areas of work
The World Bank	It has provided technical assistance for the development and adjustment of its unique scheme for public assets insurance and the housing insurance implemented by the Municipality of Manizales.

8. Cali report

Figure 11. Cali 100 year fluvial and pluvial flood map (Source: KatRisk with data set licenses by Willis Towers Watson)



Cali DRM Summary

Location	Population	DRM Plan	Principal Risks according to DRM Plan	Risks prioritized by Cali Municipality
Southwest Colombia	2,420,100 (DANE, 2017)	A sort of DRM, called Plan for Emergencies and Contingencies, developed by municipality in (2009). It has a 2016-2019 Development Plan, which refers to DRM.	<ol style="list-style-type: none"> 1. Flooding 2. Drought 3. Forest fire 4. Earthquake 	<ol style="list-style-type: none"> 1. Earthquake 2. Flooding 3. Landslide

DRM in Cali is not well coordinated among institutions (at Department level, Regional Autonomous Corporation, universities), while the 100 Resilient Cities Office is coordinating institutions on resilience efforts. The Regional Environmental Authority (CAR) and the municipality have their own monitoring stations and do not coordinate among them. The local DRM unit is focused mainly on mitigation and

disaster response. Several major projects, including the Jarillón (dike) of Cali project²⁰ to reduce flood risk posed by the Cauca River (see p. 42) and reinforcement of public school infrastructure (under the 100 Resilient Cities project), are being implemented by the municipality, including community work. Micro-zoning studies are being updated. Studies of climate-related hazards were developed with the support of the CAR.

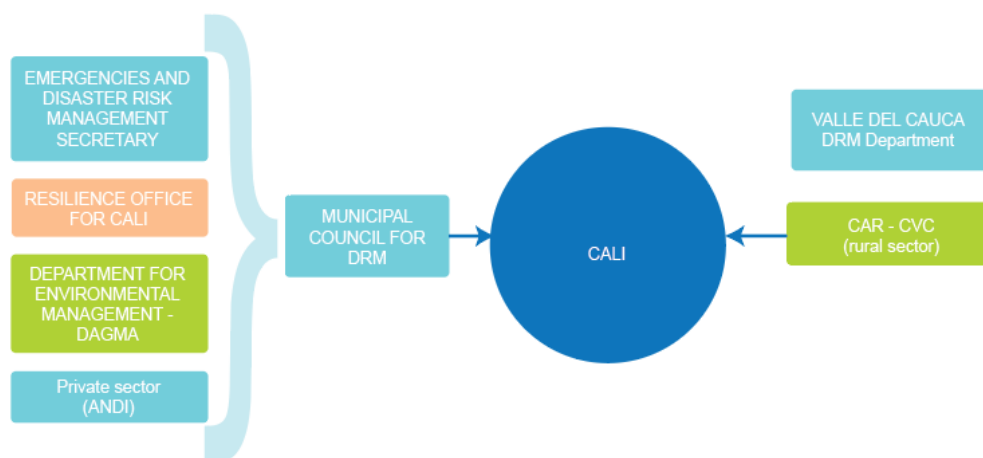
8.1 Current state of municipal DRM, including current and past local government initiatives

8.1.1 DRM Governance Framework for local DRM: Main actors and their responsibilities

In accordance with Act 1523 of 2012, Cali created a structure for DRM at the city level, consisting of mainly a Municipal Council for DRM and a Department for Disaster and Emergencies Risk Management (SDRM). The local unit mainly focuses on knowledge management and disaster response. As an example, the regional autonomous corporation (CAR), Corporación del Valle del Cauca (CVC), and the municipality have their own monitoring stations and do not coordinate. The CVC has one of the most advanced networks of hydro-meteorological stations in the country and provides information to IDEAM.

The Resilient Office for Cali, established in 2016, has been appointed as the coordinator of the Resilient Strategy for the City, under the 100 Resilient Cities program, reaching a good level of coordination and recognition.

