DIGER
Dirección de Gestión del Riesgo
DOSQUEBRADAS

# DISASTER RISK AND CLIMATE CHANGE

## FINANCIAL PROTECTION STRATEGY

### DOSQUEBRADAS MUNICIPALITY (RISARALDA)

MUNICIPIO DE DOSQUEBRADAS

EMPRESA DOSQUEBRADAS DE TODOS

# DISASTER RISK AND CLIMATE CHANGE FINANCIAL PROTECTION STRATEGY

## DOSQUEBRADAS MUNICIPALITY (RISARALDA)

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This document was prepared by the Disaster Risk Management Directorate of the Municipality of Dosquebradas Risaralda

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# Acronyms

| | |
|---|---|
| AMCO | West Central Metropolitan Area |
| AMIT | Malicious Acts of Third Parties |
| CARDER | Risaralda Regional Autonomous Corporation |
| CC | Climate Change |
| CRI | Emergencies and Disasters Immediate Response Center Dosquebradas |
| COP | Colombian Pesos |
| DIGER | Risk Management Directorate Dosquebradas Municipality |
| DNP | National Planning Department |
| ECOPETROL | Colombian Petroleum Company |
| FPS | Financial Protection Strategy |
| FMGRDD | Municipal Fund for Disaster Risk Management Dosquebradas, Risaralda Department |
| FINDETER | Subnational Development Finance Institution |
| GHG | Greenhouse Gases |
| DRM | Disaster Risk Management |
| HMACCoP | Strike, Riot, Mutiny, Civil or Popular Unrest |
| MCR2030 | Building Resilient Cities Initiative |
| NOAA | National Oceanic and Atmospheric Administration of the United States of America |
| FP | Financial Protection |
| PMGRD | Municipal Disaster Risk Management Plan Dosquebradas, Risaralda Department |
| POT | Land Management Plan |
| SbM | Nature-based solutions |
| SECO | Swiss Economic Cooperation and Development |
| SINAP | National System of Protected Areas |
| UN | United Nations |
| UNGRD | Disaster Risk Management National Unit |

# PRESENTATION

The municipality of Dosquebradas Risaralda is a city of just over 220,000 inhabitants and 74 km$^2$ crossed by 32 streams; a territory of industrial, commercial, and rural vocation, a city that stands out for its prosperity, for being a refuge for locals and visitors seeking a very good quality of life in a beautiful, friendly, and thriving territory.

Dosquebradas stands out for being the first subnational entity to promote active and constant disaster risk management with the formulation of risk prevention and mitigation policies in the department of Risaralda.

To this extent, it was also the first territory to include financial protection goals in the Municipal Disaster Risk Management Plan (PMGRD, for its acronym in Spanish) and Climate Change 2023-2035, with the purpose of reducing fiscal vulnerability to disasters; it also created the Municipal Disaster Risk Management Fund, generating a close link between disaster risk management and financial protection as a comprehensive piece of said policy.

The Municipal Risk Management Fund implemented by means of Municipal Agreement N°032 of December 04, 2016, which was superseded by Municipal Agreement N°002 of January 21, 2022, thus commencing budgetary activities at the beginning of 2022, has assigned administration's resources to knowledge, disaster reduction and management, thus encompassing the preparation, response, rehabilitation and reconstruction for the disasters that affect the municipality by their nature and in turn corresponding to the need to address the calamities by means of the resources framed or allocated from the municipal risk management fund.

As mentioned above, since the beginning of the Fund's budgetary duties, resources have been allocated to disaster knowledge, reduction and management, these subaccounts organically make up the legal composition of the FMGRD, which is stated in the Municipal Decree No. 274 of July 18, 2022, modified by Municipal Decree No. 130 of March 14, 2023, this decree regulates it and, in turn, as a financing mechanism for the Municipality, allows securing the resources from external sources to the Municipality for the purpose and for the fulfillment of preparedness, response, rehabilitation and reconstruction actions within the framework of calamities declared by the Municipality.

For this reason, it has been fundamental for Dosquebradas to receive support for the formulation and implementation of the Financial Protection Strategy. We are grateful for the support of the Swiss Economic and Development Cooperation SECO and the World Bank's Disaster Risk Financing and Insurance Program, the Disaster Risk Management Unit UNGRD, the National Planning Department DNP, the Disaster Risk Management Directorate DIGER, the Ministry of Finance and Public Credit and the Municipal Finance Secretariat in the development of this Strategy.

**JORGE DIEGO RAMOS CASTAÑO**
Mayor Dosquebradas

# Preface

The Ministry of Finance and Public Credit -MHCP- leads and implements the National Strategy for Financial Protection against Disasters, Epidemics and Pandemics Risk, which seeks to reduce fiscal vulnerability to these events; however, we are aware that this task must be carried out jointly with the subnational territories, which is the reason why the financial management strengthening was included as an objective of the subnational entities.

For the Public Credit and National Treasury Directorate it has been a privilege to support and accompany the construction of the Financial Protection Strategy of Dosquebradas, a subnational territory that stands out for its progress in disaster risk management, especially in risk reduction through innovative measures such as Nature-Based Solutions (NBS), which has positioned it as the only intermediate city in the world, certified as a resilience hub and now the only non-capital city to have a strategy of this sort in the country.

The Financial Protection Strategy constitutes a roadmap for the reduction of the financial vulnerability of the subnational territory associated with disasters, with this policy document we hope to strengthen the capabilities of Dosquebradas on its way forward, becoming a resilient subnational territory through better public policies, complementing its progress in risk reduction.

We are grateful to the Swiss Economic Cooperation and Development (SECO), which finances the Disaster Risk Financing and Insurance Program (DRFI) of the World Bank, which provides technical support to this process.

Finally, I highlight this strategy as a starting point for intermediate cities in Colombia to implement public policies framed in fiscal responsibility to protect themselves financially against the impacts generated by disasters, which are increasingly visible due to Climate Change.

**José Roberto Acosta Ramos**
General Director of Public Credit and National Treasury
Ministry of Finance and Public Credit.


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# Introduction

The municipality of Dosquebradas is subject to multiple threats, which generate, among other negative effects, fiscal vulnerability. Within this context, the regulations stipulate activities in financial protection, for which a public policy is established in this regard, embodied in this Disaster Risk and Climate Change Financial Protection Strategy, which establishes as policy objectives: (i) Identification and understanding of fiscal risk due to the occurrence of disasters, (ii) Financial management of disaster risk and the adverse effects of climate change (financial instrumentation), (iii) Catastrophic risk insurance of public assets and (iv) Coordination with public sectors and the private sector.

The guiding framework of the public policy objectives was established aligned with those of the National Strategy for Financial Protection from Disaster Risks, Epidemics and Pandemics (2021), but recognizing the risk and economic specificities of Dosquebradas. Additionally, the policy objectives are aligned with the Municipal Disaster Risk Management Plan of Dosquebradas (2020).

The objectives are, among others, for Dosquebradas to have a diversified portfolio of instruments that incorporate the retention, financing and transfer of disasters and adverse CC events risks. Thus, Dosquebradas currently has a portfolio of FP instruments, such as the Municipal Disaster Risk Management Fund and the insurance of public assets that are property of the municipality, which seek to strengthen and expand, so that the municipality has financial instruments that allow it to have access to immediate liquidity for the response to severe events, as well as resources for recovery processes.

In the strategy document the context of Dosquebradas is presented first. Subsequently, the policy objectives established in Disaster Risk and Climate Change Financial Protection Strategy are described. Third, the description of the regulatory framework considered for the undertaking of the strategy. Subsequently, the description of the work around the exposure to disasters and climate change, including a description of the risk scenarios prioritized by the Risk Management Directorate of Dosquebradas (DIGER). Likewise, highlights the impacts of climate change on precipitation and temperature scenarios, emphasizing their impact on the micro-watersheds.

The undertaking of the strategy was led by Dosquebradas and the Ministry of Finance and Public Credit, and supported by the National Planning Department (DNP), the National Unit for Disaster Risk Management (UNGRD), the World Bank's Disaster Risk Financing and Insurance Program (DRFI Program) and the Swiss Economic and Development Cooperation (SECO)[1] .

1 The opinions and contents expressed in this document are not the responsibility of SECO.

# Context

The Municipality of Pereira, *"along with Dosquebradas and La Virginia municipalities, is part of the West Central Metropolitan Area. It is also part of Subregion 1 of the Department of Risaralda with the municipalities of Dosquebradas, Marsella and Santa Rosa de Cabal, according to CARDER's Environmental Land Planning process. It is located on the western slope of the Central Mountain Range (...) with altitudes between 1,350 and 2,180 m.s.n.m. Its precipitation range varies between 2600 mm/year and 3200 mm/year. Its average temperature is 18°-22° C very uniform, with a relative humidity of 66%"*[2] .

"*Dosquebradas is a municipality founded as a subnational entity in 1972, attached to the Department of Risaralda in the south of the Department (...) Dosquebradas is crossed by the Troncal del Eje Cafetero highway, yielding a strategic location as a hub and meeting spot for Valle, Antioquia, Quindio and* Caldas departments"[3] .

The municipality Dosquebradas (Figure 1) is a second category municipality[4] . Administratively, its urban center is divided into twelve (12) communes, made up of groups of neighborhoods. The rural area is made up of twenty-nine (29) villages divided into two (2) townships (Alto del Nudo, Alto de las Marcadas)[5] .


2 (Source: http:/www.dosquebradas.gov.co) quoted in MUNICIPALITY of "DOSQUEBRADAS" (Risaralda) - Municipal Council for Disaster Risk Management. Municipal Disaster Risk Management Plan. December 2020. p. 5.

3 Municipality of Dosquebradas, 2020. Development Plan, Dosquebradas Empresa de Todos (2020-2023), p. 36.

4 According to Article 6 of Law 136 of 1994 (amended by Article 153 of Decree 2106 of 2019), municipalities in Colombia are organized into seven categories divided into three groups: (i) large municipalities (special category and first category), (ii) intermediate municipalities (second, third and fourth category) and (iii) basic municipalities (fifth and sixth category). The second category are intermediate municipalities featured by: (i) Population between fifty thousand one (50,001) and one hundred thousand (100,000) inhabitants, (ii) Annual current revenues of free destination: Over fifty thousand (50,000) and up to one hundred thousand (100,000) legal monthly minimum wages in force. Considering the value of the legal minimum salary in force in 2023, which corresponds to $1,160,000, this range would be between $58 billion and $116 billion COP. Category 2 of the municipality of Dosquebradas (Risaralda) was certified for 2023 by Resolution No. 314 of November 30, 2022 (article 2 item 8 page 16) issued by the Special Administrative Unit of the General Accounting Office of the Nation, based on the regulations.

5 Ob. Cit. Development Plan, Dosquebradas (2020-2023) and Dosquebradas Municipality, 2023. POT. Annexes Environmental Affairs. ANNEX E. Basic assessments of rural settlements and population centers.

