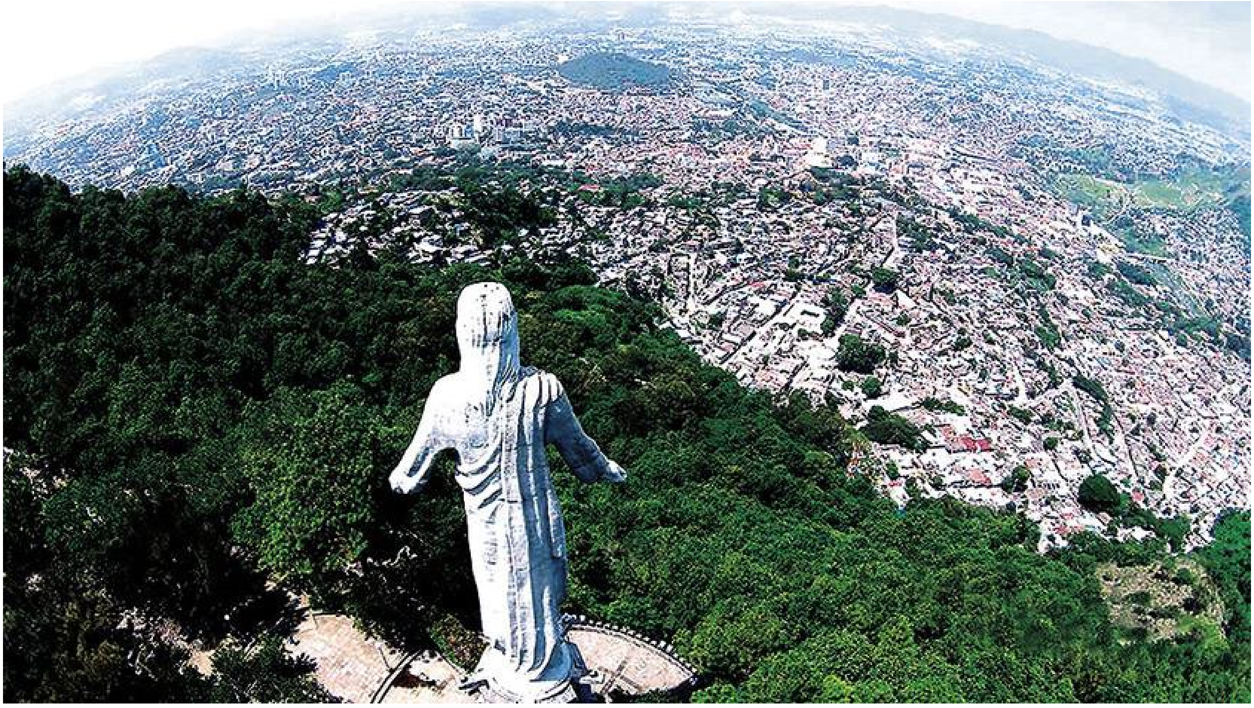


ASSESSMENT OF RISK EXPOSURE &DISASTER RISK MANAGEMENT AND PROPOSAL OF A POTENTIAL RISK TRANSFER SOLUTION

FOR THE MUNICIPALITY OF THE CENTRAL DISTRICT

Prepared for the Frankfurt School of Finance and Management on behalf of the InsuResilience Solutions Fund (ISF), the German Development Bank (KFW) and German Federal Ministry for Economic Cooperation and Development (BMZ)

September 30, 2020

Global Communities Partners for Good

Willis Towers Watson

Content

Acronyms

AHAC- Honduran Civil Aeronautics Agency
AMDC- Central District Municipal Government
BMZ- German Federal Ministry for Economic Cooperation and Development
CABEI- Central American Bank of Economic Integration
CCA- Climate Change Adaptation
CENAOS- Center for Atmospheric, Oceanographic and Seismic Studies
CNBS- National Commission for Banking and Insurance
CODECE- School Center Emergency Committee
CODECEL- Work Center Emergency Committee
CODED - Departmental Emergency Committee
CODEM - Municipal emergency committee
CODEL – Local emergency committee
COHEP- Honduran Private Sector Council
COPECO – Permanent Commission for Contingencies
COMUDE- Municipal Committee for Territorial Data
ENEE- National Electric Energy Company
HDI-Human Development Index
IADB- Inter-American Development Bank
ICF- Institute for Forestry Conservation
ISF- InsuResilience Solutions Fund
IPCC- Intergovernmental Panel for Climate Change
KfW - German Development Bank
MDC –Municipality of the Central District (Geographic coverage)
MiAmbiente- Secretary of Environment
NAP- National Adaptation Plan
NDCs- National Determined Contributions
POT- Territorial Ordering Plan
RCP- Representative Concentrations Pathways
SANAA- Autonomous National System of Aqueducts and Sewage
SAT- Early Warning System
SINAGER- National System for Risk Management
SIMET - Municipal Information System for Territorial Studies
SoF – Secretary of Finance from Honduras
UMGIR- Municipal Unit for Integral Risk Management
UNISDR- United Nations Office for Disaster Risk Reduction

Presentation

The city of Tegucigalpa, capital of Honduras, also known as the Municipality of the Central District (or MDC for its acronym in Spanish) led by Mayor Nasri Asfura since 2014 has established Disaster Risk Management and Climate Change Adaptation as cross-cutting themes in the administration, creating a dedicated structure, fostering planning and coordinated information mechanisms, as well as developing internal capacities for DRM among the municipal staff.

As part of this effort, the municipality has invested considerable time and resources – both its own and those received from international donors – on activities such as: developing, collecting, and centralizing risks-related data; planning their short, medium, and long term goals; reorganizing the staff structure to clarify roles and responsibilities. Mayor Asfura has also expressed his interest in a Climate Risk Insurance Product for the city.

Global Communities in alliance with Willis Towers Watson and with financing from the InsuResilience Solutions Funds (ISF) conducted a feasibility study to propose a risk transfer solution for the city of Tegucigalpa from January 3 to September 30, 2020. The study assessed the city's climate risk exposure for insurance and risk financing purposes, including the conditions for risk transfer solutions—such as, understanding the data challenges, the existing risk financing strategies, and other conditions that precipitate whether risk transfer is an effective solution in the context of Tegucigalpa.

Although initially scheduled to be carried out in four months (January to April 2020), due to the restrictions imposed by COVID 19, the feasibility study had to be extended until the end of September 2020. During this time the consulting team had the opportunity to talk with the representatives of all the municipal offices. Nonetheless, as the study developed, other priorities diverted the attention of key municipal officials, which made it challenging for the consulting team to obtain vital information within the proposed schedule.

For the development of an insurance product, it would be necessary for the MDC to supplement the risk data available at the local level with satellite data, both licensed and publicly available. The lack of an inventory of the MDC's public assets made it impossible to estimate the gross product value of the assets to protect.

Nonetheless based on the research carried out for this feasibility study, and guided by the input from representatives of the municipal administration, the consulting team concludes that there is feasibility for the development and implementation of climate and natural disaster risk transfer solutions for the MDC.

The political will to develop a risk transfer solution for Tegucigalpa and the efforts displayed by the current administration to mainstream DRM and CCA in the planning and implementation activities sets a clear path for developing the proposed risk transfer solution for the city.

Global Communities and Willis Towers Watson
September 30, 2020

I. Executive Summary

Honduras is one of the countries most prone to natural disasters in the world and is confronting increasing risks due to climate change. Its capital, the Municipality of the Central District (MDC), is exposed to particular hazards due to its specific geography, the lack of stormwater management, and the human-driven processes of migration and unplanned building. The city is prone to high frequency and low-intensity events as floods and landslides due to excess rain and low frequency and high impact events as tropical and convective storms, affecting its mostly low-income and vulnerable population.

To better prevent and reduce potential disaster risk, the National System of Disaster Risk Management -SINAGER- was created in 2009. Nonetheless, the system led and coordinated by the Permanent Commission for Contingencies (COPECO), is more focused on preparedness and response activities than other DRM efforts. Despite the legal existence of a National Fund for Preparedness and Response to Emergencies, (still to be operationalized), there are no dedicated funds for DRM at the national level. The law for the creation of the SINAGER also stated that public entities should insure all public infrastructure. Due to the absence of detailed regulation, there is no agreement on public infrastructure to be considered and the minimum conditions for the underwriting. Only recently, the Secretary of Finance has commissioned the developing of a national strategy for DRM and has agreed to a Catastrophe Deferred Drawdown Option CAT DDO with the World Bank for USD 119 million.

At the local level, the current administration at AMDC has invested its own and international cooperation resources to set up DRM and CCA as cross-cutting issues in all planning and implementation activities. The municipality has developed a series of policies and plans with a participatory approach to analyze risks and define the route to follow to reduce the city´s vulnerability to hazards. The city has developed the capacities on DRM and risk assessment of its cadre and has promoted local (community) committees for DRM. AMDC has also created a Municipal Committee for Territorial Data to centralize all data generated for risk management and territorial ordering planning and implemented a platform open to the public domain with different layers of risk data information at the cadastral level. Also, the AMDC is in the process of setting up an early warning system for the city. An updated Municipal Emergencies Plan, including community emergency plans and the Plan for Mitigation of Climate Change have been delayed because of restrictions imposed by the COVID-19. Moreover, it is difficult to estimate if the efforts carried out, as of now, on DRM will continue with the municipal and national elections taking place in January 2022[1].

The current administration has invested significant resources on dredging rivers to reduce the risk of flood for the excess of rain and to build new roads, bypass, and viaducts to facilitate traffic flow. Drawing on international cooperation, the AMDC has also invested in retention walls and ditches at the community level, and stabilization works for preventing landslides in strategic zones of the city. The city is also working to improve water and sewage networks, as it has initiated the tender processes to build water reservoirs and dams. Notwithstanding these efforts, it is deemed necessary to develop a plan to prioritize retrofitting and reinforcing of critical (typically old, yet vital) infrastructure such as the bridges connecting Tegucigalpa and Comayagüela. The inventory of public assets will also allow to define additional mitigation measures for assets to protect by a potential insurance product.

In the financial area, the AMDC has focused the last few years on restructuring its liabilities and implementing the accounting standards for public institutions to achieve financial stability and

[1] National and municipal elections are scheduled for November 2021. The elected authorities will take office in January 2022.

improve its credit rating. Despite those efforts, the scarcity of resources, increased by the expected economic effects of the COVID-19 pandemic, has delayed plan implementation and put at risk some goals. When a disaster occurs, the AMDC continues shifting money among budget lines and compromising future investments to respond to emergencies.

As part of its main DRM plans, the MDC has established the need to develop a strategy for the financial management of risks and promote financial risk transfer solutions to protect the city. Currently, it has multi-risk insurance protection only for the municipal administrative buildings.

The AMDC has expressed its interest to obtain a risk transfer solution for the city, prioritizing this protection against the risk of floods and landslides for municipal infrastructure including roads, viaducts, bypasses, and bridges, markets, and key municipal buildings. The city has also prioritized the water distribution networks and sewage pipelines which will soon be handed over for municipal management.

For the development of an insurance product, it would be necessary to complement the risk data available at the local level, which is currently being updated, with satellite data, both licensed and publicly available. The lack of an inventory of the MDC's public assets made it impossible to estimate a gross product value of the assets to protect. need a sustainable financial strategy for DRM, which include insurance with a probable premium subsidy at an initial stage.

The AMDC would undoubtedly need a sustainable financial strategy for DRM, including financial protection against climate risks (i.e. insurance). A premium subsidy, at an initial stage, would probably be needed while the municipality establishes a sustainable mechanism to finance it and allocates its cost as a recurrent budget line.

Past Initiatives to develop parametric products in the country have not been successful. However, there is currently an expressed interest from the insurance supervisory authority and the insurance industry on parametric products to protect the agriculture sector, for promoting economic reactivation in the country. That interest could facilitate a regulatory framework for parametric products that do not exist in the country yet. Moreover, due to high staff turnover in the private and public insurance sector, staff retention strategies as well as capacity building efforts in the field of parametric product development and supervision for the local industry would be needed.

The political will to develop a risk transfer solution for the city and the efforts displayed by the current administration to mainstream the DRM and CCA in the planning and implementation activities would set up the path for developing the proposed risk transfer solution for the MDC. The need to guarantee that willingness and for continued efforts by the new administration in January 2022, combined with the time needed for MDC to set up a financial payment strategy and for the country to set up a regulatory framework for parametric products, will set the pace for the proposed product implementation.

A summary of criteria assessed in this report, for the development of a risk transfer solution for MDC is presented in the chart below:

Table 1: Criteria Assessed:

Criteria	Assessment	Explanation
Relevance of climate change risks for MDC	High	• Major hazards patterns -floods and landslides- will worsen because of climate change under all IPCC scenarios (more days without rain but more intense precipitation in fewer days each year)
Willingness to develop an insurance protection	High	• Expressed interest by the mayor and AMDC staff
Political and or socio-economic factors	Medium	• Change of administration (January 2022) could impact continuity in interest and implementation of policies
Institutional framework for DRM at local level	High	• DRM and CCA are cross-cutting issues in AMDC planning • Territorial ordering has been prioritized as a major goal for city development • Local organization for DRM and CC reinforced: functions separated from merely response of emergencies • Emergency Plan pending to be updated
DRM awareness at local level	Medium	• No involvement of the private sector • Limited involvement from academia • Growing community sector involvement
Financial framework and management for DR	Low	• No existing financial strategy for DRM • No financial tools in place for DRM • DRM implementation activities depend heavily on international cooperation
Ability and capability to pay premiums	Low	• AMDC as a public entity can buy insurance from a local insurance company or an authorized subsidiary of foreign company • Premiums payment will need specific institutional arrangements • Central government funding for DRM is not available, only limited for response
Risks, damages and losses data	Low	• Gap on reliable damages and losses data (2019- 2020) • Hazard (flood and landslides) data system under development • Dependance on national institutions for data analysis
Linkage between assets to protect and benefit to poor and vulnerable population in the city	High	• Most of assets to protect benefit indirectly the low-income population (used to communicate both cities within AMDC), with exception of: ○ Markets, which are important for food security ○ Water and sewage system fundamental for health, economy, and recovery of population
Mitigation measures	Low	• Mitigation measures to lower the risk of floods and landslides within AMDC have been planned and execution in progress. • Critical mitigation measures for community (public) infrastructure have been identified and planned. Execution was planned for 2020 but has been delayed by the Covid 19 crisis.
Regulatory insurance framework for parametric/innovative products	Low	• No regulatory schemes for innovation • New regulation for index-based insurance for agriculture sector under development

Insurance sector risk appetite	Medium	• There is no available protection developed specifically for climate risks up to now, with exception of those included on multi-risk coverage • Expressed Interest from the supervisory authority and insurance sector to develop protection of CCA related risks • Due to high staff turnover in the private and public insurance sector, staff retention strategies as well as capacity building efforts in the field of parametric product development and supervision for the local industry would be needed.

II. Introduction

Honduras. Honduras is located in Central America, bordering El Salvador, Guatemala and Nicaragua, and has access to the Pacific Ocean and the Caribbean Sea. Honduras has been considered a lower-middle-income country according to the World Bank classification[2], with 48.3% of its population classified as poor in 2018.[3]

Honduras is also one of the most prone countries to natural disasters – an increasing risk from the effects of climate change – due to its particular location and geography, mainly covered by mountains with few lowlands along the coasts. From 1994 to 2013, Honduras was ranked first among the ten most affected nations in the world, according to the long-term Global Climate Risk Index[4]. According to the World Bank's Disaster Hotspot report, Honduras ranks 9th among countries with high mortality risk from exposure to two or more hazards, and 24th among countries with high economic risk exposure from two or more threats[5]. The three most significant risks affecting the population of Honduras are storms, floods, and droughts.

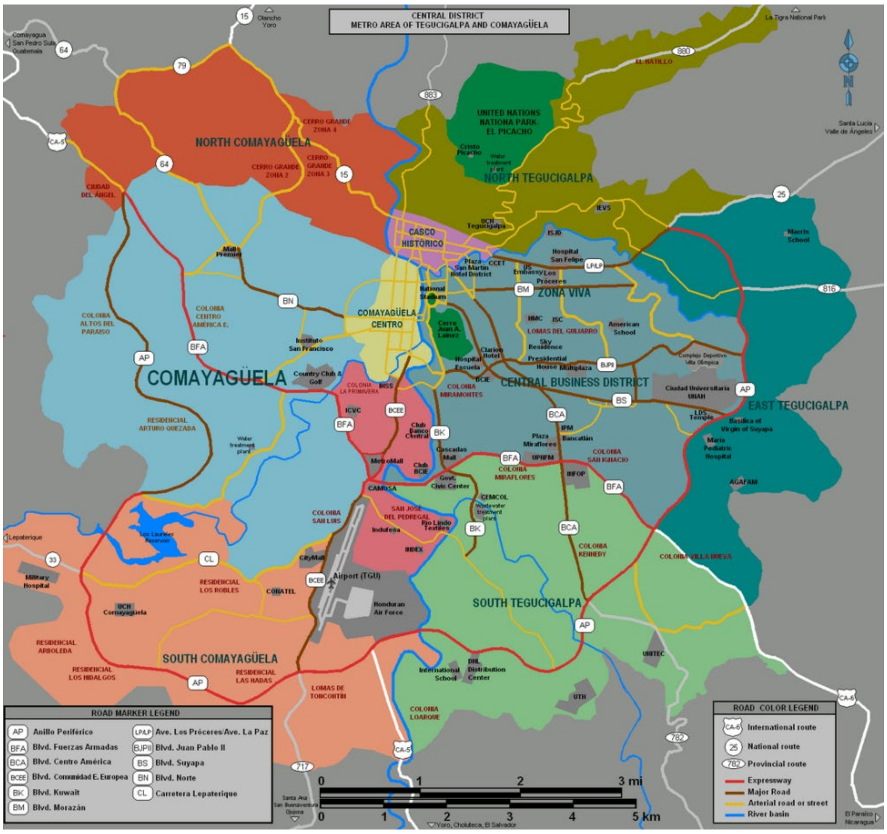
[2] Source: https://data.worldbank.org/country/honduras. GNI per capita-Atlas method (2018), $2350.00

[3] According to the National Institute of Statistics from Honduras, the national poverty line in 2018 was equivalent to US$3.1, near the lower-income class poverty line of US$3.3 established by the World Bank.