Figure 12. DRM structure in Cali



8.1.2 Level of risk awareness and state of development and implementation of DRM plans at the city level

In 2010, the Jarillón, the main dike of the Cauca River, nearly overflowed during La Niña in 2010-2011. Cali authorities are now working on DRM activities at the community level, including strengthening the dike, and is developing a DRM Plan and the development of new Emergency Plans. As a roadmap, the Development Plan of the municipality for 2016-2019 establishes some activities but does not make any specific reference to risk transfer.

To date, most of the DRM activities are focused on disseminating knowledge about risks to the population, using the different materials developed by the UNGRD, adapted at the city level, to generate

²⁰ <http://sitio.fondoadaptacion.gov.co/index.php/atencion-al-ciudadano/preguntas-frecuentes/proyecto-jarillon-de-cali>
http://www.cali.gov.co/gestiondelriesgo/publicaciones/110844/plan_jarillon_de_cali/

awareness and a change of attitude among Cali residents.

The CVC has developed a Climate Change Adaptation Plan for the whole Valley of Cauca River; DRM is an integral part of this plan. The CVC also supports the municipalities to incorporate climate change adaptation into planning. The Environmental Management Plan for Cali, approved in 2016, has DRM as a cross-cutting theme and includes some specific activities to achieve effective coordination among environmental and DRM activities, including creating a committee at city level, investing in monitoring and early warning system tools, and unifying the coordination of the monitoring system, among others.

The university representatives interviewed mentioned that it is very difficult to access information from monitoring services for analysis and research by academia and there is not much of a connection between universities and DRM stakeholders.

8.1.3 DRM measures in place (including funding, mitigation/infrastructure measures, fiscal measures and risk transfer)

Funding

Cali has a fund for DRM that is managed independently. Most of the budget for the Department of DRM according to Department officials, is dedicated to preparation and response activities (90%), while only a limited portion is used on knowledge and mitigation activities. The DRM budget does not include mitigation work currently underway for the Jarillón de Cali project and those made by each individual department of the Municipality. When a disaster occurs, funding is allocated according to need.

Mitigation

The main mitigation project being developed is the Jarillón de Cali project, which is jointly implemented by the Adaptation Fund and the Municipality of Cali. The total budget of the project is US\$370 million which will be jointly invested by the national government, through the Adaptation Fund, the Municipality of Cali, the local municipal public services enterprise (EMCALI) and the CVC. The project has been underway for three years and will last until all informal settlements are relocated. The project includes:

- The recovery of 10.87 miles of the dike area which was occupied by informal settlements. As of March 2018, 9.87 miles had been recovered.
- The relocation of 8,837 households who settled in the dike reserved area. 3,390 have been relocated so far. To improve living conditions, relocated families are provided with education, healthcare, housing and public services.

POTENTIAL EFFECTS OF DAMAGE TO JARILLÓN (DIKE) OF CALI

The resilient assessment of Cali concluded in 2017 as part of the 100 Cities resilient Initiative estimates that the destruction of the Jarillón could cause economic losses of about US\$11.4 billion and would leave 80% of the city without potable water, while 900,000 inhabitants would be affected.

Since seven rivers pass through Cali, the municipality has invested in an early warning system for floods. The municipality also has a seismic accelerometer.

Risk transfer

As with other municipalities, Cali has an insurance policy to cover its public assets under a multiperil policy. However, as with many schools in the city which do not meet standards for seismic resistance set by regulation, we can assume that the condition of the infrastructure is not considered in detail and they are not fully covered by insurance policies.

Insurance companies have attempted to offer risk solution to the Municipality of Cali to protect housing against earthquakes, floods and related risks, but we do not have confirmation that policies have been put in place.

8.1.4 Existing data sources (open and commercial) and available data about risk exposure and vulnerability to natural hazards- including projections of future risks and costs associated with these risks

The POT was approved in 2014 and included studies done by Corporación OSSO, which include extensive details based on mapping that depicts population density, so there was no need to update them after the new regulation for Land-Use Planning (POT) was issued. The only missing studies are the ones related to the physical vulnerability of building and housing in the city for houses with less than three floors.

