



**Cartagena  
Competitiva y  
Compatible  
con el Clima**

## **Plan 4C**

**A Competitive and Climate Compatible Cartagena**





# Plan 4C

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Competitiva y  
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INVEMAR was the entity responsible for the implementation of the project. It is a non-profit scientific and technological Research organization attached to the Ministry of the Environment and Sustainable Development, whose mission is to carry out basic and applied research into renewable natural resources and the environment on marine and oceanic coasts and ecosystems of national interest for the purposes of providing the scientific knowledge necessary to establish policies, take decisions and draw up plans and projects that lead to their development, focused on the sustainable management of resources, the recuperation of the marine and coastal environment and improvement of the quality of life of Colombians through the rational use of the scientific capacity of the Institute and its articulation with other public and private entities.

## PARTICIPATING INSTITUTIONS

<b>Office of the Mayor of Cartagena de Indias</b>	This is a territorial entity of the district of Cartagena de Indias. As part of its mission, it ensures the collective construction of the city, respecting all that is public, while preserving its natural resources and its Caribbean identity. It participates in territorial planning and in decision making processes through the Planning Department, which is the local project coordinating entity that encourages the participation of the public sector and introduction of adaptation.
<b>Ministry of the Environment and Sustainable Development</b>	The leading national public entity that establishes guidelines for the management of environment renewable natural resources and promotes activities aimed at regulating environmental order in the territory, defining national policies on the environment and renewable natural resources and, in general, the nation's environmental policies and regulations. It participates as the entity responsible for coordination at national level through the Climate Change Department of the Vice Ministry of the Environment and Sustainable Development and in accordance with the legal regulations in force.
<b>Marine and Coastal Research Institute (INVEMAR)</b>	This Institute carries out basic and applied research into renewable natural resources, the coastal environment and marine and oceanic ecosystems of national interest in order to provide the scientific knowledge necessary for the formulation of policies, decision making and the preparation of plans and projects for sustainable development. It participates as the project executor and coordinator of the technical component, for which it works in an articulated manner with the rest of the participating entities.
<b>Climate and Development Knowledge Network – CDKN</b>	The Climate and Development Knowledge Network helps decision-makers in developing countries design and deliver climate compatible development. For this purpose, it combines research, advisory services and knowledge management in support of political processes administered at the local level. It is the only international cooperation partner that provides resources for this initiative. Its purpose is to provide the Office of the Mayor of Cartagena with collaboration in the decision making process, together with the private, non-governmental sector at national, regional and global levels in order to integrate climate into public development policies.
<b>Cartagena Chamber of Commerce</b>	This is a private entity created in 1915 on the initiative of 45 merchants in the city. It is responsible for promoting competitive entrepreneurial development in this jurisdiction and improving the quality of life on the basis of knowledge management and guiding social and environmental responsibility on the part of the local business community. It is linked to the project as the representative of the private commercial and economic sector of Cartagena, in order to articulate planning processes between the public and private sectors and to facilitate the incorporation of adaptation to climate change into sectoral management.



# PROLOGUE

## A Competitive and Climate Compatible Cartagena

The world is experiencing profound changes in its geographic physiognomy, which, in spite of their apparent imperceptibility, will necessarily exert an enormous influence on life in coastal cities.

As a result of global warming and the ensuing thaw at the Poles, the level of the oceans is inexorably rising, thus threatening coastal cities with the loss of considerable portions of their seashore areas or, in the worst case scenario, the apocalyptic vision of being wiped off the map. These predictions are far from being feverish visions of disaster mongers. They are based on scientific models capable of predicting what will happen in the near future.

Our own Cartagena de Indias is a jewel that has remained placid for 481 years. It is surrounded by the Caribbean and its interior bodies of water, to which it owes much of its charm. The city walls, forts and strongholds rise only a few meters from the sea, a heritage of its glorious past; behind them is an imposing ancient city of temples, great houses and Colonial relics.

In the tourism district, graceful edifices form a cordon of investments whose value rises as a result of the privilege of overlooking the sea and Bay, which, if we do not react quickly enough, will be devoured in the near future. Given the climate projections, if we fail to act within the next 25 years, the sea will sweep away our historic heritage and the enormous investments in the buildings of the modern city.

Y –Ahora Sí- (And –Yes and Now-) we are preparing ourselves for our city to become more resilient to climate phenomena.

For the first time, adaptation to climate change is included in the district development plan as a cross-cutting topic of great importance in the territorial use of land in the city, which, in turn, articulates with other planning tools, such as the Territorial Land Use Plan (POT) and the Risk Management Plan.

Through participative formulation of Plan 4C “A Competitive and Climate Compatible Cartagena”, the city is becoming the first in this country to have created a long term vision in which the climate of the future will become an opportunity for its development. The Plan will position Cartagena as a model and a leader in Latin America, showing the way to achieving climate compatible development. It will also contribute firm responses on the part of the citizens of Cartagena with, for example, the design and creation of an adapted neighborhood in a zone where the socio-economically vulnerable communities are feeling the effects of climate change.

Thanks to Plan 4C and the leadership assumed by our Mayor’s Office and the District Planning Department, we are converting climate compatible development into a city policy that will transcend administrations and projects, starting today for the Cartagena of the future. To this effect, we have defined, together with the actors of the city, five strategic lines and concrete actions to promote the development and competitiveness of its economic sectors in the long term, to reduce poverty levels in the city and in our islands and to create new sources of employment:

- To promote a climate compatible port and industrial zone: to coordinate and encourage innovative climate actions to reduce risk and introduce adaptation and mitigation measures that project their future competitiveness.

- To promote a climate compatible tourism sector: to involve the hotel sector, operators and tourists in the understanding and creation of adaptation and mitigation measures to ensure that Cartagena remains the main tourist attraction on the Colombian Caribbean.
- To prepare adapted neighborhoods to the climate of the future: to promote adaptation measures that include water, basic sanitation, construction, energy, transportation, and citizens' climate knowledge, in order to succeed in preparing both people and neighborhoods for the climate of the future.
- To restore Cartagena's ecological balance: to restore the ecosystems and ecological structures at the level of beaches, wetlands and swamps in order to ensure the resilience of the city and its inhabitants.
- To protect our historic patrimony and our assets of cultural interest: to carry out restoration and protection actions to maintain their value as part of a Historic Heritage of Humanity at the service of both the Cartageneros, the people of Cartagena, and its visitors.

Our commitment is to make our city an example to be followed and to inspire the transformation of other coastal cities; to be a competitive, climate compatible city. This is the only way to act responsibly towards future generations and to articulate the necessary actions to serve the local people, the nation and the world in preserving one of its most inestimable treasures: Cartagena de Indias.

A handwritten signature in black ink, consisting of a large, stylized 'D' followed by a series of vertical, slightly wavy lines that resemble a stylized 'V' or a series of connected strokes.

**DIONISIO VÉLEZ TRUJILLO**

Mayor of Cartagena de Indias  
Touristic and Cultural District



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Our special thanks are also due to experts, companies and connoisseurs of the City who participated in meetings and workshops, creating highly valuable inputs for Plan 4C. We likewise highlight the work of each of the researchers and officials of the different entities which contributed to the evaluation of Cartagena’s vulnerability to climate change study, which forms the baseline for the preparation of this planning instrument.

Finally, we thank the local media for their willingness and commitment to bringing this message to the citizens of Cartagena and to the country in general on our progress in the formulation of Plan 4C and the strategies defined to promote climate compatible development in one of the most important cities of the Colombian Caribbean.

# INTER-INSTITUTIONAL COMMISSION ON CLIMATE CHANGE OF CARTAGENA

The Commission was created in January 2013 as an advisory group to strengthen the institutions and the mainstreaming of climate compatible development in Cartagena de Indias. It was through the Commission that the Plan 4C was formulated, promoted and targeted. Its members are key actors and representatives of different sectors of the political, public, private, entrepreneurial, academic, sectoral, social and institutional life of the city, as listed below:

- Ministry of the Environment and Sustainable Development (MADS).
- Government of Bolívar Department.
- Office of the Mayor of Cartagena de Indias – District Planning Department (SPD).
- Cartagena de Indias District Council DT and C.
- Canal del Dique Autonomous Regional Corporation (Cardique).
- Cartagena Public Environmental Establishment (EPA).
- “José Benito Vives de Andrés” Marine and Coastal Research Institute (Invemar).
- General Maritime Department (DIMAR).
- Oceanographic and Hydrographic Research Center (CIOH).
- Corales del Rosario and San Bernardo National Natural Park (PNNCRSB).
- Colombian Rural Development Institute (Incoder).
- Academic representatives: Cartagena University.
- Cartagena Chamber of Commerce.
- Cartagena de Indias Tourism Corporation (Corpoturismo).
- Colombian Travel and Tourism Agencies Association (Anato)
- Hotel and Tourism Association of Colombia.
- National Association of Entrepreneurs of Colombia (ANDI Bolivar Division).
- Mamonal Foundation
- National Federation of Merchants (FENALCO).
- Cartagena Regional Port Company (SPRC).
- Compañía de Puertos Asociados S.A. (Compas).
- Canal del Dique Promotion Foundation.
- Bolivar Engineers and Architects Society (SIAB).
- Cartagena District Federation of Community Action Committees (Cartagena JAC).

## GLOSSARY OF ACRONYMS

<b>ACD</b>	Development Cooperation Agencies
<b>AF</b>	Adaptation Fund
<b>AFE</b>	Association of Entrepreneurial Foundations
<b>AMP</b>	Protected Marine Area
<b>ANDI</b>	National Association of Industrialists
<b>AOD</b>	Official Development Aid
<b>BAU</b>	Business as Usual (without adaptation measures)
<b>BIACI</b>	Cartagena de Indias International Contemporary Art Biennial
<b>BIC</b>	Asset of Cultural Interest
<b>BID</b>	Inter-American Development Bank
<b>BIOCF</b>	Bio-carbon Fund
<b>BIRF</b>	International Bank for Reconstruction and Development
<b>BM</b>	World Bank
<b>CACC</b>	Climate Action Center for Cartagena
<b>CADF</b>	Carbon Asset Development Fund
<b>CAF</b>	Andean Development Corporation
<b>CAR</b>	Regional Autonomous Corporation
<b>CARDIQUE</b>	Canal del Dique Autonomous Regional Corporation
<b>CC</b>	Climate Change
<b>CCC</b>	Cartagena Chamber of Commerce
<b>CCORAL</b>	Caribbean Climate Online Risk and Adaptation Tool
<b>CDCF</b>	Community Development Carbon Fund
<b>CDKN</b>	Climate Development Knowledge Network
<b>CEDEC</b>	Development and Competitiveness Study Center
<b>CEPAL</b>	Economic Commission for Latin America and the Caribbean
<b>CIF</b>	Climate Investment Funds
<b>CICCC</b>	Cartagena Inter-institutional Climate Change Commission
<b>CH</b>	Historical Center
<b>CIIFEN</b>	International Research Center on El Niño
<b>CIOH</b>	Caribbean Oceanographic and Hydrographic Research Center

<b>COMBAS</b>	Neighborhood Committees
<b>COPOLCO</b>	Consumer Policies Committee
<b>COP</b>	Colombian Pesos
<b>CORVIVIENDA</b>	Fund for Housing of Social Interest and Cartagena District Urban Reform
<b>CPF</b>	Carbon Partnership Development Facility
<b>CRUE</b>	Emergency Regulatory Center
<b>CTF</b>	Clean Technology Fund
<b>DAC</b>	Development Assistance Committee
<b>DANE</b>	National Statistics Administrative Department
<b>DAVD</b>	Cartagena District Cartagena Evaluation Administrative Department
<b>DIAN</b>	National Tax and Customs Department
<b>DIMAR</b>	Maritime Directorate
<b>DNP</b>	National Planning Department
<b>EACC</b>	Economics of Adaptation to Climate Change
<b>EBA</b>	Ecosystem-based Adaptation
<b>EDURBE</b>	Bolivar Urban Development Company
<b>EEUU</b>	United States of America
<b>EPA</b>	Cartagena Public Environmental Establishment
<b>EUROPEAID</b>	European Development Fund
<b>FDCCC</b>	Cartagena District Climate Change Fund
<b>FICCI</b>	Cartagena de Indias International Film Festival
<b>FINNFUND</b>	Finnish Fund for Industrial Cooperation
<b>FIP</b>	Forest Investment Program
<b>FMI</b>	International Monetary Fund
<b>FNGRD</b>	National Disaster Risk Management Fund
<b>FONADE</b>	National Development Fund
<b>FPT</b>	Tourism Promotion Fund
<b>GCCA</b>	Global Climate Change Alliance
<b>GCF</b>	Green Climate Fund
<b>GEF</b>	Global Environment Facility
<b>GEI</b>	Greenhouse Gases
<b>HCMI</b>	Hotel Carbon Measurement Initiative
<b>ICAT</b>	Industry, Trade, Notices and Boards Tax

<b>ICF</b>	International Climate Fund
<b>ICLD</b>	Free Use Current Income
<b>IDE</b>	Specific Use Income
<b>IDEAM</b>	Colombian Hydrology, Meteorology and Environmental Studies Institute
<b>IDER</b>	Cartagena de Indias Recreation and Sports Institute
<b>IFC</b>	International Finance Corporation
<b>IKI</b>	International Climate Initiative of Germany
<b>INAP</b>	National Adaptation Pilot Project
<b>INCODER</b>	Colombian Rural Development Institute
<b>INFRAFUND</b>	IDB Infrastructure Fund
<b>INVEMAR</b>	Marine and Coastal Research Institute
<b>IOM</b>	International Migrations Organization
<b>IPCC</b>	Inter-governmental Panel on Climate Change
<b>IPCC</b>	Cartagena Heritage and Culture Institute
<b>IPU</b>	Unified Property Tax
<b>ISO</b>	International Standardization Organization
<b>LED</b>	Light Emitting Diode
<b>MADS</b>	Ministry of the Environment and Sustainable Development
<b>MCIT</b>	Ministry of Trade, Industry and Tourism
<b>MDG</b>	Millennium Development Goals
<b>NAMA</b>	Nationally Appropriate Mitigation Action
<b>NBI</b>	Unsatisfied Basic Needs
<b>NGO</b>	Non Governmental Organization
<b>OECD</b>	Organization for Economic Cooperation and Development
<b>OPE</b>	Outdoor Advertizing Organization
<b>PLAN 4C</b>	A Competitive and Climate Compatible Cartagena
<b>PPCR</b>	Pilot Program for Climate Resilience
<b>PDD</b>	District Development Plan
<b>PEMP</b>	Special Management and Protection Plan
<b>PND</b>	National Development Plan
<b>PNN</b>	National Natural Parks
<b>PNNCRSB</b>	Corales del Rosario and San Bernardo National Natural Park
<b>POT</b>	Land Use Plan