[4] According the Global Climate Risk Index, German watch 2015, Honduras was the country most affected in the world by the impact of weather event-related loss, reaching 3.3.% of its GDP, in the period 1994-2013. Source; https://germanwatch.org/sites/germanwatch.org/files/publication/10343.pdf

[5] Dilley, Maxx; Chen, Robert S.; Deichmann, Uwe; Lerner-Lam, Arthur L.; Arnold, Margaret. 2005. Natural Disaster Hotspots: A Global Risk Analysis. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/7376 License: CC BY 3.0 IGO.

Exacerbating these concerns, Honduras has also experienced high levels of urban growth, with an increasing number of low-income families and communities exposed to severe and extreme weather events. A lack of urban land management, increasing internal migration, and real estate speculation during the 1980s and 1990s led to the development of housing projects in areas of irregular topography and the creation of a growing number of informal settlements.



Map 1-MDC. Source: https://commons.wikimedia.org/wiki/File:Tegucigalpa_Map_7.png

The country experiences two main seasons defined by the level of precipitation: the rainy season from May to October and the dry season from December to March. During the rainy season, the city is affected by frequent landslides and flooding, which disproportionately affect the poor.[6]

Tegucigalpa, also referred to as the Municipality of the Central District (MDC), is one of the country's most vulnerable areas along with its surroundings. The MDC is located in the south-central region of the country, part of the Francisco Morazán Department, and integrates two cities Tegucigalpa and Comayagua divided by the Choluteca River. The total area is approximately 1,514.72 square kilometers.

In addition to the factors affecting the country's climate patterns, rapid and informal growth has made many of the MDC's low-income settlements particularly exposed to environmental degradation and natural disasters. Construction in impervious areas, lack of storm-water management, and unplanned building in risk-prone zones all contribute to the increased potential of flooding and landslides.

[6]The definition used for poor people is the one considered by the World Bank, as the ones who live with less than U$ 5.50 dollars a day (2011 PPP- purchase power parity). Source: https://www.worldbank.org/en/topic/poverty/overview

MDC Data	Total	% of pop.
Population (2019)(1)	1,259,646	100 %
Urban Population	1,143,373	90.8%
Rural Population	116,273	10.2%
Population (2016) (2)	**1,157,509**	
Relative poverty (2016)	663,604	57.3%
Extreme poverty (2016)	401,597	34.7%
Medium-high income	92,308	8.0%
With less than $ 1 a day		6%

Source: 1. National Institute of Statistics of Honduras: https://www.ine.gob.hn/V3/pobrezamonetaria/;
2. Local Action Plan for DRM and resilience. Municipality of the Resilient and Sustainable Central District (2018), projections based on 2013 National census.

High population density is also becoming a problem for the city. In 1970 the city's total population was around 270,000, located on about 4,000 hectares; by 1998, the population had risen to approximately 576,000; and in 2019, was estimated at more than 1.2 million (25 % of the country's total urban population and 14% of its total population). In 2016, the MDC had a density of 11,023 hab/km2. The urban area is expected to increase by the end of 2021 as the city´s authorities are planning to extend the urban borders for facilitating the city´s growth and for regulating informal settlements built on the outskirts of the town. The MDC includes 912 quarters and neighborhoods (human settlements located in urban areas), as well as 43 villages and 538 hamlets (located in rural areas)[7].

With annual growth rates of 2.2 percent, the MDC also has the most significant concentration of urban poverty in the country. In 2016, 57.3% of the population was considered poor and 34.7% extremely poor[8,9]. With a Human Development Index (HDI) of 0.794 (2016), the MDC ranks higher than the country as a whole which has a HDI of 0.623 (2018)[10].

One of the most severe disasters that occurred in recent decades was Hurricane Mitch in October 1998, a breaking point for the Honduran authorities and the population in terms of interest in and concern for disaster risk management (DRM). The MDC sustained significant damage during Hurricane Mitch, which also devastated large areas of the country. The saturated soil could not absorb the heavy precipitation. Deforestation and debris left by the hurricane led to catastrophic flooding throughout widespread regions of the country, especially in MDC. Heavy rain caused flash floods of the Rio Choluteca's tributaries, and the swollen river overflowed its banks, tearing down entire neighborhoods and bridges across the ravaged city.

The increasing regularity of events in recent years, such as excess rain over several days and higher temperatures with extended dry seasons, has also increased the interest of authorities to act to prevent future losses from natural disasters.

In Central America, the climate change indicators are influenced by droughts, hurricanes, tropical storms, and the "El Niño, Southern Oscillation" (ENOS). According to the Central America Commission for Environment and Development[11], in the last 60 years, at least ten ENOS phenomena have occurred, indicating that climate change is increasing their frequency and intensity.

[7] Plan de Acción Local para la GRD y la resiliencia. Municipio del Distrito Central Resiliente y Sostenible (2018).

[8] Plan de Acción Local para la GRD y la Resiliencia. Municipio del Distrito Central Resiliente y Sostenible (2018), projections based on 2013 National census performed by the National Institute of Statistics form Honduras.

[9] Information of poverty at local level – MDC- is only available considering national poverty lines. The National poverty line for 2016, was equivalent to U$ 6.70 a day (PPP2011) and the extreme poverty line was equivalent to US$ 3.80 (PPP 2011) a day. Source: National Institute of Statistics from Honduras: https://www.ine.gob.hn/

[10] In 2016, Honduras had an IDH of 0.625, while in 2019 its IDH declined to 0.623
Sources: http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf; http://hdr.undp.org/sites/default/files/hdr2019.pdf.

[11] The National Adaptation Plan from Honduras.

According to other studies for Central America, the "canicula"[12] period has extended, now starting in June and finishing in September[13]. The Report of the Environment Status from Honduras, published by MiAmbiente (2014) indicates that in Central America from 1961 to 2003, extremely hot temperatures for days and nights have increased by 2.5% and 1.7% per decade, respectively, while the cold days and nights have decreased by 2.2% and 2.4% per decade, respectively. The same document indicates that precipitation levels have decreased in Honduras between 7 to 10mm in each decade for the last 50 years. At the same time, the annual precipitation in the southern region (Choluteca River) has increased, however occurring over a fewer number of days. These climate patterns lead to the need to re-design and amplify the pluvial drainage in urban areas and to store excess water for the dry period. The rise in temperatures has also generated an increase in the number of forest fires each year, adversely affecting lives and biodiversity, and causing an increase in deforestation.

III. The National and Municipal DRM Systems

3.1 The National DRM system

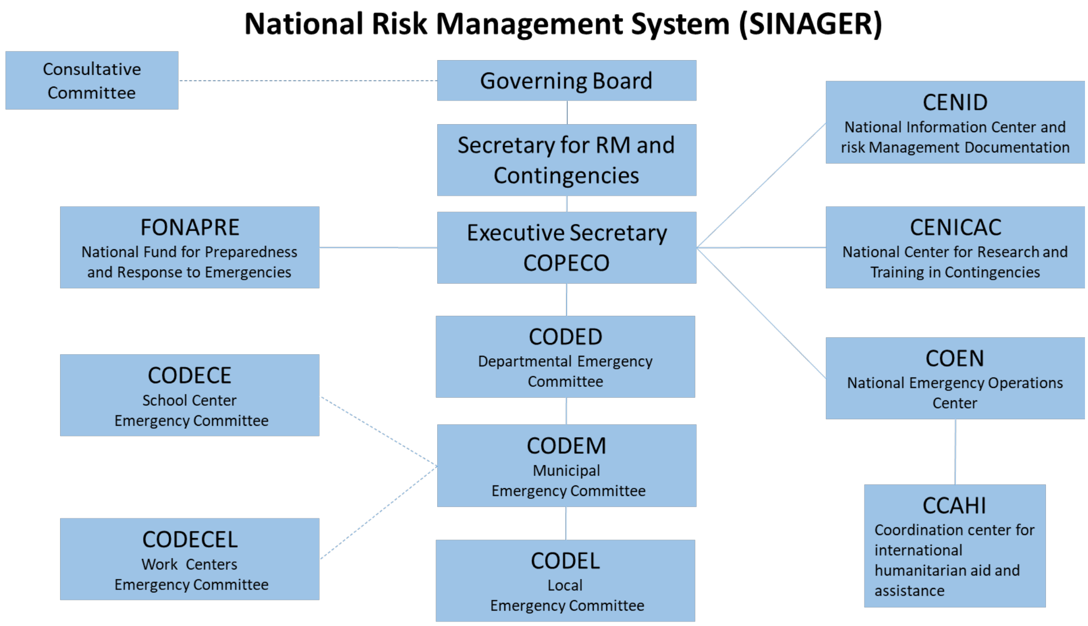
National DRM System according to law. The National Disaster Risk Management System (SINAGER) in Honduras was established by Law No. 151[14] establishing the institutional framework for DRM in Honduras, the principles and objectives underpinning DRM in the country, the structure of the system, and the responsibilities of its members. Previously, the

[12] The rainy season also sees the so-called "canicula" - a significant decrease of precipitation between July and August.
[13] Tenorio and Ochoa, 2015.
[14] Law No. 151 was published on December 26, 2009, and further detailed in Executive Agreement No. 33 on October 11, 2010

response to natural disasters was managed by the National Commission for Contingencies (COPECO) created in 1990.

The DRM policies and laws in the country are established by the Governing Board of SINAGER, which is comprised of the President, the Council of Ministries, different private and public guild representatives, and the National Bureau for DRM. Among the members of SINAGER´s Governing Board are the National Association of Municipalities (AMHON), the Honduran Private Sector Council (COHEP), and representatives from universities, union organizations, and producer associations among others. Unfortunately, in practice, the Governing Board is only convened when the President of Honduras decides and usually only when a disaster occurs. Graphic 1, maps the structure of the SINAGER, see Annex 2 for more details about different entities, roles and responsibilities in the system.

Graphic 1- National Risk Management System



Source: Prepared by the authors on the basis of the PNGIRH 2014-2019

About the leadership and execution. All institutions recognize COPECO as the leader of DRM policy development and execution in the country. COPECO is responsible for leading, organizing, and coordinating DRM efforts, developing the DRM capacities of its members, and mainstreaming DRM in public institutions, programs, and investments in the country. COPECO is also responsible for updating the National Plan for DRM and obtaining approval from the SINAGER Governing Board every four years and proposing other regulations for the system. Despite its extended power, COPECO focuses its work more on preparatory and response activities than on prevention activities. The institution has performed limited work on risk reduction initiatives except for collaboration with the Secretary of Finance (SoF) in the guidelines for risk evaluation for public investment projects.

Regional and local linkages. According to the law, there are Departmental (CODED) and Municipal (CODEM) Emergency Committees, which are linked to the Permanent Commission for Contingencies (COPECO). Nonetheless, in practice, there is no interaction or complementarity among the municipal and departmental political levels, and the CODEMs interact directly with COPECO. The departmental level of DRM appears in the law but has no political power, systemic responsibilities, or budgetary decision. Besides we found no records of an existing CODED.

Financial Strategy for Risk Protection. Through the Agreement 195- 2020 of February 2020, the SoF instructed to the Vice-Secretary of Public Debt to elaborate the Financial Strategy for DRM for Honduras. The SoF also has assigned to the Unit for Fiscal Contingencies the identification, estimation, and quantification of the possible passive contingencies for Honduras if a natural disaster occurs. The Unit for Fiscal Contingencies has to estimate the potential fiscal impact of disaster risk natural phenomena, concerning the Honduran GDP. Those activities have suffered delays because of the COVID-19 pandemic as well.

Funds for DRM. Law No. 51 from 2010 also created the National Fund for Preparedness and Response (FONAPRE). COPECO is named the administrator of FONAPRE, while the Central Bank of Honduras is the financial manager according to law. FONAPRE was established to be dedicated exclusively to the preparation and response to emergencies and to provide immediate support for recovery to the population after a disaster occurs. According to law, FONAPRE's budget shall be integrated by a cumulative annual transfer from the Central Government´s account from all donations and contributions received from public or private institutions for preparedness and response to disasters. However, FONAPRE is only a line in COPECO´s budget and its governing rules have not been issued, so it does not operate in practice.

Infrastructure insurance protection. Law No. 151, in its article 58, established that all public institutions should insure their assets against natural and anthropogenic disasters. The law indicates the institutions shall request a risk assessment from SINAGER of the assets to protect as a basis for negotiation with insurance companies. Despite this guideline, there is no regulation of how to implement the protection for public assets or which sanctions are applicable if this law is not fulfilled. Nowadays, there is no estimation by the national government or the national association of insurance companies, which is the amount/deficit of insured public infrastructure.

The SoF, in collaboration with COPECO, established guidelines for the Risk Evaluation on Public Investments, which are mandatory for all public investment projects. If the investment is the result of a private-public alliance (APP), it shall include multi-risk insurance protection policy for the assets while is operated by the private party (the operator).

If it is an infrastructure built with public funds and relevant risks are detected in the evaluation, the investment shall also apply to the so-called methodology of "project shield." The "project shield" consists of reserve an amount (not more than 15% of the overall cost of the infrastructure) to cover the estimated value of corrective actions for any likely damage the work can suffer because of a natural disaster during the construction and after its completion . In this way, the useful lifetime of the infrastructure is ensured and disaster risk management is included since project inception according the SoF. [15, 16]

Declaration of emergencies and calamities. According to law, an emergency, national disaster, or calamity at the national level is declared by the President, by request from the Commissioner of COPECO, according to law. In the case of epidemiological emergencies, the

[15] http://www.sefin.gob.hn/wp-content/uploads/2011/05/METODO-BLINDAJE-DE-PROYECTOS.pdf

[16] Information obtained by officials from the Public Investment Direction at the SoF from Honduras, from our interview on September 3rd, 2020.

Secretary of State for Health declares emergencies and leads the other SINAGER institutions in responding to the crisis. The Secretary of State for Natural Resources and Environment has the responsibility of declaring environmental emergencies.

At the local level, the Municipal Council can issue the declaration of emergencies or public calamity in its jurisdiction. At the same time, it shall immediately communicate that declaration to SINAGER´s Governing Board through COPECO´s Commissioner.

Level of risk awareness and state of development and implementation of DRM plans at the national level: The current government, which started its mandate in 2018, has granted a significant relevance to the need to act against the effects of climate change, which threaten the country's development and increase the natural disaster risks. During 2018 and 2019, a series of policies and plans have been discussed and developed in the country. Those policies establish the country´s line of actions on environmental issues, including the Master Plan for Water, Forest and Soil; the National Adaptation Plan; the National Strategy for Climate Change, among other plans under development. The main policies included in those plans are detailed on the chart below.

Table 2: Main policies related to Climate Change in Honduras

Plan Name	Main policies	References to DRM and disaster risk finance
Master Plan for Water, Forest and Soil (2017)	Plan includes policies regarding the sustainable use and exploitation of water, forest and water resources, considering three processes and strategic lines of actions for each one, as follows: 1. Governance, which includes two strategic lines: 1.1. Local governance for the soil, water and forest, integrated management; and 1.2 Strengthening of the legal and institutional framework as well as financial mechanisms; 2. Knowledge Management, which includes two strategic lines of action: 2.1. data generation and management for decision making; and 2.2. Strengthening of human capacities and competencies development; and 3. Sustainable Practices Implementation with two strategic lines of actions: 3.1 Sustainable conservation, restauration and utilization of water, forest and soil, and 3.2 Infrastructure development for efficient treatment and use of pluvial and residual water.	The financial mechanisms included in the strategic line number are the design, promotion and development of incentives for the integrated management of natural resources, such as, ecosystem services, compensation mechanisms for ecosystem products and services, promoting the participation of the private sector. No reference to disaster risk finance mechanism is made in the Plan.
National Strategy for Climate Change Honduras (2017)	The national strategy establishes a policy framework for the country to adapt to the climate change effects and contribute to the mitigation of climate change at a global level. To do that the plan establishes 17 strategic lines of actions: 15 related to	The Risk management actions are focused on measures to recover and improve the fluvial system functionality -runoffs-, improve the territorial ordering to reduce the impact of informal settlements and displacement

	prioritized sectors and systems in the evaluation of vulnerability and impact, and two lines of actions related to mitigation. The 15 strategic lines on adaptation are related to the following seven prioritized sectors and systems: 1. Water resources; 2. Agriculture, soil and food security; 3. Forest and biodiversity; 4.Coastal and marine systems; 5. Human health; 6. Risk Management; 7. Hydro-electric energy; The mitigation strategic lines are focused on the 1. Reduction of GHG; 2. Strengthen the synergy among adaptation and mitigation measures.	on the exposition and vulnerability of population to climate risks, establish regulation to promote the resilience of infrastructure to climate change. The financial mechanisms section highlights the need to create an institutional mechanism responsible for requesting and managing the available international aid resources, establish contributions to climate change adaptation and reduction by developed countries. No other references to disaster risk finance measures are made in the strategy.
National Plan for Adaptation (2018)	The National Adaptation Plan's objective is to guide the implementation of adaptation actions for sustainable development with a focus on prioritized sectors and pursue the mainstreaming of climate change adaptation in public policies. The prioritized sectors are: 1. Agriculture and Food Security; 2. Human Health; 3. Forest and Ecosystems; 4. Infrastructure and Economic Development; and 5. Water Resources. Each sector includes actions that consider four cross-cutting pillars: a. knowledge management; b. gender and vulnerable population; c. development and human rights; and d. risk management and territorial ordering.	Risk management appears again as a cross-cutting topic for climate change adaptation. Under the strategic sector, infrastructure and economic development, there are three objectives: a. territorial ordering to reducing risk; b. increasing the resilience of grey infrastructure[17], and 3. strengthening the focus on resilient cities and communities. The only financial mechanism considered (recommended) under the objective to strengthen risk management and climate risk adaptation is the set-up of a financial mechanisms for the prevention and rehabilitation of risk zones at municipal level.

The importance given to planning environmental efforts shows the interest of the current government for prevention and planning against risks associated with climate change, as part of risk management, which is establish as a main pillar for those plans.[18] Those efforts have been communicated with the DRM system through the participation and contribution of the Center for Atmospheric, Oceanographic and Seismic Studies (CENAOS). However, no one of those plans establishes financial mechanisms for risk transfer.

Another significant effort in this field was the creation of the Presidential Office for Climate Change, named CLIMA+, which is in charge of implementing the financial strategy for climate change in the country. Due to the lack of financial resources, Clima+ is searching for the

[17] Grey infrastructure is that developed through engineering projects that use concrete and steel as opposed to green infrastructure that consists of natural elements.