The city also has detailed studies about flood risk, which were used for the planning of the Jarillón Project.

The CVC has already concluded the studies for landslides at the rural level, but detailed data for landslides at an urban level in Cali is missing. Also needed are studies of forests fires and their causes.

There is no information of the costs of past events and projections about future events, except for estimates of the potential damage caused by failure of the Jarillón de Cali. ²¹

8.1.5 DRM projects currently being implemented

The Municipality of Cali is currently implementing the following projects:

- Studies of risk and vulnerability for landslides, and maps of water resources, being developed jointly with the Universidad del Valle;
- The development of all early warning system which is currently managed by different institutions: IDEAM; CVC and the Administrative Department for Environmental Management (DAGMA);
- The promotion in schools of knowledge about risks, supporting the elaboration of a DRM Plan for schools
- The dissemination of information about the Jarillón Project activities, supplementing the relocation process with economic subsidies and economic development programs, to support the creation of livelihoods for displaced populations;
- As part of the 100 Resilient Cities strategy to create a resilient educational infrastructure, the Municipality of Cali is implementing the “My Community is a school” program. This US\$170 million program aims to retrofit 150 centers, rebuild 34 schools and build seven early childhood development centers, bringing the city’s school infrastructure to the seismic-resistant regulation. This program has received technical assistance from the World Bank’s Global Program for Safer Schools, which aims to boost and facilitate informed, large-scale investments for the safety and resilience of new and existing school infrastructure at risk from natural hazards, contributing to high-quality learning environments. The city has evaluated all educational infrastructure in collaboration with the Universidad de Los Andes, which was based on information in the Land-Use Plan. The Director of the Resilience Office coordinate this program.
- A project for structural strengthening of poorly-built urban settlements on the hillsides and other unsafe parts of the city.

The main climate change mitigation projects in Cali’s resilience strategy are:

- The recovery of the natural hydraulic network as a regulator of urban drainage, a joint project of DAGMA and CVC;
- A project for the protection and restoration of water production areas;

²¹ Resilient Cali 2018. A city of opportunities for progress. Resilient Strategy. Cali, July 2018.

- The CVC will study how much it will cost for the transformation to alternative energy for the city.

8.1.6 Other city-level DRM stakeholders, particularly non-traditional stakeholder (NGOs, business associations, etc) and other donors acting in the field-

Table 9. Stakeholders in Cali DRM

Stakeholder name	Relevance/Areas of work
Rockefeller Foundation	In 2013 the Rockefeller Foundation established the 100 Resilient Cities program to respond to 21 st century challenges such as globalization, urbanization and climate change. Cali was selected as one of the cities at the end of 2015. The program is committed to supporting Cali in the elaboration and implementation of its resilience strategy, which was recently published.

Annexes

Annex 1: Methodology and list of institution interviewed

Data and Information Collection Methods

Data and information were collected through:

- Desk research of current DRM and climate change adaptation plans, related laws at the national and municipal level, studies about risks and previous disasters and risk maps.
- Information collected during the UN Conference for DRM for the Americas, which took place from June 20th to June 22nd in Cartagena de Indias.
- Interviews made with relevant officials and institution representatives, in Cartagena, Bogotá, and Medellín, as well as community leaders in Medellín, during the field trip from June 20th to June 29th.
- Phone interviews made during the weeks of July 2nd to July 13th.
- Interviews made with relevant officials and institution representatives, in Bogotá, Pasto, Manizales, and Cali, during the field trip from July 16th to July 31th.
- Interview with officials from KfW, National government institutions and partners at Bogota from June 25th to 26th, as well as on July 31th

Interviews at the national level were limited because officials from the main national institutions were dedicated to transferring Government portfolio to recently new elected Government.

There was no opportunity to interview all relevant high- level officials from the Cartagena municipality and Bolivar Department—to which Cartagena belongs—as there were assigned to the organization of the global Cartagena Climate Conference or attending to a recent emergency in the Department.