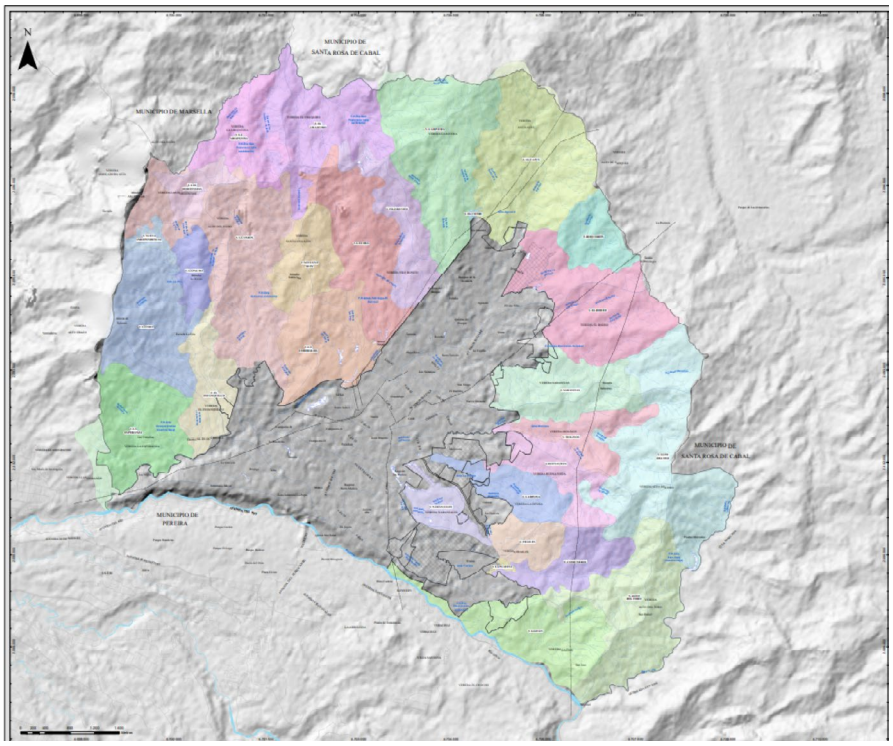


***Figure 1. Dosquebradas Municipality.***
*Source: Subnational Management Plan (2023)*

*"The main micro-basins in the municipality of Dosquebradas are La Fría, Gutiérrez, Tominejo, Amoladora (Barrizal), Aguazul, La Chillona, Manizales, La Soledad, Molinos, La Víbora, Frailes and Gaitán. The Dosquebradas stream basin has a circular shape, which makes it susceptible to flooding. Due to its shape, geology, high slopes and average annual rainfall, floods and landslides are the most recurrent and impacting natural events in the municipal territory, among other* events"[6] .

"*National Parks statistics determine that 22% of the territory of Dosquebradas is incorporated into the SINAP (...) the fact that one fifth of the territory is part of the SINAP creates the need to position the environmental component within the municipal public agenda, in order to ensure its management and special protection against threats arising from the environmental productive exploitation."*[7] . Consequently, the Development Plan, Dosquebradas Empresa de Todos (2020-2023) recognizes in strategic line 3 (Environmental Territory) that *"Climate change, as a factor of increased disaster risk, is part of the reality of Dosquebradas: working towards adaptation, resilience and knowledge, will allow our system of disaster response and prevention to answer and continue strengthening with which all its parts are in harmony and allow to continue with the purpose of Dosquebradas: Empresa de* Todos"[8] .

6 Ob. Cit. Development Plan, Dosquebradas (2020-2023), p. 7 and 8.

7 Ibid. p. 182.

8 Ibid. p. 179 and 180.

**Dosquebradas, Resilience Node MCR2030 Making Cities Resilient 2030 of the United Nations for Disaster Risk Reduction UNDRR**

Dosquebradas maintains as one of its main strategic lines of work, Resilience in Disaster Risk Management, which includes the commitment to share experiences, accompany the cities in their path of Resilience and in the Strengthening of the Subnational Risk Management Offices of the interested cities, based on the city policies that have been developed in Dosquebradas focused on the Resilience of our communities.

To this end, it was given the task of working on 10 essential aspects, so called by the United Nations, which establish the viability of a city to enter the initiative and, after complying with its policies, become a Resilience Node.

This is how DIGER Dosquebradas has embarked on an essential and necessary path to improve the quality of life of the inhabitants, building self-determined and proactive communities that have the vision to react effectively and quickly to the effects of the materialization of risk.

Dosquebradas is one of three cities in the country that are Resilience Nodes, along with Bogota and the Special District of Science, Technology and Innovation of Medellin, and the first non-capital city to be certified as a Resilience Node by the United Nations. The recognition was given in Punta del Este Uruguay in the framework of the PR23 Event in March of this year. This recognition puts Dosquebradas in the global sphere for the actions implemented in the framework of Disaster Risk Reduction.


And it puts on the table the prospective objective of formulating projects to reduce the risk conditions of the communities of Dosquebradas and opens the doors to obtain international resources to execute the works.

MCR 2030 Iniciativa Desarrollando Ciudades Resilientes


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BIBLIOTECA MUNICIPAL

# Policy objectives

Dosquebradas is subject to multiple hazards, which generate, among other negative effects, fiscal vulnerability. Within this context, the regulations stipulate financial protection activities, which is why a public policy is established, embodied in this Disaster Risk and Climate Change Financial Protection Strategy.

The guiding framework of these public policy objectives is aligned with those of the National Disasters, Epidemics and Pandemics Risks Financial Protection Strategy (2021)[9] . Consequently, the FPS of Dosquebradas is liased with the national level FPS (2021), but recognizes the risk and economic particularities of the municipality.

## Policy Objective 1: Identification and understanding of fiscal risk due to disasters.

This policy objective is aligned with Strategy 1 of the PMGRD, which corresponds to "Local knowledge of natural and/or anthropogenic origin risks".

To move forward in the identification and understanding of fiscal risk due to disasters and adverse events due to CC, robust information is required to analyze and support decision making, which entails, among others:

- **Knowledge and evaluation of natural, socio-natural, technological, and unintentional human origin risks**. It seeks both to reduce vulnerability and to improve response capacity.
- **Carry out assessments and putting together the hazard maps, identifying hazards of natural, socio-natural, technological, and unintentional human origin, as well as assessments on exposure and vulnerability**. It seeks to build models on the potential impact on the territory of the diagnosed and identified hazards, as well as to identify the vulnerability of all exposed elements.
- **Implement and strengthen surveillance and early warning services to monitor the behavior of risk generating factors in the municipal territory**. It seeks to reduce losses and damages, as well as to improve response capacity.
- **Generation of information for emergency response**. The municipality has a platform to manage information for emergency response. Through standardized formats (configurable and parameterizable), information is collected in the field, which is automatically consolidated, allowing mining and big data, while reducing the risk in humanitarian assistance management and the possibility of fraud.
- **Sizing fiscal risk**. The quantification of the contingent due to disasters and adverse events caused by the CC will reinforce the need to implement a FPS to reduce the municipality's fiscal vulnerability.
- **Generation of information for municipal environmental accounts.** This information will improve the understanding of the interaction between the environment and the economic loop. Among others, these

9 Available in: https://www.minhacienda.gov.co/webcenter/ShowProperty?nodeId=%2FConexionContent%2FWCC_CLUSTER-180375%2F%2FidcPrimaryFile&revision=latestreleased

accounts should include information on the quantity of emissions generated by combustion processes within the marketplace[10] .

## Second policy objective: Financial management of disaster risk and the adverse effects of climate change (financial instrumentation).

This policy objective is aligned with Strategy 5 of the PMGRD, which corresponds to "Risk transfer: a path towards territorial resilience". This strategy includes the program "Collective insurance of goods, environmental services, agricultural activities and municipal infrastructure", which aims to ensure the financial resilience of the municipality and the improvement of response, rehabilitation, and reconstruction levels of vital infrastructure. The program includes, among others, the following activities:

- Action 1. Diagnosis, evaluation and characterization of the condition, vulnerability and economic valuation of the municipality's assets and infrastructure.
- Action 2. Design, formulation, coordination, and socialization of the policy for collective insurance of institutional assets and infrastructure.
- Action 3. Formulation of a municipal policy for collective housing insurance for strata 1-2-3-4.
- Action 4. Diagnosis, parameterization of agricultural productive activities and design of a rural collective insurance policy.
- Action 5. Characterization and assessment of natural capital and municipal environmental accounts.
- Action 6. Socialization and municipal dissemination of the importance of collective insurance.

This policy objective seeks to ensure that the municipality of Dosquebradas has a diversified portfolio of instruments that incorporate the retention, financing and transfer of disaster risk and adverse CC events (Figure 2), for which the municipality of Dosquebradas currently has a portfolio of FP instruments, which it wishes to strengthen and broaden.

10 DANE (2017). Environmental and economic accounts in Colombia. Indicators and Environmental Accounts Group, Synthesis and National Accounts Directorate.

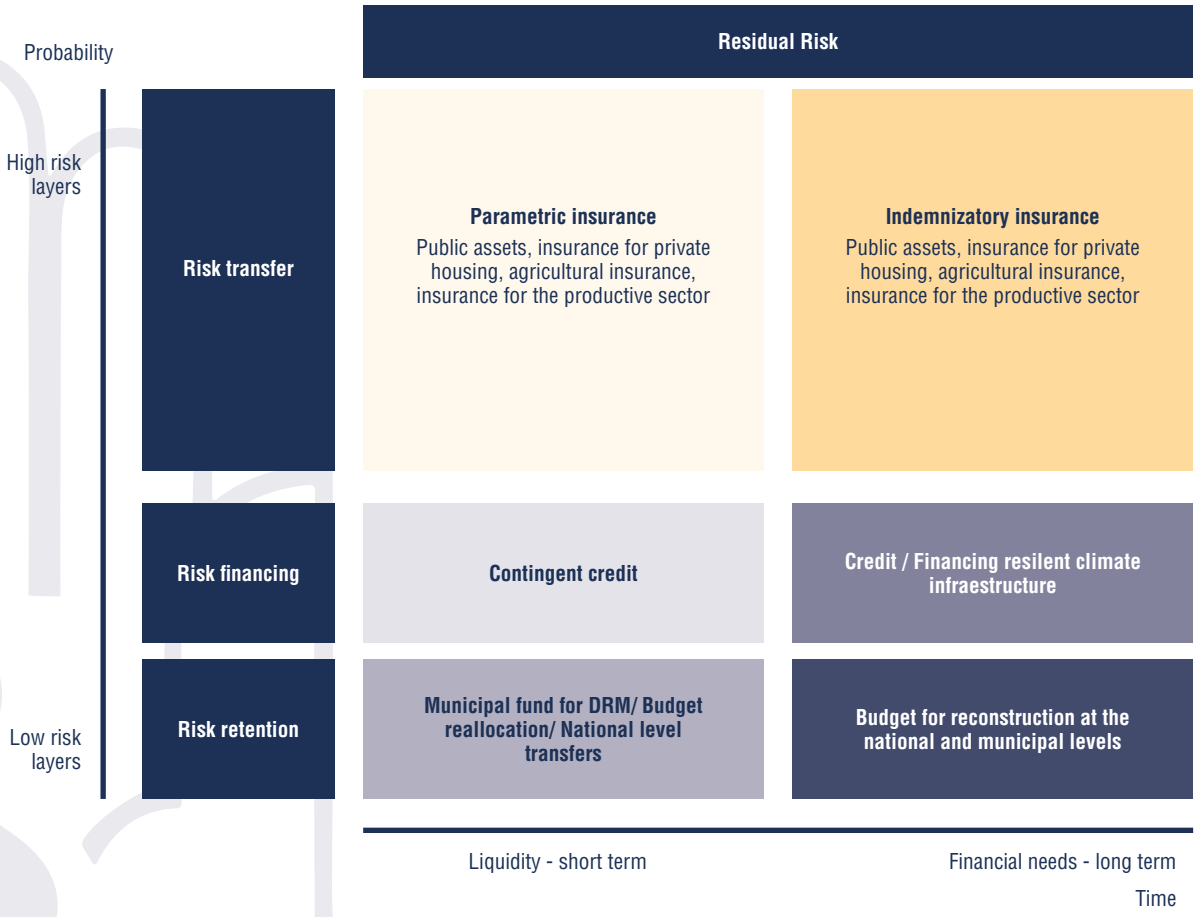



***Figure 2. Layered risk financing scheme.***

## Financial instruments currently in place for Dosquebradas:

- **Dosquebradas Municipal Fund for Disaster Risk Management, Department of Risaralda (FMGRDD)**