[18] The National Adaptation Plan to CC and the Mitigation have as one of their pillars, the risk management. The National strategy for CC, establishes the risk management as a strategic area of action, focused on territorial ordering, to recuperate and rehabilitate fluvial systems´ functionality, the regulation of the design and building of resilient infrastructure, and promoting the civil protection for the population displaced as effect of climate risks.

financial support from international donors to implement the National Adaptation Plan and the National Determined Contributions (NDCs) proposed by the country.

Available financial tools and resources -public or private- for DRM: The Honduras Government has recently signed an agreement with the World Bank (May 20, 2020), for a Disaster Risk Management Development Policy Credit with a Catastrophe Deferred Drawdown Option (CAT DDO), for USD 119 million, active up to June 30, 2023, and to be paid until 2049. The loan will be used in case a declaration of emergency is issued according to the country´s laws to respond to an imminent or occurring natural catastrophe, including a natural disaster, a disease outbreak, and/or an epidemiological emergency in the human population. There is interest among multilateral banks, as the Central American Bank for Economic Integration (CABEI) to support the DRM in Honduras through financial tools to protect basic infrastructure, but who usually request a counterpart fund, which the government of Honduras is not able to provide.[19] There are also recent dialogues to consider the inclusion of Honduras in a new catastrophic parametric scheme to be implemented by the CCRIF[20] for the Central American countries, which would be adapted to their protection for droughts and floods.

Key Points

- The SINAGER system is mainly focused on preparation and response to emergencies with limited work in relation to other risk management activities.
- The National Fund for DRM is not functioning in practice.
- All budget definitions depend on the Secretary of Finance.
- There are ongoing efforts with the World Bank to develop a financial strategy for DRM and provide to the country some financial tools for DRM (CAT-DDO and CCRIF).

[19] Past initiatives on financial protection were rejected by the Secretary of Finance because of lack of resources.
[20] The Caribbean Catastrophe Risk Insurance Facility. https://www.ccrif.org/

3.2. The Local DRM system in MDC

3.2.1 The structure and leadership of the system

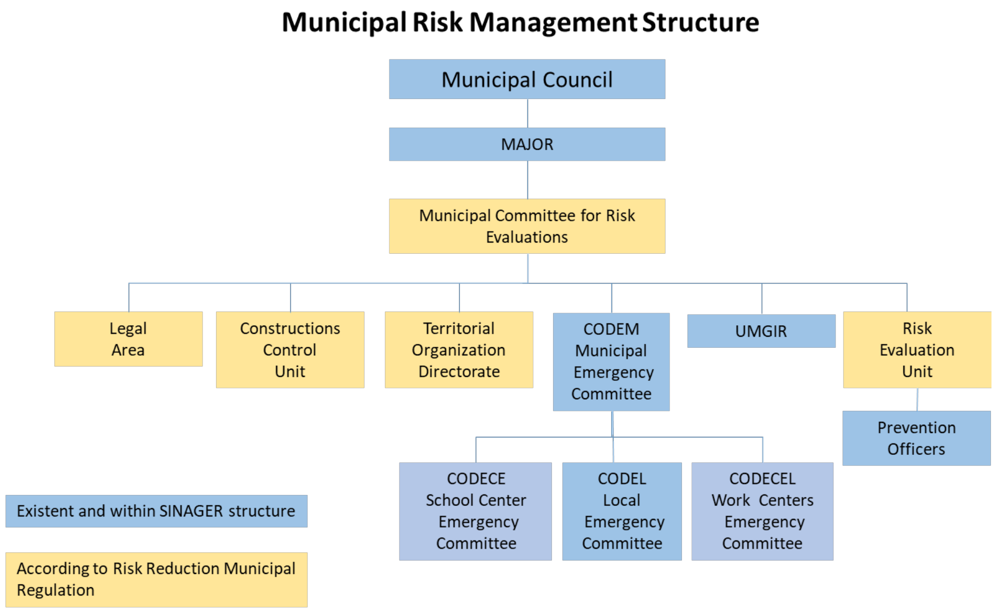
SINAGER's structure considers the three governing levels in Honduras: the central, departmental, and the local governments (municipalities). The municipal level recognizes the authority of the Municipal Council lead by each mayor. Nonetheless, its primary nexus at the municipal level are the Municipal Emergency Committee (CODEM), created before Law No. 151. At its time, CODEM is the linkage with the community level for DRM, the Local Emergency Committee (CODEL).

Under the political initiative of the current administration, the AMDC established the DRM and CCA as cross-cutting topics in the administration, creating a dedicated structure, fostering planning and coordinated information mechanisms, as well as developing internal capacities for DRM among the municipal staff.

As part of this strategy in October 2014, the AMDC´s Council created the Municipal Unit for Integral Risk Management (UMGIR) as the responsible unit for the development of policies and risk management plans. The UMGIR is also responsible for the implementation of these plans, as well as to support all DRM activities performed by other management units at AMDC. The UMGIR leads and coordinates all DRM activities, except for those assigned by law to the CODEM. However, the recognized leader for DRM at the city level is the mayor, who is accountable for the key decisions.

Graphic 2 below shows the structure of the DRM system at the AMDC and Annex 3 details roles and responsibilities within the system.

Graphic 2- Municipal Risk Management Structure



Source: Prepared by the authors based on AMDC information and interviews.

3.2.2 DRM governance in place.

In the last decade, the AMDC has made a great effort to mainstream disaster risk management and build climate change resilience across its activities. As part of this effort, the municipality has invested considerable time and resources – both its own and those received from international donors – on activities such as: developing, collecting and centralizing risks-related data; planning their short, medium, and long term goals; reorganizing the staff structure to clarify roles and responsibilities and to develop capacities among staff.

As part of this effort, the AMDC has participated in a series of international initiatives and developed a series of plans and tools for DRM, summarized on Annex No.4.

Over the last couple of years, the UMGIR, currently led by the Chief Municipal Officer, has developed the following central policies and plans, which are the framework for DRM in the city and further explained in detail in Annex 4:

- The Municipal Policy for the Integrated Management of Disaster Risk at MDC (2018), in the context of Climate Change and land-use planning: This Policy establishes the need to generate municipal capacities for the financial management of risk and climate change adaptation as an objective. As a main policy for DRM at city level its implementation will guide actions oriented to disaster risk finance efforts in future administrations.
- The Implementation Strategy for the Municipal Policy for the integral Management of DR at MDC: The document includes an objective for developing tools for financial risk management and developing insurance markets with this purpose. Even if the goal to develop insurance markets for DR goes beyond what the AMDC can reach by itself, the AMDC is in fact representing the demand interest for disaster risk insurance.
- The Local Action Plan for Disaster Risk Reduction and Resilience (2018). The Plan was developed with a participatory methodology, gathering the contribution of a series of representatives from the public, private, and non-governmental sectors in workshops and revisions. The Plan gives a particular emphasis to develop a financial strategy for financial protection against disaster risks, including the need to develop fiscal and financial mechanisms -retention and risk transfer mechanism- and the promotion of local insurance markets.

Impact of COVID-19 on the AMDC activities

The municipality had to transfer funds from other designated activities during initial response to the COVID-19 emergency.

The Honduran government has limited mobility on streets to prevent the spread of COVID-19 in the country. The population can leave from their homes to do basic activities certain days according their ID numbers. Online working is permitted and promoted.

These restrictions, which have been in place since March 16th, have impacted planned activities for this year by delaying them between 3 to 4 months. Implementation of plans requiring community approval are also delayed since meetings and on-site activities are restricted by the pandemic. AMDC is reviewing how to continue with its implementation using digital tools.

Most of the activities listed on those plans have not been implemented yet, except for the Platform for International Donors, to channel all DRM needs from the MDC.

Staff training has been an integral part of most DRM projects developed by the AMDC. Thanks to this interest nowadays, the AMDC benefits today from having a strong cadre of staff with extensive experience in DRM, some of whom with previous working experience at COPECO. Nonetheless, there is no guarantee that all these efforts will continue after January 2022, when the current administration ends its term. There is not a public administration career at the municipality to ensure that staff trained in DRM will continue in their position under the new administration.

3.2.3 Funding for DRM

The current administration received a municipal budget committed to different obligations up to 2022. Thus, their first initiatives were focused on organizing financial management and restructuring its debt.

In this framework, the AMDC has not implemented a separate or dedicated line for DRM and has no chance to constitute the expected dedicated Fund for DRM, referred by its policies and plans. Prevention activities are basically performed with the budget from other areas such as the infrastructure area and environmental area, among others, and the funds from projects implemented with international cooperation.

To respond to emergencies, there is a contingencies fund of 20 million lempiras[21]. However, when an emergency occurs, as with the COVID-19 pandemic, the AMDC can respond to it by shifting resources from different budget lines and/or drawing on central government and international cooperation support. According to the Law No.151- 2009 and its regulations, the Executive Agreement 032-2010, the central government support is activated with the declaration of emergency or public calamity issued by the Municipal Council, which needs to be communicated to COPECO and include a preliminary evaluation of damages and resources needed to respond. Public institutions as municipalities can ask for central government support through COPECO after exhausting their own emergency funds. There is no rule for the level of funding a municipality could receive, but essentially the amount will depend on the balance of resources needed and resources available at the national budget. Thus, in the case of extended and severe disasters, COPECO could transfer funds which only partially covers needed resources and often the municipalities have to look for other funding sources.

Indeed, the main mitigation measures for DRM currently implemented in the city are mainly funded by foreign cooperation (as will be detailed further down in this report) and the response to COVID-19 pandemic effects have been covered by its own funds and international cooperation support. Requests to foreign cooperation agencies are channeled through the foreign assistance platform created in this administration.

3.2.4 Fiscal measures and risk transfer

After the efforts from local authorities to restructure the MDC and organize the Municipality´s income and expenses, last year the MDC achieved a B+ credit rating from the World Bank and is in the process of negotiating its liabilities.

Moreover, for having some available funds to build new infrastructure for the city, the AMDC created a trust fund with the proceeds of all taxes (such as the vehicle tax[22]), fees and other taxes. The trust fund was approved by the Municipal Council (Corporation) and its trustee – a

[21] Approximately USD 800,000.00
[22] A contribution paid for users of the city roads.

local bank- was selected through a tender process. The bank is authorized to use the proceeds collected according to the regulation issued by the technical committee, which also authorizes every payment the trustee shall execute. The Technical Committee for the Trust fund consists of the mayor, the treasurer and a member of the trustee Bank[23].This mechanism has allowed the AMDC to build, maintain, and retrofit main avenues, bridges, viaducts, among other main works in the city in the last several years. Municipal officials, including the municipality's Chief of Staff and the Financial Manager, confirmed that the mandate of the current trust fund could be expanded to cover the payment of insurance premiums, this would require an amendment to the current trust approved by the Council. In terms of ultimate destination of the funds, this is under the Municipality's purview, and further detailed in Section 4.4.

Due to the COVID-19 outbreak, the AMDC´s income has been reduced by approximately 30% as of June 2020, as compared with previous years. However, a more significant annual reduction is expected as some taxes are due in the second half of the year.

Concerning risk transfer solutions, MDC benefits from a traditional insurance policy to protect some municipal administrative buildings against multi-risks such as earthquakes and floods, acquired directly by the AMDC through a tender process according to procurement laws.[24] Besides that measure, MDC has no other fiscal or risk transfer solution in place to protect its assets or those of its population.

3.2.5 Mitigation and infrastructure measures

When new infrastructure is built, the first fiscal step is the measure recommended by the SoF, the so-called project shield - 15% of any public investment value for protection against natural disaster during construction.

[23] Details about the trust fund were provided on communication sent by the AMDC officials on November 11th, 2020.

[24] The AMDC did not share more details about this policy and assets covered.

AMDC has made significant investments in new infrastructure in the city, especially to alleviate heavily congested areas to facilitate connections and flow of traffic. Works such as roundabouts and bypasses as the ones built on Juan Pablo II Blvd., Centro America Blvd., Suyapa Blvd., 21 de Octubre Blvd, CEE (La Granja) Blvd. and those currently built such as Avenida La Paz, Residencial La Hacienda and Multiplaza. Additionally, the first phase of the express way along the Choluteca River is already completed (with two more phases expected). Only investments funded by the National Government apply the "project shield" methodology recommended by the SoF.[25]

Impact of COVID-19 on the AMDC Budget

The AMDC provides facilities for payment to the contributors, to alleviate the economic impact of the COVID-19 among families and businesses. Those facilities include to extend discount for soon payment until August 30th, the possibility to pay some taxes on installments, exemption of fines, among others.

According the Financial Area of AMDC, the projected income of the municipality has decreased by 25% in the first half of the year.

The vehicle tax contribution are due in the second half of the year, the total of the economic impact of the pandemic will be confirmed at the end of the year.

As part of mitigation measures implemented by the AMDC with international donors and other bilateral funding, it is worth noting:

- With the contribution from JICA, stabilization work has taken place in strategic zones, such as El Berrinche, and the Reparto, located in the northwestern steep hills of the city.[26]
- The AMDC invested approximately 40 million lempiras[27] in river dredging and is also working to improve water and sewage networks, building new water reservoirs and dams, while waiting for the already-approved transfer of the water system administered by the Autonomous National System of Aqueducts and Sewage (SANAA).
- With a loan from the Central American Bank for Economic Integration (CABEI), through the Honduras Government, the AMDC executed the reconstruction of a retaining wall along the Sapo Ravine and rehabilitation of nearby streets. The purpose of the project was to protect the houses close to the ravine, to rehabilitate streets near the retaining walls, to keep the traffic flowing during the rainy season. The project, which ended in April 2017, also facilitated the evacuation route in that area[28].
- Carried out maintenance of all bridges, entries, and exits of main roads.

After the flood occurred in the Sapo Ravine in 2017, which flooded one of the most critical public markets in the city, the AMDC implemented a reorganization of public markets, which are owned by the AMDC, but currently rented to private administrators. A new central distribution center has been built under this administration.

Finally, in areas where mitigation measures cannot be implemented, due to illegal occupation or lack of a community structures, there is an effort from the Municipality to promote the

[25] The AMDC didn't provide information on other kind of climate risk assessment apply to investments on infrastructure. The information would be available when the inventory of MDC assets is ready.
[26] Source : https://www.elheraldo.hn/metro/586877-213/tegucigalpa-estabilidad-de-el-berrinche-sera-puesta-a-prueba-en-invierno
[27] Approximately US 1.6 million
[28] Source: http://www.amdc.hn/index.php/ejes-de-desarrollo/category-page

creation of a new CODEL.[29]

Besides those efforts, the main group of mitigation measures for natural disasters currently being implemented are the ones under the KFW Program for Urban Adaptation. The program's objective is to reduce the risk of floods and landslides in at-risks urban areas of the MDC, particularly in highly populated neighborhoods. The program includes the implementation of structural and non-structural mitigation measures, the institutional governance strengthening for CCA and DRM as well the strengthening of the AMDC´s capacity to identify and reduce risk. The program counts on the German Government contribution through KfW, of 23 million euros, plus an in-kind contribution by the AMDC of 5.5 million euros.

The program has 2 phases. The first phase, which is under implementation, includes: 1. supporting the development of a Territorial Ordering Plan; 2. supporting the development of the Plan for Social and Environmental Management; and 3. the design of a methodology for the identification and definition of areas where structural mitigation measures need to be implemented.

KfW funded Urban Adaptation Program

Working with previous data on exposure and vulnerability that AMDC had, 735 areas on the need for mitigation measures were analyzed. The methodology included the analysis of risk, population density, population poverty level, legal facilities to intervene in the area, and community organization.

The methodology for the definition of measures to be implemented includes a consultation process with the communities for which structural measures will be designed and implemented. The program also foresees that the communities - through CODEL - will oversee the maintenance of the mitigation measures that are implemented.

After an initial assessment, 35 areas were selected for implementation of different types of mitigation measures, such as ditches for preventing floods, retaining walls for preventing landslides, and retrofitting of shelters.

The second phase, which will be implemented in 2021, includes: 1. the development of local DRM plans; 2. implementation of the Territorial Ordering Plan and of the Plan for Social and Environmental Management; 3. Implementation Economics for Climate Adaptation methodology for the city of Tegucigalpa; and 4. Additional mitigation measures.[30]

On its efforts to migrate their financial system to the International Public Sector Accounting Standards, the AMDC started an inventory of its assets (95% advanced) as well as inventory of mitigation measures already in place. The latter is an effort led by the COMUDE.

There is a substantial gap in mitigation measures related to the bridges that connect Tegucigalpa and Comayagüela, divided by Choluteca River. Hurricane Mitch (1998) severely damaged those bridges; some were reinforced, and others built again during the following years. Those bridges present natural abrasion for being continuously be swamped on each rainy season and represent one of the most crucial infrastructures to protect in case of heavy

[29] Interview with Mr. Ruben Hernández - UMGIR.

[30] The structural measures are on the design process by the AMDC and it is expected implementation begins at the end of 2020. Up to June 2020, there were 8 designs of mitigation measures approved.

floods. Even if they have benefitted from river dredging, these bridges would require specific maintenance and retrofitting investments.

3.2.6 Other DRM measures in place

Besides the mitigation measures on infrastructure listed above, the AMDC is implementing the following disaster risk management measures:

In relation to DRM and CCA knowledge and data generation. At the local level, instead, there is a significant effort to coordinate, centralize, and update relevant information for DRM. As of now, the data generated by the Municipal SAT systems is provided to COPECO, which analyzes it and delivers reports and forecasts to the AMDC for decision-making.

