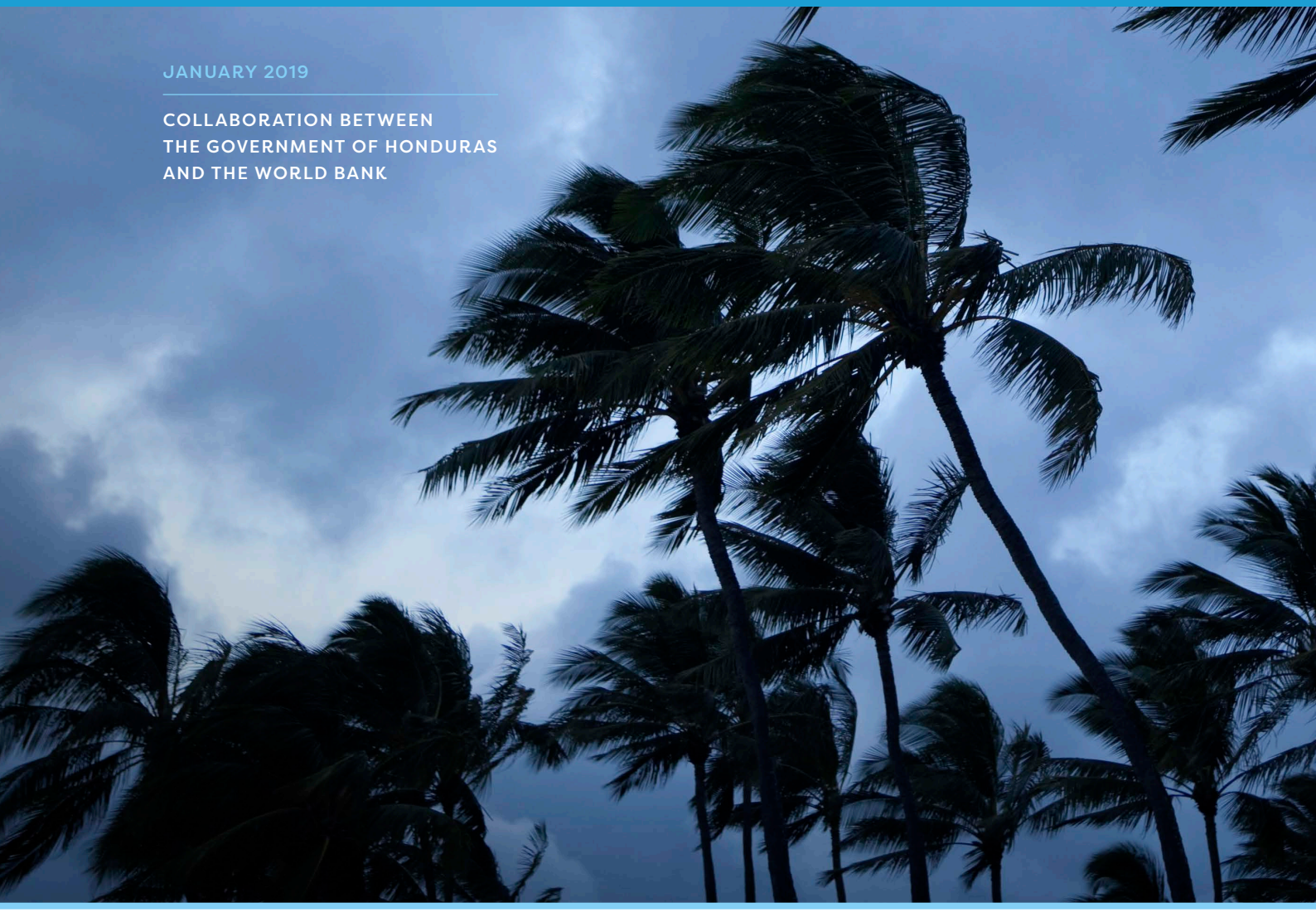
HYDROMETEOROLOGICAL AND CLIMATE SERVICES MODERNISATION PLAN FOR **HONDURAS**



JANUARY 2019

COLLABORATION BETWEEN
THE GOVERNMENT OF HONDURAS
AND THE WORLD BANK

WORLD BANK GROUP

GFDRR
Global Facility for Disaster Reduction and Recovery

EXECUTIVE SUMMARY

Honduras is vulnerable to all types of disasters, including drought, flooding, tropical cyclones, hurricanes, landslides and forest fires. Its geographical location and the mountainous topography of a large part of the country influence this vulnerability. Honduras experiences 1.67 disasters per year on average, with an average of 521 people losing their life and 402 people getting hurt, and a much larger number of people surviving and being affected by the disaster.[1]

Honduras is the country most affected by extreme meteorological phenomena in the world according to the Global Climate Risk Index (CRI)[2]. Figures for the past four decades show that Honduras is the country in the region with greatest economic losses as a result of disaster and eighth across the world. These losses are expected to increase as a result of the *ENSO* phenomenon (El Niño-Southern Oscillation) and climate change. More than 50% of disasters that occur in the country are linked to events with a hydrometeorological origin.

Extreme meteorological and hydrological events negatively affect several key economic sectors and infrastructures of the country. On average, economic losses amount to approximately 150 million dollars per year, which represents 1.66% of its GDP.[3]

Hydrometeorological and climate information provided to the different socioeconomic sectors in Honduras is insufficient, as is the ability of the national institutions to make assessments and carry out forecasts. **Bridging the gap of meteorological, hydrological and climate services to improve the safety of the population and to strengthen the productive industries in the economy is a priority, especially in regard to improving early warning systems.** The Government of Honduras requested technical assistance from the World Bank to draft a Modernisation Plan that can respond to such need.

[1] Emergency Events Database (EM-DAT): The OFDA/CRED International Disaster Database, Université Catholique de Louvain, Brussels, Belgium.

[2] Germanwatch: Global Climate Risk Index 2018.