<b>REFICAR</b>	Cartagena Refinery
<b>RETILAP</b>	Technical Public Lighting Regulations
<b>SACSA</b>	Coastal Airport Society
<b>SCCF</b>	Special Climate Change Fund
<b>SECCI</b>	IDB Sustainable Energy and Climate Change Initiative
<b>SGP</b>	GEF Small Grants Program
<b>SIAB</b>	Bolivar Engineers and Architects Society
<b>SLR</b>	Sea Level Rise
<b>SPD</b>	Cartagena District Planning Department
<b>SPRC</b>	Cartagena Regional Port Company
<b>SREP</b>	Scaling up Renewable Energy Program
<b>UNEP</b>	United Nations Environmental Program
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UNGRD</b>	National Unit for the Management of Risks of Disasters
<b>UNWTO</b>	World Tourism Organization
<b>WTTC</b>	World Travel and Tourism Council



# CONTENIDO

## Introduction. . . . . 20

### Chapter I

#### An overview of Cartagena . . . . . 23

1. The historic legacy of Cartagena de Indias . . . . . 25
2. Cartagena de Indias today . . . . . 28
3. The environmental conditions: the foundation of the city. . . . . 31
4. The climate today . . . . . 33
5. Present planning and future development . . . . . 34

### Chapter II

#### Climate Change in the city of Cartagena . . . . . 37

6. Vulnerability to climate change in the city of Cartagena . . . . . 38
7. Vulnerability to Climate Change in the islands of Cartagena . . . . . 45

### Chapter III

#### Strategies and measures for climate compatible development . . . . . 49

8. Structuring the plan . . . . . 50
9. Structural axes . . . . . 52
  - 9.1 Axis of integrated adaptation to the economic development of the city . . . . . 52
    - 9.1.1 Strategy 1: Climate Compatible Ports and Industries . . . . . 52
    - 9.1.2 Strategy 2: Tourism sector committed to climate change. . . . . 59
    - 9.1.3 Strategy 3: Protection of historic heritage . . . . . 72
  - 9.2 Axis of citizens and adaptation to climate change . . . . . 79
    - 9.2.1 Strategy 4: Neighborhoods adapted to climate change . . . . . 84
  - 9.3 Axis of ecological restoration: Water and life . . . . . 84
    - 9.3.1 Strategy 5: Ecosystem-based adaptation . . . . . 84

10. Cross-cutting axes. . . . .	89
10.1 Information and monitoring . . . . .	89
10.2 Education and communication . . . . .	95
10.3 Planning and Land Use . . . . .	100

## **Chapter IV**

### **Financing the plan . . . . .103**

11. Costs of the plan . . . . .	104
12. Sources of financing . . . . .	105
12.1 Public and local resources . . . . .	106
12.1.1 Cartagena District Climate Change Fund (FDCCC) . . . . .	106
12.2 National Public resources . . . . .	107
12.3 International climate finance . . . . .	108
12.4 Private resources at national and international levels . . . . .	110
12.5 Projection of investment in Plan 4C by financial sources . . . . .	110
13. Operationality for the spending of resources from different origins . . . . .	111

## **Chapter V**

### **Implementation of the plan . . . . .113**

14. Institutional scheme. . . . .	114
14.1 Climate Action Center for Cartagena . . . . .	114
14.2 Inter-Institutional Commission on Climate Change for Cartagena (CICCC) . . . . .	115
14.3 Follow-up and Plan evaluation entity . . . . .	117

## **Chapter VI**

### **Follow-up and evaluation . . . . .119**

15. Climate management follow-up and evaluation indicators. . . . .	120
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## **Chapter VII**

### **The resilient and competitive Cartagena we dream of . . . . .123**

### **Bibliography . . . . .125**

## Index of Tables

<b>Table 1.</b> General characteristics of the localities into which the district of Cartagena de Indias is divided politically and administratively . . . . .	28
<b>Table 2.</b> Threats of climate change: present and future situation in Cartagena de Indias . . . . .	38
<b>Table 3.</b> Vulnerability profile. . . . .	47
<b>Table 4.</b> Terms for implementation of Plan 4C . . . . .	51
<b>Table 5.</b> Strategies and programs to face the climate change challenges . . . . .	51
<b>Table 6.</b> Description of the programs for a climate compatible Port and Industrial zone . . . . .	53
<b>Table 7.</b> List of projects for a climate compatible Port and Industrial zone . . . . .	53
<b>Table 8.</b> Description of programs for a tourism sector committed to climate change . . . . .	60
<b>Table 9.</b> List of projects for a tourism sector committed to climate change. . . . .	60
<b>Table 10.</b> Description of programs of the historic heritage protection strategy . . . . .	73
<b>Table 11.</b> List of projects under the historic heritage protection strategy (figures in millions of pesos) . . . . .	73
<b>Table 12.</b> Description of programs under the Neighborhoods adapted to climate change strategy. . . . .	80
<b>Table 13.</b> List of projects in the Neighborhoods adapted to climate change strategy (figures in millions of pesos). . . . .	80
<b>Table 14.</b> Description of the programs of the Ecosystem-based Adaptation Strategy . . . . .	85
<b>Table 15.</b> List of projects of the Ecosystem-based-Adaptation strategy (figures in millions of pesos) . . . . .	85
<b>Table 16.</b> Description of the cross-cutting axis program: Information and monitoring . . . . .	89
<b>Table 17.</b> List of projects of the cross-cutting axis projects: Information and monitoring (in millions of pesos) . . . . .	90
<b>Table 18.</b> Description of the cross-cutting axis program: Education and communication . . . . .	95
<b>Table 19.</b> List of projects of the cross-cutting axis on education and communication (in millions pesos) . . . . .	96
<b>Table 20.</b> Principal planning instruments of the district of Cartagena de Indias . . . . .	100
<b>Table 21.</b> Projects of the city that would complement the management of climate compatible development . . . . .	101
<b>Table 22.</b> Distribution of the amounts of investment required for Plan 4C by axes and strategies: 2014-2040 (figures in millions of pesos) . . . . .	104
<b>Table 23.</b> Local financial mechanisms identified for financing of Plan 4C. . . . .	105
<b>Table 24.</b> Projection of income from ICAT . . . . .	106

<b>Table 25. Terms for implementation of Plan 4C . . . . .</b>	<b>120</b>
<b>Table 26. Indicators of management and impacts for evaluation and follow-up of Plan C . . . . .</b>	<b>121</b>

## Index of Figures

<b>Figure 1.</b> The Marine breakwater: ((a) plan of the Marine breakwater and (b) aerial photograph of Jaime Borda Martelo, highlighting the shade of the marine breakwater. Taken from: Presentation of Heritage Management (IPCC, 2014) . . . . .	26
<b>Figure 2.</b> Plan and location of the Bocagrande channel: on the left of the plan of the channel prepared by Don Antonio de Arévalo), and on the right, an image of Google Earth. . . . .	26
<b>Figure 3.</b> Changes in the occupation of the Matuna soil: (a) plan of Juan de Herrera y Sotomayor (1730); (b) Aerial view of Chambacu Island in the foreground (1928and (c) La Matuna, Google Earth image 2013 . . . . .	27
<b>Figure 4.</b> Changes in the occupation of the soil of the Marina Park: (a) copy of the plan of 1789 by Antonio de Arevalo, taken from the presentation of the IPCC Heritage Department (2014); (b) Railroad line, 1928, and (c) Marina Park, Google Earth Image . . . . .	27
<b>Figure 5.</b> Populations settled on (a) Santa Crux rocky island; (b) Bocagrande and (c) surroundings of La Virgen marsh. Source: Invemar archive and Infrastructure Department . . . . .	29
<b>Figure 6.</b> Distribution of socio-economic strata in the urban area and rural total. Source: SPD (2013). Source SPD (2013) based on population data of DANE census 2005. . . . .	29
<b>Figure 7.</b> Vulnerable settlements of Cartagena de Indias: (a) La Boquilla sector; (b) and (c) neighborhoods on the border of La Virgen marsh. . . . .	30
<b>Figure 8.</b> Principal ecosystems of the Cartagena de Indias district. Source: Invemar archive . . . . .	31
<b>Figure 9.</b> Ecosystems present in the district of Cartagena de Indias and its island area. . . . .	32
<b>Figure 10.</b> Types of coast of the Cartagena de Indias district . . . . .	34
<b>Figure 11.</b> Articulation of Plan 4C with other regional and local policies, plans and planning instruments. . . . .	35
<b>Figure 12.</b> Natural green and blue axes of the Cartagena de Indias district . . . . .	36
<b>Figure 13.</b> Severe flooding scenarios (SLR + heavy rainfall) projected to the year 2040 . . . . .	39
<b>Figure 14.</b> Threat of coastal erosion in the Cartagena de Indias district . . . . .	40
<b>Figure 15.</b> Threat of coastal erosion in the island area of the Cartagena de Indias district . . . . .	41
<b>Figure 16.</b> Climate change impacts on the pessimistic scenario in 2040 (SLR + heavy rainfall) . . . . .	42
<b>Figure 17.</b> High and medium vulnerability in different sectors of Cartagena de Indias. . . . .	43
<b>Figure 18.</b> Vulnerability of the ecological heritage of Cartagena de Indias . . . . .	44
<b>Figure 19.</b> Severe flooding scenarios (SLR + heavy rainfall) projected to the year 2040 . . . . .	46
<b>Figure 20.</b> Axes and strategies identified for climate compatible development in Cartagena de Indias. . . . .	50
<b>Figure 21.</b> Visitors in Cartagena. Source: CCC based on MCIT data . . . . .	59
<b>Figure 22.</b> Total coasts of Plan 4C 2014-2024 (figures in millions of pesos) . . . . .	104

<b>Figure 23.</b> Distribution of the amounts of investment required for Plan 4C by axes and strategies, 2014-2040 (figures in millions of pesos) . . . . .	105
<b>Figure 24.</b> National funds with resources to finance Plan 4C projects. . . . .	108
<b>Figure 25.</b> Channels through which international climate finance is provided (excludes private funds) . . . . .	109
<b>Figure 26.</b> Foundations in Colombia which could finance projects under the Plan . . . . .	110
<b>Figure 27.</b> Resources to finance Plan 4C projects according to their origin . . . . .	111
<b>Figure 28.</b> Flow chart of operation of Plan 4C projects . . . . .	112
<b>Figure 29.</b> Main functions of the Cartagena Climate Action Center . . . . .	114
<b>Figure 30.</b> Initial operational structure of the Climate Action Center for Cartagena . . . . .	115
<b>Figure 31.</b> Actors of the Inter-Institutional Commission of Climate Change for Cartagena de Indias . . . . .	116
<b>Figure 32.</b> Structure of the sub-commissions of the Inter-Institutional Commission of Climate Change . .	117





# Introduction

## Introduction

The vision of a climate compatible Cartagena de Indias, from today onward and for the next hundred years, has brought us to think of the possibility of turning a climate challenge into a great opportunity to ensure the well-being of its citizens and prosperity and competitiveness for the city.

Cartagena de Indias is an emblematic city, whose history is directly linked to the origin and development of this country and whose legacy qualified it to be declared a Historic Heritage of Humanity.

It is at present a source of industry and progress, with a port zone through which 60% of Colombian maritime trade passes. It is home to over 2,500 industries, which contribute 6% of national GDP and growing in investments in tourism that confirm it as one of the cities with the greatest international projection in this country.

However, in spite of Cartagena de Indias being a city with important wealth indices, it has a social debt that cannot be postponed. It is reflected in considerable inequality in the distribution of income, which has direct repercussions on the living conditions of its population: 32.7% of its inhabitants live in poverty. Although the climate affects everyone equally, low income families are nevertheless the most vulnerable to climate change.

The city's development has been within a framework of transformation of the landscape: its sandy beaches, marshes, channels, seashore, dunes and mangrove swamps have been transformed into an urban conglomeration of buildings, hotels, industries, ports and the necessary road infrastructure. Likewise, the poorest have been

gradually displaced to zones most at risk, such as the islands and surroundings of La Virgen marsh. This transformation, caused by man, has placed at risk both the ecological structure of the city and the benefits it provides in terms of protection from the effects of climate change. Today, this situation is exacerbated by the present and future challenges the ecosystems face.

The new climate projections for the planet predict that with a 2°C increase in temperature the sea level in Cartagena de Indias will have risen by 60 cm in the year 2040. The Inter-Governmental Panel on Climate Change (IPCC) indicates that the temperature will increase between 4 and 6°C, which would raise the sea level even more, as well as increasing rainfall and droughts (IPCC, 2014).

It is within this context that it becomes necessary to re-think Cartagena de Indias. In the past, lasting protection measures were implemented for the city walls, which they now reflect and are a symbol of. However, the climate and present circumstances require much more: it is no longer a question of city walls and infrastructure, but also of changing the people's way of life and how they live, think, feel and project the city.

Being aware of this great challenge, Cartagena de Indias now presents its Plan 4C: a framework for planning and action in response to the need for a more climate compatible development. Cities that understand the future climate and prepare to face it will be more competitive. Taking steps today in order to be prepared for future conditions will be much more cost-effective than waiting to introduce costly planned emergency measures. Likewise, adaptation and mitigation measures will be able to provide the city with an interesting range



of possibilities and opportunities for the social and economic development of its population.

The plan promotes Cartagena de Indias as an icon of the climate and competitiveness, with its inhabitants, the Cartageneros, committed to their vision of the city, which includes: beaches, coral reefs, mangrove swamps and marshes in a symbiotic landscape; clean channels and sea free from contamination; coastal wetlands and marshes that recover their ecosystemic wealth and services; planned and adapted neighborhoods and islands with their inhabitants; a protected historic heritage, with an ever more abundant flow of tourists; flourishing and dynamic industries, more efficient in the use of resources, which will make it possible to improve its inhabitants' quality of life, create jobs and achieve sustained, competitive and more equitable growth for everyone.