As an initial first effort, the AMDC decided to create the COMUDE - Municipal Committee for Territorial Data in 2017, covering 21 areas for the Municipality to centralize, harmonize and manage all relevant information for the territorial management and DRM in the city. There is a long list of activities planned under the COMUDE framework for data generation which are detailed on Annex 5. Among those the most relevant have been the articulation of a new Early Warning System (SAT) focused on floods (collecting pluvial and fluvial information), which collects information of rain and river levels. Details on the time and kind of information collected is provided in Annex 5. The COMUDE framework also included the creation of an open platform at the cadastral level currently under the address https://amdc.giscloud.com/. The platform includes a series of maps, which provides different layers of information, showing the risk of flood, landslides, and other hazards, evidencing the collaboration among international donors on different projects, as detailed in the following chapter (3.3.1) of this report.[31]

In relation to prevention and preparation for response. As part of DRM measures, the AMDC has been fostering the implementation of a new territorial organization. This effort includes:

- The definition of a new urban perimeter, to promote the orderly expansion of the city. This new perimeter excludes protected areas and suburbs without risk information, while fostering the inclusion of so-called "rural areas" - areas with urban uses and characteristics. This new urban perimeter proposal is ready to be approved by the Municipal Council.
- A new Territorial Ordering Plan (POT), which considers exposure and vulnerability to risks for territorial zoning (the previous POT did not do this). This plan will draw on the efforts implemented by the KFW Program for Urban Adaptation, which is currently supporting the elaboration of community-based territorial ordering plans.
- The evaluation of risks implemented by the Risk Evaluation Area. For any new or any modification of construction in the city, the Risk Evaluation Unit issues a risk evaluation report made by the Prevention Officers. To get authorization for the construction/modification, the property owners need to fulfill the basic requirements established in the risk evaluation; otherwise, they won't be allowed to conduct such construction or modification. If the construction location, according to the cadaster is found in an area exposed to flood or landslide risk, the municipality could request risk mitigation measures as a requirement to authorize any new work.

[31] Detailed information about the SAT hasn't been shared during research time for this report. Thus, the feasibility to use the information from SAT for developing the proposed insurance product shall be explored during the product development process.

To strengthen the DRM in the city, the AMDC has initiated a process of identification, regularization, and certification of CODEL, as well as the strengthening of CODEL´s capacities for preparedness and response.

Also, under the Adaptation to Climate Change PLAN, and with the support of the Institute for Forestry Conservation, the CODEM plans to create, train and monitor a new CODEL model, an Environmental CODEL. The Environmental CODEL will have as a primary objective to work on measures to prevent forest fires, through sustainable forestry and fire protection, as well as through reforestation works.

Unfortunately, both initiatives concerning CODELs have been suspended because of the mobility restrictions imposed in the city by the COVID-19 pandemic.[32]

3.2.7 Other DRM projects currently being implemented

Mindful of the budget restrictions facing the current administration, the AMDC is currently implementing DRM projects with the support and funding from international donors. The main projects are detailed in the following chart:

Table 3: Main DRM projects carried out by the AMDC

Counterpart	Project name	Objective	Status
USAID- GOAL	Project for the development of a Municipal System of Territorial Studies Information (SIMET)	To collect, back up, and provide unified information for policy planning and decision making as a tool for territorial organization, DRM, and CCA. The SIMET will implement 3 modules: 1. The Information Management Module 2. The Territorial Management Module 3. The Monitoring and Evaluation Module.	The SIMET is currently on its basic module, strengthening the early warning system
JICA	Control and mitigation of disaster on hills for the Metropolitan Area of Tegucigalpa	The objective is implementing mitigation measures for preventing landslides in four selected areas of Tegucigalpa, two by JICA and two by the AMDC. This project is part of a Master Plan developed by JICA which initiated its cooperation to MDC after the Hurricane Mitch impacted the city. JICA has contributed for almost two decades with MDC in the following projects: - In 2002, JICA elaborated the study for control of floods and prevention of landslides for the Metropolitan Area of MDC. - In 2006, it started the Regional project for the capacity development on DRM for Central America, called BONSAI-Phase 1. - The studies for the prioritized zones with higher risk of landslides (Berrinche, Reparto and Bambu) in MDC, started in 2007. - Program of strengthening of Honduran Academia in	It started in 2019 In execution up to 2021. The execution of retaining walls designed for 2 areas “Fuerzas Unidas” and “Campo Cielo” shall be tendered.

[32] The Municipal Community Management and Human Development Department is working to implement digital mechanisms to communicate and engage community leaders, to continue training and participatory processes.

		exchanges with the Polytechnic University of Engineering, which developed the maps of the inventory of landslides for the metropolitan area of MDC in 2011. - In 2015, it started a project to strengthen capacity building of MDC staff on control and mitigation of landslides - In 2017, JICA signed a donation agreement for the Project Landslides Prevention in the National Road Number 6 CA-6	

3.2.8 Other municipal-level DRM stakeholders

Besides the institutions already mentioned in this report, other institutions very active on supporting the AMDC on DRM activities are:

a. Other donors: After supporting Tegucigalpa through its Initiative for Emergent and Sustainable Cities (ICES), IADB has continued its support both directly and indirectly. As part of the ICES Initiative with the Autonomous University of Honduras (UNAH) in 2010, it developed an inventory of greenhouse emissions (GHE) for the MDC. Afterwards the IADB supported the analysis which was the basis for the Municipal Information System for Territorial Studies (SIMET) for Tegucigalpa. Currently IADB is developing a Forestry Development Project for Honduras, which has received a grant from the Green Climate Fund, for protecting the river basins that supply water to Tegucigalpa.
b. Universities: The National University of Honduras, through its Institute for Earth Sciences, have collaborated in the development of risk studies for the AMDC, providing data collected through its meteorological network. Other university working in the field of DRM is the Zamorano University which has a training program for meteorologists.

Other institutions are called for action on a case-by-case basis, as recently happened during the COVID-19 response. E.g. the private sector through COHEP was called to be part of a committee to support the municipal response to the needs suddenly surged by the epidemic. However, there is not a specific and/ or permanent platform including the participation of the private sector in DRM activities on a regular basis.

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

As mentioned before, the impact of events such as Hurricane Mitch, as well as, the recurrence of floods and landslides, have made the population and authorities in the AMDC aware of how the city is exposed to these risks and how they could potentially affect people´s lives.
The relevance given to DRM and CCA by local authorities as cross-cutting issues for planning and management activities, confirm this. Despite its limited resources, the current administration of AMDC has invested considerably in DRM planning, drawing from the support from international donors and available technical local capacities. The COVID-19 pandemic has halted many DRM activities, but they are expected to resume progressively. Nonetheless, it is uncertain if the effort investing on risk knowledge and planning would keep pace after this administration and/or if the plans would be implemented, considering the scarcity of resources.

Key Points

The current AMDC administration has made a major effort to enforce DRM and CCA in the planning and implementation of all its activities.

DRM governance has been reinforced through capacity-building of municipal staff and the general population.

To fulfill its goals the AMDC has strategically drawn on a variety of resources, including those from international donors. Nonetheless, there is no guarantee that those efforts will continue after this administration term ends in January 2022.

A strategy for financial protection for the city is a priority. While there is a limited budget for emergencies, there is not a separate budget for DRM. Consequently, the AMDC often withdraws resources from other budget lines to respond to emergencies, affecting its financial stability and compromising investments for other areas of development.

The scarcity of financial resources can affect the possibility to protect what was built up to now for protecting the city against disaster risks.

3.3. Risk exposure, vulnerability and natural hazards data:

3.3.1 Existing data sources

a. At the national level

At the national level, several institutions collect, administer, and analyze meteorological and seismological information. Some of those institutions are listed in the following chart.

Table 4: Main sources of meteorological information

Name of Institution	Network
CENAOS- the National Center for Atmospheric, Oceanographic, and Seismological Studies	A network of automatic stations functioning since 2018 and an extended network of conventional meteorological stations working throughout the country since 1965.
AHAC- Honduran Agency for Civil Aviation	A network of meteorological stations located in airports within the country, which has information from 1950.
Secretary of Natural Resources and Environment – MIAMBIENTE	Controls a network of conventional stations and satellite ones.
National University of Honduras	A network of meteorological stations located in three campuses in the country with information collected since 1976.
The Autonomous National System of Aqueducts and Sewage (SANAA)	15-20 stations in the country for measuring river level and quality of water.

There are also other sources of data as the National Electric Energy Company (ENEE), the Ministry for Agriculture and Livestock, and private networks such as the ones owned by telecommunications companies. Members of the SINAGER indicate there is limited coordination among all these institutions. To overcome this challenge, in 2018, the World Bank made an evaluation and proposal for the modernization of the hydro-meteorological and climate services in Honduras as a plan for future improvements in the system[33].

The only open-source data about previous natural hazards, epidemic, and their consequences in terms of life and economic losses is the DESINVENTAR database.[34] It has information from past events from 1915 to 2015 for Honduras and from 1966 to 2015 for Tegucigalpa. However, according to interviewed SINAGER members, the information on DESINVENTAR is not accurate, especially that referring to losses and damages.

[33] According to CENAOS the implementation of measure recommended in the plan require a combination of political willingness and budget which is pending of approval.

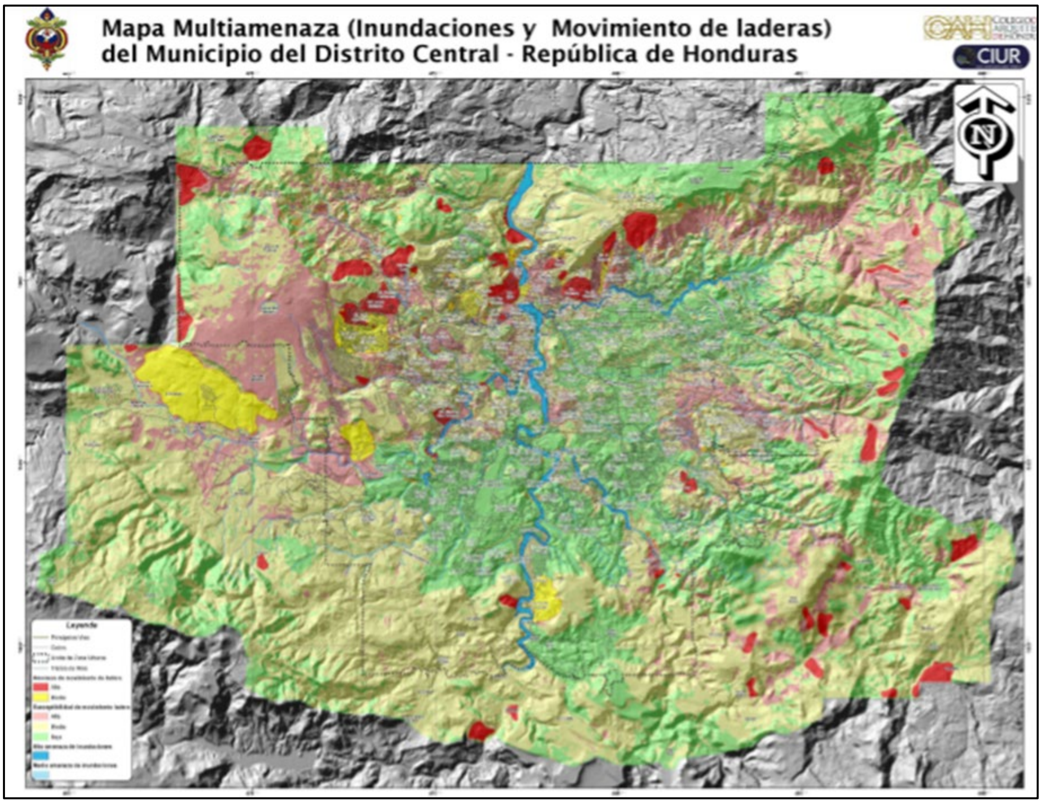
[34] Desinventar or Inventory system of disasters, is a regional disaster database, with information of little, medium and high impacts and was developed for the Network of Social Studies for Disaster Prevention in LAC (LA RED). Originally, its integrated news on communication means and official information about disasters. https://www.desinventar.net/DesInventar/profiletab.jsp#more_info

b. Existing data at the local level

Data from all studies made in the last years at AMDC has been included in the open public platform at the cadastral level: https://amdc.giscloud.com/. The platform consists of a series of map layers showing the risk of flood, landslides, and other hazards, such as:

a) The flood hazard maps developed under the framework of the Emerging and Sustainable Cities Initiative from IADB in 2014.
b) The multi-risk hazards map developed with the collaboration of PNUD 2010 and the National University of Honduras.
c) The landslide inventory made with the support from JICA.
d) The diagnostic of floods and landslides made by JICA, after the Mitch catastrophe, made between 2001-2002, from which a Master Plan for landslides control is developed
e) The study of superficial geology susceptibility conditions.

All those sources of information appeared under the following map.



Map 2 – Multihazard map of MDC. Source: https://amdc.giscloud.com/

3.3.2 Available data about risk exposure and vulnerability to natural hazards

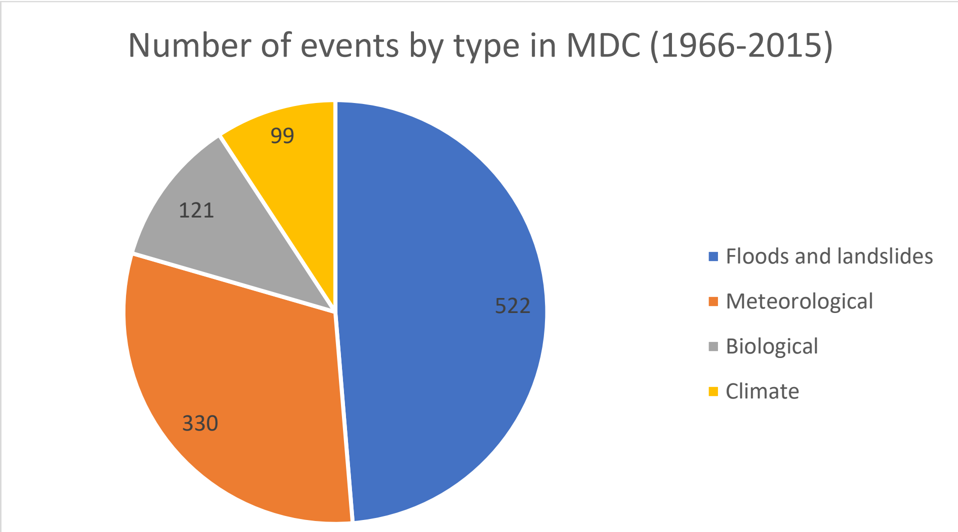
Available data

Risk exposure and vulnerability of the MDC is a result of a combination of factors and processes. On the one hand, the city's location – a valley with several lower hills surrounded by a chain of mountains – make it vulnerable. On the other hand, its unplanned expansion, influenced by a migration process from the rural areas, with the high occupation along steep slopes, has produced a tremendous pressure on land-use. The lack of territorial planning and the limited-to-no enforcement on the approved regulation has increased the city's vulnerability even beyond the regular rainy season.

The main data set is recorded on the DESINVENTAR platform, which has updated records from 1915 to 2015. In 2015, the AMDC joined with the collaboration between the United Nations Office for Disaster Risk Reduction (UNISDR) and Corporation OSSO, and the work of the Honduran Institute for Earth Sciences Historical from the National University of Honduras, to update the 1643 records of events produced in Tegucigalpa. That data shows an alarming increase of the number of events in recent decades: 137 events from 1990 to 1999, 234 events from 2000-2009, and 425 events from 2010-2015. Currently, the UMGIR is updating the DESINVENTAR data files from 2016 to 2020.

Graphic 3 shows that of the total number of 1,072 events reported from 1966 to 2015, 49% have been hydrological events (floods and landslides) followed by 31% meteorological events (as hurricanes, tropical storms, extreme temperatures, among other), 11% biological events, and 9% climate events.

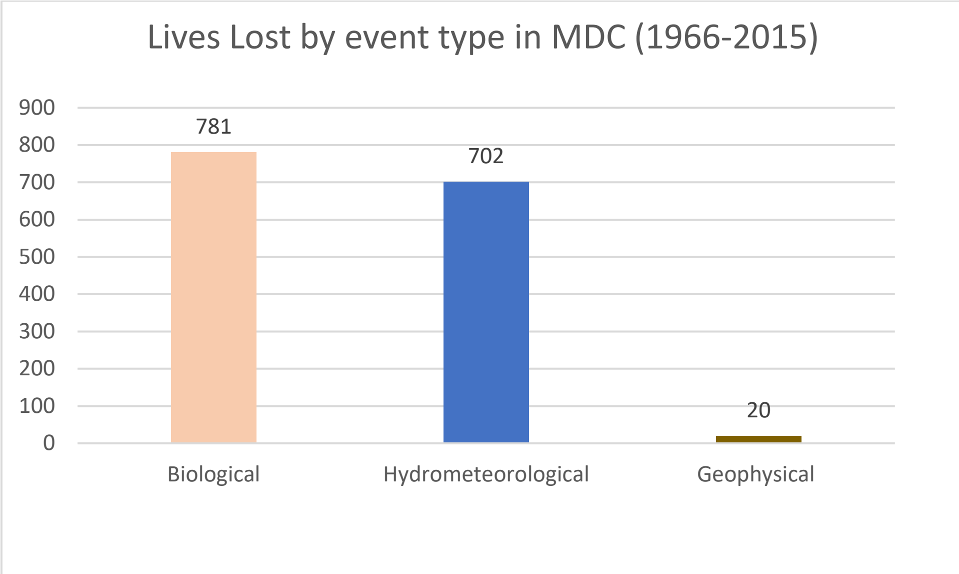
Graphic 3- Number of events by type in MDC



Source: Desinventar - Local Action Plan for the Disaster Risk Reduction and Resilience (2017)

Among the recorded events in DESINVENTAR, those that have produced more lives lost are: the ones of the biological origin, with 781 deaths in total, due to bacterial diseases as cholera, leptospirosis, by viral illnesses (such as dengue) or by parasites as malaria and massive intoxications. However, it is essential to note that most of those diseases have surged after events associated with floods. The number of deaths from hydrometeorological events (floods, hurricanes, tropical cyclone/storm, convective storms, and high temperatures) reached 701 people in the same period. In contrast, the human losses for geophysical events (seismic events and landslides) were 20[35].

Graphic 4- Number of lives lost by type of event at MDC



The losses produced by COVD-19 were not taken into account in DESINVENTAR records. Until August 30, 2020, the recorded number of lives lost from COVID-19 is 2,249, a more significant number than the total 1,503 deaths from all causes from 1966 to 2015.[36]

The greatest number of events registered in a year was in 2010, with 309 events recorded. In that year, Tropical Storm Agatha produced severe floods and other related events, such as overflowing of rivers, flash floods, and landslides, in different areas. As in that case, the hydrological events are regularly linked with meteorological events.

Annex 6 shows information from past events, mainly hurricanes and tropical storms, in terms of losses of life, number of houses affected, and infrastructure damage.