In Dosquebradas, the FMGRDD was created by Agreement No. 032 of December 2016 (modified by Agreement No. 002 of January 21, 2022) as a special budget account, without legal personality, with equity, administrative, and accounting independence, developing its functions and operations in a direct or complementary manner, under inter-institutional schemes of co-financing, concurrence, and subsidiarity.

Dosquebradas must guarantee the budgetary appropriation of the FMGRDD so that it has annual resources of no less than 700 legal monthly minimum wages in force (Article 12 of Municipal Agreement No. 032 of 2016, modified by Article 5 of Municipal Agreement No. 002 of January 21, 2022), which is 812 million pesos[11] .

11 The value of the minimum legal salary in force in 2023 corresponds to $1,160,000.

The FMGRDD has a financial protection subaccount, whose resources will be used to support the financing of financial mechanisms or instruments for intentional risk retention or risk transfer that are established ex ante, in order to gain ex post access to economic resources for emergency response and recovery.

Dosquebradas maintains resources in the disaster management sub-account between $150 and $200 COP million (buffer to address the occurrence of disasters and the adverse effects of the CC).

- **Municipal budget resources**

In the case of an event that cannot be covered with FMGRDD resources, a statement of emergency is established, in order to request from the municipal council an addition of resources to respond to the emergency.

Dosquebradas is authorized to transfer resources to the Immediate Response Center - CRI- for the Response to Emergencies and Disasters, which is managed by the Colombian Red Cross, Risaralda Branch (Decrees 291 of May 28, 2008 and 310 of November 14, 2019). The above allows the affected population to be reached quickly in the immediacy of the emergency due to disasters or adverse CC phenomena.

Dosquebradas has a financial matrix to identify the resources that the different public and private sector entities allocate to the different DRM components, in accordance with the commitments established in the municipal development plan, the municipal DRM plan and the POT.

- **National level transfers**

Transfers from the national level are made through the National Fund for Disaster Risk Management (FNGRD), whose expenditure is managed by the National Disaster Risk Management Unit. By way of illustration, in 2022 the National Fund for Disaster Risk Management (represented by Fiduprevisora S.A.) and Dosquebradas signed an agreement for $19,864,779,545, which benefits approximately 25,000 inhabitants, to carry out corrective intervention works for disaster risk reduction through flood control of the Aguita-Montebonito stream and slope stabilization works for housing protection, within the framework of the public calamity decrees, return to normality and Specific Action Plans issued by the municipality[12].

The FNGRD resources, managed through Fiduprevisora S.A., were incorporated into the municipality's budget and subsequently transferred to the FGRDMD, for a specific purpose.

- **Insurance of public assets held in the name of the municipality.**

Dosquebradas has a combined property damage insurance policy that covers from August 2023 to November 2024 all movable and immovable property in the name of the municipality, whose current insured value is $236,234,622,951.

Regarding all risk insurance for property loss or damage, it covers all damage, loss or disappearance from any cause not namely excluded, including, but not limited to: earthquake, tremor, volcanic eruption, frost, landslides, thaw, hurricane, cyclone, tornado, storm, hail, frost, ice melting, strong winds, lightning and other natural events, accidental property damage, theft and burglary, all risk theft, weak power current, machinery breakage, AMIT (Acts

12 All monetary figures are in Colombian pesos (COP).

of malicious intent of third parties), HMACCoP (Strike, Mutiny, Riot, Civil or Popular Unrest), terrorism, sabotage, explosion from any cause, flood, avalanche, water damage, inherent fire, subsidence, settlement, landslide and displacement of land, walls, floors and roofs, falling rocks, trees and avalanches, loss of contents and spillage of tanks.

- **Credit Lines**

Dosquebradas can access credit resources to address the occurrence of disasters, as mentioned in ***Chapter VII, Article 67 of Law 1523 of 2012*** *"…. The external or internal borrowing contracts required to be entered into by the National Government, the decentralized entities of the national order, the departments, districts and municipalities or the decentralized entities of the departmental, district or municipal order to address situations of declared disaster or public calamity, will only need for their undersigning and validity, in addition to the requirements established by the Political Constitution, the prior statement of the General Directorate of Public Credit of the Ministry of Finance, the signatures of the representative of the lender entity and of the President of the Republic or of the respective Departmental, District or Municipal representative, who may delegate the subscription to the Minister, or to the Secretaries of Finance, in the case of the subnational entities. In any case, the payment capacity of the borrowing entity may not be exceeded."* Therefore, in Dosquebradas a loan was entered into for the execution of risk mitigation works in prioritized spots of the municipality, which were framed in different public calamities occurred in consecutive years, this, with an amount of $20,000,000,000 *COP* allowed the execution of 17 reduction and mitigation works in these locations.

## Other FP instruments that will be evaluated to be part of the FPS:

In addition to the financial instruments available to the municipality, other financial instruments will be evaluated to enable the municipality to access immediate liquidity to deal with high magnitude events, as well as resources for recovery processes.

- **Contingent credit line**
- **Agricultural insurance**
- **Insurance for private housing**
- **Insurance for the productive private sector**
- **Insurance for NATECH events**

The implementation of the different financial instruments will be accompanied by a process of socialization and municipal dissemination on the importance of financial disaster risk management and the adverse effects of CC.

On the other hand, it is important to note that this policy objective is complemented by Strategy 2 of the PMGRD, which corresponds to "Reduction of current diagnosed risk conditions and diminishing the generation of new risk conditions", which includes among its programs: (i) Incorporation of risk management and climate change adaptation measures in the POT and municipal and sectoral development plans and (ii) Reduction and mitigation of sectoral and subnational risk.

## Third policy objective: Catastrophic risk insurance of public assets.

Like the second policy objective, this policy objective is aligned with Strategy 5 of the PMGRD, which pertains to "Risk transfer: a path towards territorial resilience". This strategy includes the program "Collective insurance of goods, environmental services, agricultural activities and municipal infrastructure", which aims to ensure the financial resilience of the municipality and the improvement of response, rehabilitation and reconstruction levels of vital infrastructure. The program includes, among others, the following activities:

- Action 1. Diagnosis, evaluation and characterization of the condition, vulnerability and economic valuation of the assets and infrastructure of the municipality.
- Action 2. Design, formulation, coordination, and socialization of the policy for collective insurance of institutional assets and infrastructure.

Considering that in Colombia the insurance of public assets is mandatory (both at the national and subnational levels)[13] , it is sought, among other things, that the resources allocated to insurance contracting result in better coverage at better prices. Consequently, it seeks to:

- **Compile information on the inventory of public buildings and insurance policies.**

  Information on the features of the buildings (including their value) and their property insurance policies will improve the negotiation of terms and conditions, due to the reduced uncertainty regarding the portfolio of risks to be covered.

- **Strengthening the insurance of public assets**

  Assess the insurance policy in effect (combined property damage insurance policy) covering all movable and immovable property in the municipality's name in order to strengthen, if necessary, the terms and conditions.

## Fourth policy objective: Coordination between public and private sectors

Like the second and third policy objectives, this policy objective is aligned with Strategy 5 of the PMGRD, which corresponds to "Risk transfer: a path towards territorial resilience". This strategy includes the program "Collective insurance of goods, environmental services, agricultural activities and municipal infrastructure", which aims to ensure the financial resilience of the municipality and the improvement of response, rehabilitation, and reconstruction levels of vital infrastructure. The program includes, among others, the following activities:

- Action 3. Formulation of the municipal policy for collective housing insurance for strata 1-2-3-4.
- Action 4. Diagnosis, parameterization of agricultural productive activities and design of a rural collective insurance policy.

13 Law 1952 of 2020 (articles 57 and 48), Law 42 of 1993 (articles 101 and 107), National Decree 663 of 1993 (article 101) and Law 1474 of 2011 (article 118).

Within this context, the fourth policy objective seeks to:

- **Agricultural insurance**

The aim is to generate an insurance policy for the agricultural sector, the implementation of which involves the design and use of a portfolio of different financial instruments.

- **Private housing insurance**

The aim is to generate a financial instrument to promote the insurance of private housing, as shown in the following table, which summarizes the programmatic component of the PMGRD. This could be done jointly with other subnational territories, in order to take advantage of the impact that the benefits of diversification would have on the cost of the policies.