---

## Vision by 2040

**By 2040, Cartagena de Indias will be recognized as a city that is a model of urban and coastal planning based on climate compatible development, where adaptation and mitigation measures will reduce indices of vulnerability to climate change, improve efficiency of public investment, the quality of life of its inhabitants and the competitiveness of its sectors.**







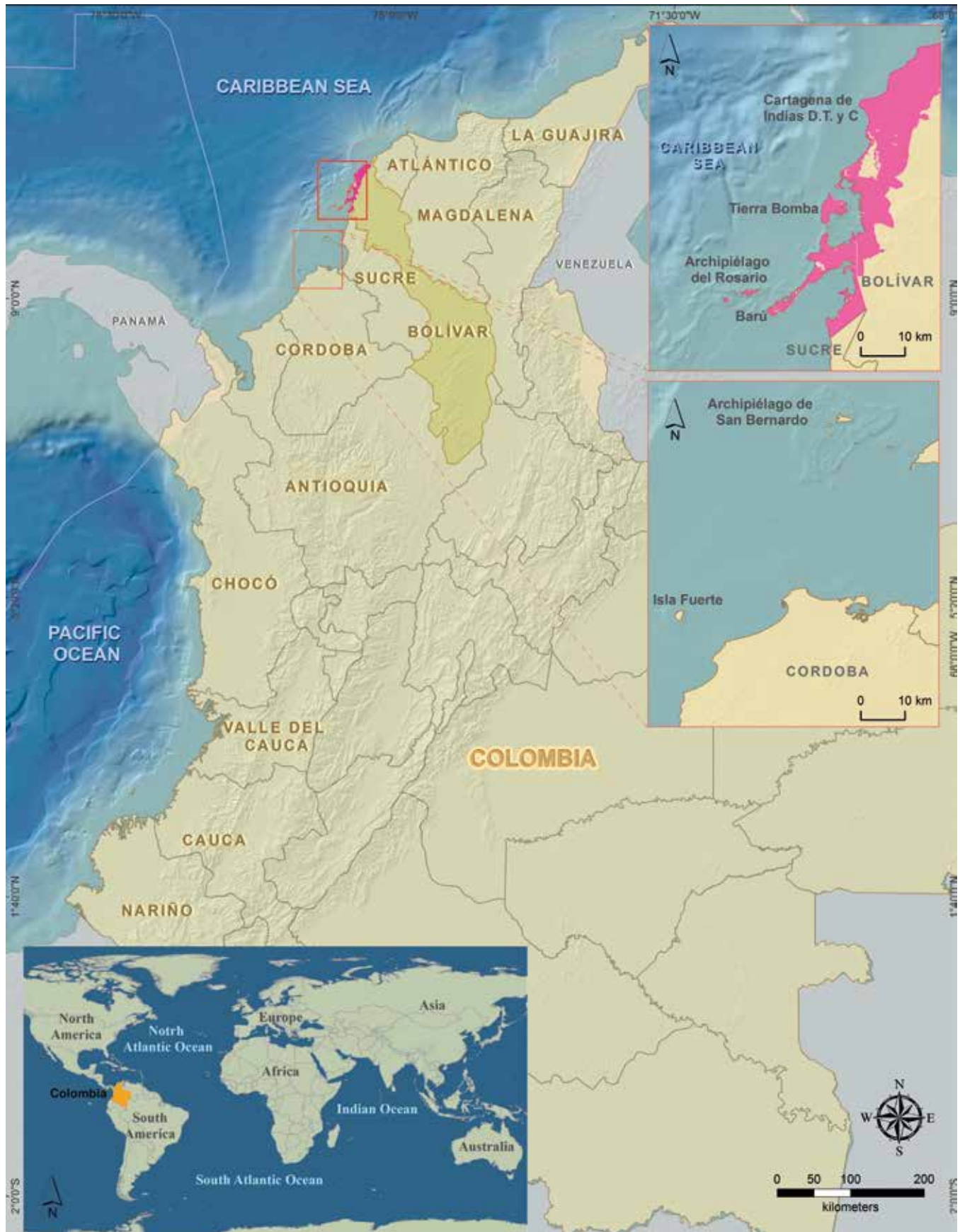
# **CHAPTER I**

## **An overview of Cartagena**



#### Plan 4C

A Competitive and Climate Compatible Cartagena





# 1. The historic legacy of Cartagena de Indias

Cartagena de Indias was built in a strategic geographic position to protect it from the constant pirate sieges. Later, the inclement weather forced the authorities to reinforce their walls to protect the coastline; even though the Spaniards who founded it were unaware of climate change, the heritage of their city walls and fortifications remains to this day.

Cartagena de Indias was founded on June 1, 1533 by Don Pedro de Heredia. On the arrival of its founder, it was considered a place of passage in which to install a provisional camp, but a few years later it became the best guarded jewel in the crown. The importance of the city lay in its strategic location, which allowed it to become one of the most important American ports in colonial times, from which precious metals and a variety of products were sent to the Old Continent and to which provisions and merchandise were brought (including slaves). It was thus that the city became the site of preference for invasions or adventurers and corsairs from other kingdoms, which is why the Spanish Crown decided to fortify it to protect it from these adversaries.

In the construction of the city's defense system, its shape formed a natural protective barrier. The first line of defense was built in Bocachica, the only possible port of entry to the bay at the time, since in Bocagrande a large sandbank had formed caused by a number of shipwrecks. This sandbank soon connected the island of Tierra Bomba with the continental area, thus preventing the passage of ships through Bocagrande. To complement the general defense system of the Bay, a series of walls and bastions was built in coral stone extracted from nearby quarries around the old city (today the Historic Center).

Since its construction and during the early years of its existence, this defense system suffered from climate-related effects. The cordon of the



city walls facing out over the Caribbean sea and all of its bastions were torn down several times by the strong winds and the force of the sea, to the point that the waves penetrated as far as the city walls. As a result of this situation, at the beginning of the year 1760, the Viceroy ordered Don Antonio de Arevalo to create a defense project, which consisted of building a dike or submarine wall, with branches, parallel to the one already built, which was begun in 1765 and ended in 1771. This work, now over 240 years old, which has never undergone maintenance, continues to protect the "Corral of Stone" from the forces of nature. Figure 1 shows the original plan of the breakwater of the marina drawn by Don Antonio de Arevalo and a present day aerial photograph showing the presence of these defense works.



**Figure 1.** The Marine breakwater: (a) plan of the marine breakwater and (b) aerial photograph by Jaime Borda-Martelo, highlighting the shade of the marine breakwater. Taken from: Presentation of Heritage Management(IPCC, 2014).

Immediately after the marine breakwater was finished (1771), Cartagena de Indias commenced construction of the Bocagrande breakwater, which had become necessary as of 1750 as a result of the opening of a small channel on the sandbank that connected the city with Tierra Bomba, which had widened with the passage of time and had become

a security risk for the city. This channel not only protected it from its adversaries, but also changed the morphology of what are today the neighborhoods of Bocagrande and El Laguito, because of the appearance of new land, which was consolidated and was urbanized in 1950. The plans and location of this submarine work, which still stands, is shown in Figure 2.



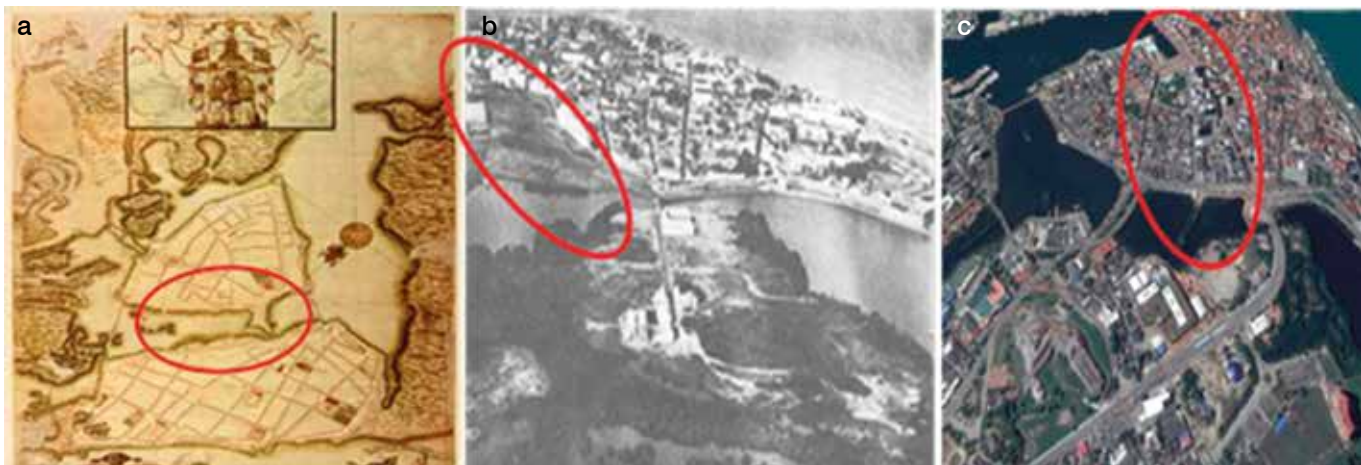
**Figure 2.** Plan and location of the Bocagrande Channel; on the left of the plan of the channel drawn by Don Antonio de Arevalo (1769) and on the right a Google Earth image in 2013.



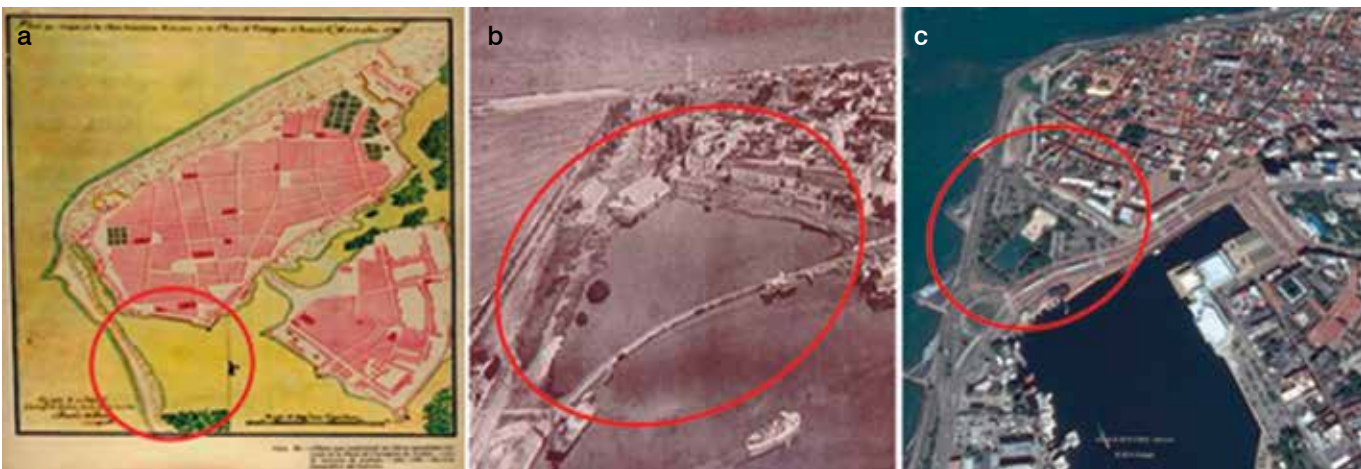
While the breakwaters of the marina and Bocagrande are the result of the historic adaptation of the city to the climate over the years, it continues to be transformed in order to gain land from the sea, thus being converted into the present day Cartagena de Indias: a city settled on the Caribbean Sea coast, with in internal bay and exposed to the variations of the climate that today are increasing due to the atmospheric change. Figures 3 and 4 clearly illustrate this assertion. What is today the Matuna (Figure 3c) was at one time the San Anastasio pipe (Figure 3a), which

was filled towards the end of the XIX Century and early XX Century, as shown in Figure 3b.

For its part, what is today the Marina Park, a green zone of the city owned by the Ministry of Defense (Figure 4c), formed part of the internal bay of Cartagena in colonial times, as shown on Don Antonio de Arevalo's plan of 1789 (Figure 4a). The railroad was built at the beginning of the XX Century (Figure 4b), which reached the station located beside the Clock Tower, thus defining the outline of what is today the Avenida Blas de Lezo (Figure 4c).



**Figure 3.** Changes in the occupation of the Matuna soil: (a) Plan of Juan de Herrera y Sotomayor (1730); (b) Aerial view with the Chambacu Island in the foreground (1928) and (c) La Matuna Neighborhood, Google Earth image 2013.



**Figure 4.** Changes in the occupation of the soil of the Marina Park: (a) Copy of the plan of Antonio de Arevalo of 1789, taken from the presentation of the IPCC Heritage Department (2014); (b) Railroad line, 1928 and (c) Marina Park, Google Earth image.

It is only by looking into the past and recalling what the city used to be like and realizing how it has changed in both physical and human terms while, at the same time, taking into consideration the dimensions of nature's inclemencies, that we can project a city that is competitive and adapted to the climate of the future. Cartagena de Indias, declared a Historic Heritage of Humanity by Unesco in 1984, and the splendor of its architecture (Historic Center, San Felipe Castle and other military constructions of the XVI, XVII and XVIII Centuries) are an invaluable asset for the development of tourism. This heritage evokes the city's capacity for protection and adaptation in the past, while at the same time projecting an equally grandiose dimension of the climate "Heroica" in the future.

## 2. Cartagena de Indias today

Cartagena de Indias, capital of the Bolivar Department, is the principal urban center of the municipality and an important focus of the city's

popular attraction. Likewise, most of the social and institutional groups, as well as the infrastructure associated with its industrial activities, ports, commerce and tourism of the Department, are concentrated within the city. These characteristics place it among the three most important cities on the Colombian Caribbean coast.

The district of Cartagena de Indias includes a series of islands, peninsulas and interior bodies of water, which form the insular and continental area, giving the city a unique identity based on its morphology. The surface area of the land in the district is 697.24 km<sup>2</sup>, of which 87.45% is rural and 12.55% urban (SPD, 2013).

For their administration, these areas are divided into three localities that group together different Community Government Units (Table 1). The insular territory forms part of the Historic Locality and Northern Caribbean which, with the exception of the island of Tierra Bomba, belong to the Corales del Rosario and San Bernardo National Natural Park (PNNCRSB) and, together with Fuerte Island and Baru form the Protected Marina Area (AMP) of the Nuestra Señora del Rosario and San Bernardo Archipelagos (Resolution 679 of 2005).

**Table 1.** General characteristics of the localities into which the district of Cartagena de Indias is divided politically and administratively

Description	Locality 1. Historic and Northern Caribbean	Locality 2. De la Virgen and Touristic District	Locality 3. Bahía Industrial (Industrial Bay)
Area	17.452,97 ha	37.102,67 ha	8.438,12 ha
Urban Government Community Units	1,2,3,8,9,10	4,5,6,7	11,12,13,14,15
Rural Government Community Units	Tierra Bomba, Bocachica, Caño de Oro, Isla Fuerte, Del Rosario islands, Santana, Baru, San Bernardo islands	Arroyo Grande, Pontezuela, La Boquilla, Punta Canoa, Arroyo de Piedra, Bayunca.	Pasacaballos.
Number of neighborhoods	74	45	68

Source: SPD, 2013.

The coastline of the district is approximately 304 km long, which is almost 95% of the total coastline of the Department. The most important source of sand for its beaches are sediments from the Magdalena river. The principal dynamic

economic activities of the Bolivar Department are centered in these areas, including the ports, industries, commerce and tourism, representing 90% of the regional GDP.