List of institutions interviewed

During the visits, we interviewed a whole range of stakeholders from the national to the community level to understand first-hand the status quo of the DRM system from knowledge to the operational and financial aspects of it. There were nearly 50 meetings and approximately 90 people interviewed.

Below is a list of institutions interviewed:

#	Institution	Area or authority Interviewed
FIRST VISIT		
BOGOTA		
1	Willis Towers Watson	Head of Facultative Reinsurance for Colombia and for selected cities
2	National Unit for Disaster Risk Management -UNGRD-	Advisor Responsible for Financial Protection Strategy
		Advisor for Financial Protection strategy
		Responsible at UNGRD to formulate project to prevent coastal erosion in Cartagena
3	DLA Piper	Senior Insurance Associate
4	FIDUPREVISORA	National Fund for Disaster Risk Management Coordinator
5	KFW	Regional coordinator for Colombia and local coordinator for transport and urban development in Colombia
CARTAGENA		
6	Cartagena Municipality	RDM Management Unit, advisor
		Infrastructure Secretary, advisor
		Planning secretary, advisor
7	Marine and Coastal research Institute -INVEMAR-Colombia	Responsible of data development for planning and development plan for Cartagena
8	Cartagena Chamber of Commerce	Executive President
MEDELLIN		
9	Antioquia Department	Coordinator for DRM Department (DAPARD)
		Sustainable Development Secretary
10	Medellin Municipality	DRM Department - DAGRED- Chief - Vice Director of Knowledge
11	Metropolitan Authority for Aburra Valley	DRM Department and responsible for POT planning
12	Local Development Enterprise Association	Environmental Management and Strategic Planning representatives
13	Local Community Boards	

14	University EAFIT	Information, research and development for Medellin DRM Plan
15	100 resilient cities Office at Medellin	Chief Resilience Officer for Colombia
SECOND VISIT		
BOGOTA		
16	Ministry of Finance	Subdirector of Risk
		Advisor at Risk Sub direction
17	Adaptation Fund	Advisor at Sub-direction of Risk Management
18	Environment and Sustainable Development Ministry	Climate Change Direction and Risk Management
19	National Department Planning	Environment and Climate Change Adaptation Sub- Direction
20	Hanover Re	Chief for Colombia
PASTO		
21	Pasto Municipality	Environment Management Secretary
22	ALCALDIA MUNICIPAL DE PASTO	Treasury Secretary
23	Nariño Governorate	DRM Direction
24	Pasto Municipality	DRM Department
25	Pasto Municipality	Planning Department
26	CORPONARIÑO	Advisor of Risk Assessment Direction
27	Pasto Municipality	Community Development Secretary
MANIZALES		
28	Instituto de Estudios Ambientales (IDEA) Universidad Nacional de Colombia (sede Manizales)	Prof. Omar Dario Cardona- Risk transfer and earthquake modeling expert
29	Instituto de Estudios Ambientales (IDEA) Universidad Nacional de Colombia	Director
30	Regional Autonomous Corporation- Corpocaldas	Environmental Planning Sub- Direction
31	Manizales Municipality	RDM Unit- Chief
32	Manizales Municipality	Planning Secretary
33	Manizales Municipality	Treasury Secretary
34	Universidad Católica de Manizales	Research are on DRM
35	Manizales Municipality	Environment Secretary

36	Universidad de Manizales	Environment and Development Research Center -Cimad
CALI		
37	Valle del Cauca Governorate	DRM Secretary
38	Cali Municipality	DRM Secretary
39	Cali Municipality	Land- Use Planning - Planning Department
40	Regional Autonomous Corporation – CVC	Environmental Management and Climate Change
41	Universidad del Valle	Environmental Urban conflict Observatory- OCAU
42	Cali Municipality	Department for Environmental Risk Management (DAGMA)
43	Cali Municipality	Resilient Office (100 resilient Cities)