- **Productive private sector insurance**

The aim is to generate a financial instrument to promote the insurance of the productive sector, first prioritizing the sectors that require solutions.

| PROGRAM COMPONENT | | | | ACTIONS | DEVELOPMENT SECTOR (STRUCTURING SYSTEM) | INDICATOR | GOAL | DEADLINE |
|---|---|---|---|---|---|---|---|---|
| | OBJECTIVE | STRATEGY | PROGRAM | | | | | |
| KNOWLEDGE | Improve knowledge of disaster risk in the municipal territory. | Local knowledge of natural and/ or anthropogenic hazards. | Zoning of hazards, vulnerabilities and risks of natural, socio-natural, technological and unintentional human origin. | Update of the inventory of housing in high-risk areas (urban/rural) and critical geotechnical sites in the municipality. | Housing and Habitat<br>Integrated risk management | Number of dwellings in high risk areas that cannot be mitigated | 100% of dwellings in identified and categorized high hazard and high risk areas | Short term |
| REDUCTION | Reduce the generation of new risk conditions in subnational, sectoral and environmental development and reduce existing disaster risk conditions. | Reduction of current diagnosed risk conditions and mitigation of the generation of new risk conditions. | Sectoral and subnational risk reduction and mitigation | Reinforcement of essential buildings | Education<br>Health<br>Construction sites and infrastructure | Percentage of buildings that have undergone structural intervention | Structurally reinforce 20% of the prioritized education institutions. | Mid/Long term |
| MANAGEMENT | Ensure timely, effective and relevant disaster management. | Timely, effective and pertinent management of disasters in the municipal territory | Formulation, updating, preparation and follow-up of the municipal strategy for emergency response (EMRE). | Diagnosis and evaluation of potential damages and impacts on the agricultural sector due to the effects of climate change. | Climate variability and change | Percentage distribution and typology of agricultural areas in the municipality.<br>Number of hectares by agricultural activity | Formulate the municipal emergency and contingency plan for the agricultural sector due to the effects of climate change. | Mid term |
| TRANSFER | Establish risk transfer strategies that guarantee the coverage and protection of all assets and population of the municipality. | Risk transfer: a pathway to subnational resilience | Collective insurance of municipal property and infrastructure, housing in strata 1-2-3-4, agricultural activities and natural heritage. | Diagnosis, evaluation and characterization of the condition, vulnerability and economic valuation of the assets and infrastructure of the municipality of Dosquebradas. | Works and infrastructure | Number of buildings diagnosed and commercial valuation | Identify/diagnose the state of structural vulnerability and commercial value of 100% of the assets and infrastructure of the municipality of Dosquebradas. | Long term |
| | | | | Design, formulation, coordination and socialization of the policy for collective insurance of institutional assets and infrastructure. | Comprehensive risk management | Public policy formulated | To reduce the state's fiscal risk by formulating a policy to insure assets and infrastructure. | Long term |
| | | | | Formulation of the municipal policy for collective housing insurance for strata 1-2-3-4. | Housing and Habitat | Public policy formulated | To reduce the state's fiscal risk, through the collective insurance of housing in strata 1-2-3-4. | Long term |
| | | | | Diagnosis, parameterization of agricultural productive activities and design of a rural collective insurance policy. | Rural land use plans | Public policy formulated<br>Type, quantities and characteristics of agricultural goods | "Reduce the fiscal risk of the state and the municipality's agricultural productive sector through collective insurance of rural productive activities.<br>Diagnose in 100% of the rural territory the typology, periodicity and quantities of agricultural activities." | Long term |
| | | | | Characterization and evaluation of the natural capital and municipal environmental accounts. | Environmental system | % of hectares characterized<br>Type and value of ecosystem goods provided | "Characterize the areas that make up the main ecological structure of the municipality.<br>Define the environmental and ecosystem services provided in the main ecological structure of the municipality.<br>Environmental valuation of the ecosystem services provided in the main ecological structure of the municipality." | Long term |
| | | | | Municipal socialization and dissemination of the importance of collective insurance | Public information | Number of campaigns carried out<br>Number of people and/ or institutions informed | To advance thematic information and dissemination campaigns on the importance of collective insurance. | Long term |

- **Financing resilient and low-emission climate infrastructure**

It seeks to evaluate options for financing resilient and low-emission climate infrastructure, in a context where "*For the year 2019 in the Central West Metropolitan Area (AMCO), there was a total GHG generation of 1,120,342 (Ton CO2 Eq), of which 72% was generated in Pereira (863,271 Ton CO2 Eq), followed by Dosquebradas with 25% (298,193 Ton CO2 Eq) and La Virginia with 3% (38,665 Ton CO2 Eq). For this same year, transportation generated 50% of AMCO emissions (562,115 Ton CO2 Eq), followed by stationary energies with 33% of emissions (367,702 Ton CO2 Eq), while waste represents 17% (190,525 Ton CO2 Eq)*"[14] . It is important to note that in the case of Dosquebradas, the residential sector is the source with the highest amount of GHG emissions (42%), followed by the industrial sector with 37% and the commercial and institutional sector with 20%[15] (Table 1).

| ***Source*** | ***Total emissions (Ton $CO_2$ Eq)*** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ***2016*** | | ***2017*** | | ***2018*** | | ***2019*** | |
| Residential buildings | 38,337 | 45% | 31,099 | 43% | 32,658 | 43% | 37,353 | 42% |
| Commercial and institutional buildings and facilities | 17,733 | 21% | 15,062 | 21% | 16,305 | 21% | 18,081 | 20% |
| Manufacturing and construction industries | 28,097 | 33% | 25,327 | 35% | 26,542 | 35% | 33,468 | 37% |
| Unspecified sources | 778 | 1% | 387 | 1% | 482 | 1% | 756 | 1% |
| TOTAL | 84,945 | 100% | 71,874 | 100% | 75,987 | 100% | 89,658 | 100% |

***Table 1. GHG emissions from stationary sources in Dosquebradas***
*Source: WWF and Proyecto Catalizar Local Implementation of Climate Action: Unlocking the Potential of Cities, 2021.*

14 WWF and Proyecto Catalizar the Local Implementation of Climate Action: Unlocking the Potential of Cities (2021). Inventory of greenhouse gas emissions in the Central West Metropolitan Area - AMCO - Pereira, Dosquebradas and La Virginia, 2021. WWF and Proyecto Catalizar Local Implementation of Climate Action: Unlocking the Potential of Cities Project, prepared by Hernández et al. p. 15.

15 WWF and Proyecto Catalizar Implementation of Climate Action: Unlocking the Potential of Cities Project (2021). Inventory of greenhouse gas emissions in the Central West Metropolitan Area - AMCO - Pereira, Dosquebradas and La Virginia, 2021. WWF and Proyecto Catalizar Local Implementation of Climate Action: Unlocking the Potential of Cities project, prepared by Hernández et al.

**NbS Nature-Based Solutions**

Dosquebradas has many green areas and natural resources, such as rivers and forests. We take advantage of these characteristics to implement Nature-based solutions, such as the conservation and restoration of local ecosystems.

As is known, in Colombia, the local government of Dosquebradas is using NbS in urban planning to address the challenges posed by climate change at human-environment interfaces.

Through city initiatives, Dosquebradas bets on the NbS actions and establishes a guiding execution framework under the agreements that have been established for our country and in particular our territory.

*Credits: DIGER*

In recent years, Dosquebradas has formulated and executed disaster risk reduction actions integrating gray or traditional infrastructure works with green actions, such as Nature-Based Solutions. Not all risk reduction measures should be treated as gray actions.

These construction approaches include the restoration of urban and rural peripheral areas to protect slopes, protect communities from flooding, and the creation of green areas that establish green belts in the areas where these actions are undertaken. This improves the environmental sustainability of our communities.

Last year, Dosquebradas executed 13 NbS actions with its own resources, at low cost (understanding the resource limitations of our municipalities), where community participation is an essential ingredient, as well as the coordination of several government agencies. This earned us the entry as a node city of residence in the MCR2030 initiative of the UN.

It is important to recall that these actions can significantly improve the resilience and sustainability of the communities in the face of natural disasters. They are actions that allow vegetation to return to the site, that harmonize with the cultural landscape of the coffee region and the best part is that the community takes care of them because it feels that they are part of it.

It is worth mentioning that this strategy is part of objective 5 of the National Disasters, Epidemics and Pandemics Risk Financial Protection Strategy, which corresponds to financial protection in subnational entities.

# Legal framework

## Regulatory Framework for Disaster Risk Financial Management (GFRD) applicable to Dosquebradas (Risaralda).

Within the functional duty of public authorities to protect the life, property and rights of people, established by the Political Constitution of 1991, the general normative foundations of the FP Strategy of Dosquebradas (Risaralda) are based on the regulations related to: (i) the National Disaster Risk Management System (SNGRD), (ii) the National Development Plan (PND), (iii) the Mandatory Insurance of public goods, (iv) Land Use Planning, and (v) other regulations associated with the nation's macroeconomic and fiscal forecast and climate change.

(i) DRM is the responsibility of the public authorities - as members of the SNGRD - for the development and execution of the DRM processes within the framework of their competences, scope of action and jurisdiction, under the application, among others, of the principles of concurrence[16] and subsidiarity[17]. This is established in Law 1523 of 2012[18] whose regulatory decrees are equally relevant in relation to the DRM Plan of the Public Entities and the operation of the FNGRD as a financing mechanism of the SNGRD[19] .

(ii) The PND 2022-2026 (adopted by Law 2294 of 2023[20] ) reiterated[21] the responsibility of the MHCP to design a strategy for insurance against natural and/or unintentional anthropic disaster risks, aimed at reducing the fiscal vulnerability of the State[22]. Additionally, it namely established the incorporation

16 *"The concurrence of competencies between national and subnational entities of the public, private and community spheres that constitute the national disaster risk management system, takes place when the efficiency in the processes, actions and tasks is achieved through joining efforts and non-hierarchical collaboration between the authorities and entities involved. Concurrent action may benefit all or some entities. The concurrent exercise of competences requires the respect of the attributions of the authorities involved, the clear agreement on the common goals and on the processes and procedures to achieve them."* (L 1523/12 art. 3 no. 13).

17 *"It refers to the recognition of the autonomy of the subnational entities to exercise their competences. Subsidiarity can be of two types: negative subsidiarity, when the territorial authority of higher rank refrains from intervening in the risk and its materialization in the sphere of the authorities of lower rank if these have the means to do so. Positive subsidiarity imposes on the higher authorities the duty to come to the aid of the lower authorities, when the latter do not have the means to face the risk and its materialization in disaster or when a value, an interest or a protected legal right relevant to the higher authority that comes to the aid of the affected entity is at risk".* (L 1523/12 art. 3 no. 14).

18 (April 24) "Whereby the National Disaster Risk Management Policy is adopted and the National Disaster Risk Management System is established, and other provisions are issued". Responsibility in risk management (Art 2.), Policy and SNGRD (Art 4 No. 19), Financial Protection, SNGRD Financing Mechanisms, National Fund for Disaster Risk Management (FNGRD) and Subnational Funds for Disaster Risk Management (Arts. 47 to 54).

19 National Decree 2157 of 2017. Disaster Risk Management Plan for Public and Private Entities (PGRDEPP). Financial Protection: Financial mechanisms/ instruments-intentional retention/risk transfer- Ex ante to access Ex post to economic resources for attention and recovery. National Decree 1289 of 2018 - FNGRD Regulation.

20 (May 19) "Whereby the National Development Plan 2022-2026 "Colombia World Power of Life" is issued.

21 Article 372 paragraph 2. Originally stipulated in Article 220 of Law 1450 of 2011 (PND 2011-2014) and continued by Articles 267 of Law 1753 of 2015 (PND 2014-2018) and 269 of Law 1955 of 2019 (PND 2018-2022).

22 Said strategy was designed by the MHCP in 2013, updated in 2016 (under the initial name of Public Financial Management Policy Strategy for Disaster Risk due to Natural Phenomena) and relaunched in December 2021 by the MHCP as the National Strategy for Financial Protection from Disaster, Epidemics and Pandemics Risk 2.0. Said Strategy established as its fifth policy objective, FP in territorial entities. (Available at: https://www.minhacienda.gov.co/webcenter/ShowProperty?nodeId=%2FConexionContent%2FWCC_CLUSTER-180375%2F%2FidcPrimaryFile&revision=latestreleased ).

of parametric or index insurance within the financial system[23] and the insurance regime[24] of Colombia and the possibility of considering as unrestricted income those payments related to disbursements of instruments, contingent credits, insurance, mechanisms and/or contracts, made in favor of subnational level entities that are framed in duly approved subnational PF strategies to face disaster risk, for disaster response and recovery needs.