Cartagena de Indias has a population of 978,600 inhabitants, of whom 4.4% live in the rural area, of which most densely populated El Islote and Isla Fuerte (Figure 5a). In the urban area the population is divided into zones that have differing degrees of vulnerability to future climate risks and which, in many cases, coincide with the neighborhoods with strong growth and are very densely populated, as in the case of Bocagrande

(Figure 5b) and those surrounding the La Virgen marsh (Figure 5c). According to the District Planning Department projections for 2013, based on the DANE census of 2005, the total number of houses in the district is 195,802, with an estimated deficit of approximately 67,000. Around 27,500 are located high risk zones where mitigation is impossible (Cartagena Como Vamos, 2013).



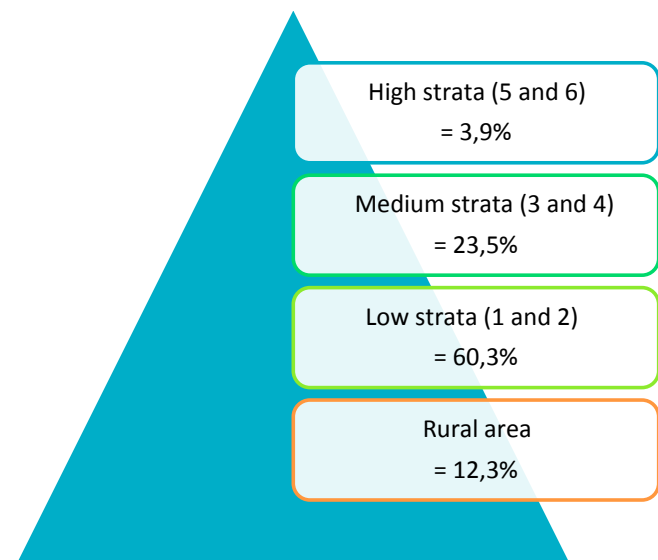
**Figure 5.** Populations settled on (a) Santa Cruz the rocky island, (b) Bocagrande and (c) surroundings the La Virgen marsh. Source: Invemar and Infrastructure Department archive.

60.3% of the population of the city belong to strata 1 and 2 (Figure 6), with poverty levels that in many cases classify as extreme.

The so-called “other Cartagena” is located in high risk zones where the climate is of special importance (Figure 7). It is to these populations that the city must assume a larger commitment and they are of special importance for this Plan. However, the climate impacts do not differentiate between the socio-economic conditions of the inhabitants, as the city has grown in a disorderly fashion with no consideration as to the risks of, and vulnerabilities to flooding, coastal erosion and effects on the principal ecological structure.

In turn, the city’s public services have been expanding their coverage in response to the needs of its growing population. According to “Cartagena cómo vamos” (Cartagena, how are we doing?) (2013), the water supply and sewage system coverage in the city is 99.9% and 88.56%, respectively. Coverage of waste collection is

99.9% and electricity 100% in the urban zone and 79.65% in the rural area.



**Figure 6.** Distribution of socio-economic strata in the urban area and rural total population. Source: SPD (2013) based on data of DANE census 2005





**Figure 7.** Vulnerable settlements of Cartagena de Indias: (a) La Boquilla; (b) and (c) neighborhoods on the border of La Virgen marsh and (d) Tierrabomba island.

The road network of the Cartagena de Indias district is 759 km, of which 656 km are urban and the rest are rural. According to the district Infrastructure Department, 52% of this road network is in bad condition, 34% in good condition and the remaining 14% is poor. To improve and maintain this system, it must be understood that roadways must be able to resist the effects of climate, both present and future, and must be in line with the projected conditions of a higher sea level.

In addition, the main economic activities are related to the petro-chemical industry, ports, tourism, commerce and services. In order for these productive types of activity to continue to generate wealth and prosperity for the city, it is vital to consider prompt mitigation and adaptation actions. This implies an understanding of their location, more efficient use of inputs, having early response capacity and taking into account the city in which they live as a whole. In this sense, adaptation to climate change is, undoubtedly, an indispensable factor in making Cartagena more dynamically competitive.



#### Industry

Industry is centered in the conglomerate located in the Mamonal zone, distributed mainly among 2,539 companies. This sector represents 95% of Bolivar Department industry GDP and contributes 6% of national GDP. The principal industrial development areas are: oil and derivatives, plastic, industrial raw materials, chemical products and, to a lesser extent, the food and drinks sector (CCC, 2013).



#### Ports

The ports infrastructure of Cartagena is one of the most complete in the country and handles 60% of its total cargo in containers. The private docks used for public service – among them the Sociedad Portuaria Regional de Cartagena (SPRC) and the Sociedad Portuaria de Mamonal, Compas and Contecar - handle close to 20% of total cargo mobilized by Cartagena. The rest is handled directly at over 20 private docks belonging to Mamonal companies. Cartagena has been gaining space at national level and, as of 2000, became the number one port on the Caribbean coast (Acosta, 2012).



#### Tourism, commerce and services

Because of its rich history and landscape, Cartagena de Indias is considered the tourism capital of Colombia. Apart from historic and sun and beaches tourism, which are its comparative advantage, the city has been consolidating other tourism service lines, such as, for example, organizing congresses, business rounds and receiving cruise ships, among others. According to CCC (2014), the tourism sector comprises 2,610 principal companies and assets worth COL\$1.600,000,000,000, the productive group with the largest number of companies identified in the Competitiveness Plan for the City and the Department. The hotel occupation rate in 2013 was over 65%.

### 3. The environmental conditions: the foundation of the city

The ecological heritage of the district of Cartagena de Indias is formed by a unique mosaic of ecosystems (Figure 8), which include sandy beaches, mangrove swamps,

a complex of wetlands formed by marshes and coastal lakes, dry forest relics, marine grasses and coral reefs, which vary from continental territory to insular areas (Figure 9). These island areas are closely linked to the ecology and tourism development of the city and include the Del Rosario and San Bernardo Corals archipelago, the Baru and Fuerte Island peninsula, which form part of Colombia's system of protected areas.



Figure 8. Principal ecosystems of the Cartagena de Indias district. Source: Invenmar archives.



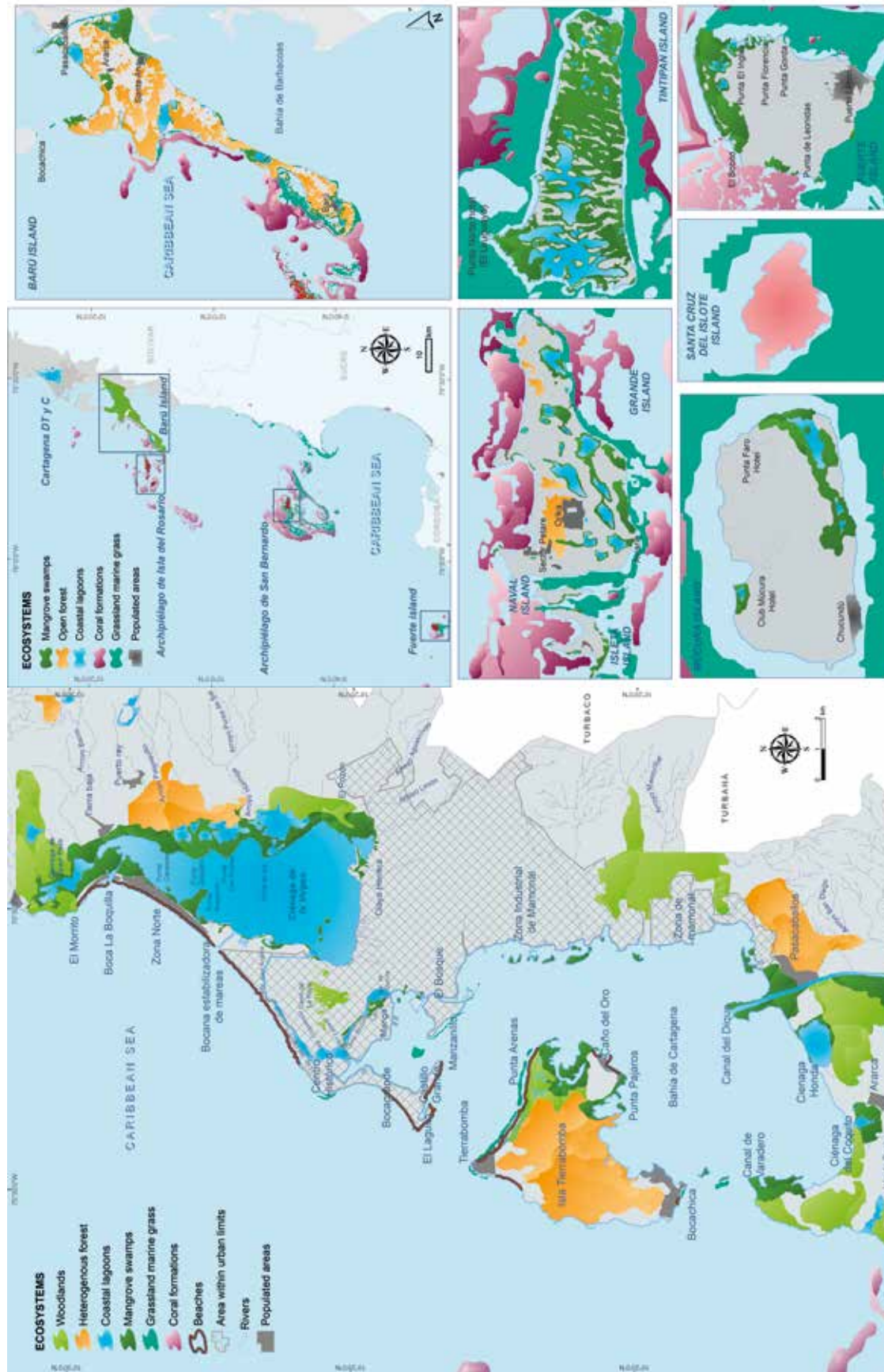


Figura 9. Ecosistemas presentes en el distrito de Cartagena de Indias y su área insular.



These ecosystems provide a series of goods and services that represent an important environmental asset for the district, serve to support local populations and provide possibilities for protection from climate threats. Notwithstanding, population growth and increased productive activities have put pressure on these ecosystems and altered their capacity for resilience.

espiga Cartagena de Indias has grown mainly at the expense of coastal landscapes such as sandbars and longshore bars, and infills of adjoining mangrove swamps. According to Correa (2005) and Posada and Henao (2008), this has generated greater susceptibility to erosive process on the coastline (which is sometimes 3 m/year) and flooding phenomena caused by either the tide or extreme rainfall. The latter represent 43.3% of the events reported, the most susceptible sectors being Manga, El Centro, Marbella, Bocagrande, Castillogrande, El Laguito and the La Boquilla zone, La Virgen marsh and Manzanillo del Mar.

The city must be conscious of the fact that its natural heritage forms part of its main protection and resilience system. It is only by understanding the dynamics of its ecosystems that it will be possible to devise an integral plan for the city of today and that of the future.

## 4. The climate today

The Cartageneros are feeling the climate. The temperature has already reached maximum values of up to 36.7°C, with long dry periods and more intense rains that destabilize the functioning of the city. In fact, the multi-annual average temperature in the period 1995-2005 in Cartagena was 27.9°C; according to this trend, an increase of 0.017°C per year or 0.17°C per decade can be expected (Ecovera, 2010). The

surface temperature of the sea fluctuates in the range of 25 to 28°C in the Caribbean region, at a multi-annual average value of 27.9°C in Cartagena.

The characteristic precipitation regime is that of two seasons per year: a dry season from December to April with rainfall below 50 mm per month and a rainy season from May to November. The months with most precipitation are September, October and November, with October showing the highest levels of rainfall at a multi-annual monthly average of 250 mm.

According to Andrade (2002) and Restrepo and Lopez (2008), based on the existing data on variations in sea level in the city of Cartagena de Indias, increases of up to 15 and 22 in the last 100 years have been recorded, indicating that increases of 2 to 5 mm per year can be expected, in which case the level of the waters could increase by between 80 cm and 1 m by the year 2100.

In this context, Cartagena de Indias has seen more and more frequent floods in its neighborhoods and on its roads. The city has suffered long periods of water and electricity rationing, general deterioration in the city's infrastructure, an increase in diseases transmitted by vectors, such as dengue, heat waves which mainly affect the health of the elderly and children, all of which influence tourists who, for the most part, are seeking sun and sand.

The significant climate variations that affect the capital include, among others, physical, geographic, social, economic and political factors that affect its development and make the city a critically vulnerable area: its characteristic as a natural river bank (Figure 10) leaves it exposed to the effects of marine-coastal processes (erosion and accretion) and to the impacts of the climate phenomena of a marine or continental origin that influence its territory.



Figure 10. Types of coasts of the Cartagena de Indias district.

## 5. Present planning and future development

Cartagena de Indias, like all the other cities in this country, base their planning on four yearly periods during which they produce development plans. The present development plan “Ahora Sí Cartagena (“Now Yes Cartagena) 2013-2015” includes climate change as a variable in the environmental regulations of the territory, in accordance with the stipulations in the 2010-2014 National Development Plan “Prosperity for All” and in its National Climate Change Strategy. Likewise, Plan 4C articulates with other local, regional and national planning policies, plans and instruments.

Among the local planning instruments, the city has the Territorial Land Use Plan (POT) formulated in 2001, which is at present going through a structural revision process. The climate variable must form the base of the future POT, so that new neighborhoods will develop in accordance with these considerations and those existing at present will have to adapt to the conditions of the climate of the future. It is also necessary to have an integral vision of the infrastructure of the city, both physical and natural, in which its green axis (vegetation) and blue axis (water) both invigorate and transform it (Figure 12).

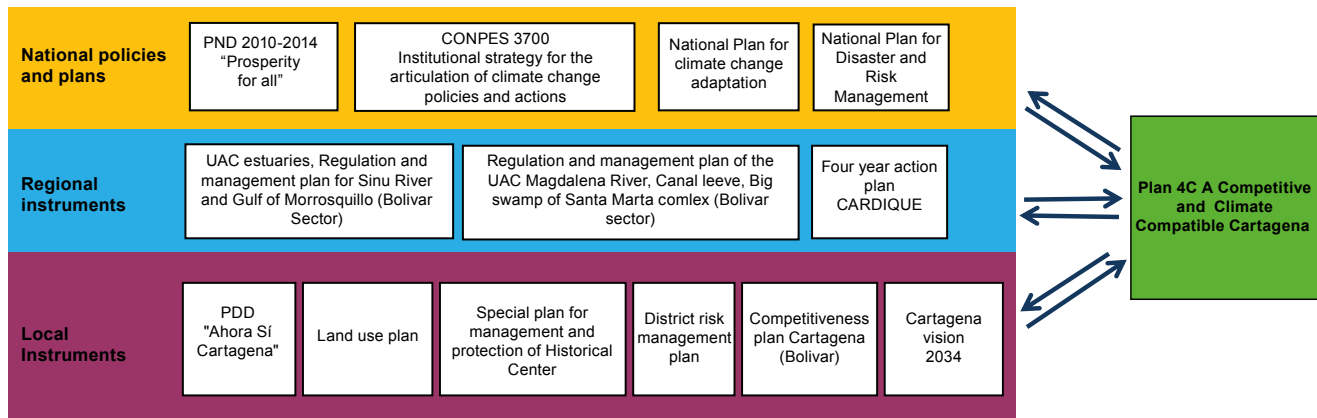
It is important to stress that, right from the beginning of the process of analyzing the climate vulnerability of Cartagena de Indias, the basis for

1. Because of by-elections, Cartagena's present Development Plan is only for two years: 2013-2015.

the implementation of this Plan 4C, the different administrations have ratified their decision to contribute to its construction. Thus, the climate change begins to be seen more as a policy of the State rather than that of a government.