The DESINVENTAR records do not reflect precisely the economic impact of all the registered events, since there was not a standardized report of damages and losses and only directed losses at the time of the event were reported. According to DESINVENTAR, the hydro-meteorological events in the MDC has generated losses of approximately USD 582 million from 1965 to 2015. According to the Local Action Plan for Disaster Risk Reduction and Resilience (2018), of all events, Hurricane Mitch had the highest economic impact to the MDC with about USD 460 million of losses, 300 lives losses and 63 families affected. Those numbers appear underestimated considering the estimations describe above for the entire country and being MDC historically, the capital and the most significant urban area in the country and base of important economic activities.

[35] Source: Local Action Plan for Disaster Risk Reduction and Resilience (2017), based on Desinventar data base.
[36] Source: https://covid19honduras.org/, as of September 25, 2020.

Using insurance proprietary technology, an analysis of the risk profile of the MDC is included as Annex 7.

Projection of future risks

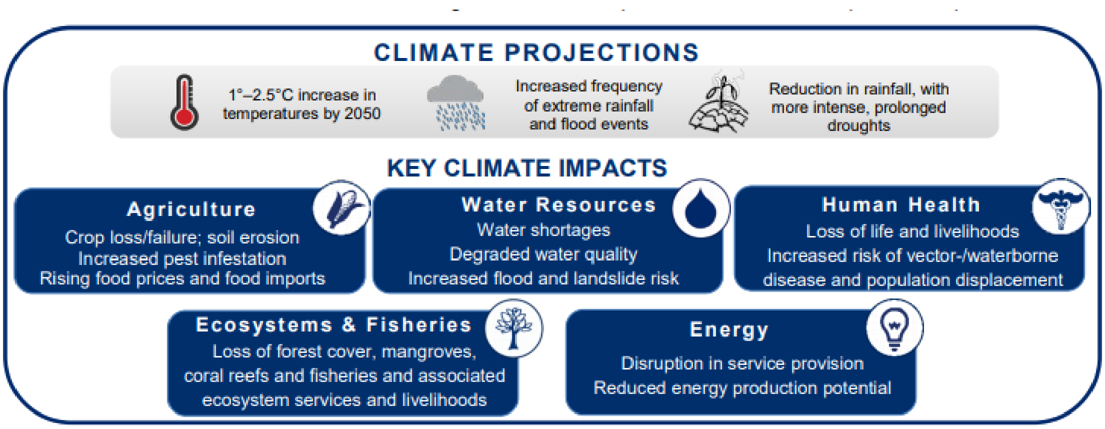
Per USAID Climate Change Risk Profile, "Honduras, one of the poorest countries in the Western Hemisphere, is vulnerable to climate change due to its high exposure to climate-related hazards (hurricanes, tropical storms, floods, droughts, landslides) that devastate crops and critical infrastructure. In 1998, Hurricane Mitch destroyed an estimated 70 percent of the country's crops and infrastructure, causing more than 10,000 deaths and $3 billion in damage, significantly setting back Honduras' development process. The economy has diversified into industry and services, but agriculture still accounts for 14 percent of GDP. Honduras has a high rural population (more than 50 percent), of which 65 percent lives in poverty. The rural poor overwhelmingly depend on rainfed agriculture as their principle livelihood and are concentrated in the southern and western regions, known as the Dry Corridor, where food insecurity has become a recurrent issue; 58 percent of children under five suffer from chronic undernutrition. In urban areas, migration from rural areas and population growth have pushed settlements into hazard-prone zones that lack water management systems, resulting in frequent flooding and water scarcity in major cities and towns (Tegucigalpa, San Pedro Sula, La Ceiba, Choloma and Tela). Climate change will increase the frequency and severity of water scarcity and climate-related hazards and put additional strain on the Honduran government's capacity to address ongoing development barriers, including extreme inequality, low levels of education, acute environmental degradation, and rampant crime and violence."[37,38,39,40,41]

The Plan for Adaptation to Climate Change for MDC includes the projections established by the 3rd National Communication[42] for Climate Change for the 4 RCP[43] set by the Intergovernmental Panel for Climate Change (IPCC) for climate scenarios to 2030, 2050, and 2080 estimated for MDC. The projection set the following patterns:

a) Scenarios projected to 2030: The precipitation scenarios show deficits in the humid period that means an intensification of the "canícula" (dry days in the rainy season) period. For the rest of the year, there is a projection of an increase of precipitation, especially during March, April, and May, extending the rainy season. The precipitations patterns change in +10% and -10%
b) Scenarios to 2050: Those continue the projections of precipitations deficits, especially during June, July, August (-8% to -15%). In the four scenarios considered, there is an increase in precipitation in March, April, and May, reaching +20% on the optimistic and lower optimistic scenarios.
c) Scenarios to 2080: There is a decrease in precipitation during the whole year in the pessimistic scenario, while there is a low reduction in rainfall only for the trimester December, January, and February in the optimistic scenario. See consequences on next graphic.

[37] CLIMATE CHANGE RISK IN HONDURAS: COUNTRY RISK PROFILE. https://www.climatelinks.org/sites/default/files/asset/document/2017_USAID%20ATLAS_Climate%20Change%20Risk%20Profile_Honduras.pdf
[38] Canadian Catholic Organization for Development and Peace. 2015. Feeling the Heat.
[39] CIA. 2016. World Factbook: Guatemala.
[40] USAID 2014. Honduras Nutrition Profile.
[41] World Bank. 2014. Country Data
[42] Plan for Adaptation to Climate Change from MDC (2019).
[43] RCP, representative concentrations pathways. RCP is a greenhouse (CO2) concentration (not emission) adopted by the IPCC, used for climate modeling and research. The four RCP are set on 2.6 (optimistic),4.5 (lower optimistic), 6.0 and 8.5 (pessimistic).

Graphic 5 - Climate Projections[44]



Because of climate change, the pattern of the rainy season will show an increase in intensity and volume in a lower number of days and an extension of the number of dry days. Considering climate change impacts for the whole country are an expected rise in annual temperatures, the decrease of annual precipitation, and more extreme events.

As a summary, the main natural hazards related to climate change that could affect the city will be those with the hydrologic origin, being the floods and landslides the main ones. Floods could be associated to river overflow, river flood, landslides after the event or flash floods. The landslides can produce slides of soil, stones and debris.

Among those meteorological origin, as tropical cyclone or convective storms and those of climatological origin as drought and uncontrollable fires. The convective storms and tropical cyclones can generate strong wind and intense rain. The droughts and uncontrollable fires can affect forest and lands for agriculture, with the affectation of lives, biodiversity, and increase of deforested areas.

These climate patterns create the need to re-design and amplify the pluvial drainage in urban areas and store excess water for the dry period.

Cost of those risks

Hurricane Mitch from 1998 produced a significant impact on the lives and economy of the country and is usually considered as a breaking point on DRM in the country. It is by far the most studied, despite other events as the Tropical Storm Agatha produced more subsequent events.

One report prepared by the CEPAL in 1998[45]estimated the economic impact of the Mitch Hurricane (direct and indirect losses) was approximately USD 4,000 billion, an equivalent of 70% of the GDP of 1998. The report mentioned the sectors which presented more losses were agriculture, transportation, communications (mainly roads), and housing. The productive

[44] Graphic Source: CLIMATE CHANGE RISK IN HONDURAS: COUNTRY RISK PROFILE.https://www.climatelinks.org/sites/default/files/asset/document/2017_USAID%20ATLAS_Climate%20Change%20Risk%20Profile_Honduras.pdf

[45] Source: Honduras: Evaluación de los Daños ocasionados por el Huracán Mitch, 1998. https://repositorio.cepal.org/bitstream/handle/11362/25352/LCmexL367spa_es.pdf?sequence=1&isAllowed=y

losses form 1998 and 1999 were estimated at USD 1,800 billion. According to the Health Secretary of Honduras and the Pan-American Organization for Health[46], the affected population by the Hurricane reached 1.5 million people, while approximately there were 5,657 dead people plus 8,085 missing people, 12,272 injured people, and 285,000 people lost their houses

According to the study prepared in 2015 by the IADB's[47]Initiative for Emerging and Sustainable Cities (ICES) , the expected median annual value of flood damages could duplicate, going from the estimated amount of USD 7.5 million in 2014, to 15.08 million in 2050 if the MDC does not take measures to prevent floods of any origin in the city and control the patterns of urban development. On the other side, if measures to improve water use (from rain and natural sources) are not undertaken, the water supply could be a considerable barrier for city development in the next decade.

Key Points

Floods and landslides risks represent the greatest concern for MDC, due to their recurrence and impact on the city. The economic impact of those risks has not been adequately estimated, limiting its comparison with the costs of prevention and reduction measures.

Nonetheless, a series of mitigation measures for infrastructure against natural disasters risk have been carried out by the current administration.

The main stakeholders supporting DRM and CC planning and activities are international donor agencies.

Financial tools to provide protection against the effects of natural disasters are in the process to be implemented at the national level and do not exist at the city level.

[46] Source: El Huracán Mitch en Honduras. Secretaría de Salud y Organización Panamericaca de la Salud. CIDBIMENA. http://cidbimena.desastres.hn/ri-hn/pdf/spa/doc12140/doc12140-contenido.pdf

[47] ICES (2015). Diagnostic MDC. Emerging and Sustainable Cities Initiative. Tegucigalpa: IDOM

4. Potential insurance solution proposal

Based on the research work carried for this feasibility study, and guided by the input from representatives of the municipal administration, we conclude that there is feasibility for the development and implementation of climate and natural disaster risk transfer solutions for CDM. The main guiding factors for this conclusion include:

- climate and natural disaster risk exposure of vulnerable populations
- existing demand for the insurance products, manifested to KfW and ISF as well as Global Communities and WTW, to protect important investments in real assets by the municipal government
- display of understanding by city-officers of disaster insurance and need for risk transfer products to complement existing insurance portfolios.
- inexistence of such products for the target policy holder and ultimate beneficiaries currently in the local market,
- an all-parties perception that the risks addressed will become more severe as a result of climate change
- confirmed risk capacity appetite for climate and natural disaster protections in Honduras by the international reinsurance markets.

Additionally, the city administration is keen on supporting the development of conducive regulatory frameworks, as needed, to further foster the implementation of new, innovative insurance solutions, in particular in the form of parametric risk transfer instruments.

Out of the feasibility study, the project's objective will be to develop new, tailor-made, and sustainable climate and natural disaster risk insurance protections for the MDC.

Along the process to develop an insurance product for AMDC, we will seek to engage with risk management representatives of other cities in Honduras, involving them early on to create awareness of the possibilities for risk transfer via innovative insurance solutions. The goal of this engagement will be to test the basis for replication with cities across the country, including considerations for city risk pools.

4.1. Main characteristics of a potential insurance product for AMDC

Policy holder: the city government of the Central District (indirect macro-level type cover).

Beneficiaries: all population of the MDC will be indirectly benefited from the insurance product

Insured climate related perils: floods and landslides.

The AMDC is exposed to both pluvial and fluvial flood, as per the risk scoring and/or input from the municipal representatives. There is currently no available flood risk model for Honduras that is available to WTW (or the insurance industry); this may change as the project advances. Without a flood risk model, the flood peril will be addressed via excess rain coverage, a common practice for parametric solutions worldwide.

We acknowledge that landslide is not a climate risks, it is a natural disaster risk. Moreover, it is not present in the Risk Scoring (Annex 7). However: a) the municipality has expressed concrete need for protections against this peril, and b) landslides can be caused by heavy rain, a natural hazard that will increase in severity (and probably frequency) in the region due to climate change. Priorities identified by the municipal government:

Risk	Priority
Floods	1
Landslides	2
Forest Fires	3
Droughts	4
Plagues due to climate change	5
Heat waves, diseases associated with high temperatures	6

Insured Assets:
Municipal infrastructure:

- municipal buildings
- municipal markets
- road infrastructure: bridges, main city roadways
- municipal viaducts
- water and sewage network (becoming municipal property by the end of 2020)

During the engagement with the Administration of MDC, we aimed to receive a list of potential insured values. It should be noted that the COVID crisis has impacted the Finance Department of the municipality of the MDC, resulting in a reduced work forced and overlapping priorities, hence the municipal government could not deliver, by September 30th 2020, a final list of assets and insured values.

Product type:

- Food parametric cover. Please read additional details for considering this product as Annex 8.
- Indemnity landslide cover. As we submit this feasibility study, consideration is being given to latest research on the feasibility to develop parametric landslide protections. This will need time for technical research on viability; hence we will continue to evaluate feasibility in the next months as the project unfolds.

Insurance payout structure:

- Flood parametric: Likely parametric index or modelled loss, variable pay-out structure by peril
- Landslides indemnity: To be determined upon product structuring but likely to be conventional indemnity based on loss adjustment against insured value

Geographical coverage: MDC

Stand-alone or bundled with other services: Stand alone, integrated into Municipal Emergency Response Plans.

Type and number of aggregators providing access to end-beneficiaries: 1 aggregator in the form of the municipal government of the MDC.

Relation between insurance sum and potential loss/ damage:

- Flood parametric: Insurance will be designed to cover costs of emergency response and operations; damage to infrastructure and restoration of basic services run by municipality; general continuity of governance and social stability.
- Landslides indemnity: Indemnity cover so will cover ex-tent of losses once adjustment and policy conditions are factored in (e.g. deductible)

Frequency of payouts & premium levels (RoL in %): To be determined during product structuring and in close consultation with the Municipality.

Data basis (incl. type, source, granularity, data history, availability):

- Flood parametric: Satellite data, both licensed and publicly available (rainfall, flood extent/depth/duration, potentially acute landslide location/extent if viable parametric landslide). Potentially modelled outputs (ground shaking, rainfall, flood). Ground data (rainfall, ground shaking, river flow)
- Landslides indemnity: On-the-ground post-event loss adjustment

Deductibles:

- Flood parametric: None; parametric structuring will accommodate equivalent of deductible in indemnity programs
- Landslides indemnity: To be determined upon product structuring

Loss assessment method:

- Flood parametric: Parametric
- Landslides indemnity: Conventional post-loss engineering and loss analysis by insurer per claims settlement process captured in policy terms and conditions

Average time till the benefit reaches end-beneficiaries:

- Flood parametric: Maximum 14 days until benefit reaches policy holder. This cover aims to unlock funding for immediate response by municipal agencies, in the knowledge that insurance pay-outs will offset immediate response costs. If funding is available, a further project shall aim to introduce the insurance solutions into existing municipal disaster response plans, and where possible, foster municipal Post-Risk Event Response and Recovery Plans.
- Landslides indemnity: Likely to be slower than parametric and replace like-for-like in terms of built infrastructure damage and destruction so slower process of pay-out funds being spent

Type of basis risk:

- Flood parametric: Circumstances on the ground poorly reflected in parametric proxy, therefore access to satelital data would be explored during product development process.[48]
- Landslides indemnity: Client expectations vs policy conditions (e.g. deductible, under-insurance, etc.)

Mandatory or voluntary: Voluntary (decision by the municipal authorities to purchase the product designed with and for them).

[48] Despite the short period of registries from SAT (manual stations' data since 2014 and automatic stations' data since 2018), the feasibility of using that information for developing the proposed insurance product will be explored during the product development process.

Index definition: For flood parametric cover, certain flood extent / duration / depth, certain seismic shaking intensity. If landslide parametric viable, intensity of rainfall and seismic shaking in landslide-prone areas for landslide component

Premium payment: by Municipal Government of the Central District (AMDC) (indirect macro-level type cover), via allocation of premium funding in the municipal budget, which annually gets approved on November 30th, however, can be amended via the Municipal Council. The budgetary allocations are backed up by a public financial trust.

Parties to be involved in the insurance development process and their role: The product development process will require the contribution of the main DRM stakeholders at national and city level, which are briefly detailed below:

Table 5: Parties Involved in Insurance Development Process

Institutions	Role
AMDC	It shall confirm the assets, provide information about those and potential sources of funding for paying premiums. It also can provide additional detailed risk data. It shall include premium payment on the annual budget. I t shall include the product development process on all relevant implementation plans for DRM and CCA (including a financial strategy) It needs to guarantee the proper used of payouts for the agreed protection and include relevant flow of processes on Plan for Emergency Response update.[49, 50]
Autonomous National System of Aqueducts and Sewage (SANAA)	To provide detailed information about the network that would be transferred to the AMDC (at the end of this year) which will be subject to protection
International donors	Support the development of a strategy to prioritize mitigation actions on crucial infrastructure in the city. Provide premium subsidy and support the development of a phase/ out strategy
CAHDA - Insurance Company Association from Honduras	CAHDA shall support the initiative and propose a conducive regulatory framework for parametric products It could also support the capacity building efforts among the industry members A local insurance company shall be the risk- taker for the product
Reinsurance industry	The availability of reinsurance capacity shall be considered up front, to properly define the nature of the risks and to support the financial capacity of any Honduran insurance company
Universities	They can contribute with relevant data and risk research studies (specially landslides)

[49] The current Plan for Preparation and Response from AMDC (2013) indicates that it is the Human Development Area – part of the Community Management and Human Development Direction- the area in charge to provide humanitarian assistance in case of a disaster. To define the kind of assistance needed, the Human Development Area and the Prevention and Mitigation Areas in coordination with the Local Emergency Committees, shall develop the Damages Assessment and Needs Analysis (EDAN) and issue a preliminary report at the first eight hours after the event and other reports within the 24 hours and 72 hours and a final report. The Prevention and Mitigation area evaluates the damages to main basic services and houses in the areas affected, while the Human Development Area, evaluates the humanitarian needs of population affected: shelter, food, health and security. In the case of a disaster event, the MDC deliver emergency relief packages by family with basic food, hygiene kits, as well as temporary shelter.

[50] A new Plan for Emergencies Response is under development. It is expected to be approved before the end of 2020. Any further product development will need to align with the new Plan, when it will be published.

4.2 Gaps which need to be fulfilled

a. **Budget gap** It has not been possible to assess the potential budget gap from AMDC to pay for the proposed product, for the reason previously exposed. the MDC limited economic capacity has been mentioned along this report. The trust fund used as a financial tool by AMDC for the development of public infrastructure, could potentially be used also for funding premiums, which will require the approval of the Municipal Council. The lack of a financial strategy for DRM evidence the need of the AMDC to approach this topic since a broader perspective. Premium subsidies would be needed in an initial phase and a phase-out strategy shall be required.

b. Insurance regulatory landscape for product development.