(iii) The insurance of assets owned (or under administration) of the State in Colombia is mandatory. This has been established from a sanctioning perspective by various disciplinary and fiscal rules that establish this obligation on the head of public managers[25] .

(iv) The regulation related to land use planning namely establishes the inclusion of DRM in municipal land use plans. Law 388 of 1997[26] established within its objectives, the establishment of mechanisms that allow the municipality to prevent disasters in high-risk settlements and the guarantee of land use by its owners in terms of environmental protection and disaster prevention[27.] Likewise, it contemplated the location of critical areas of recovery and control for disaster prevention as one of the urban planning actions through which municipalities exercise the public function of land use planning [28] . Finally, it established that, for the preparation and adoption of their POTs, municipalities must consider as Level 1 determinants those related to conservation, protection of the environment and ecosystems, the water cycle, natural resources, prevention of threats and disaster risks, climate change management and food sovereignty[29].

(v) To that extent, Decree 1807 of 2014[30] (compiled in Decree 1077 of 2015 Sole Regulatory Decree of the Housing, City and Territory Sector) established the conditions and scales of detail to gradually incorporate the DRM in the revision of the medium and long term contents of the municipal POT or in the issuance of a new one[31.] . These land use planning regulations must be articulated with the provisions of Law 1523 of 2012. [32]

23 Article 241. Adds numeral 4 of Article 183 (Authorized Operations) of Decree 663 of 1993 (Organic Statute of the Financial System).

24 Articles 242, which adds the second paragraph of article 1088 (COMPENSATORY CHARACTER OF INSURANCE) and 243, which adds the third paragraph of article 1077 of Decree Law 410 of 1971 (Code of Commerce).

25 Articles 57 numeral 13 and 48 numeral 1 and 2 of Law 1952 of 2020, 101 and 107 of Law 42 of 1993, 101 numeral 4 of National Decree 663 of 1993 and 118 of Law 1474 of 2011 establish as an obligation of all public servants and individuals (punishable up to dismissal and inability to perform public duties), the mandatory insurance of funds, property (movable and immovable) or securities of the State that they manage or have under their care and/or management, through the acquisition of insurance policies with any of the legally authorized insurance companies, in order to carry out the surveillance and safeguarding of the property, assets and securities entrusted to them, as well as to ensure that they are used in a proper and rational manner.

26 (July 18) "Whereby Law 9 of 1989 and Law 2 of 1991 are amended and other provisions are enacted".

27 Article 1 (Objectives) paragraphs 1 and 2.

28 Article 8 (Urban development action) numeral 11.

29 And within these determinants of land use planning, those referring to *"Policies, guidelines and regulations on prevention of hazards and disaster risks, the identification and location of risk areas for human settlements, as well as management strategies for areas exposed to natural hazards and risks, and those related to climate change management".* (paragraph d).

30 (September 19) "Whereby Article 189 of Decree-Law 019 of 2012 is regulated in relation to the incorporation of risk management in land use plans and other provisions are issued".

31 Article 1.

32 Article 39 on the duty to include risk analysis in the biophysical, economic and socio-environmental diagnosis in the POT and to consider disaster risk as a conditioning factor for the use and occupation of the territory, thus avoiding the creation of new risk conditions, and article 40 on the inclusion in the POT of the provisions of Laws 9 of 1989 and 388 of 1997 on mechanisms for the inventory of high-risk settlements, the identification, delimitation and treatment of zones exposed to hazards derived from natural, socio-natural or unintentional anthropogenic phenomena, including mechanisms for the relocation of settlements; the transformation of the use assigned to such zones to avoid high-risk resettlements; the constitution of land reserves

(vi) The Medium Term Fiscal Framework 2023[33] (MFMP) recognizes in the subnational FP strategies some important governance Instruments that are part of the active FP management that has allowed Colombia to be a world reference in terms of DRM, and that in its subnational scope, strengthen the knowledge and institutional capacities of the territories by identifying the fiscal vulnerability derived from disaster risks, which allows outlining concrete initiatives to financially protect the territory. Similarly, the guidelines for climate change management in the decisions of public and private persons, including municipalities, established by Law 1931 of 2018[34] , are relevant and should be understood in a linked manner with DRM and its regulation.

## Regulatory Framework for DRM in the municipality of Dosquebradas (Risaralda)

### (i) Municipal Plan for Disaster Risk Management of Dosquebradas, Department of Risaralda (PMGRD)

Adopted by Municipal Decree No. 656 of December 14, 2020, the PMGRD includes among its specific objectives: "*Establish risk transfer strategies that guarantee the coverage and protection of all assets and population of the municipality*". Consequently, it includes Strategy 5 "*Risk transfer: a path towards territorial resilience*" which is structured from one (1) program and five (5) actions as follows:

*(...)*

*"a) Collective insurance of municipal property and infrastructure, housing of strata 1-2-3-4, agricultural and livestock activities and natural equity.*

*Program 5.1 Collective insurance of goods, environmental services, agricultural activities and municipal infrastructure, which aims to guarantee the financial resilience of the municipality and the improvement of response, rehabilitation and reconstruction levels of vital infrastructure. This program undertakes the following activities:*

*Action 1. Diagnosis, evaluation and characterization of the condition, vulnerability and economic valuation of the assets and infrastructure of the municipality.*

*Action 2. Design, formulation, coordination, and socialization of the policy for collective insurance of institutional assets and infrastructure.*

to make such resettlements possible and the use of legal instruments for the acquisition and expropriation of real estate necessary for the relocation of high-risk populations, among others.

33 Available at: https://www.minhacienda.gov.co/webcenter/ShowProperty?nodeId=%2FConexionContent%2FWCC_CLUSTER-223865%2F%2FidcPrimaryFile&revision=latestreleased

34 (July 27) "Whereby guidelines are established for the management of climate change".

*Action 3. Formulation of the municipal policy for collective housing insurance for strata 1-2-3-4.*

*Action 4. Diagnosis, parameterization of agricultural productive activities and design of a rural collective insurance policy.*

*Action 5. Characterization and evaluation of the natural capital and municipal environmental accounts.*

*Action 6. Socialization and municipal dissemination of the importance of collective insurance".*

*(...)*[35]

Within the long-term goals established for actions 2 to 4 and 6 (5.1.2 to 5.1.4. and 5.1.6.) are established, respectively:

- *To reduce the state's fiscal risk by formulating a policy to insure assets and infrastructure.*
- *To reduce the state's fiscal risk through the collective insurance of housing in strata 1-2-3-4.*
- *To reduce the fiscal risk of the state and the productive agricultural sector of the municipality, through the collective insurance of rural productive activities.*
- *Diagnose in 100% of the rural territory the typology, periodicity, and quantities of agricultural activities.*
- *To carry out thematic information and dissemination campaigns in 100% of the municipal territory on the importance of collective insurance.*

Within the diagnostic section 1.3. (General characterization of the "flood" risk scenario), when analyzing the factors that favored the occurrence of damage caused by this natural phenomenon in the municipality, the economic factors indicate that *"The municipality has been overwhelmed in its financial capacity to provide an effective, timely and comprehensive response to all locations in the municipality that present flood risk conditions"* and within the institutional factors *"The municipality's low financial capacity to respond to all critical locations identified as being at risk due to flooding".* [36]

### (ii) Municipal Fund for Disaster Risk Management of Dosquebradas, Department of Risaralda (FMGRDD)

The FMGRDD was created by Municipal Agreement No. 032 of December 2016 (modified by Municipal Agreement No. 002 of January 21, 2022) as a special account of the budget, without legal entity, with equity, administrative, and accounting independence developing its functions and operations in a direct or complementary manner, under

35 Municipality of "Dosquebradas" (Risaralda) - Municipal Council for Disaster Risk Management. Municipal Disaster Risk Management Plan. December 2020. p. 56 to 58.

36 Ibid. p. 32

inter-institutional schemes of co-financing, concurrence and subsidiarity, where the resources are unseizable, cannot be cash flows united with the other revenues of the Municipality and are cumulative in nature so they are not subject to the budgetary principle of annuity. Dosquebradas must guarantee the budgetary appropriation of the FMGRDD so that it has annual resources of no less than 700 legal monthly minimum wages in force.

The FMGRDD was regulated by Municipal Decrees No. 038 of February 2021 and No. 274 of July 18, 2022, establishing, among others, that:

- The resources are managed by the Municipal Finance Secretariat, in an account specifically established for this purpose, without merging with the other resources of the municipality (Articles 2 and 3 of Municipal Decree No. 038 of February 2021 and Municipal Decree No. 274 of July 18, 2022).
- The investment plan of each of the subaccounts must be articulated with the PMGRD, the Development Plan and other planning instruments of the municipality (Municipal Decree No. 130 of 2023).
- The Mayor (Municipal Agreement No. 002 of 2022) is in charge of the authorization of expenditures, subject to the approval of the Fund's Board of Directors (Municipal Decree No. 620 of 2020), which approves, among others, the allocation, transfer and addition of resources.
- The resources of the Financial Protection Subaccount *"will be destined to support the financing of mechanisms or financial instruments of intentional retention or transfer of risk that are established ex ante, in order to have ex post access to economic resources for emergency response and recovery. This includes: insurance, credits, reserve funds, CAT bonds, among others. " (...) "will be aimed at the implementation of financial protection mechanisms for the different territorial sectors affected or potentially affected by extreme meteorological and hydro-climatic phenomena and/or caused with or without intention by people, as well as the design of disaster risk insurance instruments for the public, private and community sectors and the insurance of vital public services, among others, according to the needs of the Municipality, in order to guarantee an adequate response to the occurrence of disasters and protect the long-term fiscal balance"*, through it *"the Municipality with the support of the Secretariat of Treasury and Public Finances and the DIGER shall enter into instruments or contracts with national or foreign entities that allow financial protection against the risk of disasters or public calamities"* and *"The management, negotiation, acquisition or celebration of instruments, contracts, agreements, covenants and other compatible legal business, individually or collectively, that develop, consolidate or include any type of insurance, reinsurance, coinsurance, insurance brokerage or intermediation, credits, reserve funds and other financing, retention or risk transfer instruments offered by departmental, interdepartmental or municipal entities or markets, that allow financial protection against disaster risk, shall be ordered by the Municipal Mayor, with the support of the Treasury and Public Finance Secretariat and the DIGER".*

### (iii) Development Plan Dosquebradas "Empresa de Todos" 2020-2023

The programs proposed for strategic line 3 consider, among others, that the application of the Municipal Disaster Risk Index adjusted by capacities developed by DNP, established that it is necessary to reduce the gap in capacities such as financial, DRM and socioeconomic actions. In this sense, the "Resilient City Dosquebradas Program" is included, which includes as an activity the implementation of financing mechanisms for disaster risk management[37] .