[3] Emergency Events Database (EM-DAT): The OFDA/CRED International Disaster Database, Université Catholique de Louvain, Brussels, Belgium.

OBJECTIVE OF THE MODERNISATION PLAN

The objective of the Modernisation Plan is to support the development of climate resilience of Honduras by improving climate, meteorological and hydrological services and by strengthening early warning systems (EWS) regarding hydrometeorological and climate risk and the management of water resources.

The Modernisation Plan is based on an analysis of the gaps that exist between the demand made by users and the need for meteorological, hydrological and climate services versus the ability of the institutions providing such information to respond to such demand in Honduras.

The Plan puts forward actions to increase the country's ability to produce and communicate hydrometeorological and climate information. This information will contribute to supplying reliable, suitable and relevant services demanded by the different socioeconomic sectors in Honduras. Special attention will be paid to strengthening early warning systems and helping users to access, interpret and use this information alongside other technical information as a foundation for planning and decision-making.

Given their institutional competences, the Modernisation Plan approach is led by the **Centre for Atmospheric, Oceanographic and Seismic Studies of the Permanent Contingency Committee (COPECO-CENAOS)** and the **Office for Energy, Natural Resources, Environment and Mining (MiAmbiente)**, as core institutions. The Plan also counts on the participation of the **Civil Aviation Agency of Honduras (AHAC)**, **National Service for Aqueducts and Sewage Systems (SANAA)**, **National Electrical Energy Company (ENEE)** and the **National Autonomous University of Honduras (UNAH)**. Although these institutions play a very active role, their role will be to coordinate value chains in meteorological, hydrological and climate services that include other institutions that use data and products, such as the agricultural industry and other industries, as well as the end users.

In short, strengthening meteorological, hydrological and climate services is a cross-sectoral activity that should involve several institutions from the public and economic sectors and the wider population, forming a true hydrometeorological national system.