In this line of thought, the city seeks to promote resilient territory, planned according to an accurate

analysis of risk and vulnerability, and with a long-term vision that indicates the right roadmap for the different sectors, both public and private, to work in coordination towards the Cartagena of the future. In other words, the city trusts that Plan 4C will be a source of jobs and well-being and that the climate conditions that affect it will be transformed into development opportunities.



\*Currently in development

**Figure 11.** Articulation of Plan 4C with other regional and local policies, plans and planning instruments.



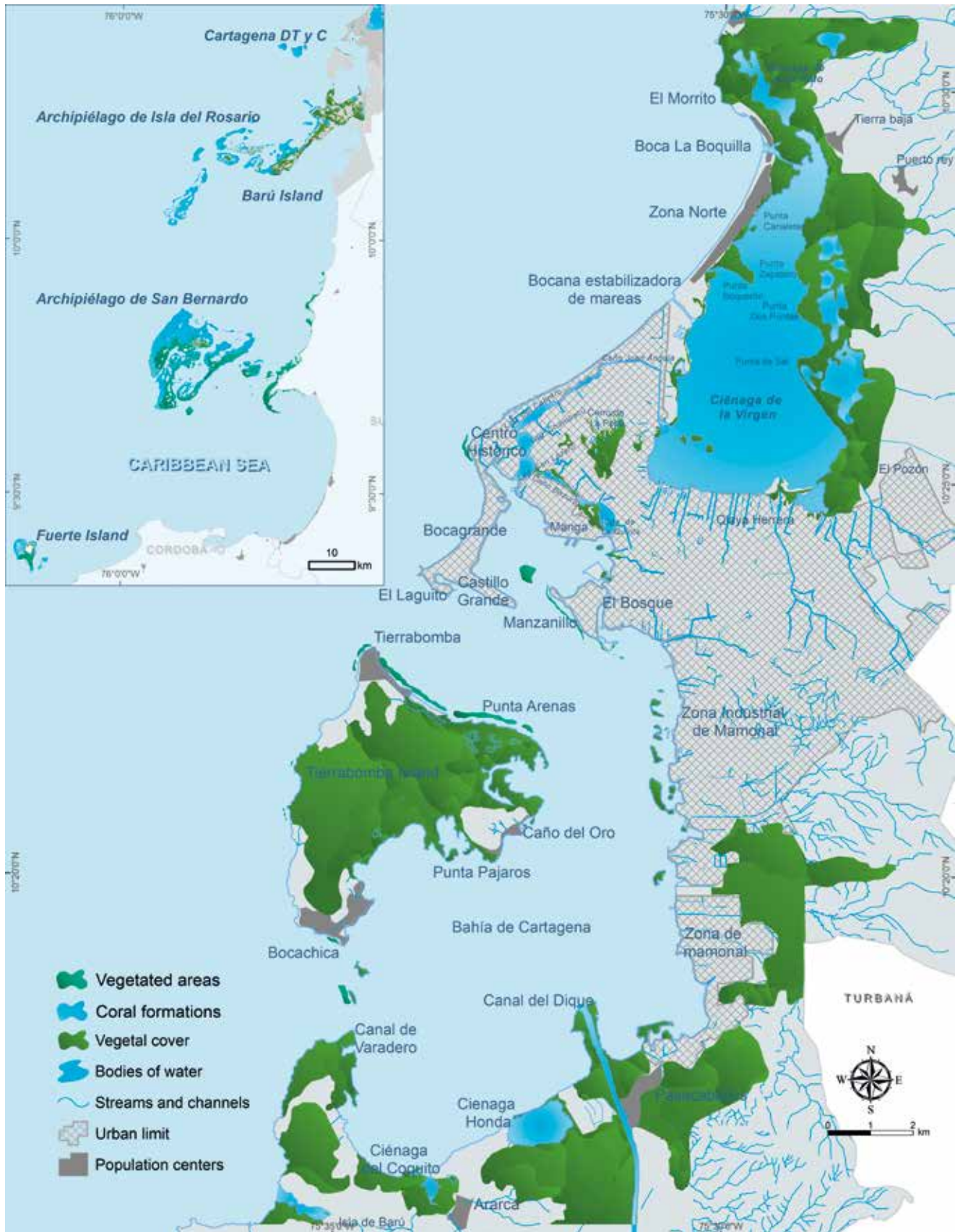


Figure 12. Natural green and blue axes of the Cartagena de Indias district.



## Chapter II

# Climate Change in the city of Cartagena



## 6. Vulnerability to climate change in the city of Cartagena

The principal climate-related phenomena that are a permanent threat to Cartagena de Indias include an increase in sea level and extreme

events such as tidal waves, torrential rains and intense heat seasons, which have historically caused disasters and damage to the inhabitants, to economic activities and to the historic heritage. According to the Intergovernmental Panel on Climate Change the frequency and intensity of these phenomena are expected to increase and, if the city does not introduce measures to deal with some, the impacts may be significantly greater.

**Table 2.** Threats of climate change: present and future situation in Cartagena de Indias

Threatening climate phenomena	Present year 2010	Future projections 2040	Consequences in 2040
Increase in temperature	27,9°C	29,1°C	<ul style="list-style-type: none"> <li>- Redistribution of ecosystems and species, and possible alteration in environmental services.</li> <li>- duplication of cases of diseases transmitted by vectors, such as dengue and leptospirosis.</li> <li>- Effect on productive activities, such as fishing.</li> </ul>
Sea Level Rise	14 cm	15-20 cm	<ul style="list-style-type: none"> <li>- Constant increase of some 2 to 5 mm per year.</li> <li>- Gradual loss of large areas of land and extension of floods during rainy seasons.</li> <li>- Loss of ecological heritage and retrogression of beaches.</li> <li>- Damage to houses, historical and cultural heritage, road, port and industrial infrastructure.</li> </ul>
Increase in months with extreme rainfall	3% (4 months of extreme rainfall)	30% (36 months of extreme rainfall)	The trend towards increase in likelihood of occurrence and intensity of extreme events suggested by the IPCC (2007) will continue: increase in intensity and frequency of rains, heat waves and increase in frequency of hurricanes in the Caribbean.

Floods are a recurrent problem in the Bolívar department. The 2010-2011 wave of heavy rainfall caused economic losses estimated at more than 5% of departmental GDP (calculated using data obtained from DANE, IDB and Cepal for 2010). Also, the latest census of victims of the rainy season of 2010-2011 indicates that 43,500 families suffered damage caused by the emergency (Government of Bolivar, 2011).

This is a clear example of how the climate can affect socioeconomic development and competitiveness, both of the Department and of its capital, with deterioration in the living conditions of the population. If this trend continues, the costs

of the lack of action will be much higher than those assumed so far.

Figure 13 shows the pessimistic scenario<sup>2</sup> of an increase in sea level due to climate change projected for Cartagena de Indias in 2040; it is notable that the zones bordering on the Virgen Marsh, the tourist zone of the city (Bocagrande, Castillogrande, El Laguito and the Historic Center) and the Port and industrial zone would be the most affected by the increase in sea level. The neighborhoods most exposed are Olaya Herrera (39,649 inhabitants), el Pozón (2,122), Manga (6,052), Bocagrande (13,296), Crespo (14, 710) and Castillogrande (6,759).

2. This was calculated on the assumption that the city will not acquire capacities for prevention or response to impact and that its degree of exposure to rain will remain similar to that of the present.





Figure 13. Severe flooding Scenarios (SLR + heavy rains) projected to the year 2040.

well as the infrastructure of Tierra Bomba island, the touristic zone of the city, the port and industrial zone, Playetas and Punta Gigante on Baru Island, the Rosario and San Bernardo archipelagos and Fuerte Island (Figures 14 and 15).





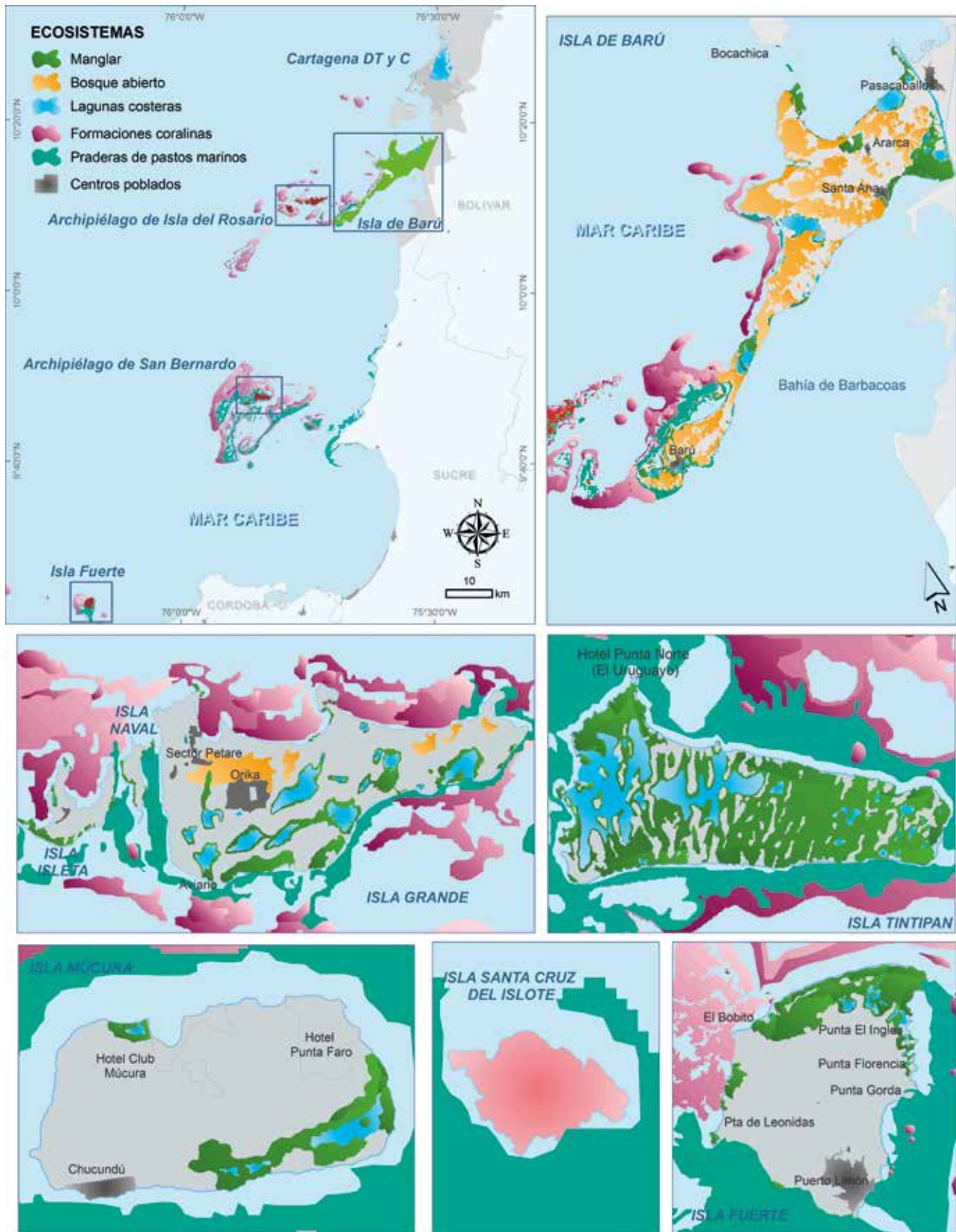
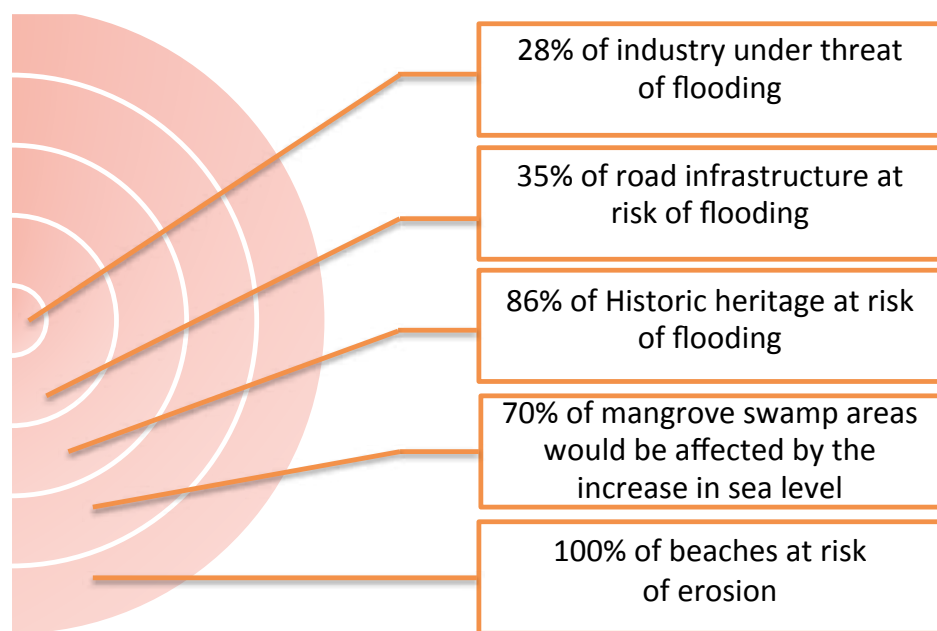


Figure 15. Threat of coastal erosion in the island area of the Cartagena de Indias District.

If no adaptation measures have been introduced by 2040, one of every five Cartageneros could be affected by high tides; likewise, 27.5% of the population and 26.2% of houses would be flooded

and the natural base would be affected. This would have serious implications for the competitiveness of the city, its economic development and the social well-being of its inhabitants (Figure 16).



**Figure 16.** Climate change impacts on the pessimistic scenario in 2040 (SLR+ heavy rainfall).

Given their unfavorable socio-economic conditions, the following are the most vulnerable sectors (Figure 17):

- Tierra Bomba and La Boquilla are considered high vulnerability areas due to the poor coverage of public services in some zones of the neighborhoods and because of the type of housing found there. This is in addition to the effects caused by coastal erosion and floods.
- The neighborhoods bordering on the La Virgen marsh, which are exposed to flooding caused by both the rise in sea level and the effect of rainfall; moreover, due to poverty, it should be stressed that, in this sector, the use of residential land predominates and

coincides with the zone with the largest population expansion rate in the city.