37 Ob. Cit. Development Plan, Dosquebradas (2020-2023).

## Disasters and climate change exposure

The risk scenarios prioritized by DIGER in the municipal territory are:

| Scenario | Recurrence | Impact | Priority |
|---|---|---|---|
| Floods | Associated with the region's bimodal rainfall regime and worsen in times of La Niña phenomenon. | Damage to commercial sectors, loss of merchandise and household goods, damage to health services, road infrastructure and public services. | High |
| Landslides | The Municipality has several events per month, both in the urban area as well as rural, conditioned by the high slopes, the dynamics of the use of the soil, the properties of the geological materials and the anthropogenic interventions. The occurrence of events increases in the rainy months of the bimodal rainfall regime of the region and in the high slope areas of the municipal territory. | Loss of life, collapse of homes, loss of property, loss of road infrastructure, affectation of water and sewage, public services, water intakes, collective equipment and areas of environmental interest | High |
| Earthquakes | Due to the geographic Location of the municipality, the type of soil dynamics of urban/rural land occupation and the construction quality of a high percentage of houses, the municipality is highly susceptible to the effect of occurrence of moderate and big earthquakes | Loss of life, impact on to housing, infrastructure educational, health, road, public utilities, and economic losses. In general, a high impact on the territorial development | High |
| Gales | As a phenomenon associated with climate variability, in recent years, has happened several times per year. This phenomenon is related to the occurrence of rainfall of high intensity and winds hurricanes affecting geomorphological zones of the foothills and hill backs | Housing collapse, deroofing in large part of the municipality, loss of household goods, fall of vegetation cover, damage to service networks and obstruction of public roads | Moderate |
| Technological Events | The number of industries and companies in the municipality and especially those that operate, distribute and market chemical substances and hazardous raw materials, have generated events, from mild to severe at least once a year | Loss of life, personal injuries, major economic losses, impact on the employment generation, demand for high-cost health services and environmental impact. | From moderate to low |
| Fall of vegetable coverage (trees and bushes) | The falling of vegetation coverage as a factor generator of thread and risk, has been associated with age, health phytosanitary, specie and maintenance of plants that belong to the municipal ornamentation and that are in parks, front porches, and water courses. It has been also common in peri-urban and rural areas that need to be warned about the presence of trees/bushes located in slopes potentially unstable and eventually become a factor of threat and risk | Loss of life, impairment to housing and property, public utility networks, damming and clogging of watercourses, environmental impact. | From moderate to low |

| Scenario | Recurrence | Impact | Priority |
|---|---|---|---|
| Vegetation coverage fires | More than the level of recurrence are prioritized by the threat to protected environmental systems. This event has been uncommon, except for those events where controlled fires or incineration of leaf litter response entities have been called upon. | Extinction of flora and fauna, affecting the conservation districts, serious environmental and water impact | Low |
| Biological | Defines as the possible exposure to microorganism or pathogens that by means of respiratory, digestive, skin or mucous, transmission, become a risk factor highly impactful against population groups and the socio-economic and cultural development of the towns. This risk for Dosquebradas has been linked to he COVID-19 Pandemic. | Great impact upon heath and quality of life in all population groups. Effect on the psycho-social health of people and devastating economic impact for the society, governments and businesses. | Low |
| Volcanic (fall of pyroclastic material) | The recurrence of this event in Dosquebradas has proven that depending on the volcanic activity of the Ruiz- Cerro Bravo-Tolima complex aside from speed and wind direction, has brought this municipality to be categorized in low volcanic thread, with very low likelihood of impact due to pyroclastic material | Understanding that it is the whole Dosquebradas population, exposed to this phenomenon, it is assumed that 204,739 people, in 64,576 homes and 63,439 houses, would be exposed to the natural phenomenon. In addition, the private property, such has homes and vehicles, can suffer damages or losses during volcanic events. The homes could collapse or suffer damages on their covers due to the accumulation of ash and lapilli. The environmental goods can also be affected due to volcanic events. In the environment sector, damages can be seen to protected areas, that would cause loss of biodiversity and natural resources. Public utilities service provision can be affected and damages to crops, depending on the magnitude or volume of the materials falling on top. | Low |

*Source: DIGER (2023)*

The description of three of the risk scenarios is broadened:

- **"Flood" risk scenario**

*"Floods have historically been the natural phenomenon with the greatest impact on the municipal territory, since their recurrence is associated with the winter seasons of the bimodal rainfall regime of the Colombian Andean region. The climatic and morphometric conditions of the Dosquebradas stream basin, in addition to the strong pressure on rural lands due to the expansion of the agricultural and livestock frontier, manifested in a progressive increase in the deforestation of protected areas, and the urban occupation of the water courses (...).*

*The causes of flooding in the municipal territory are basically associated with the following:*

- *Local precipitation regime (over 2600 mm/year)*
- *Morphometric parameters of micro basins and hydraulic gradient of surface drainages.*
- *Urban occupation of water courses and reduction of natural water sections*

- *Land use conflicts in the headwaters of micro-watersheds*
- *Hydraulic inadequacy of works to occupy watercourses, in particular water crossings of secondary and primary roads*
- *Inadequate maintenance of drains and local storm sewers*
- *Excessive increase in rainfall linked to the advent of the Niña phenomenon, as has occurred during the years 2010-2011; 2020-2022."*[38].

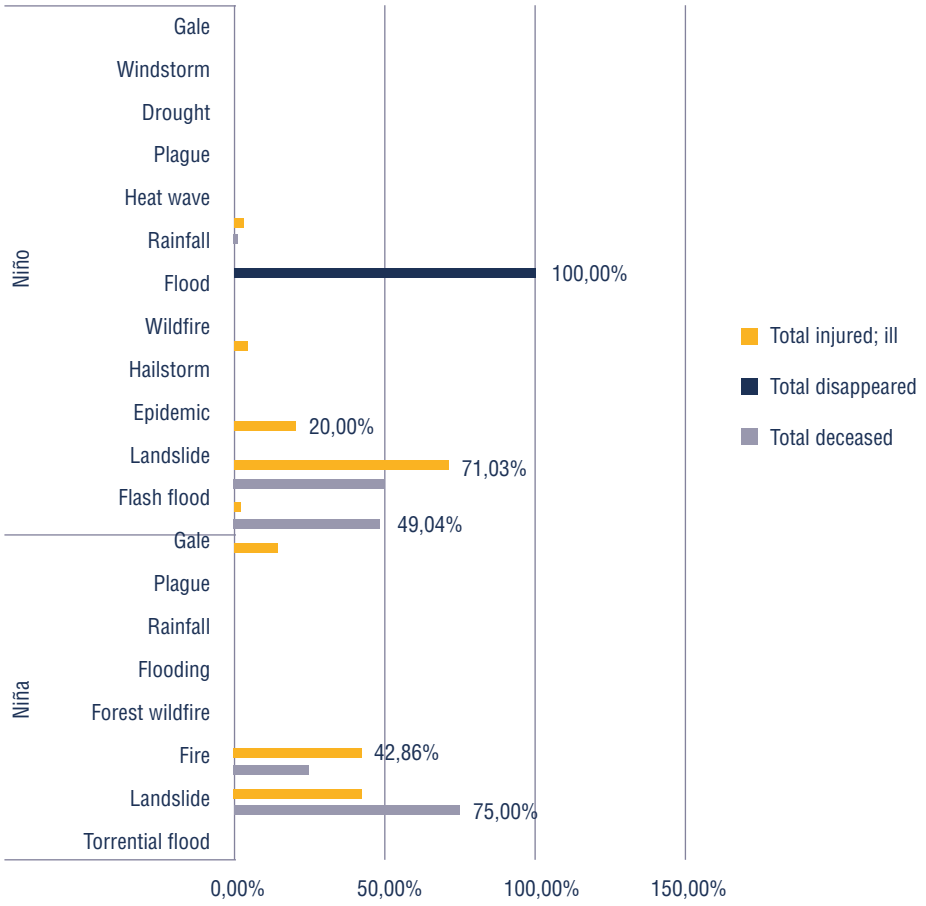
In relation to the adverse impact of hydrometeorological events on Dosquebradas, using information from DESINVENTAR (records from 1933 to 2014), the UNGRD (period 2006 to 2016), NOAA (from 1950) and from the Inter-administrative Agreement 290 of April 24, 2015 between the Ministry of Environment and Sustainable Development and the Technological University of Pereira, CARDER (2017) concludes that *"....the events with the highest historical proportion of affected population have been associated with landslides, floods, torrential floods and windstorms.*

Of a cumulative total of 16,632 people affected, the highest proportion was due to floods with 6,850 people (41.19%), followed by torrential floods with 5,949 people (35.77%) and windstorms with 2,198 people (13.22%).

*The total number of people affected, i.e., those who suffered indirect or secondary effects due to the disaster (isolation, deficiencies in the provision of public services, in commerce, at work) totaled 9,828 people, of whom 3,324 were affected by windstorms (33.82%) and 2,815 by floods (28.64%)"*[39] (Figure 3).

38 Disaster Risk Management Municipal Council -CMGRD- of Dosquebradas, Risaralda (2020). Municipal Disaster Risk Management Plan, p. 78.

39 CARDER-UTP (2017). Territorial Climate Profile of the Municipality of Dosquebradas, Risaralda. Grupo de Investigación en Gestión Ambiental Territorial -GAT- Facultad de Ciencias Ambientales, Universidad Tecnológica de Pereira. Technical input for the diagnosis of the Land Management Plan of Dosquebradas (2021). Chapter on threats and risks of natural, climatic, and anthropic origin, pgs. 54 and 55.




***Proportion of the population affected in some way by the occurrence of a climate event during the El Niño or La Niña phenomenon in the Municipality of Dosquebradas Risaralda, 1950-2014.***
*Source: CARDER, 2017*

- **Seismic risk scenario for Dosquebradas for essential buildings for educational use and relief agencies *(valued at 330 billion COP).***

*"Dosquebradas, due to its location in southwestern Colombia, has three recognized seismogenic sources: tectonic earthquakes (subduction zone and Benioff plane), which in most cases are considered medium to deep earthquakes. The levels of damage expected in high-rise buildings are associated with the seismic vulnerability of the constructions and the type of foundation soil; and cortical (crustal) earthquakes, considered surface earthquakes with highly significant levels of damage expected for local* low-rise *constructions*"[40] .