Regulatory issues. The insurance sector in Honduras is supervised by the National Commission of Banks and Insurance (CNBS), and the Superintendency of Insurance, which has authority to propose laws to the National Congress and to issue decrees and guidelines for the industry. They are currently drafting a modification of the Law for Insurance Institutions as well as a new regulation for agricultural insurance.

The Law for Insurance and Reinsurance Institutions from Honduras, Decree 22-2001, established that only national and foreign companies formally established and authorized by the Central Bank of Honduras, could perform risk taking activities. However, operations of fronting are also legally feasible, with the condition that the contractor will be a person o legal entity located abroad. [51]

The new regulation for agricultural insurance is being developed as part of the

Project for a parametric product for droughts in Honduras

From 2014 to 2018, the Climate Change Adaptation and Food Security Program (CGIAR) and the International Institute for Climate and Society (IRI), jointly with the Zamorano University and the Secretary of Agriculture from Honduras, developed a proposal for a parametric risk product focused on the agricultural sector – to protect small producers of different basic seeds in Honduras from droughts. The project developed the models and a technical note for the product, which was submitted to the Insurance Superintendency at that time. The process included a training session about parametric insurance for the local insurance industry. Ultimately the product was not marketed, possibly due to the lack of a reinsurance company committed and involved in the product development from the beginning, limited interest of insurance companies in the product, and a lack of regulation for parametric products.[i]

i. Interview with the CGIAR-IRI Project Coordinator, Ms. Sofía Martínez, held on July 30th, 2020.

[51] Regulation for Reinsurance Operations and Foreigner Reinsurance and Brokers Registry. Resolution SS- 2016/16-12-2010.

government's broader effort to promote food security in light of the current COVID-19 pandemic.[52] The National Association of Insurance Companies has announced its interest to participate in the process for the regulation of agricultural insurance and has made a proposal through the COHEP.

Given the relative urgency of properly addressing climate risk and the government's expressed interest in risk transfer solutions related to this risk, approval of this proposed parametric cover could be secured through the issuance of a supportive decree or other form of legal support from the government as an interim step before a formal regulatory solution is possible. The support of the local insurance industry should be available in light of their support for the agricultural product and the implicit expansion of insurance coverage in the market; and given the relative sophistication of the parties entering into the arrangement, securing a parametric cover at the municipal level should not be subject to delays in the approval process to account for consumer protection concerns considered for retail products issued to the public.

More formally, insurance contracts are regulated by the Code of Commerce, while the regulation for the insurance contract and policies registry were established under CNBS Circular No. 001/2017. According to the Insurance Superintendency, while there is no restriction in the law for the development of a parametric or index insurance product, it is worth noting that the insurance industry had not expressed interest in issuing such a product until the recent discussions on agricultural insurance.[53]

Although not prohibited, there is also no explicit authority for the issuance of parametric insurance in Honduras. Because payments are made based on the triggering of an index and not indemnification of an actual loss, it is not unusual that parametric insurance is not addressed in the insurance law. The regulatory process currently under development by the Insurance Superintendency for a parametric product to protect the agricultural sector in response to the COVID-19 pandemic could serve as a model for the creation of a regulatory regime for other parametric products. Previous initiatives didn´t reach success also due to high staff turnover in the private and public insurance sector, staff retention strategies as well as capacity building efforts in the field of parametric product development and supervision for the local industry would be needed.

Recent statements of interest from the National Commission for Banking and Insurance (CNBS) and of the local association of insurance companies[54] in considering a parametric product to help address climate-related risk can be leveraged to establish a proper foundation in the insurance law for the further use of such a product.

4.3. Summary of suggested risk mitigation measures for the assets to protect

Risk mitigation measure for vial infrastructure implemented by the AMDC during current administration was described in numeral 3.2.5 of this report.

[52] The framework for the government response to the COVID-19 pandemic and food security guarantee is established in Decree 33-2020 - Law for supporting the productive sector and workers against the effects of the COVID-19 pandemic.

[53] Article 1124 establishes that for a risk to be insurable, it must provoke financial damage, in the form of damages, loss of income or failure to receive expected benefits.

[54] As it was expressed in interviews held with the CNBS on July 13th, 2020 and with the Honduran Insurance Companies Association (CAHDA) on July 23rd, 2020. Details on official participating in both meeting are included in Annex 1.

In relation to the water and sewage network the AMDC expressed they knew those networks hasn´t received any investment since 30 or 35 years ago. Indeed, the CABEI funded a Master Plan for investments on reservoirs for MDC in 1998. But it was not implemented, due to the lack of counterpart contribution from Honduras. Among the expected investments is the Guacerique II, which will allow the management of water for MDC and would cost USD 800 million and a wastewater treatment plant.

Despite the AMDC has not received the administration of the network from SANAA yet, it has been advancing the process to building infrastructure to increase the capacity of the city's water supply. Some of these projects are:

- Design and construction of the reservoir Rancho Viejo in the El Picacho area, which also includes the regulation of water supply in the El Picacho subsystem, and a reserve for the control of forest-fires in the Park National La Tigra.
- Design and construction of micro dams in the Guacerique river basin, to improve the catchment capacity for the Laureles dam.
- Tender for the construction of the San José dam, in the Sabacuante basin.

Other important group of mitigation measures consisted on ditches will be implemented at community level with the support of KFW Program for Urban Adaptation, as it was detailed on section 3.2.5.
Notwithstanding these efforts, it will be necessary to develop a plan to prioritize retrofitting, reinforcing, and/or building of crucial infrastructure in the city such as multiple bridges required to connect the twin cities of Tegucigalpa and Comayaguela[55]. These bridges have a direct impact on the livelihoods of low-income population, connecting neighborhoods and enabling the population access to basic services. The inventory of public assets will also allow us to define additional mitigation measures for assets to protect by a potential insurance product.

4.4. Ability and capability to pay premiums

The city government of the Central District (indirect macro-level type cover), as a legal public entity is authorized to acquire services and goods, following the procedures[56]) establishes by the Law 74- 2001, Law on Public Contracting and its regulations, the Executive Agreement 55-2002. Applying that regulation, the AMDC acquired an insurance protection for administrative buildings, as explained in this report.

The AMDC has expressed its interest and willingness to pay for an insurance protection as such proposed in this study on interviews held with the responsible of its DRM area and the Director of the Administrative and Finance Area from MDC, who also they mentioned was confirmed by the Major [57]. They expressed that even if here is not a current budget line or Fund to pay the proposed product, they will be able to ask to the Municipal Council for an special approval to allocate resources for the insurance premiums in the municipal budget, which is submitted in September for approval of the

[55] Why bridges? JICA wrote "*All these activities generate an important amount of economic benefits to families, communities and in general, the areas affected with more income, employment and merchandising of products".* Please find more The Seven Bridges Construction Report including three at the MDC. https://www.mofa.go.jp/policy/oda/evaluation/FY2004/text-pdf/honduras.pdf

[56] The law established 3 type of procedures public tender, public contracts or direct hiring, according thresholds established annually in the general budget

[57] Interviews hold with the Chief of the DRM Unit, Ms. Cinthia Borjas and the Chief of the Financial and the Director of Administration and Finance. Mr. Mario Zeron, on July 11th and September 25th, 2020

Municipal Council in November each year, and adjusted during the year if it is needed with the required approval of the Municipal Council.[58]

Key Points

The proposed risk transfer solution is a flood parametric cover and indemnity landslide cover for the protection of municipal infrastructure and support disaster response operations by the municipality.
MDC will need premium subsidy at an initial stage. To guarantee product sustainability a broad financial strategy for DRM shall be in place.
The expected regulatory framework for a parametric product to protect for the agriculture sector could serve as a reference for parametric products for climate-related risks.
Due to high staff turnover in the public and private insurance sectors, the development of an insurance product for climate change risk should include a capacity building facility for the insurance sector in Honduras, to foster a sound foundation for the regulation and market for the product, and also to facilitate replicability in other municipalities in Honduras.
The availability of reinsurance capacity shall be considered up front, to properly define the nature of the risks and to support the financial capacity of any Honduran insurance company to take up climate-related risk.

[58] As there was not available information on the value of the assets to insure it has not been feasible to provide an estimation of insurance premium. Despite this fact, the referred authorities mentioned their willingness to allocate resources for this purpose.

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Annexes

Annex 1. Interviewed Institutions and officials

No.	Date	Institution	Participants
1	16-Mar-20	KfW Honduras	Ivettte Velaquez
2	16-Mar-20	Program for Climate Change Adapatation in Urban Areas ,	Marcelino Jimenez
3	18-Mar-20	ECA: Economics of Climate Adaptation Program	Maxime Souvignet, Alvaro Rojas Ferreira
4	11-Jun-20	GC, WTW and managers from the Tegucigalpa Municipality	Municipality staff, GC, WTW, KfW
5	22-Jun-20	Municipal Unit for Comprehensive Risk Management-UMGIR	Ruben Hernandez
6	23-Jun-20	Directorate of Territorial Planning and Civil Works	Julio Avilez
7	25-Jun-20	Administration and Finance Department	Marjorie Alvardo
8	25-Jun-20	Directorate of Community Management and Human Development	Fanny Mejia
9	29-Jun-20	Project for the Control and Mitigation of Disasters in the Slopes of the Central District (JICA)	Cincy Rosa
10	1-Jul-20	Environmental Management Unit-UGA	Silvia Becerra
11	6-Jul-20	Mayor representative and Finance Director	Cinthia Borjas, Mario Zeron
12	9-Jul-20	Coordinator -Disaster Risk Management Project-COPECO	Manuel Humberto Sanchez
13	13-Jul-20	National Banking & Insurance Commission-CNBS	Julieta Suazo (Superintendent), Dustin Uriel Santos Barahona , Ramón Cáceres Velásquez; Alejandra María Argueta Hernández ; Cinthya S. Martínez Pinel ; Cynthya Hernández; Alma R. Lazzari Huete ; Angela Flores
14	14-Jul-20	Director of Information Technology and Communications, COPECO	Gonzalo Funes Siercke
15	14-Jul-20	Municipal Unit for Comprehensive Risk Management-UMGIR	Roberto Granados Chahín
16	22-Jul-20	Center for Atmospheric, Oceanographic and Seismic Studies -CENAOS-COPECO	Jamilh Nasser, Estefana Velasquez
17	23-Jul-20	Honduran Chamber of Insurance Companies	Lesyi Araujo, Tesla Rivera, Maribel Cruz
18	27-Jul-20	National Center for Research and Training for Attention to Contingencies -CENICAC- COPECO	Lester Carias
19	28-Jul-20	National Directorate of Climate Change / AdaptarC + Project Coordinator- Ministry of the Environment	Sergio Palacios
20	29-Jul-20	National Association of Muncipalities	Maria Teresa Antunez, Daniela Reyes
21	31-Jul-20	CGIAR-International Research Institute for Climate and Society (IRI)Project Coordinator	Sofía Martínez
22	8-Aug-20	Presidential Office for Climate Change - Clima +	Orlando Garner
23	8-Aug-20	Ministry of Foreign Affairs	Wendy Flores, Leiny Guerrero
24	18-Aug-20	Honduran Private Sector Council (COHEP)	Gustavo Solorzano, Marvin Oseguera
25	3-Sep-20	Secretary of Finance	Lourdes Gonzales, Carlos Roberto Gutierrez, Juan Jose Urquiza, Oscar Berganza, Nestor Duron Aguilar
26	9-Sep-20	Central American Bank for Economic Integration	Norma Palma, Anel Murillo, Eduardo Gonzales, Javier Palacios
27	25-Sep-20	Municipality of Tegucigalpa	Cinthia Borjas, Mario Zeron, Maria Fernanda Flores

Annex 2. The National System of DRM

The system´s central coordinator and executing agency is the Permanent Commission for Contingencies (COPECO), led by the Commissioner, who also holds the post of Secretary of the system. However, last year the Executive Decree PCM No.057-2019 created the Secretary of Risk Management and National Contingencies, under which COPECO has been placed. No other change was made in the structure, and nowadays, the Commissioner also holds the position of Secretary of Risks Management and National Contingencies.

Last year through the Executive Decree PCM No.057-2019, it was created the Secretary of Risks Management and National Contingencies, under which umbrella COPECO has been allocated. The Secretary will be the policies leader of the system, while COPECO become the executing agency. No other change was made in the structure, and nowadays, the Commissioner also holds the position of the Secretary of Risks Management and National Contingencies.

All institutions recognize COPECO as the leader of DRM policy development and execution in the country. COPECO is responsible for leading, organizing, and coordinating DRM efforts, developing the DRM capacities of its members, and mainstream DRM in public institutions, programs, and investments in the country.

COPECO is also the institution in charge of proposing the National Plan for DRM and its updates for its discussion and approval by the SINAGER Governing Board, every four years, as well as other regulations for the system.

Other important institutions operating under COPECO's umbrella are:

- CENAOS – the National Center for Atmospheric, Oceanographic and Seismological Studies, which concentrates and administers part of the national data on these areas. As we will detail afterwards it is responsible for analyzing the information generated by all early warning systems of institutions in SINAGER and providing the reports to the decision-takers to issue warnings.
- CENICAC - the National Center for Training and Research about Contingencies, which is in charge of providing general guidelines to train CODEM and CODEL and disseminate available information about how to confront natural disasters. Their current main activity is to support the development of and to approve all municipalities' Emergency Plans. Regulation for the 2020 Honduran Republic Budget mandates all municipalities to have an emergency plan approved by COPECO, as a requirement to receive emergency funds from the Secretary of Finance.[59] In addition, training workshops for other levels of the SINAGER structure are provided upon request.
- COEN - National Operation Center for Emergency established by COPECO for each emergency that occurs in the country.
- CCAHI - the Coordination Center for International Humanitarian Help.

COPECO holds institutional, technical, administrative, and financial autonomy. It has a separate budget for its institutional activities according to law.

[59] Decree No. 171-2019.

Regional and local linkages. According to the law, there are Departmental (CODED) and Municipal (CODEM) Emergency Committees, which are linked to the Permanent Commission for Contingencies (COPECO). Nonetheless, in practice, there is no interaction or complementarity among the municipal and departmental political levels, and the CODEMs interact directly with COPECO. The departmental level of DRM appears in the law but has no political power, systemic responsibilities, or budgetary decision. Besides we found no records of an existing CODED.

Declaration of emergencies and calamities. According to law, a situation of emergency, national disaster, or calamity at the national level is declared by the President, attending the request from the Commissioner of COPECO. In the case of epidemiological emergencies, the Secretary of State for Health declares the emergencies and lead the other SINAGER institutions for responding to the crisis. The Secretary of State for Natural Resources and Environment has the responsibility of declaring environmental emergencies.
At the local level, the Municipal Corporations can issue the declaration of emergencies or public calamity in its jurisdiction. At the same time, it shall immediately communicate that declaration to SINAGER´s Governing Board through COPECO´s Commissioner.

Annex 3 – The local system for DRM at MDC

According the Law. No152, which established the National System for DRM in Honduras, the local level of the system is integrated by the Municipal Committees for Emergencies (CODEM), the Local Committees for Emergencies (CODEL), the Committees for Emergencies at Enterprises (CODECEL) and the Committees for Emergencies at Schools (CODECE).

a. The CODEM, CODEL and CODECE

The CODEM is the unit responsible for working on prevention, preparedness, and response to emergencies. The CODEM develops and proposes updates of the Emergency and Response Plan which is submitted to the Municipal Corporation for approval. It is indeed the largest CODEM from a city in Central America counting 71 staff.

The CODEM also has the responsibility of collecting the information and administer the early warning system (SAT). The SAT counts with 40 manual meteorological stations in the city and the Phone Line 100 for emergencies. It collects the data from the SAT and CODEL and provides that information t to COPECO. With the analysis reported by the COPECO, the CODEM issue early warnings for the city.

The constitution, training, and certification of new local committees for emergencies (CODEL) is a CODEM function. CODEL representatives are voluntary. Currently, there are 250 conformed CODEL along with the city territory. However, only 39 have been certified by now. At the community level, the CODEL are also responsible for monitoring the stations installed in their area and are the primary contact in case a disaster occurs.

The CODEM shall coordinate with Work Centers´ Emergency Committees (CODECEL) and the School Centers´ Emergency Committees (CODECE). Nonetheless, there is no CODECEL register by CODEM, while there is a process for the constitution of CODECEs at schools, which was deferred by the COVID-19 outbreak.

Law No. 151 prescribed that each public or private institution shall have a prevention officer responsible to follow-up the accomplishment of DRM regulation at the institutional level. In the case of MDC, the prevention officers work for the Risk Evaluation Area. Prevention officers prepare risk evaluation reports for any new construction or modification prior the permits are approved.

b. Other units involved in DRM at AMDC

The Municipal Council, in October 2017, issue the Agreement No. 20, which established the regulation for the reduction of DR at MDC, and delineate the roles and responsibilities of all areas working in DRM, which are briefly described below:

Roles and Responsibilities at the Municipal Disaster Risk Management System	
Unit	Responsibility
Municipal Unit for Integral Risk Management-UMGIR	• To establishes the guidelines for planning, action, and follow-up of the Risk Management Policy for MDC and coordinate the development and implementation of its application strategy. It also monitors the DRM plans,

	coordinate DRM projects and action in DRM and climate change.
Risk Evaluation	• To Perform risk evaluation of new/ enhancement/ modifications of properties • To evaluate risk and damages in case of a natural disaster occurs • Prevention Officials -indicated as main evaluators and comptroller of law fulfillment- are part of this unit, and their evaluation is definitive for the approval of works in the city.
Environmental Management	• To perform the environmental assessment of new projects • To issue the environmental licenses for new buildings
Territorial Organization Direction	• To issue the new building licenses through a specific area (Control of Construction area) • To administrate the cadastral base
Municipal Community Management and Human Development Department	• To coordinate the communities´ approval to new works in their area

Municipal Council Agreement No.29 dated October 18th, 2017 also created the Municipal Committee of Risk Evaluation, which is integrated by all these areas plus the legal area, the Cadastral area, and the Control of Construction area. This Committee has the responsibility to decide in the case a new construction presents a complex risk scenario, on which a joint agreement is requested.

Additionally, another institution involved in disaster response is the General Fire Department.