- Bocagrande, Manga, the Historic Center and the Industrial Zone, which include neighborhoods with good coverage of public services, medium and high income levels and buildings of more than one floor. Here, the uses of the soil are residential, commercial and industrial. Nevertheless, there is high exposure to climate hazards, such as flooding caused by extreme events, coastal erosion and the loss of beaches, among others. However, owing to their socio-economic situation, they are less sensitive to these impacts and, therefore, they are considered to be of medium vulnerability.

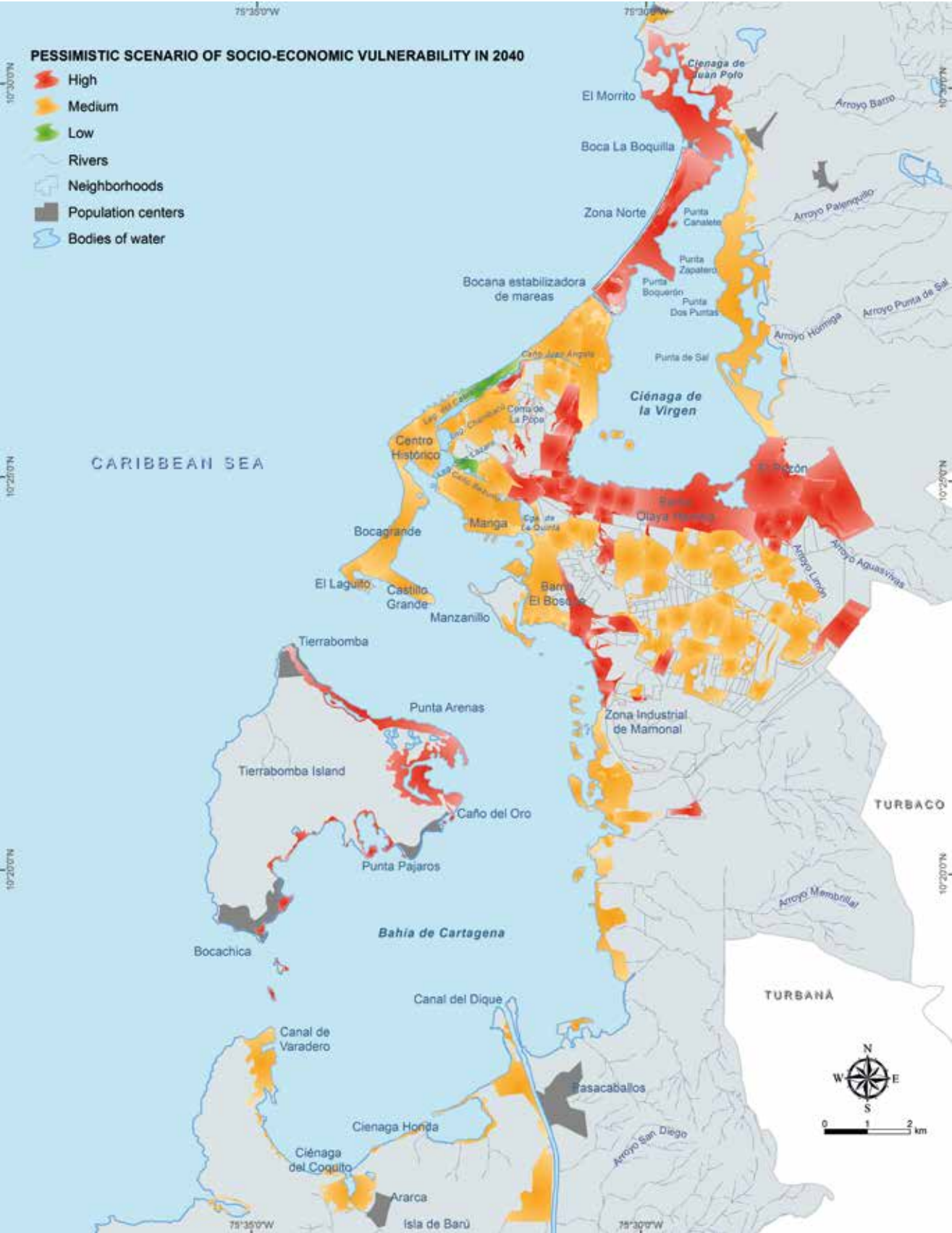


Figure 17. High and medium vulnerability in different sectors of Cartagena de Indias.



## Natural heritage vulnerable to climate change

The natural resources most vulnerable to climate change are the ones related to water, mangroves and beaches (Figure 18). The zones most under threat are those of La Virgen marsh, the islands of Tierra Bomba and Grande Islands

and the Playa Blanca, Playetas and Baru sectors (south coast). La Virgen marsh is affected by floods which place at risk the principal ecosystems of the city's mangrove swamps, while in the rest of the areas there is a high level threat of coastal erosion which, added to intermediate to high degree of urban development, makes these areas much more vulnerable to this phenomenon.

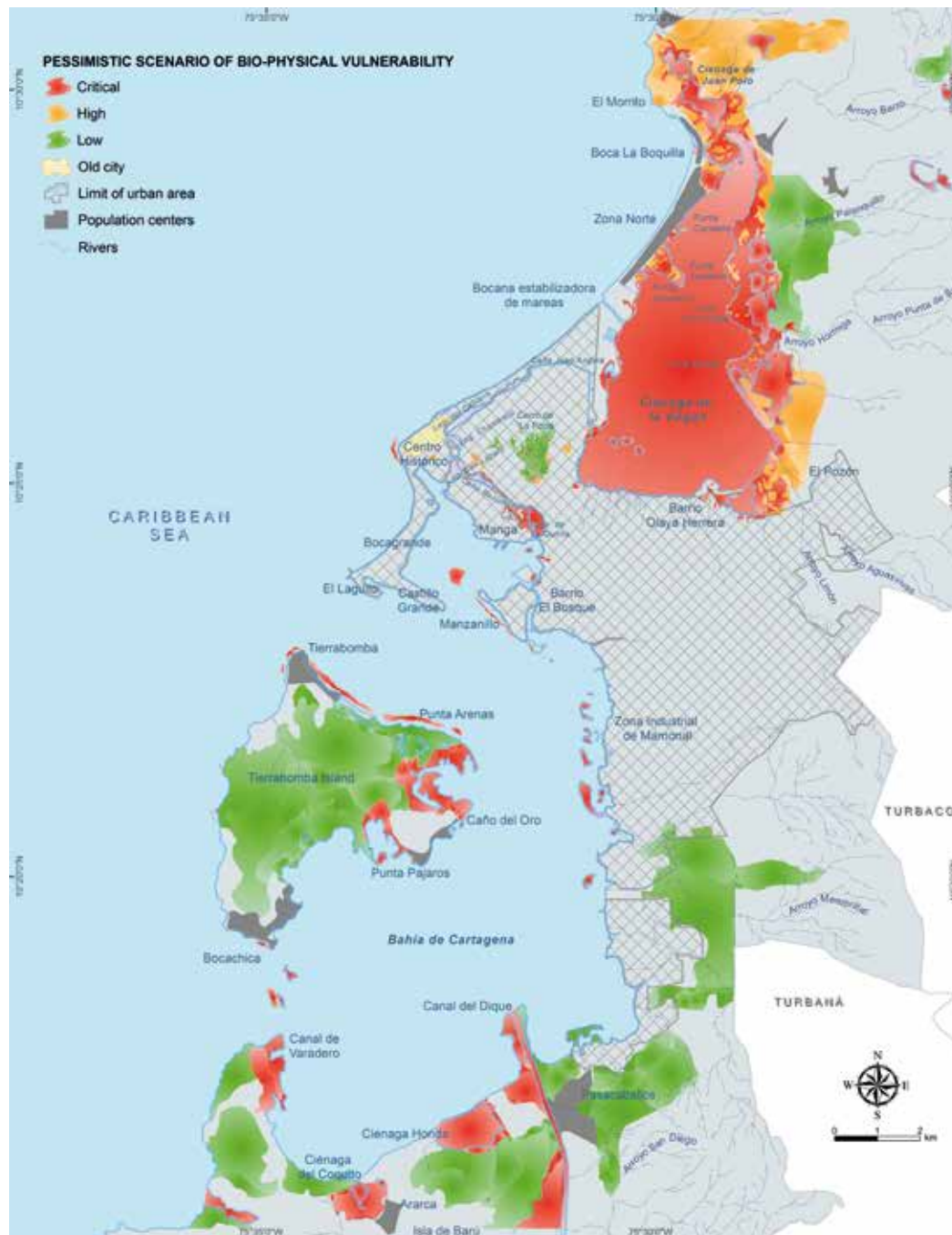
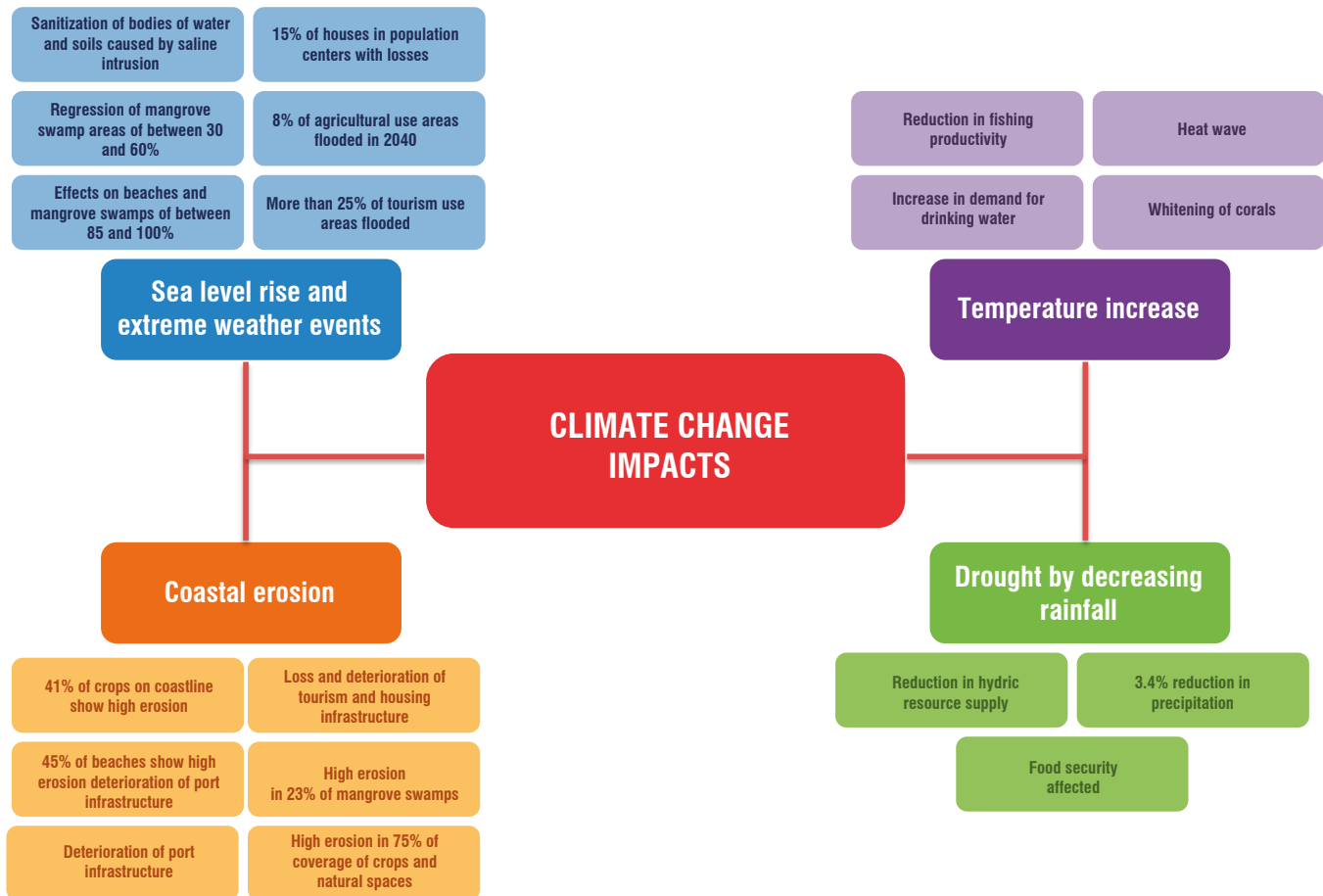


Figure 18. Vulnerability of the ecological heritage of Cartagena de Indias.



## 7. Vulnerability to Climate Change in the islands of Cartagena

The main impacts of climate change quantified for the islands in 2040 are:



At socio-economic level the consequences would be:

- Approximately 2,121 persons affected directly in the entire insular area, that is 478 homes in 410 houses that could suffer total or partial losses.
- The highest number of population affected will be located in Ararca, Santana and Baru, with 1,466 persons in 345 homes in 301 houses

which could suffer total or partial losses.

- More than half the population on the Islote will be affected, which is equivalent to 125 homes with 621 persons living in 102 houses.
- On Fuerte Island, there will be impacts on 8 houses, in which 34 people live in 8 homes.
- Figure 19 shows the sectors that would be affected by the increase in sea level under the pessimistic scenario for 2040.