40 Municipality of Dosquebradas, 2022. POT. Threats of natural and anthropic technological origin. Diagnosis, p. 82.

DIGER (2023), using CAPRA-GIS software, estimated the physical losses of properties corresponding to buildings essential for educational use and relief organizations at approximately 330 billion COP, in the probable scenarios of Romeral, Ibagué and Subduction[41] , which are presented in Table 2.

| Economic losses associated to | Possible event | Expected Losses (Pesos) | Average Expected Damage (% of the value of exposed properties) |
|---|---|---|---|
| Nearby source Romeral | Magnitude 6.52 Mw at a hiccup center distance of 15 ± 4 km. | $187,721,766,104.00 | 56.936% |
| Intermediate source Ibagué | Magnitude 6.74 Mw at a hiccup center distance of 45 ± 5 km. | $17,596,572,060.55 | 5.337% |
| Intermediate source subduction | Magnitude 8.3 Mw at a hiccup center distance of 120 ± 30 km. | $215,221,818,574.07 | 65.277% |

***Table 2. Physical losses of properties corresponding to buildings essential for educational use and relief organizations in the probable scenarios of Romeral, Ibagué and Subduction.***
*Source: DIGER, 2023*

Additionally, Figure 4 shows the compilation of the results obtained from the seismic risk assessment through the CAPRA-GIS software for the Romeral, Ibagué and Subduction scenarios, for buildings of use III and IV of the municipality of Dosquebradas, which correspond to educational and health institutions, children's homes, fire and civil defense and red cross, i.e., essential public buildings. It was found that the portfolio of educational buildings is the one with the highest exposed value, as well as the highest percentage of expected losses. In addition, it was found that the probability of damage increases in simple masonry buildings (unconfined), which are more concentrated in rural areas.[42]

41 *"A total of 174 structures (about 74873.1213 m2) were evaluated in detail during the field inspection work. A total of 92 buildings (53% of the total) were built before 1984, which indicates that probably these buildings did not consider any standard for earthquake resistant construction, because the first earthquake resistant code of the country came into force in 1984; 62 buildings (35% of the total) were built between 1984 and 1998 during the validity of the Colombian Code of Seismic Resistant Constructions.... 7% of the evaluated buildings (13 buildings) were built after 1998 under the Colombian Seismic Resistant Construction Code NSR-98 .... Finally, 8 buildings (5% of the total) were built after 2010 under the validity of the NSR-10 standard."* (DIGER, 2023, pg 18). For the purposes of the analysis, the following variables were considered for the buildings: ID, Use, Number of floors, Floor area, Built-up area, Appraisal, Occupancy, Structural system and age.

42 Municipality of Dosquebradas, 2022. POT. Threats of natural and anthropic technological origin. Diagnosis.

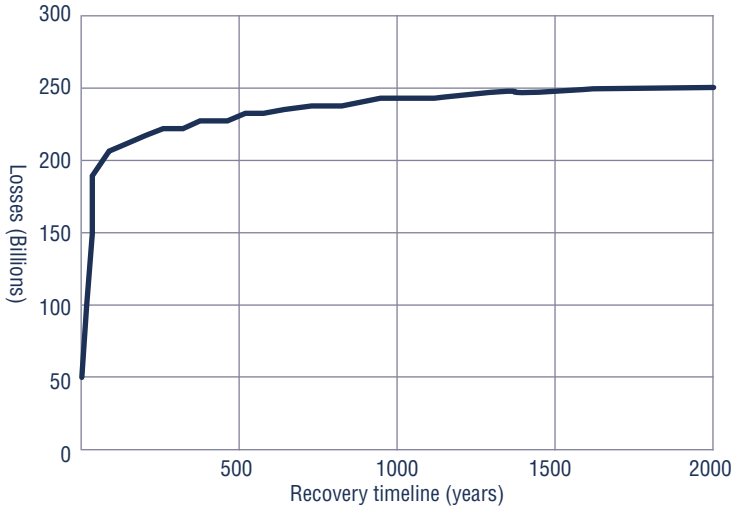



***Figure 4. Probable Maximum Losses Curve***
*Source: Municipality of Dosquebradas, 2022*

- **Accidental technological events**

Industrial activities present a technological risk potential for the municipality[43] . By way of illustration, the event occurred on December 23, 2011, where due to heavy rains during the winter wave of 2011, water saturation accelerated a mass movement by ground creep, which generated a pressure that exceeded the resistance level of the pipeline of a section of the Puerto Salgar-Cartago polyduct, assigned to Ecopetrol. The fuel spill that reached the Aguazul stream, when it found a hot spot, caused explosions and the subsequent conflagration along the stream[44]. As a result, 33 people died, 110 people were injured, 81 domestic animals were injured, 106 houses were affected, 38 houses were destroyed, 6 commercial establishments were lost and 3 aqueducts were affected (La Romelia, La Divisa and Acuaseo)[45] .

*"In the industrial zones of Dosquebradas there are establishments that fulfill the functions of storage and distribution of petroleum derivatives and chemical elements necessary for the transformation of raw materials with which the products that are manufactured or distributed in or from the municipality are made. Dosquebradas due to its growth in the last 20 years, does not have a special zone dedicated to the industrial sector, that is why in all its communes we find industrial economic activity according to decree 2157 of* 2012"[46] (Figure 5). On the other hand, throughout the urban territory of the municipality there are fuel service stations[47] .

43 Municipality of Dosquebradas, 2023. POT. Environmental Dimension. Threats of natural, climatic and anthropic technological origin.

44 Ecopetrol, Veeduría Ciudadana and Fundación Social COOPLAROSA (2015). Huellas de Esperanza, UNGRD (2018). What you should know about technological risk and Langebeck E. and Giraldo N. (2021). Multitemporal evaluation of community resilience to technological risk disasters in commune 10 of the municipality of Dosquebradas. Ten years after the tragedy. Catholic University of Manizales. Faculty of Engineering and Architecture. Specialization in Prevention, Reduction and Attention to Disasters Manizales.

45 Lozano H., Western Regional GSR Coordinator, Ecopetrol Social Management Directorate (2014). Presentation: Risk Management and Local Development Approach, Case applied in Emergency of 23 12-2011 Dosquebradas, Risaralda, held at the Regional Platform for DRR in the Americas (Guayaquil, Ecuador, May 2014 and Langebeck E. and Giraldo N. (2021). Multitemporal evaluation of community resilience to technological risk disasters in commune 10 of the municipality of Dosquebradas. Ten years after the tragedy. Catholic University of Manizales. Faculty of Engineering and Architecture. Specialization in Prevention, Reduction and Attention to Disasters Manizales.

46 Municipality of Dosquebradas, 2023. POT. Environmental Dimension. Threats of natural, climatic and anthropic technological origin. p. 12.

47 Municipality of Dosquebradas, 2023. POT. Environmental Dimension. Threats of natural, climatic and anthropic technological origin.

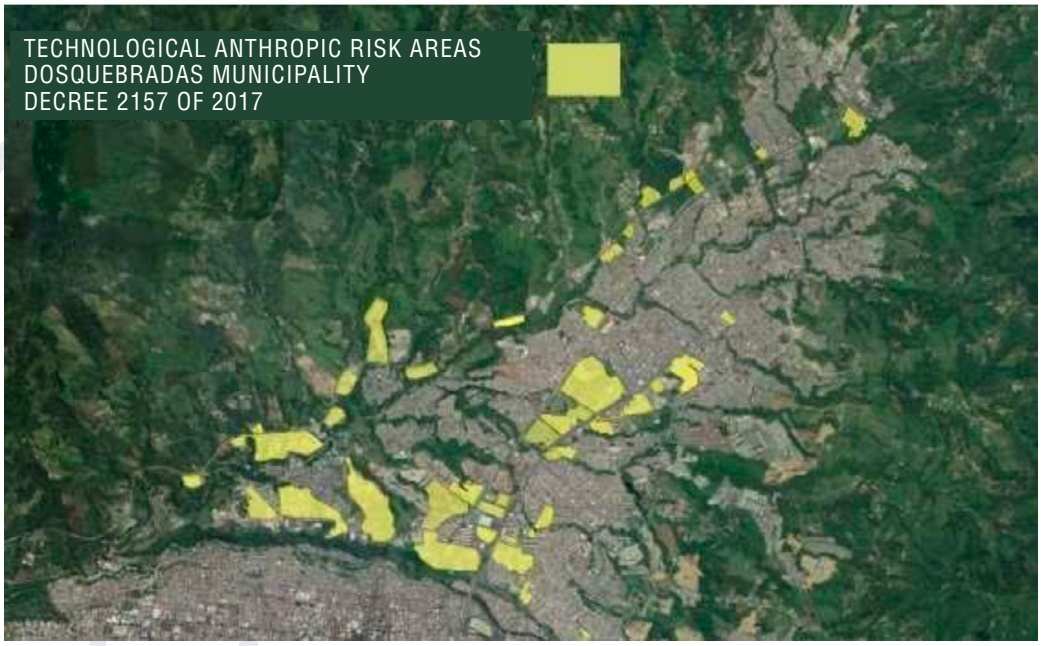



***Figure 5. Technological anthropic risk areas, municipality of Dosquebradas, Decree 2157 of 2017.***
*Source: Municipality of Dosquebradas, 2023b*

"At present, *more than 3200 emergencies are serviced each year, among which fires, spills, leaks and occupational accidents involving hazardous materials have increased considerably in the city, generating economic losses per year of approximately 8,000 to 14,000 million* pesos"[48] .

48 Municipality of Dosquebradas, 2023. POT. Environmental Dimension. Threats of natural, climatic and anthropic technological origin, p. 34.

# Impacts of climate change on precipitation and temperature scenarios.

- **Precipitation scenario**

The reference scenario for the period 1976-2005 considers average precipitation to be 2501 mm/year and 3000 mm/year[49] . CARDER (2017) estimated precipitation scenarios for 2011-2040, 2041-2070 and 2071-2100 (Table 3).

| 2011-2040 | 2041-2070 | 2071-2100 |
|---|---|---|
| A variation of -10% to 10% was calculated for this scenario vs the average | The temperature forecasted for this scenario will probably be around -10% to 10% compared to the average yearly precipitation on the benchmark scenario for almost all of the municipality, except for the micro-basins of the Colombia streams (high areas) La Fría, and the lower areas of the Dosquebradas stream, whose likely values of precipitation will be around 10 to 20% | The forecasted precipitation will vary around -10% to 10% regarding the benchmark scenario for the micro-basins located west of Dosquebradas. For the mico-basins Dosquebradas lower area, La Fría, Colombia (high area), El Chaquito y Gutiérrez-Cristalina, a probable change in precipitation was forecasted at an average yearly precipitation of 10 to 20%. |

***Table 3. Forecasted changes in Dosquebradas for the three precipitation scenarios.***
*Source: CARDER, 2017*

- **Temperature Scenario**

The 1976-2005 reference scenario indicates 4 different temperature zones[50] . CARDER (2017) estimated temperature scenarios for 2011-2040, 2041-2070 and 2071-2100 (Table 4).

| 2011-2040 | 2041-2070 | 2071-2100 |
|---|---|---|
| The temperatures changes forecasted for this scenario are around 0.81º-1ºC for the whole municipality. | For this scenario, the forecasted temperature changes will be to the north of the Cima village between 1.01º and 1.2ºC and for the rest of the municipality of Dosquebradas, probable changes are expected compared to the reference scenario between 1.21º and 1.6º C. | For this scenario, three areas with different temperature averages are again observed.<br><br>The first one corresponds to the Alto del Nudo and La Marcada Land Management Districts, with forecast between 1.81º and 2ºC, the northern zone of Aguazul with values varying between 1.61º and 1.8ºC, and the third zone corresponds to the urban area of the municipality, La Badea and Boquía with 2.01º and 2.1ºC. |

***Table 4. Forecasted changes in Dosquebradas for the three temperature scenarios.***
*Source: CARDER, 2017*

49 CARDER-UTP (2017). Territorial Climate Profile of the Municipality of Dosquebradas, Risaralda. Grupo de Investigación en Gestión Ambiental Territorial -GAT- Facultad de Ciencias Ambientales, Universidad Tecnológica de Pereira. Technical input for the diagnosis of the Land Management Plan of Dosquebradas (2021). Chapter on threats and risks of natural, climatic and anthropic origin.