DIAGNOSTICS: MAIN FINDINGS

COPECO-CENAOS and MiAmbiente, the two main institutions in charge of meteorological and hydrological activities have insufficient human and financial resources to satisfy the demand of users and to develop new services. Not many staff in either institution is qualified in meteorology and hydrology. Strengthening human talent, both in quantity and in increasing their capabilities, is a determining factor to improving services.

Besides staff limitations, CENAOS, within the structure of COPECO, does not have an operational structure in place that can develop the hydrometeorological and climate activities it should be carrying out as the technical division of COPECO. The interconnected areas of hydrometeorological observation, data analysis and forecasting required to activate EWS should fall within its organisational structure.

There are current limitations to accessing hydrometeorological and climate data and products. Furthermore, participation from users in defining meteorological, hydrological and climate products and services geared towards products and services that specifically respond to each industry is low. In this regard, institutions in Honduras with competences in meteorology, hydrology or climate activities have expressed the need for a national mechanism that fosters the exchange and easy access to information from public institutions and users.

There are shortfalls in the current infrastructure of COPECO-CENAOS and MiAmbiente for meteorological and hydrological monitoring and forecasting capabilities using modern tools (which includes remote sensors). Limited budgets for maintenance and low investment in observation infrastructure are leading to the progressive wear of equipment which requires periodical calibration. There is no integrated monitoring system in place regarding subterranean water. Also, there is no consolidated database of the monitored pools to support the allocation of subterranean water. Honduras does not count on a good national water network or a reference national laboratory to regulate water quality analysis and protocols.

Meteorological modelling in Honduras is very limited. AHAC operates the regional version of the WRF model and uses these results in aeronautical meteorology. Meteorologists at COPECO-CENAOS and AHAC are in contact at technical level in regard to forecasts. The main problem faced by both COPECO and AHAC in regard to meteorological modelling is the lack of qualified staff and of suitable equipment and facilities for this task. Honduras does not have a unified national hydrological forecasting system in place to manage its water resources and to prevent flooding.

Most EWS regarding flooding in Honduras work on the basis of predefined thresholds according to the amount, intensity or duration of rainfall, and the measurement of river flow and water levels. They do not use **rain forecasts**, which could improve timings in regard to anticipating warnings and alarms. In the sphere of EWS, the monitoring and forecasting stage based on defined thresholds is the weakest stage in the chain of elements. To date, no EWS for drought has been coordinated despite the negative consequences of prolonged drought for agriculture, especially in the *Dry Corridor*.

Hydrometeorological and climate information presented to users through the media is very limited and is difficult to access and interpret. COPECO does not have a space for CENAOS on its website showing meteorological forecasts with brief explanations, seasonal climate forecasts and climate conditions regarding the rain or temperature recorded in different areas across the country. Furthermore, all such information should be illustrated with radar and satellite images and an interpretation thereof so that users may understand what they mean.

RECOMMENDATIONS OF THE MODERNISATION PLAN

The experience of many countries that have undertaken this process shows that modernisation of hydrometeorological services needs to tackle three spheres complementarily:

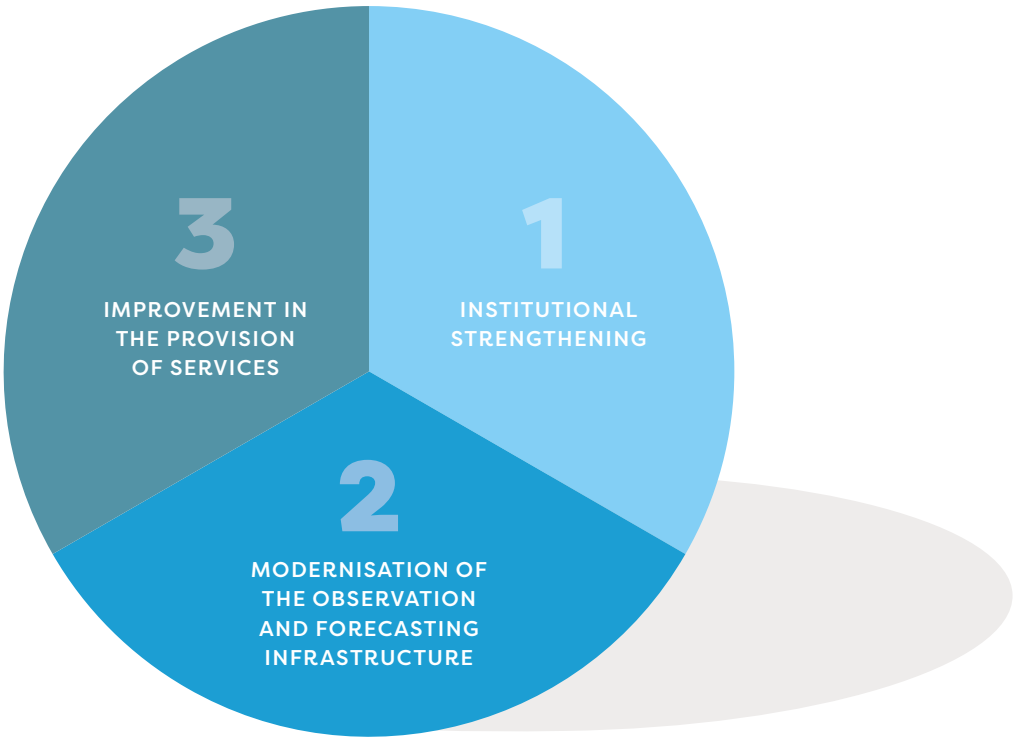
1) Institutional strengthening.

2) Modernisation of the observation and forecasting infrastructure.

3) Improvement in the provision of services.

The Plan proposes **20 activities grouped into these three spheres, structured across a 6-year timeline,** with activities to be implemented in the short term (1 to 3 years) and in the middle term (4 to 6 years).

The three complementary spheres to modernise hydrometeorological services:



1 INSTITUTIONAL STRENGTHENING

The proposal is made to establish a **national platform** that fosters the exchange of information and the development of hydrometeorological and climate services for the different sectors of users. Additionally, the recommendation is made to design a staff training and qualification programme (in the short, middle and long term) towards strengthening the technical capabilities of COPECO-CENAOS, MiAmbiente-DGRH, Aeronautical Meteorology-AHAC, SANAA and the Agriculture and Farming Office (SAG), with qualified staff to perform different roles in meteorology and hydrology and the development and implementation of products and services for users. The recommendation is also made to provide CENAOS with a travel plan that allows it to suitably develop the work areas for a National Meteorological System in stages, covering staffing needs with the required profiles, when economic resources to carry this out are made available.

2 MODERNISATION OF THE OBSERVATION AND FORECASTING INFRASTRUCTURE

Strengthening the observation infrastructure is considered to be the basis for improving priority services such as meteorological and hydrological forecasts to support the EWS, especially in regard to flooding and landslides or for the agricultural industry and water resources, for instance. This pillar takes into account the strengthening of observation networks, redesigning these networks to improve optimisation, operation and maintenance. The strengthening of equipment considers the following priority areas, according to demand: procuring satellite images to monitor and forecast atmospheric and environmental conditions; automatic weather and hydrological stations; and stations to measure subterranean water and water quality. The Modernisation Plan establishes the integration of a national hydrometeorological and climate database, providing equipment, telecom and technical assistance requirements in order to have real-time and historical data available online for all participating institutions. Actions recommended for this pillar include the improvement of weather and climate forecasts through the professional training of staff and participation of the relevant institutions for each type of forecast. Suitable management of water resources is a priority in Honduras, especially in the *Dry Corridor*, where hydrological modelling is required. This includes a calculation of water balance towards water management. The Modernisation Plan emphasizes the development and deployment of hydrological forecasting models to support the EWS and water resources in Honduras.