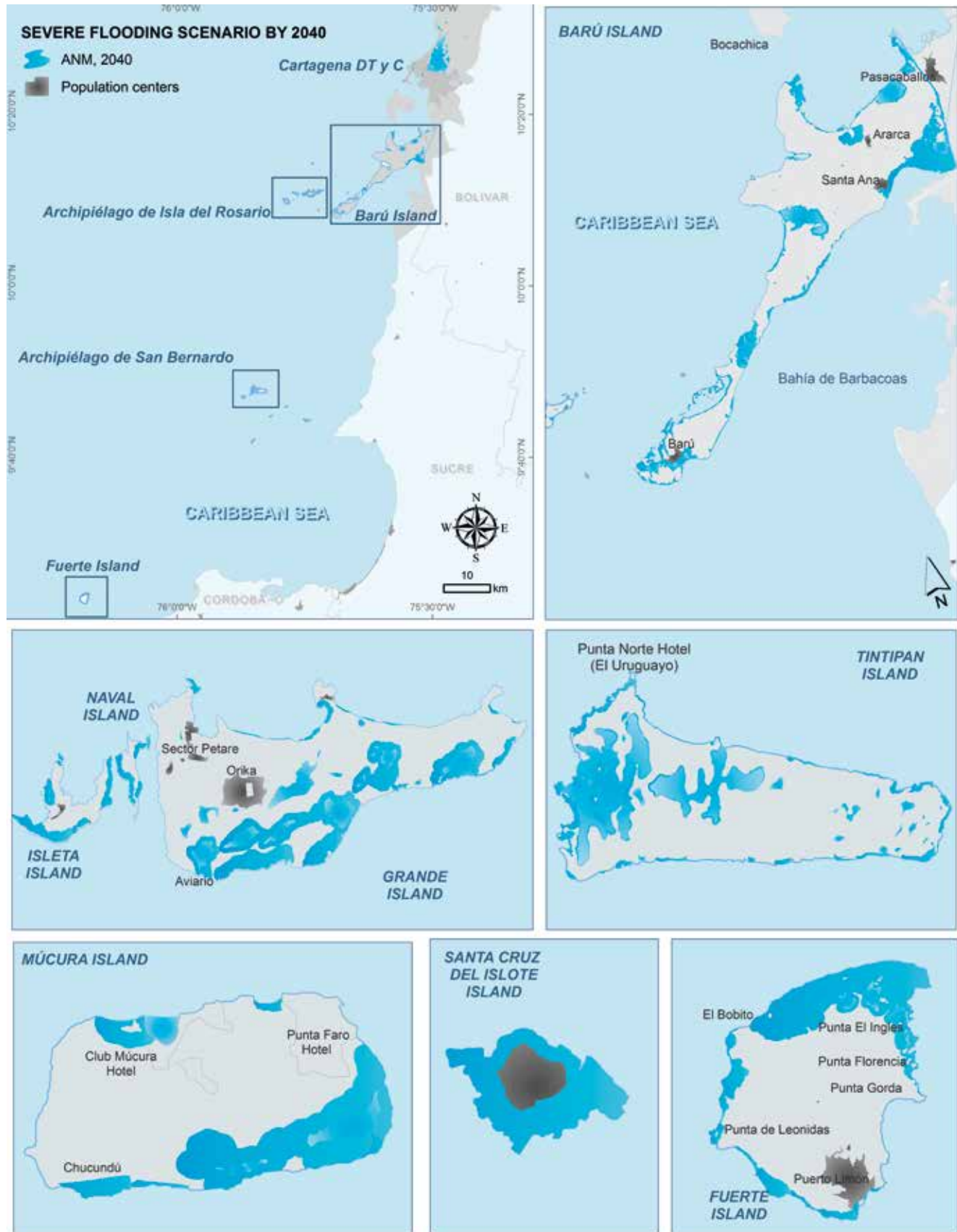


Figure 19. Severe flooding scenarios (SLR + heavy rainfall) projected for the year 2040.

It is necessary for the district and communities to work together in short-term adaptation actions, because, in the short term, the natural supply that contributes to the competitiveness of the city in terms of tourism, food security and

social development appropriate to this territory could be affected. Table 3 shows the vulnerability profile for the islands, the situation being critical for the Islote, Múcura, Grande Island and Fuerte Island.

**Table 3.** Vulnerability profile

Vulnerability					
	Population	Tourism	Agriculture	Availability of water	Mangrove Swamp ecosystem
Critical	Islote Mucura Island I	Grande Island Fuerte Island	Fuerte Island Mucura Island	Islote Grande Island	Isla Isleta Isla Naval
High	Baru Fuerte Island	Fuerte Island Mucura Island	Grande Island Baru	Mucura Island Baru	Grande Island Fuerte Island
Moderate	Grande Island Titipan Island	Tintipan Island Islote	Tintipan Island	Fuerte Island Tintipan Island	Baru Mucura Island





# **Chapter III**

## **Strategies and measures for climate compatible development**

## 8. Structuring the plan

Planning for climate compatible development in Cartagena de Indias is based on three main axes and three cross-cutting axes (Figure 20). The principal axes are established in strategies

that materialize in programs and projects which have resulted from work with local actors. Each project has a cost<sup>3</sup>, an area of intervention, one person responsible and a term for duration and performance (Table 5).

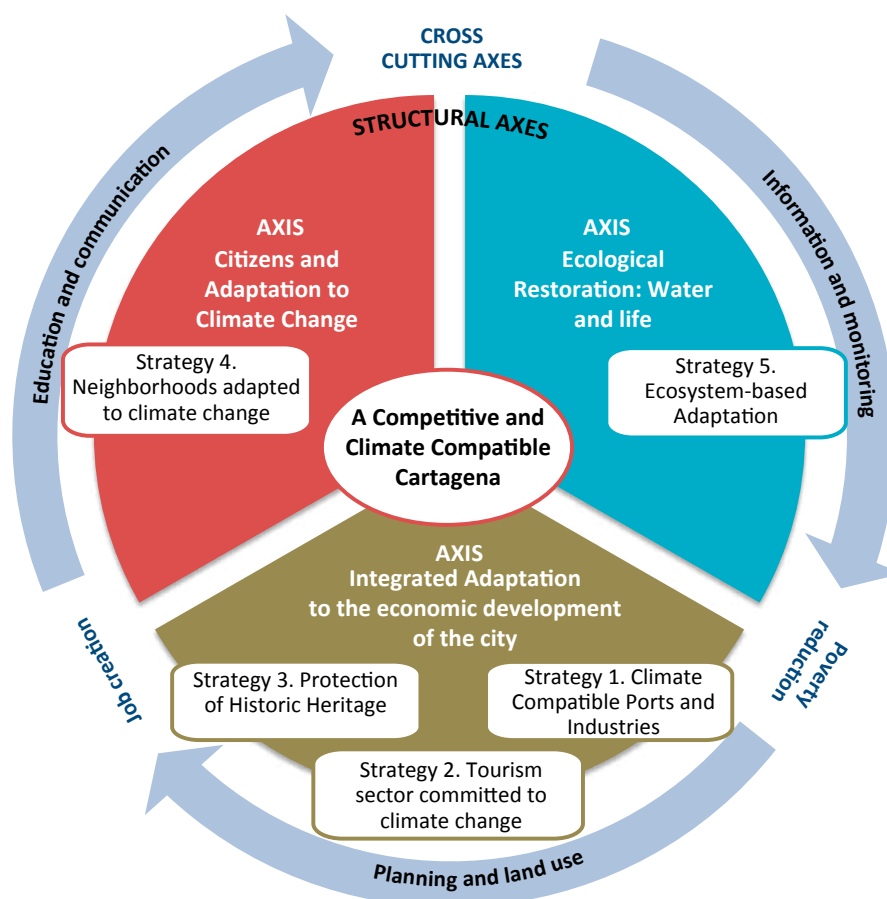


Figure 20. Axes and strategies identified for climate compatible development in Cartagena de Indias.

According to the foregoing, and taking into account that the effects of climate change are foreseeable on the basis of projections to 2040, the strategies proposed are the result of that temporality; moreover, they are within the framework of the Vision Cartagena 2034. The "Ahora Sí Cartagena" (Yes Now Cartagena) District Development Plan, as well as articulated with the different plans, programs and projects under way

at national, regional and local levels. To progress towards the vision set out in the Plan to 2040, a time horizon of ten years (Table 4) has been proposed. On this initial horizon monitoring and follow up will be carried out in order to evaluate the effectiveness of the projects proposed and to define their continuity or new actions or projects to achieve the objectives set.

3. Costs were estimated in Colombian pesos on the basis of: i. Values in similar projects, ii. Proposals or quotations from consultancies and iii. Valuation of the resources required for implementation. The latter are analyzed in Chapter IV.



**Table 4.** Terms for implementation of Plan 4C.

Performance term	Period of time
Short term	2014-2015
Medium term	2016-2020
Long term	2021 onward

**Table 5.** Strategies and programs to face the climate change challenges.

Structural axes	Strategies	Programs
<div>1</div> <div>Integrated adaptation to the economic development of the city</div>	Climate Compatible Ports and Industries	Energy Efficiency
		Adaptable buildings and infrastructure
		Contributions to ecological integrity
		Integral Risk Management
	Tourism sector committed to Climate Change	Hotels sector committed to climate change
		Tourism infrastructure adapted to climate change
		Support system for decision-making on climate change
		Education on climate change for tourists and service providers
		Marketing and promotion of climate change
	Protection of historic heritage	Protection of assets of cultural interest from climate change
		Greener Historic Center and buffer areas with reduced emissions
<div>2</div> <div>Citizens and Adaptation to Climate Change</div>	Adapted Neighborhoods to Climate Change	Urban neighborhoods adapted to climate change
		Community-based Adaptation in rural communities
<div>3</div> <div>Ecological Restoration: Water and Life</div>	Ecosystem-based Adaptation	Resilient ecosystems
		Promotion of ecological connectivity
		Habitat and reduction of emissions
CROSS-CUTTING AXES		
Information and Monitoring		
Education and Communication		
Planning and Land Use		

## 9. Structural axes

### 9.1 Axis of integrated adaptation to the economic development of the city

#### 9.1.1 Strategy 1: Climate Compatible Ports and Industries

The pessimistic climate change scenarios by 2040 indicate that 28% of industry and 35% of road infrastructure will be under the threat of flooding caused by both rainfall and the increase in sea level. Likewise, 100% of the coastline will be at a moderate risk of coastal erosion. (Invemar, *et al.*, 2012).

### Vision at 2040

By the year 2040, Cartagena will be a model of port and industrial city prepared to climate change, in which innovative actions will be planned, implemented and articulated with the public sector, hence reducing risks, strengthening the local economy and improving the sector's competitiveness within a framework of climate compatible development.

#### Key points to achieve this vision

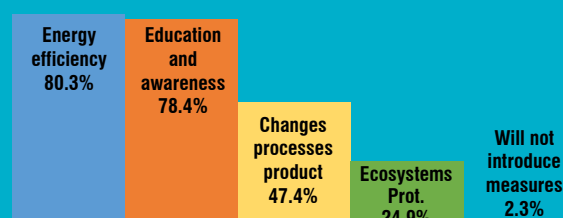
- ❖ Use inputs efficiently as well as cleaner production mechanisms in order to reduce emissions and waste.
- ❖ Plan and regulate the port and industrial zone, taking into account the climate change impacts by 2040 and adapt the infrastructure necessary to prevent economic losses.
- ❖ Contribute to maintenance of the ecological integrity of the city.
- ❖ Improve response capacity of companies and the nearby communities in order to reduce the effects of extreme events.



### Key Data

- ❖ Number of companies in the industrial and ports sector: 2,539.
- ❖ Five companies that concentrate 63% of the industrial sector income: Refinería de Cartagena S.A., Zona Franca Argos S.A.S., Mexichem Resinas Colombia S.A., Biofilm S.A., Abonos Colombianos S.A.
- ❖ Industrial sector contribution to GDP: almost the entire Department of Bolívar and 6% of national GDP
- ❖ Main Caribbean port: handles 60% of total cargo in containers in the country
- ❖ Main public service private docks: Sociedad Portuaria Regional de Cartagena, Contecar, Compas and Sociedad Portuaria de Mamonal.
- ❖ Losses in the industrial sector caused by natural disasters (flooding): over 80 million dollars between 2010 and 2011
- ❖ Survey of opinion on climate change in the industrial sector: 70% believe that they will be affected.

#### Measures to be introduced by entrepreneurs to deal with climate change in the next 5 years



Source: ANDI (2010): Survey of opinions on climate change.

**Table 6.** Description of the programs for a climate compatible Port and Industrial zone.

Program	Description and results expected
1. Energy efficiency	The purpose of this program is to consolidate the competitiveness of Cartagena and its ports and industries through efficient use of energy and fossil fuels and by promoting the use of alternative energy sources. By promoting this energy saving, Cartagena will reduce its Greenhouse Gas (GHG) emissions, as well as its production costs and will take advantage of opportunities for income from coal markets. In addition, the use of new sources of energy will create business and job opportunities.
2. Adapted buildings and infrastructure	The adapted buildings and infrastructure are designed with a view to the long-term in order to reduce erosion and flooding from rainfall, tidal waves and increased sea level. The aim for the future is for it to be possible to have a more resilient infrastructure in order to prevent companies from closing down and collective economic losses caused by the effects of climate change.
3. Contributions to ecological integrity	Surrounding the Port and industrial areas there are still conserved ecosystems which, as part of the ecological structure, play a fundamental part in the reduction of climate risks. This program seeks to channel resources from the environmental management of companies to the conservation of these ecosystems, as a natural adaptation measure.
4. Integral risk management	The industrial and port zone has progressed in matters of integral risk management with the participation of both companies and communities. Given the existing synergies between this and adaptation to climate change, what is sought is to create articulated and coherent processes which help to strengthen local disaster prevention and management.

**Table 7.** List of projects for a climate compatible Port and Industrial zone.

Program	No	Project	Type of measure	Duration	Start of Term	Executors	Management Status	Costo	Ficha
1. Energy efficiency	P-1	Estimate of the baseline for the implementation of technologies to reduce emissions in the Mamonal industrial zone	Mitigation	2 years	Short term	ANDI	Project profile for management	\$250	Yes
	P-2	Design and implementation of technologies for the reduction of emissions in the Mamonal industrial zone	Mitigation	5 years	Medium term	ANDI	Project profile for management	\$15.000	No
2. Adapted buildings & infrastructure	P-3	Study of alternatives for coastal protection in the zone of influence of ports and industries in the bay of Cartagena	Adaptation	1 years	Short term	Cartagena Mayor's Office	Project profile for management	\$1.500	Yes
	P-4	Preparation of a pilot plan for coastal protection in the most critical erosion zone in the bay of Cartagena	Adaptation	3 years	Medium term	Companies in port and industrial sector	Project profile for management	\$20.000	No
3. Contributions to ecological integrity	P-5	Conservation of mangrove swamp areas in the interior of the companies in the Mamonal zone as a measure for coastal protection and environmental conservation	Adaptation	10 years	Short term	Companies in port and industrial sector	Project profile for management	\$ 500	Yes
4. Integral risk management	P-6	Strengthening capacities for adaptation to climate change at the corporate and community levels	Adaptation	10 years	Short term	ANDI and Mamonal Foundation	Performance	\$ 400	Yes


\* Projects with sheets are those that were prioritized in the participation process.