Annex 2: National system for DRM in Colombia

The national DRM system includes every government level as illustrated in Figure 2, from which we highlight the following main institutions:

a. The National Council for DRM

This is the main political body, responsible for the approval of DRM policies and guidelines. It is comprised of the President, all ministers, the National Department for Planning (DNP) and the National Unit for DRM (UNGRD)

b. The National Unit for DRM (UNGRD)

UNGRD is the leading implementation institution of the system, responsible for the elaboration of the National Plan for DRM and the general DRM guidelines for all government levels, including updates to the Plan and coordination of its implementation among all institutions in the system. The National Chief, Carlos Iván Marquez Pérez, has headed the Unit since its creation in 2012 and is a major champion for the institution.

c. Committees: The National System has three permanent working groups:

1. Committee for Knowledge of Risks: responsible for assessing and planning the implementation of activities to increase knowledge about risks. It includes the UNGRD Director, DNP, and entities dedicated to information and knowledge generation for disaster risk prevention, such as IDEAM, the National Federation of Departments, and the National Federation of Municipalities, among others.
2. Committee for Risk Reduction: responsible for assessing and planning the implementation of the disaster risk reduction processes. This committee includes the UNGRD Director, DNP, the National Federation of Departments and the National Federation of Municipalities, the National Association of Insurance Companies (FASECOLDA), representatives of public and private universities, and the Colombian Security Council.
3. Committee for Disaster Management: responsible for assessing and planning the implementation of the disaster management process. It includes the UNGRD Director, all military forces, national police and firefighters, and the Colombian Red Cross.

d. Ministry of Finance (MOF)

The Ministry of Finance is responsible for providing technical assistance on financial matters. The recently created Sub Directorate of Risks has the role of defining and proposing the financial strategy for confronting natural disasters at the sub-national level.

Annex 3: Sub- national Level Regulations and Guidance Issued Recently by UNGRD

1. *Guidance to help public entities to understand the concept of financial risk reduction and support them in the process of acquiring insurance for public assets.* The general guidelines were elaborated as part of the Committee of Risks Reduction contribution -which includes FASECOLDA-, as well as *Colombia Compra Eficiente* –the entity responsible to facilitate cost-efficient purchases for the Colombian State-, with the support of MOF, World bank and SECO with the aim to facilitate the understanding of local authorities about insurance-related concepts, and to support them in the process to acquire adequate insurance coverage. Nonetheless, there were limited efforts to disseminate this guidance.
2. *Integration of the concept of DRM into land-use planning.* A Decree 1807 of 2014 positioned DRM on sub-national agendas, and requires the incorporation of DRM into Land-Use Planning at every government level, and require elaborate studies for the medium-term and long-term planning.
3. *Regulation on Territorial Funds for DRM.* Decree 063 from October 9th, 2017 issued by the UNGRD regulates the management of National Fund for DRM and the Territorial Funds for DRM (Departmental and municipal funds). These dedicated funds were created by Act 1523 from 2012 (the law that established the National System for Disaster Risk Management), but its regulation was pending and discussed for many years among authorities. The decree established that the Territorial Funds will be managed by a board of directors comprised of the main public authorities for DRM at the local level. Funding sources include the central government or other public institutions, local public budget, credit lines, and also donations and are required to have enough a level of funding determined by the estimated risk at department and municipal level. Monies in in the Fund must remain in the fund after the end of fiscal year, and are not reimbursed to the original source of funds. The Territorial Fund has five dedicated purposes: 1) risk knowledge; 2) risk reduction; 3) disaster management; 4) recovery; and 5) financial protection. The corresponding authorities shall ensure that the Fund has enough resources to cover activities planned and for emergency response. However, these requirements have proven challenging for most municipalities that have a limited budget and little or no knowledge of financial management of risk.

Annex 4: Principal Institutions in the Medellín DRM System

The Medellín department for DRM -DAGR- is responsible for the implementation of DRM at the municipal level.