Annex 4. Main Policies issued in the last few years in AMDC

In the last years, the UMGIR has developed the following central policies and plans, which are the framework for DRM in the city:

- The Municipal Policy for the Integrated Disaster Risk Management at MDC (2018), in the context of Climate Change and land-use planning, counting with the funding and support from USAID through the NGO goal. This Policy establishes as objective number 5th, the need to generate municipal capacities for the financial management of risk and climate change adaptation, to implement structural and non-structural investments for urban and rural resilience.
- The Implementation Strategy for the Municipal Policy for the integral Management of DR at MDC, also funded through USAID-GOAL. The strategy includes a series of guidelines, activities, and measures to implement the Municipal Policy for DRM in the short, medium, and long term, to be implemented for the period 2018 to 2028. The document includes as objective number 5 of the Municipal Policy for DRM:
    - To search for international cooperation assistance for: a. developing the municipal capacities for the financial management of DRM b. formulating a financial strategy for DRM c. Developing tools for financial risk management d. Developing insurance markets
    - Creating a dedicated Municipal Fund for contingencies
    - The possible inclusion of a new dedicated contribution for funding DRM at the city

- The Local Action Plan for Disaster Risk Reduction and Resilience (2018), was funded by the UNISDR and the European Commission. The Plan was developed with a participatory methodology, gathering the contribution of a series of representatives from the public, private, and non-governmental sectors in workshops and revisions. It integrates a situational analysis of the current state of DRM in the city (needs, gaps, and opportunities) to land in a list of four main pillars, ten areas, and twenty-nine action lines. Among them, the second pillar of work, described as functional, is the financial capacity for increasing resilience. That pillar includes as main action lines, to develop a financial strategy for financial protection against disaster risks -including retention and risk transfer mechanism as insurance and promoting the development of local insurance markets- ; to understand the economic impact of disasters and the need to invest on resilience; to have dedicated budget lines for DRM and resilience; and to strengthen the MDC financial capacities for responding to recovery and reconstruction processes. The instrument also has particular a value because of its multi-stakeholder’s approach and approval.

  Other DRM Plans and regulation issued on the last years, appear on the following Chart.

DRM Plans and Regulations developed in the last years	
Year	**Plan/regulation**
2013	Updated Plan for Preparation and Response to Disasters- CODEM
2014	Municipal Development Plan with focus on territorial organization
2015	Action Plan for the Emerging and Sustainable Cities (ICE) Initiative promoted by the IADB
2017	Regulation for Sustainable Building
2017	Regulation for DR Reduction at the MDC
2018	Zoning regulation
2019	Municipal Plan for Climate Change Adaptation

An updated Plan for Emergencies is being developed and is expected to be approved for the end of the current year.

Annex 5. Activities to be performed under the COMUDE Initiative

The COMUDE - Municipal Committee for Territorial Data (2017), covering 21 areas for the Municipality to centralize, harmonize and manage all relevant information for the territorial management and DRM in the city.

Among the activities planned under the COMUDE framework for data generation are:

a. The creation of the SIMET, the Municipal System of Territorial Studies. The SIMET was created to collect, back up, and provide unified information for policy planning and decision making as a tool for territorial organization, DRM, and CCA. The SIMET was created pursuant to a recommendation of the IADB-ICLEI project, which left a diagnostic. It has been implemented thanks to the contribution of the USAID-GOAL project. The SIMET is currently on its basic module, strengthening the early warning system.

b. The Early Warning System (SAT) focused on floods. The SAT is under implementation with the support of the USAID- GOAL project. The project has provided funding for the purchase of 14 automatic stations, seven rain gauges, and seven river level meters, which are operating since October 2018.
   The automatic stations have registered information since 2018 on: rain, temperatures, river level, barometric pressure, and piezometric levels. Rain information at automatic stations is collected every 5 minutes and every hour. Atmospheric pressure and piezometric levels´ information are collected every hour.
   The early warning system will also include the information of 40 manual stations administered by the CODEM. Since 2014 these manual stations have registered information about rain and piezometric level that contributes to landslides. Rain gauges collect information every day, while inclinometers and piezometric levels' information is collected every 15 days.
   The automatic network of stations will be extended with the contribution of the Program for Urban Adaptation from KFW. The project aims to develop a warning system that could be easily used by the CODEM to send opportune alerts to the population through an app and messages, as well as reports to decision-makers. It would be completed in August 2021. [60]

c. Additionally, there is an Early Warning System (SAT) administrated by the CODEM, consisting of 40 rain gauges, all of them monitored manually by the CODEL. There is also a landslide monitoring system – which was funded by the BCIE – consisting of six (6) stations, of which only two (2) are currently functioning. The network of stations, property of the Autonomous National System for Aqueducts and Sewage (SANAA), will be transferred to the AMDC administration as soon as the end of this year.

d. With the collaboration of the Corporation OSSO[61], the AMDC is in the process of reviewing and updating information about past natural disasters from 2016 to 2019. The revision of the 2019 files has finished already.

e. Adaptation of the Damages, Loss and Needs Assessment methodology (in Spanish EDAN[62i]) to the city needs.

f. Supported by COPECO, AMDC will develop municipal models for precipitation

[60] Despite the short period of registries from SAT, the feasibility of using that information for developing the proposed insurance product will be explored during the product development process.

[61] One of the institutions which helped to create and develop the DESINVENTAR platform.

[62] EDAM: Evaluación de Daños y Análisis de Necesidades

forecasts.

g. The acquisition of a new back-up equipment to keep all information records centralized.
h. The development of an open platform at the cadastral level, which supports different layers of information, currently under the address https://amdc.giscloud.com/. The platform, which is a product of collaboration among international donors on different projects, includes a series of maps with different layers showing the risk of flood, landslides, and other hazards. The platform is a tool currently used for the population to identify the level and kind of risks to which their properties are exposed, as a requirement to get an authorization for build or renovate them. There is a pending initiative to acquire a broad band and to migrate the platform from giscloud to Geonode to facilitate the extended and continuous access to the platform by the citizens, but has not been implemented since those costs were not considered in the project and will require additional funding.

Annex 6. Historic data about disasters occurred in MDC.

TYPE OF EVENT	DATE	CATEGORY	IMPACTS
Francelia Hurricane	August 29 - Sept 4 Sept, 1969	3	Physical and economic damages to some houses.
Fifí Hurricane	Sept 14 - 22, 1974	2	Material losses Infrastructure damages Floods in some areas of MDC
Gilbert Hurricane	Sept 3- 19, 1988		Material losses Infrastructure damages Floods in some areas of MDC
Mitch Hurricane	Oct 22- Nov 5, 1998	5	80 quarters and 11 neighborhoods affected, damaged or completely destroyed River overflows Landslides
Félix Hurricane	August 31- Sep 5, 2007	5	Damages in El Chile quarter (8 sheltered people), Betania quarter (111 sheltered people), Soto neighborhood (128 sheltered people). Market: Las Américas, Colón y San Isidro evacuated.
Alex Hurricane	June 25 – July 2, 2008	2	Collapsed walls. Flooded houses in Ulloa neighborhood Sinking of Roads
Agatha Tropical Storm	May 29-30, 2010		Flood in Public Market La Isla. It affected: 324 merchants Electric Network Potable Water System distribution Sewage System Losses for 20 million of Lempiras.
Matthew Tropical Storm	Sept 23-26, 2010		Miramesi neighborhood was affected in a main road Public markets in Comayaguela were affected, for a total of 1,500 market stalls 1 loss life In El Chile quarter, 50 people were sheltered.
Harvey Tropical Storm	Aug 18-22, 2011		The Miramesi neighborhood was affected by landslides, 99 people sheltered In Roberto Suazo Córdova neighborhood, 55 people were sheltered
Source: Adapted from “Updated MDC *Municipal Plan for Preparation and Response.”* CODEM. 2013			

Annex 7. MDC Natural Catastrophe Risk Profile

The 226 locations in Tegucigalpa shown in Figure 1 are analyzed with Willis Towers Watson Global Peril Diagnostic (GDP) and Property Quantified (PQ) proprietary tools. The results are shown next.

River flood is flooding from rising water levels which overtop the riverbank to flood surrounding land. The river flood hazard layers have been created using the JBA global flood model, which uses elevation data from the Shuttle Radar Topography Mission to generate flood layers at the 1-in-100 (risk score = 5) and 1-in-500 (risk score = 3) year return periods.

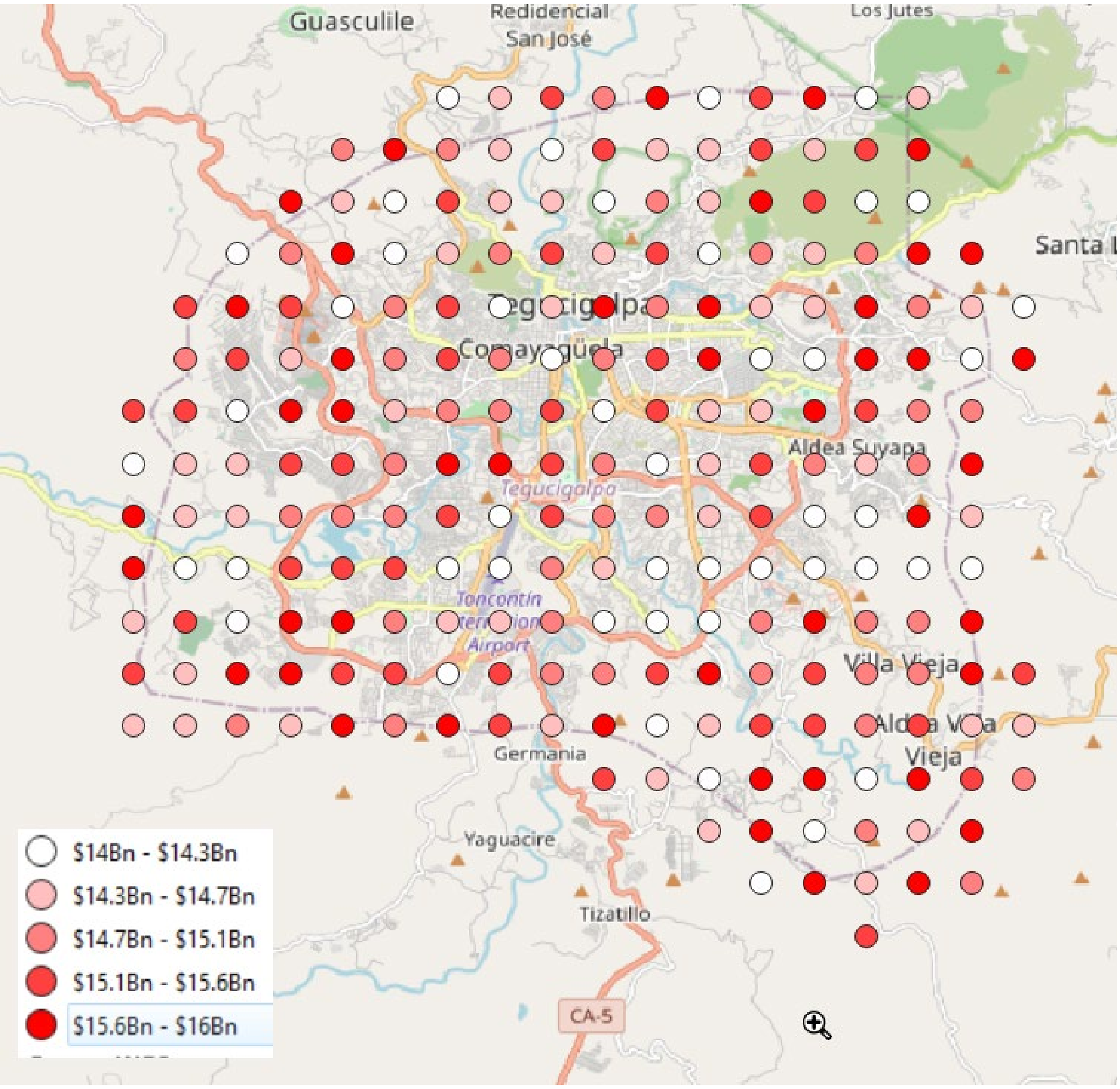


***Figure 1**: Theoretical exposure 1-km grid in Tegucigalpa constructed in order to analyze compute natural hazards risk scores and catastrophic losses. The exposure values were assigned randomly since an inventory of assets to be protected has not been available. The total amount of locations is 226.*

In the following maps risks to flood and landslides are shown.

The analysis shown in Figure 2 for Tegucigalpa, Honduras, aims to illustrate Willis Towers Watson's analytical capabilities. A more accurate and in-depth analysis can be performed if and when a detailed portfolio of risks for the area is provided.

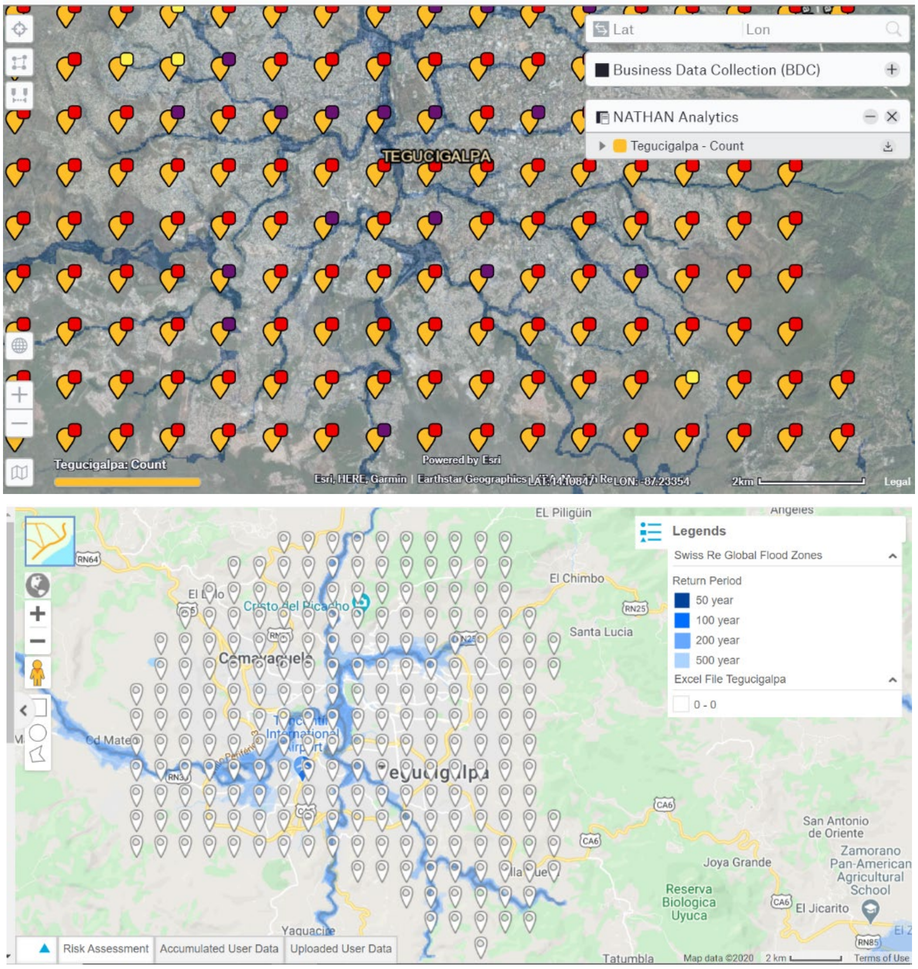


***Figure 2**: Flood Risk Scores distribution in Tegucigalpa from Munich Re (above) and Swiss Re (below).*

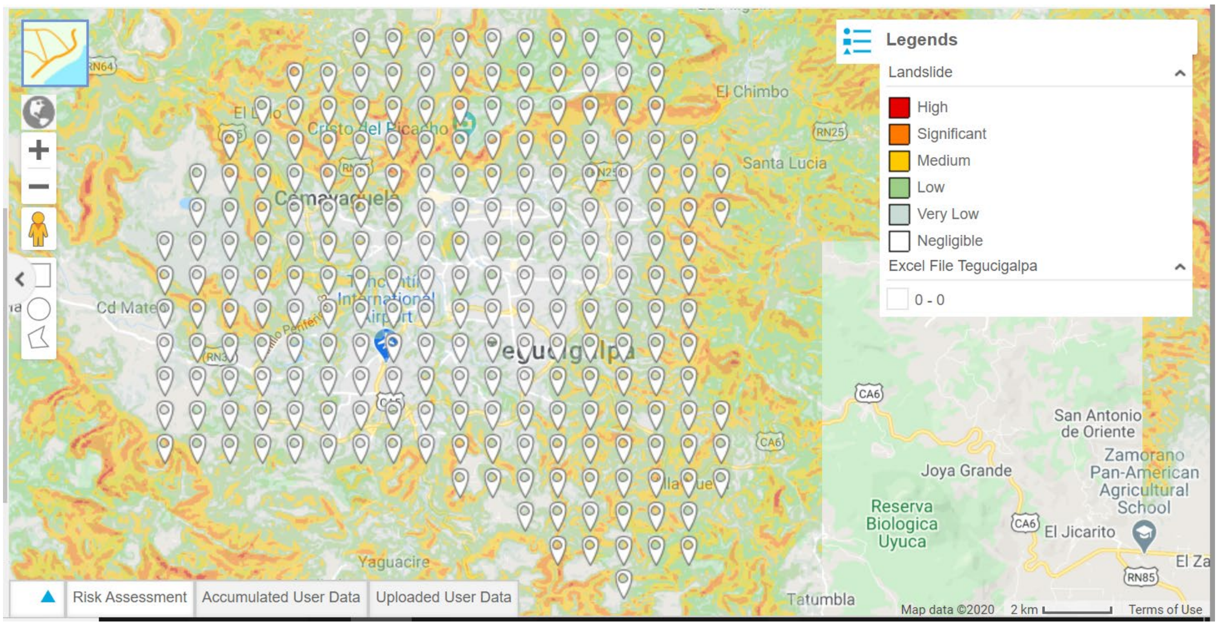


***Figure 3**: Mudslide Risk distribution in Tegucigalpa from Swiss Re CatNet Tool.*

As it is shown in Figure 3, mudslides risk goes from medium (yellow) to significant (orange) in the slopes surrounding the city.

Climate and Catastrophe Risk Exposure Analysis – Global Peril Diagnostic Tool

In this section, we show a pilot Climate and Catastrophe Risk Exposure Analysis for Tegucigalpa, using Willis Towers Watson's propriety Global Peril Diagnostic (GPD) Tool.