3 IMPROVEMENT IN THE PROVISION OF SERVICES

This pillar includes **activities to bring the services provided closer to the specific needs of different users**. In particular, there are three activities whose development and implementation are considered to be key to achieving the objectives of the Plan: a) establishing committees of users and the providers of data and hydrometeorological and climate products; b) strengthening the service provision system to improve assistance to users; and c) training of users. Similarly, this pillar of the Plan establishes the development of three areas that are considered a priority: 1) strengthening of EWS for fast events (flooding and landslides) in vulnerable regions; 2) development of EWS for droughts, especially in the *Dry Corridor*; and 3) the development of climate services for the agriculture and farming industry.

COSTS AND BENEFITS OF THE MODERNISATION PLAN

The Modernisation Plan reflects on the agreement between the main stakeholders involved regarding the priorities for coming years and the strategic plans that should be followed for Honduras to count on the tools that allows it to better face hydrometeorological threats and the effects of climate change, as well as to manage its natural resources in a sustainable way to benefit its economy and population.

The estimated investment to implement the Plan is 10 million USD. The Plan was completed with an economic analysis of the profitability of middle and long term investment with a cost-benefit analysis that took into account potential benefits of the actions proposed based on three different methods:

1) Protecting the population and reducing economic losses that are mainly related to the risk of flooding and landslides.

2) Favouring the development of industries that are sensitive to climate variability, such as agriculture.

3) Other joint benefits, such as benefits for the water, energy and transport industries, for instance.

The project was feasible in all scenarios considered, with all current net value estimates being more than 0 and benefit-cost ratios being significantly higher than 1.

Also, potential total benefits have been underestimated in the cost-benefit analysis as many industries have not been included in the economic analysis and the reduction in the loss of human life (estimated at 15 losses per year on average) has not been taken into account.

In short, the economic analysis of the investment proposed for the Modernisation Plan for the following 15 years estimates an average cost-benefit ratio of almost 1:7 on average; that is, a return of $7 for every dollar invested, which means the project is economically feasible.

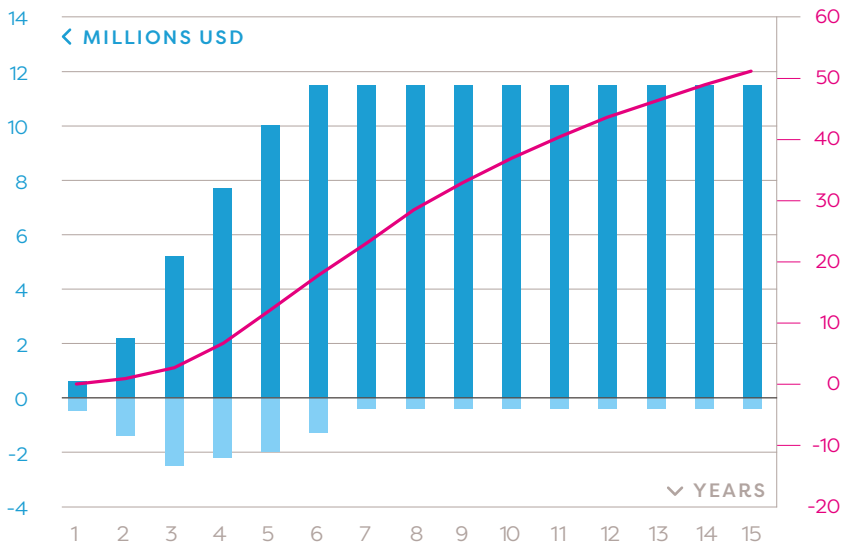
COSTS
BENEFITS
ACCUMULATED NPV

CURRENT BENEFITS VALUE
60.39 MM USD

CURRENT COSTS VALUE
8.78 MM USD

CURRENT NET VALUE
51.61 MM USD

COST-BENEFIT RATIO
1:6.9



THIS INITIATIVE BENEFITED FROM THE FINANCIAL SUPPORT OF THE GOVERNMENT OF JAPAN THROUGH THE "GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY (GFDRR)" OF THE WORLD BANK.

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