Since its creation, it has contributed to the elaboration of the Local Plan for DRM, implemented projects to promote knowledge about risk among communities and supported many projects and efforts for DRM in the municipality. It is also responsible for the coordination and implementation of the Local Plan for DRM in the three areas of work:

1. Knowledge;
2. Reduction; and
3. Disaster Management.

It participates jointly with nine other municipalities in the Metropolitan Authority for the Aburrá Valley (AMVA). Activities include working with some communities on knowledge promotion and risk mitigation. They also engage in joint efforts with the National Trade Federation of Medellín (FENALCO Medellín) to include micro- and small enterprises in disaster risk knowledge promotion and management activities, supported by USAID, among other projects.

The DRM office at the Metropolitan Authority, which represents Medellín at the Departmental Council, is accountable for major infrastructure that connects the ten municipalities of Aburrá Valley, such as the river basin infrastructure and the Metro.

The Metropolitan Authority is the Council of the ten municipalities located at the Aburrá River basin that make up this autonomous institution. Its main activities are to:

- a. Represent the ten municipalities at Departmental-level working groups, representing their joint interest;
- b. Manage land use planning in the sub-region;
- c. build the public infrastructure of metropolitan interest;
- d. Oversee non-urban road network and transport;
- e. Serve as the sub-region's environmental authority and as the leader of environmental control and surveillance, environmental management and risk disaster management.
- f. Manage metropolitan infrastructure Aburrá River basin and the Metro, which is the main transport system connecting all municipalities.
- g. Act as a subsidiary to the municipality support system for DRM, with responsibility for the microzone project, as well as for the public property inventory projects for the Metropolitan area.

The Departmental DRM Unit of Antioquia Department has a subsidiary role in Medellín

The Departmental Unit for DRM represents the Department at the National Council for DRM Committees and has the role to act in case of disaster under the subsidiary principle -when the respective municipality has no more resources to respond. However, considering Medellín has sufficient own funds, their role is the coordination of reports to the central UNGRD and field coordination, for example when a disaster occurs in a nearby municipality.

The Resilience Office in Medellín has been constituted as independent office and has a distant relationship with the local unit for DRM.

The Resilience Office for Medellín is one of the Rockefeller Foundation's 100 Resilient Cities. As of this year, this office is an independent institution managed by a board whose members represent the private sector and academia. The Resilience Office is focused on promoting projects with other partners (the World Bank, Build Change, among others) to work on public-private-partnership with communities through public-private partnerships on DRM projects such as risk mapping using drones, and improving

homes to meet earthquake resistance standards.

Annex 5: Community-led Approach to DRM

The level of involvement of communities in the local risk management system is a reflection of the current state of DRM in the five cities included in this study.

Where governance and inter-institutional coordination are weak, the role of communities in prevention and/or implementation of risk mitigation measures is almost non-existent. However, some cities have a history of addressing risks, and communities have been integrated in the identification and implementation of mitigation measures.

Cartagena

Cartagena is the city most frequently affected, of those assessed; by recurring floods, landslides and other effects of coastal erosion, yet it has the weakest DRM planning. There is no clear institutional linkage, and external stakeholders such as the UNGRD and the Adaptation Fund carry out the most relevant projects.

Although recurrent floods in Cartagena are, in-part, related to man-made interventions, there are no visible efforts to involve communities as part of the solution to problems like the following:

- La Virgen Swamp (north of Cartagena) that used to provide a buffer between the sea and the streams coming from the inland have been changed by man-made interventions, such as the filling of the lagoon, which was followed by construction of illegal settlements in the inter tidal zone and on beaches and dunes.
- The natural drainage into the lagoon has been altered by extraction of sand and gravel from channels and river beds, indiscriminate felling of mangroves, the modification of the topography by the construction of illegal structures along channels, occupation of the banks or set-back areas, urbanization and its residual discharges, deforestation of land in the basin, higher level streets, accumulation of garbage and debris, and build-up of sediment due to the lack of maintenance of drainage channels and culverts.

These conditions can be improved if officials value the potential involvement of communities in awareness, risk reduction and preparedness.

Medellín

Medellín has a long history of community organization and has developed a strong institutional architecture for DRM.