This tool uses natural hazard databases, including the third-party database of Munich Re, to assess the level of hazard for **2 natural perils for 226 locations in Tegucigalpa** shown in Figure 1. The following chart, Figure 4, presents risk scores for flash flood and river flood for Tegucigalpa.

Exposure					GPD - Risk Scores - Hazard Only			Model Loss ($)			Model Loss as a % of Total Loss	
Facility	Country	Longitude	Latitude	TIV	Earthquake	Flash Flood	River Flood	Earthquake	Flood	Total	Earthquake	Flood
37	HN	-87.253	14.033	$14,617,513	3	2	1	$ 7,475	$ 2,016	$ 9,491	79%	21%
38	HN	-87.244	14.132	$14,977,864	3	3	1	$ 7,744	$ 385	$ 8,129	95%	5%
39	HN	-87.244	14.123	$14,458,492	3	2	1	$ 2,394	$ 214	$ 2,608	92%	8%
40	HN	-87.244	14.114	$15,876,426	3	3	1	$ 7,309	$ 2,329	$ 9,638	76%	24%
41	HN	-87.244	14.105	$14,293,629	3	2	1	$ 9,354	$ 531	$ 9,885	95%	5%
42	HN	-87.244	14.096	$15,588,995	3	2	1	$ 9,645	$ 3,209	$ 12,855	75%	25%
43	HN	-87.244	14.087	$15,797,927	3	3	5	$ 5,668	$ 6,542	$ 12,210	46%	54%
44	HN	-87.244	14.078	$15,541,220	3	2	1	$ 13,149	$ 495	$ 13,644	96%	4%
45	HN	-87.244	14.069	$14,895,050	3	3	1	$ 10,373	$ 1,790	$ 12,163	85%	15%
46	HN	-87.244	14.060	$15,193,902	3	2	1	$ 10,178	$ 775	$ 10,952	93%	7%
47	HN	-87.244	14.051	$15,895,383	3	2	1	$ 9,654	$ 1,243	$ 10,897	89%	11%
48	HN	-87.244	14.042	$15,260,282	3	2	1	$ 10,473	$ 1,309	$ 11,782	89%	11%
49	HN	-87.244	14.033	$15,852,196	3	2	1	$ 14,140	$ 377	$ 14,517	97%	3%
50	HN	-87.235	14.132	$15,994,090	3	3	1	$ 7,457	$ 843	$ 8,300	90%	10%
51	HN	-87.235	14.123	$14,197,641	3	2	1	$ 3,319	$ 2,746	$ 6,065	55%	45%
52	HN	-87.235	14.114	$14,069,780	3	2	1	$ 2,665	$ 3,199	$ 5,864	45%	55%
53	HN	-87.235	14.105	$14,803,607	3	3	1	$ 11,564	$ 1,045	$ 12,609	92%	8%
54	HN	-87.235	14.096	$15,004,145	3	3	5	$ 7,693	$ 8,197	$ 15,890	48%	52%
55	HN	-87.235	14.087	$14,301,650	3	3	1	$ 6,581	$ 1,579	$ 8,159	81%	19%
56	HN	-87.235	14.078	$14,818,278	3	2	1	$ 9,486	$ 56	$ 9,542	99%	1%
57	HN	-87.235	14.069	$15,041,979	3	3	1	$ 8,743	$ 1,036	$ 9,780	89%	11%
58	HN	-87.235	14.060	$15,405,306	3	3	5	$ 8,657	$ 4,978	$ 13,635	63%	37%
59	HN	-87.235	14.051	$14,704,367	3	2	5	$ 7,861	$ 10,939	$ 18,800	42%	58%
60	HN	-87.235	14.042	$15,373,546	3	2	1	$ 8,837	$ 1,998	$ 10,835	82%	18%
61	HN	-87.235	14.033	$15,072,185	3	3	1	$ 10,588	$ 593	$ 11,181	95%	5%
62	HN	-87.226	14.141	$14,190,044	3	2	1	$ 3,336	$ 2,698	$ 6,034	55%	45%
63	HN	-87.226	14.132	$15,060,255	3	2	1	$ 3,754	$ 1,777	$ 5,531	68%	32%
64	HN	-87.226	14.123	$15,150,369	3	2	1	$ 4,094	$ 2,062	$ 6,156	67%	33%
65	HN	-87.226	14.114	$14,631,076	3	3	3	$ 4,181	$ 2,027	$ 6,208	67%	33%
66	HN	-87.226	14.105	$15,517,992	3	4	1	$ 3,604	$ 790	$ 4,395	82%	18%
67	HN	-87.226	14.096	$15,299,189	3	3	1	$ 10,770	$ 1,051	$ 11,821	91%	9%
68	HN	-87.226	14.087	$14,920,320	3	4	5	$ 10,993	$ 9,647	$ 20,640	53%	47%

GPD Hazard Score	River Flood Hazard Category
0	No information available
1	Areas of minimal flood risk
3	500 year return period
5	100 year return period

***Figure 4**: Risk Scores and Model Loss results flood in Tegucigalpa from the grid in Figure 1 (table above). Perils are shown for flash and river flood. The tables on the left shows the color-scale references for flood. See also section "Climate and Catastrophe Risk Exposure Analysis – Global Peril Diagnostic Tool".*

A score has been calculated for all perils at each location based on the level of hazard. The score range is 0 to 5. A score of **5 represents a very high hazard, 1 represents a very low hazard, and 0 representing no hazard/data.** The perils included are River flood and flash flood. Details considering for the scoring are provided below.

Hazard Rankings Key	
GPD Score	**Hazard Ranking**
0	No Hazard / No Data
1	Very Low
2	Low
3	Medium
4	High
5	Very High

River Flood

- River flood is flooding from rising water levels which overtop the riverbank to flood surrounding land.
- The river flood hazard layers have been created using the JBA global flood model.
- This uses elevation data from the Shuttle Radar Topography Mission to generate flood layers at the 1-in-100 and 1-in-50r return periods.
- Due to different methodology, there may be differences between this dataset and FEMA flood zones.

GPD Hazard Score	River Flood Hazard Category
0	No information available
1	Areas of minimal flood risk
3	500 year return period
5	100 year return period

Flash Flood

- Flash flooding is caused by high levels of surface water runoff which overwhelm drainage capacity.
- The flash flood hazard layer is based on meteorological, soil, terrain and hydrographic data (slope and flow accumulation).
- The meteorological data includes the amount, variability and extreme behavior of rainfall. Soil-sealing maps, curvature (from global multi-resolution terrain elevation data with a resolution of 7.5 arcseconds), slope and flow accumulation (from conditioned terrain data based on SRTM elevation with a resolution of 15 arcseconds) have been used as modifiers to generate the final flash flood map.

GPD Hazard Score	Flash Flood Hazard Category
0	No information available
1	Zone 1: low
2	Zone 2
2	Zone 3
3	Zone 4
4	Zone 5
5	Zone 6: high

Annex 8. Disaster Risk Finance and Parametric Insurance Solutions

Layered approach to Disaster Financing

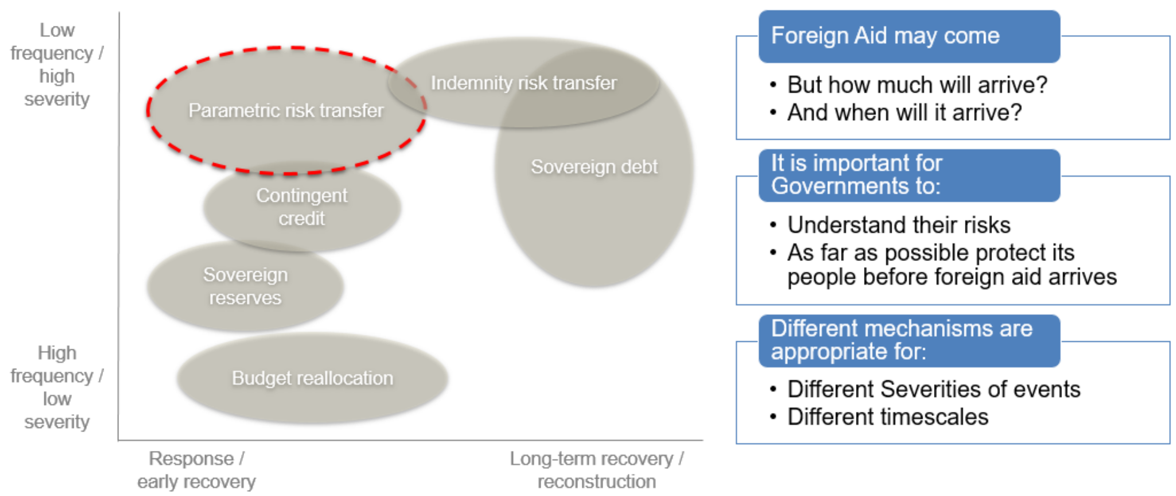


***Figure 6**: Illustration of different disaster financing schemes as a function of frequency and severity of the events and the response needs from the client.*

Parametric Insurance

***Parametric insurance** is a financial mechanism that provides pay-outs based on the occurrence of an event rather than an actual loss. This allows rapid liquidity post-event, since there is no loss-adjustment process and events are defined by verifiable independent agencies.*

Parametric insurance (also called index-based) provides immediate liquidity after an event to facilitate immediate response and recovery. The products are simple, easy to understand and structure can be flexible to the client needs. In insurance, the amount of the pay-out is dictated by an objective measure of the causal event (e.g. the speed of the wind in a cyclone, the amount of rainfall for a flood product, the shake intensity for an earthquake product). Furthermore, there is significant transparency to the client as an event's occurrence is simply recognized and verified and they are available from public sources (e.g.: real-time satellite rainfall, shake intensity maps provided by the United States Geological Service, USGS). Contrary to indemnity insurance, there is no loss adjustment process which can be costly and long, resulting in delays in payment. It is important to note that we are proposing parametric insurance for emergency response and recovery, not necessarily to protect significant assets or infrastructure fully.

The simplicity and speed of parametric insurance comes at the cost of basis risk, which is the risk that event triggered pay-outs may not relate accurately to actual loss; however, this risk is worth bearing where the speed and predictability of payment is paramount.

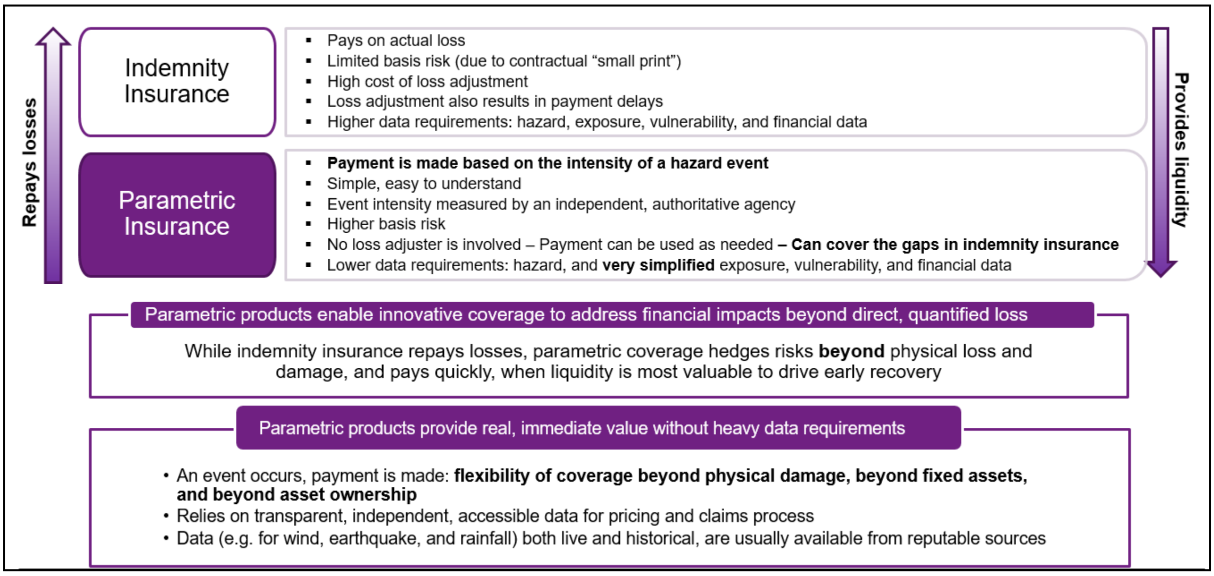
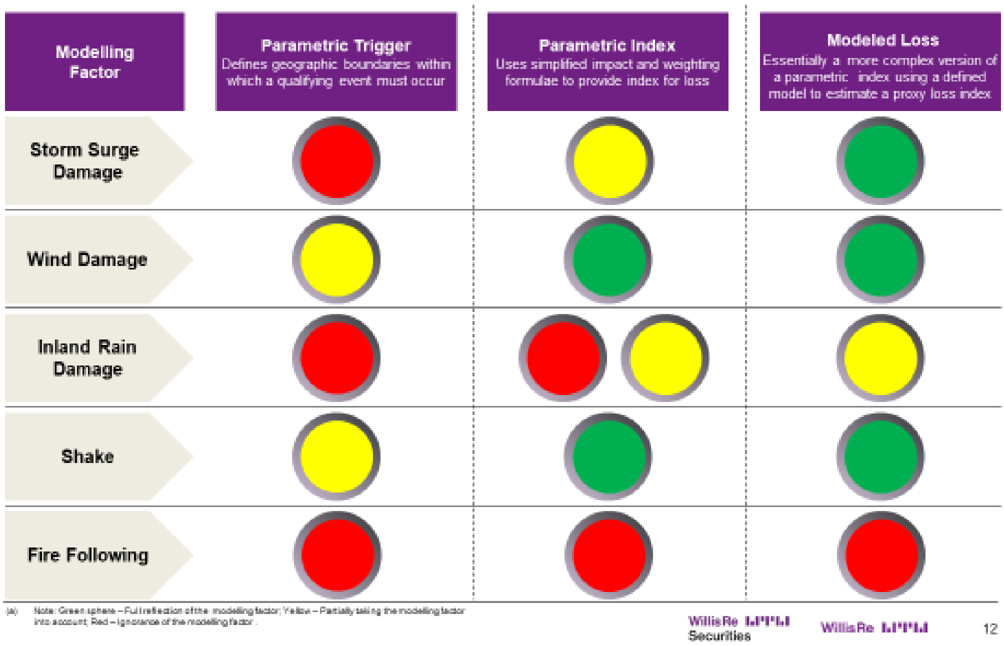


***Figure 7**: Indemnity and parametric insurance comparison.*


Modelling Factor
Parametric Trigger
Defines geographic boundaries within which a qualifying event must occur
Parametric Index
Uses simplified impact and weighting formulae to provide index for loss
Modeled Loss
Essentially a more complex version of a parametric index using a defined model to estimate a proxy loss index
Storm Surge Damage
Wind Damage
Inland Rain Damage
Shake
Fire Following
(a) Note: Green sphere – Full reflection of the modelling factor; Yellow – Partially taking the modelling factor into account; Red – Ignorance of the modelling factor .
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Excess of Rainfall Parametric Illustration

Figure 8 illustrates a conceptual excess rainfall parametric product. We would define a reasonable grid with population in the city of interest. A torrential rainfall event happens. We would determine an accumulated (1/2/3/7 day) rainfall on each grid above a pre-defined trigger. Some grids with 'switch on' and some won't, which allow us to define the torrential rain affected population. We would issue a total payout according to the payout structure defined, which will be related to how much premium the client wants to pay.

Gridded rainfall data is available through the Global Precipitation Measurement (GPM) provided by NASA at various spatial and temporal resolution. We would use this data to design the product together with potentially available and reliable gauge data on the ground.

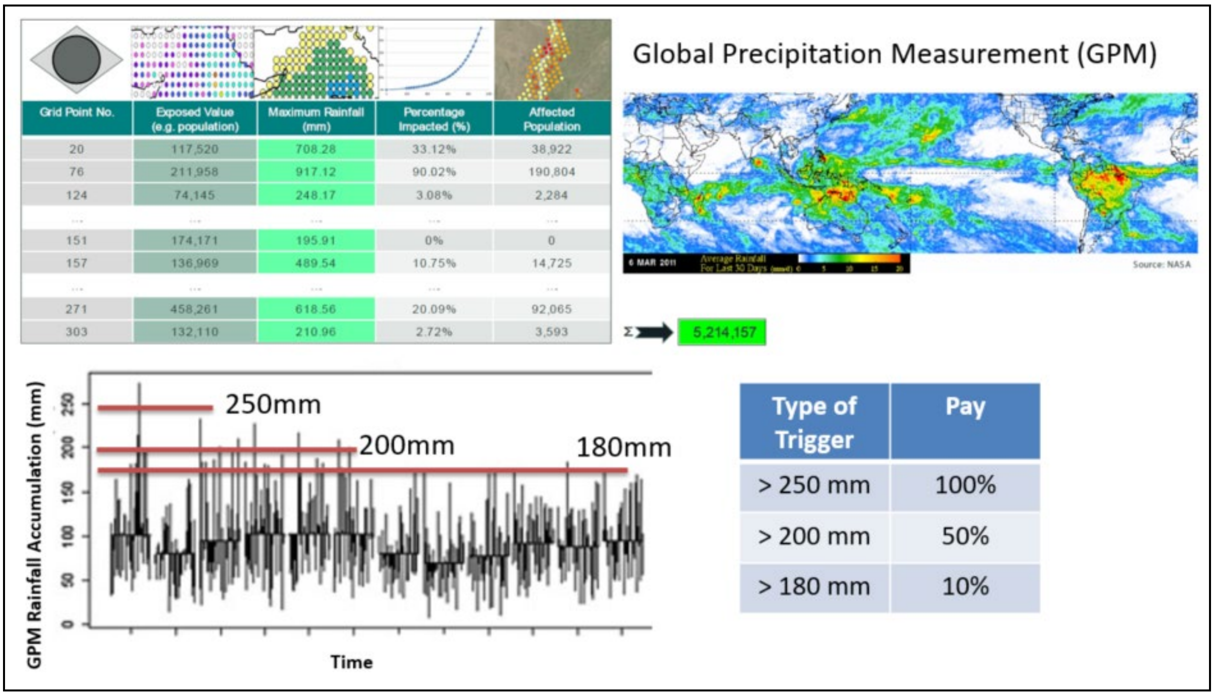

***Figure 8**: Conceptual example of an excess rainfall parametric product.*

Annex 9- List of graphic and maps

List of Maps

List of graphics