50 CARDER-UTP (2017). Territorial Climate Profile of the Municipality of Dosquebradas, Risaralda. Grupo de Investigación en Gestión Ambiental Territorial -GAT- Facultad de Ciencias Ambientales, Universidad Tecnológica de Pereira. Technical input for the diagnosis of the Land Management Plan of Dosquebradas (2021). Chapter on threats and risks of natural, climatic and anthropic origin.

With respect to the period 2071-2100, it is estimated that the greatest changes in average temperature and precipitation values with respect to the period 1976-2005 will occur in the micro-basins Quebrada La Fría, Quebrada Gutiérrez-Cristalina, Tominejo and the lower part of the Dosquebradas stream, which would affect, among other things, the supply of water resources to rural aqueducts[51] .

According to CARDER (2017), in micro-basins where there are forecasted changes in precipitation and temperature, it may occur:

| Climate change manifestations (CC) | Effects on the territory |
|---|---|
| Productive use of new climate capabilities, green businesses, etc. | Economic opportunities in the face of climate change |
| Decrease or increase of water level in reservoirs, reduced water availability | Water shortage |
| Changes in the cycles of living beings | Phenological changes in flora and fauna species |
| Impact and change in biomes (i.e. moorlands, high Andean forests, etc.) | Impact and loss of ecosystems |
| Changes in land use, and area of forest cover | GHG sequestration in soils and vegetation covers |
| Affectation of vegetation cover | Loss of vegetation cover due to fires |
| Impact on basic infrastructures, sectors, population, and ecosystems. | Affected by landslides |
| Impact on basic infrastructures, sectors, population, and ecosystems. | Flood damage |
| Impact on basic infrastructures, sectors, population, and ecosystems. | Affected by flash floods |
| Affecting agricultural, livestock, forestry, and fishing systems | Affectation of livestock and/or fishery systems |
| Affectation and loss of agricultural production systems | Loss of productivity |
| Effects on human, animal, and plants' health due to extreme temperatures | Thermal stress |
| Affections to agricultural systems | Crop damage due to extreme events |
| Impact on productive systems and infrastructure due to strong winds, frost, and hailstorms. | Damage caused by windstorms, frost and hailstorms |
| Emergence of new disease vectors affecting human health. | Impact on human health |
| Changes in production systems and consumption habits | Alternatives for GHG emission reduction |

*Source: Adapted from CARDER (2017)*

51 CARDER-UTP (2017). Territorial Climate Profile of the Municipality of Dosquebradas, Risaralda. Grupo de Investigación en Gestión Ambiental Territorial -GAT- Facultad de Ciencias Ambientales, Universidad Tecnológica de Pereira. Technical input for the diagnosis of the Land Management Plan of Dosquebradas (2021). Chapter on threats and risks of natural, climatic and anthropic origin.

# Bibliography

Dosquebradas - Risaralda Municipal Mayor's Office (2023). Decree 130 of March 14, 2023. Whereby Municipal Decree 274 of July 18, 2022 is modified, whereby the Municipal Fund for Disaster Risk Management -FMGRD- of the Municipality of Dosquebradas, Department of Risaralda was regulated.

Dosquebradas - Risaralda Municipal Mayor's Office (2022). Decree 274 of July 18, 2022. Whereby the Municipal Disaster Risk Management Fund of the Municipality of Dosquebradas, Department of Risaralda is regulated.

Dosquebradas - Risaralda Municipal Mayor's Office (2022). Agreement 002 of January 21, 2022. Whereby Agreement 032 of 2016 is amended, whereby the Municipal Fund for Disaster Risk Management of the Municipality of Dosquebradas, Department of Risaralda is created and other provisions are issued.

Dosquebradas - Risaralda Municipal Mayor's Office (2021). Decree No 038 of February 2021. By which the Municipal Fund for Disaster Risk Management of the Municipality of Dosquebradas, Department of Risaralda is regulated.

Dosquebradas - Risaralda Municipal Mayor's Office (2020). Decree 656 of December 14, 2020. Whereby the Municipal Plan for Disaster Risk Management - "PMGRD" - is adopted in the Municipality of Dosquebradas - Department of Risaralda and other provisions are issued.

Dosquebradas - Risaralda Municipal Mayor's Office (2020). Decree 620 of November 2020. Whereby the operation of the Administrative Board of the Municipal Risk Management Fund of the Municipality of Dosquebradas - Risaralda, created by Municipal Agreement 032 of 2016, is regulated.

Dosquebradas - Risaralda Municipal Mayor's Office (2019). Decree 310 of November 14, 2019. Whereby the functions of the parties that make up the Center for Immediate Response - CRI are established.

Municipal Council Dosquebradas, Risaralda (2016). Agreement No. 032 (December 04, 2016). Whereby the Fund for Risk Management in the Municipality of Dosquebradas is created and other provisions are issued.

Dosquebradas - Risaralda Municipal Mayor's Office (2008). Decree 291 of May 28, 2008. By which the Center for Emergency Attention in the Municipality of Dosquebradas Risaralda is created and regulated and other provisions are issued.

CARDER-UTP (2017). Territorial Climate Profile of the Municipality of Dosquebradas, Risaralda. Grupo de Investigación en Gestión Ambiental Territorial -GAT- Facultad de Ciencias Ambientales, Universidad Tecnológica de Pereira. Technical input for the diagnosis of the Land Management Plan of Dosquebradas (2021). Chapter on threats and risks of natural, climatic and anthropic origin.

Congress of Colombia (1994). Law 136 of 1994. By which norms tending to modernize the organization and operation of the municipalities are dictated. Published in the Official Gazette 41.377 of June 2, 1994.

Municipal Council for Disaster Risk Management -CMGRD- of the municipality of Dosquebradas, Risaralda (2021). Agreement No. 007 of May 11, 2021. Whereby the Municipal Mayor of Dosquebradas is authorized to contract a loan with financial entities, destined to finance the construction of works required to mitigate the effects of public calamities declared in the municipality of Dosquebradas, Department of Risaralda.

Municipal Council for Disaster Risk Management -CMGRD- of the municipality of Dosquebradas, Risaralda (2020). Municipal Disaster Risk Management Plan.

DANE (2017). Environmental and economic accounts in Colombia. Grupo de Indicadores y Cuentas Ambientales, Dirección de Síntesis y Cuentas Nacionales. Available at: https://www.dane.gov.co/files/investigaciones/pib/ambientales/cuentas_ambientales/informacion-general.pdf

DIGER. (2023). Synthesis of the risk scenarios diagnosed in the municipality of Dosquebradas and scenario of losses identified by earthquake. Prepared by Álvarez J. and Álzate A..

Ecopetrol, Veeduría Ciudadana and Fundación Social COOPLAROSA (2015). Footprints of Hope.

Fiduprevisora (2022). Agreement No. 9677-PPAL001-1328-2022 executed between the Fondo Nacional de Gestión del Riesgo de Desastres acting through Fiduprevisora S.A., as spokesperson and administrator, and the Municipality of Dosquebradas with NIT. 800.099.310-6.

Ghesquiere, F. and Mahul, O. 2010. Financial protection of the state against natural disasters: a primer. Washington, DC: The World Bank.

Hernández et al (2021). Inventory of greenhouse gas emissions in the Central West Metropolitan Area - AMCO - Pereira, Dosquebradas and La Virginia, 2021. WWF and Catalyzing Local Implementation of Climate Action: Unlocking the Potential of Cities Project.

Langebeck E. and Giraldo N. (2021). Multitemporal evaluation of community resilience to technological risk disasters in commune 10 of the municipality of Dosquebradas. Ten years after the tragedy. Catholic University of Manizales. Faculty of Engineering and Architecture. Specialization in Prevention, Reduction and Attention to Disasters Manizales.

La Previsora S.A. Insurance Company (2023). Policy No. 1001299. Combined property damage insurance, combined property damage policy.

Lozano H., Western Regional GSR Coordinator, Ecopetrol Social Management Directorate (2014). Presentation: Risk Management and Local Development Approach, Case applied in Emergency of 23 12-2011 Dosquebradas, Risaralda, held at the Regional Platform for DRR in the Americas (Guayaquil, Ecuador, May 2014).

Ministry of Finance and Public Credit, 2021. Estrategia Nacional de Protección Financiera del Riesgo de Desastres, Epidemias y Pandemias . Available at: https://www.minhacienda.gov.co/webcenter/ShowProperty?nodeId=%2FConexionContent%2FWCC_CLUSTER-180375%2F%2FidcPrimaryFile&revision=latestreleased

Municipality of Dosquebradas, 2023a. POT. Annexes Environmental Dimension. ANNEX E. Basic studies of rural settlements and population centers. Disponible en: https://pot.dosquebradas.gov.co/repositorio/POT%20-%20Enero%20-%202023/03%20-%20Diagnostico/3.1%20Ambiental/3.1.2%20Anexos%20amenazas%20y%20riesgos%20de%20origen%20natural%20y%20antrópico%2-0tecnológico/1.2.2.%20Anexo%20E%20Estudios%20básicos%20asentamientos%20rurales%20y%20centros%20poblados.pdf

Municipality of Dosquebradas, 2023b. POT. Environmental Dimension. Threats of natural, climatic and anthropic technological origin. Available at: https://pot.dosquebradas.gov.co/repositorio/POT%20-%20Enero%20-%202023/03%20-%20Diagnostico/3.1%20Ambiental/3.1.2%20Diagnostico%20Amenazas%20origen%20natural%20y%20antrópico%20tecnológico.pdf

Municipality of Dosquebradas, 2022. POT. Threats of natural and anthropic technological origin. Diagnosis.

Municipality of Dosquebradas, 2020. Development Plan, Dosquebradas Empresa de Todos (2020-2023). Available at: https://www.dosquebradas.gov.co/web/index.php/dosquebradas/alcaldia/plan-de-desarrollo-2020-2023

State of City Climate Finance (2015). Cities Climate Finance Leadership Alliance (CCFLA). New York. Available at: https://sustainabledevelopment.un.org/content/documents/2201CCFLA-State-of-City-Climate-Finance-2015.pdf

UNGRD (2018). What you should know about technological risk.

WWF and Catalyzing Local Implementation of Climate Action: Unlocking the Potential of Cities Project (2021). Inventory of greenhouse gas emissions in the Central West Metropolitan Area - AMCO - Pereira, Dosquebradas and La Virginia, 2021. WWF and Catalyzing Local Implementation of Climate Action: Unlocking the Potential of Cities Project, prepared by Hernández et al.