Part of the DRM system includes Community Risk Management Committees. These committees are part of the Community Action Boards that are civil society organizations that promote citizen participation in day-to-day community management and serve as liaisons with the municipal government. These committees are responsible for identifying and alerting communities about the potential natural risks so they can take preventive measures to save lives. The main focus is on disaster prevention, and mitigation strategies during an event, promoting community risk management, early-warning social networks, social mapping of risk, and disaster management strategies.

Community participation as an agent of change in their neighborhoods has brought individual and collective responsibility towards disaster risk management in Medellín. The empowerment of Community Risk Management Committees has encouraged the active participation of non-traditional sectors of the community, and improved collective awareness of risk prevention and mitigation processes.

Pasto

In Pasto, community participation in DRM is at a very early stage and is not run by the local DRM unit but

by the Municipal Community Development Secretariat.

The municipality of Pasto has 383 Community Action Boards with committees on health, housing, work, culture, etc. To date there are no Committees linked to the DRM.

Community-level knowledge of DRM is limited. Only recently has the municipality started developing plans to train the Community Action Boards. The most significant effort to date is the establishment of a communication protocol to ensure that information on possible risks is transmitted across communities in a timely manner.

At the level of the Local DRM Unit, there is no clear strategy on how to link communities to the system. Risk awareness and knowledge among the public is limited to disaster drills at schools, reaching 80% of the education centers to date.

Communities of Pasto are not ready to engage in either identifying or implementing risk mitigation measures, so extensive outreach will be necessary to first increase knowledge of risks.

Manizales

The city of Manizales has a well-developed DRM system that is based on an effective level of coordination among key stakeholders such as municipal and departmental officials, civil society, academia and communities. DRM is articulated to communities mainly through universities.

In general, there is a high level of risk awareness among residents. Most public and private organizations are aware of the risk they are subject to, and have been implementing mitigation measures.

Several universities run DRM programs and the local DRM Unit has been working with the University of Manizales to develop a DRM training program for community leaders to promote the development of DRM community plans. The university has also developed and disseminated training modules to develop a School Risk Management Plan with a psychosocial component.

Construction workers have been trained to build according seismic standards and the municipality holds a registry of certified master builders accessible to those in need of their services.

Importantly, in 2003 Manizales pioneered a unique community risk mitigation program called “Guardians of the Slope,” which aims to improve the environmental and social sustainability of the urban environmental protection slopes of the municipality of Manizales through the implementation of environmental education processes and promotion of a culture of landslide prevention. Jointly financed by City of Manizales and Corpocaldas, the program invites women (head-of-households) to carry out risk mitigation measures in their own communities. The program trains the women in the care and maintenance of hillsides and existing stabilization projects, and strengthens the concept of disaster prevention in communities, with the clear objective of raising awareness among the community of the importance of the proper management of the slopes and the need to exercise control and surveillance of project carried out on them.

Cali

Cali has made the most visible effort to date to involve communities in DRM, however it is limited to the area of knowledge. Community guidelines for the knowledge of DRM and land use plans have been distributed. Despite major advances in other areas of DRM, the local risk management unit seems to be unclear about the importance of active participation of the community in issues of prevention and risk management.

In Cali, community involvement in DRM is perceived as burdensome. This perspective differs greatly from

what currently happens in cities with similar conditions such as Medellín and Manizales, where communities have become active in the DRM of their neighborhoods and territories.

A more participatory process is led by Cali's Resilience Office. Cali's Resilience Plan is defined as inclusive and participatory; it remains to be seen whether communities will take on a more prominent role in addressing climate change.

As in cities such as Medellín and Manizales, communities could play a vital role in reducing the impact of a disaster through risk mitigation measures. People at the community level are often the most vulnerable to disaster and experience the greatest impacts for various reasons. With knowledge of the local risk context and the livelihoods options available, local communities must be involved in disaster management programs from the start, and supported by projects to develop the capacities and linkages that help overcome. For this to happen there must be a political will from the decision makers (local authorities) to engage them as active players in their own DRM plans.

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