## Project sheets

# Climate Compatible Ports and Industries





PROGRAM 1. ENERGY EFFICIENCY	
PROJECT SHEET No. 1 ESTIMATE OF THE BASELINE FOR THE IMPLEMENTATION OF TECHNOLOGIES TO REDUCE EMISSIONS IN THE MAMONAL INDUSTRIAL ZONE	
<b>Problems and justification</b>	
This country emits 0.37% of GHG worldwide. Among the principal national industrial development areas is the Mamonal zone conglomerate, an industrial centre. Mainly with 2,539 companies. The amount of GHG emitted jointly by the companies in this sector is not known for certain, because it is necessary to calculate a baseline in order to promote later the implementation of technologies to reduce it, which are directly related to the increase in temperature. Moreover, with the results it will be possible to establish performance standards to help Mamonal to consolidate as an industrial zone compatible with the climate.	
<b>Purpose of the project</b>	
To estimate the emissions baseline in the Mamonal industrial so in order to introduce cleaner operation and production methods, reduce high risks to the environment and optimize the rational use of natural resources.	
<b>Intervention area</b>	<b>Estimated cost</b>
	\$250,000,000
	<b>Duration</b>
	2 years
	<b>Executor</b>
	ANDI
	<b>Other actors</b>
	Companies of the industrial sector, EPA, Cardique, Cartagena University, District Planning Department, Energy Mining Planning Unit, Ministry of Mines and Energy, MESD Climate Change Department.
	<b>Financial mechanisms</b>
	Internal credits, international climate funds, multilateral development.
<b>Specific actions</b>	
<ul style="list-style-type: none"> <li>• Signature of protocol (memorandum of understanding) between the companies.</li> <li>• Environmental diagnosis.</li> <li>• Estimated greenhouse gas emissions.</li> <li>• Agreement between the public and private sectors on the new technologies to be used.</li> <li>• Definition of efficiency standards.</li> <li>• Actions to reduce GHG emission according to the efficiency standards defined.</li> <li>• Dissemination of the results of the public sector study and the city's hotels.</li> </ul>	
<b>Indicators</b>	
<ul style="list-style-type: none"> <li>• % Reduction in emissions.</li> <li>• % annual savings on costs.</li> <li>• Number of companies participating in the reduction program.</li> <li>• Number of new technologies.</li> <li>• Improved performance standards.</li> <li>• Number of jobs created.</li> </ul>	

**PROGRAM 2. ADAPTED BUILDINGS AND INFRASTRUCTURE****PROJECT SHEET No. 3. STUDY OF ALTERNATIVES FOR COASTAL PROTECTION IN THE ZONE OF INFLUENCE OF PORTS AND INDUSTRIES IN THE BAY OF CARTAGENA****Problems and justification**

The Bay of Cartagena is located in the central part of the Colombian Caribbean within the framework of the Castillogrande peninsula, the rest of the Continental zone, the islands of Tierrabomba and Baru. It is the principal body of water in the Cartagena hydric system with 82km<sup>2</sup> in area and an average depth of 16 m. deprivation form within the bay, with the tide coming in and going out, of less than 12 m/s. In the rainy season, the Canal del Dique influences the surface currents regime considerably while in the trade winds season (dry) the waters of the Dique reach the south of the bay, producing a deep south-north current. (Cartagena University and the Office of the Mayor of Cartagena de Indias, 2010). Because of these characteristics, the area is exposed to severe erosive processes which threaten to affect the existing infrastructure, which supports important economic activities, among others, in the port and industry.

To this effect, each company has gradually implemented, independently, protection measures aimed at reducing the damage, thereby causing possible negative effects on neighboring companies, for which reason it is necessary to define more integral solution to promote a greater benefits for all. For this purpose it is necessary for studies to be carried out in order to define the alternative solutions, taking into account that the costs of the works to be carried out would be payable by the respective company.

**Purpose of the project**

To identify cost protection alternatives to significantly reduce the wave energy on the coast on the bay of Cartagena

**Intervention area****Estimated cost**

\$1,500,000,000

**Duration**

1 year

**Executor**

Office of the Mayor of Cartagena

**Other actors**

Companies in the port sector, CIOH, Cartagena University, SIAB, Office of the Mayor of Cartagena, National Infrastructure Agency, Ministry of Transport.

**Financial mechanisms**

Free use current income (ICLD), resources of research and academic institutions, royalties fund.

**Specific actions**

- Signature of protocol (memorandum of understanding) between the companies and the district of Cartagena de Indias.
- Contracting of the company to make the study.
- Update of existing baseline information and cartography.
- Carry out the respective analyses of the evolution of the coastline in recent years.
- Preparation of projections in time of the changes that occur and impact the area.
- Definition of possible protection measures (hard and soft) to prevent and mitigate the impacts of erosion.

**Indicators**

- Number of protection alternatives identified.
- Proportion of cost-benefit of the protection measures proposed.
- Number of Cartagena companies linked to the project.

### PROGRAM 3. CONTRIBUTIONS TO ECOLOGICAL INTEGRITY

#### PROJECT SHEET No. 5. CONSERVATION OF MANGROVE SWAMP AREAS IN THE INTERIOR OF COMPANIES IN THE MAMONAL ZONE AS A MEASURE FOR COASTAL PROTECTION AND ENVIRONMENTAL CONSERVATION


##### Problems and justification

The mangrove swamps perform a key function in the protection of the posts against eolian and wave erosion; they also serve to disperse the energy of storms and winds, as well as housing animal species of ecological importance (Gilman et al., 2008). Nevertheless, in the Cartagena bay the scarce remains of mangrove swamps are threatened by expansion of Port and industrial activities and by contamination produced by the Mamonal industrial zone (Uninorte, 2001).

In this context, it is necessary to carry out conservation action in these areas in order to take advantage of the protection services that the ecosystems provide against climate change, which become an opportunity for companies, because they will be able to protect themselves from the threats of climate change and to make the environmental management that they are obliged to undertake visible.

##### Purpose of the project

To promote the conservation of mangrove swamps on the coast of the Mamonal industrial zone in order to take advantage of the services of environmental protection of the coast to protect them from climate change and to make the environmental work carried out by the companies visible.

Intervention area	Estimated cost
	\$500,000,000
	Duration
	10 years
	Executor
	Companies in the port and industrial sector.
	Other actors
	Multilateral bodies, donations, national and international foundations and private investment
	Financial mechanisms
	Private investment

##### Specific actions

- Inventory of mangrove areas and land, as well as companies and persons willing to participate in these processes.
- Diagnosis of the phytosanitary status of the mangrove areas.
- Identification of potential areas for planting mangrove areas.
- Preparation of protocols and mangrove area management actions within the companies.
- Planting mangroves in the areas identified.
- Maintenance and care of the new mangrove zones.

##### Indicators

- % areas intervened with management actions.
- Number of companies participating in the project.
- Number of m<sup>2</sup> planted.
- Number of jobs created.

**PROGRAM 4. INTEGRAL RISK MANAGEMENT**
**PROJECT SHEET No. 6. STRENGTHENING CAPACITIES FOR ADAPTATION TO CLIMATE CHANGE AT THE CORPORATE AND COMMUNITY LEVELS**
**Problems and justification**

The district of Cartagena de Indias includes a variety of territorial and economic conditions that make it highly vulnerable and prone to emergencies caused by natural and/or industrial disasters. At present, ANDI, the Mamonal Foundation are working to consolidate the Community Risk Management Organization strategy and have created 40 neighborhood committees (Combas) throughout the city, which provide support for the strengthening of the citizens, as well as their Local Risks Management System, in an effort for the communities to become key actors in early recuperation and risk management process. The project has the support of Ecopetrol, Reficar, Sacsá, Abocol and Termocandelaria, the local government, represented by the District Risk Management Office and with the accompaniment of another important group of entities which have made the articulation of economic, technical and human resources possible in order to strengthen the Local Risk Management System.

In an effort to take advantage of progress in risk management, this project seeks to strengthen the communities' and companies' capacity in order to identify and learn about present and future risks which they will face, to evaluate their real and potential vulnerability and also to define actions of protocols to deal with and know how to apply them.

**Purpose of the project**

To improve the Integral Risk Management process through an approach which supports the design and implementation of adaptive responses to the effects of climate change, to facilitate decision making and establish priorities, especially in the most threatened communities and sectors.

**Intervention area**

**Estimated cost**

\$400,000,000

**Duration**

10 years

**Executor**

ANDI, Mamonal Foundation

**Other actors**

Departmental and District Risk Management Council, CRUE, EPA, Fire Fighters, Red Cross, Civil Defense, UNDP, Rafael Nuñez University, Cartagena University, District Education Department, National Police, Ecopetrol, Reficar, Sacsá, Abocol and Termocandelaria.

**Financial mechanisms**

ICLD donations, national foundations.

**Specific actions**

- Re-training of the 40 neighborhood committees (Combas) with the support of ANDI, Mamonal Foundation.
- Creation of Combas, one of the San Bernardo archipelago and another on Fuerte Island.
- Holding risk management and climate change workshops focused on the needs of each neighborhood committee.
- Holding workshops on risk management community networks and adaptation to climate change for Municipal Risk Management Councils.
- Construction of 42 strategies for response to emergencies relating to the impacts of climate change, one for each of the Combas.
- Provide technical assistance on the adjustment of 30 School Emergency Plans.
- Holding 42 community practice exercises.
- Holding 18 school evacuation practice exercises.
- Holding a Mamonal industrial zone practice exercise using the parameters of the Integral Plan for Emergency Management (manuals APELL).
- Update of APELL land and maritime manuals as a strategy for raising awareness and preparation for local level emergencies, in articulation with the government, companies and the community.
- Provision of emergency response equipment and uniforms for the District Risk Management Council of the city of Cartagena rescue organisms (Fire Department, Red Cross and Civil Defense).
- Implementation of a system of VHF communications to interconnect the community, the Local Risk Management System and the companies affiliated to ANDI and Mamonal Foundation.

**Indicators**

- Number of updated school emergency plans.
- Number of schools practice exercises.
- Number of workshops held.
- Number of community practice exercises.
- Number of community risk management plans.
- Number of Cartagena companies linked to the project.
- Number of jobs created at community level.



### 9.1.2 Strategy 2: Tourism sector committed to climate change

This strategy is aimed at the tourism sector committed to the production of climate change impacts, for it to lead adaptation and mitigation measures to allow Cartagena de Indias to maintain its position as a national and international touristic destination, characterized by its competitiveness and high standards of quality, which will, in turn, produce sustainable economic development for the city.

## Vision by 2040

By the year 2040, the tourism sector of Cartagena de Indias will be committed to climate change and will be using this strength to increase its competitiveness as a destination, working hand in hand with the public sector, which will guarantee the planning instruments and works necessary for the city to progress towards climate compatible development schemes.

### Key factors to achieve this vision

- ❖ The hotel sector committed to the use of cleaner technologies that reduce carbon and water footprints, in addition to travel agents and tourism operators with environmental responsibility.
- ❖ Appropriate and sustainable use of natural assets and the tourism infrastructure of the city.
- ❖ Construct the infrastructure necessary as a measure for adaptation to climate change, contributing to the competitiveness of the sector.
- ❖ Articulate the subject of climate change with adaptation and mitigation actions in tourism planning instruments at local level.
- ❖ Educate tourists and service providers in the aspects of adaptation and mitigation of climate change.
- ❖ Promote a tourism infrastructure compatible with the environment that involves the respective adjustments to construction, use of the soil and contamination control regulations.



## Key Data

### World Figures

- ❖ Economic contribution of tourism in 2012 (UNWTO), 2013):
  - 9% of world GDP
  - 1 of 11 jobs
  - 6% of world exports
- ❖ Emissions from the sector:
  - 4.9% of world emissions of GEI (UNWTO, 2008).
- ❖ Main contributors to emissions:
  - 40% of transport by air
  - 32% transport over land
  - 21% of accommodation activities

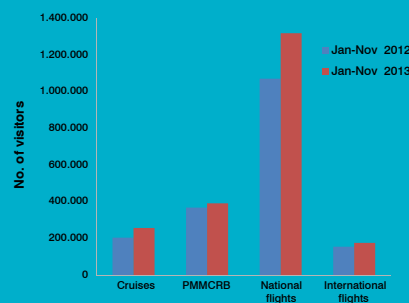


Figure 21. Visitors in Cartagena  
Source: CCC based on MCIT data

### Figures of the District

- ❖ Increase in the number of visitors to the city in 2013 in comparison with the previous year.
- ❖ Impacts of climate change by 2040
  - 100% of beaches would be eroded
  - 47% of beaches would be flooded as a result of increase in sea level

**Table 8.** Description of programs for a tourism sector committed to climate change

Program	Description and expected results
1. Hotel sector committed to climate change	The hotel sector recognizes the importance of sustainable tourism, for which reason it supports initiatives aimed at reducing emissions, the efficient use of water and the conservation of ecosystems. These initiatives will reduce pressure on the natural resources that provide the basis for the provision of quality tourism and facilitate obtaining international certificates of environmental and sustainable quality. It will also improve hotel competitiveness by reducing operating costs.
2. Tourism infrastructure adapted to climate change	To conserve the large offer of tourism in Cartagena, it is necessary to review the effects of climate change on hotels, jetties, the historic heritage, docks and other tourism infrastructure. Because of its geographic location, this infrastructure is usually situated close to the coasts and is therefore very sensitive to SLR and extreme events. The entire Cartagena Costa must be protected as one of the main tourism attractions of the city.
3. Support system for decision-making on climate change	In Cartagena de Indias there has been a continuous increase in hotel construction. A large percentage is located in its coastal zones. If present planning instruments authorize this type of construction, a system of support for decision making will ensure that property development in the tourism sector will be undertaken with resilience criteria seeking to protect these investments in the future.
4. Education on climate change for tourists and service providers	Many of the tourism services providers and the tourists themselves who arrive are not aware of the effects on the city caused by climate change. This program seeks to create awareness through educating these key actors, so that they can contribute to reducing the effects of this phenomenon.
5. Marketing and promotion of climate change	Many cities have been consolidated worldwide as venues for green events through actions that have succeeded in strengthening compensation programs. As Cartagena de Indias is, par excellence, the tourism destination of Colombia, where events of great importance are held, the present program is aimed at attracting green events to the city.

**Tabla 9.** List of projects for a tourism sector committed to climate change

Program	Number	Project	Type of measure	Duration	Start Time	Executor	Status of management	Cost	Sheet
1. Hotel sector committed to climate change	P-7	Measurement of the carbon and water footprint in the hotel sector of Cartagena	Mitigation	1 yr	Short term	CDKN, Cartagema Mayor's Office	Project profile for management/activities	\$ 120	Yes
	P-8	Design and implementation of actions to reduce the water and carbon footprint of the hotel sector of Cartagena	Mitigation	5 yrs	Medium term	Hotels in the city, Corpturismo	Project profile for management/activities	\$13.000	Yes
	P-9	Development of a manual of climate change best practices for the tourism sector	Mitigation	1 yr	Long term	Corpoturismo	Project profile for management/activities	\$ 50	Yes
	P-10	Conservation of the mangrove swamp in the La Virgen Marsh to strengthen tourism competitiveness in its zone of influence	Adaptation and mitigation	2 yrs	Short term	Hoteles de la Zona Norte	Project profile for management/activities	\$ 350	Yes

Program	Number	Project	Type of measure	Duration	Start Time	Executor	Status of management	Cost	Sheet
2. Tourism infrastructure adapted to climate change	P-11	Technical studies for the definition of coastal protection works in the tourism zone of Cartagena (El Laguito-Marbella)	Adaptación	2 yrs	Short term	District Evaluation, Administrative Department	Preparation	\$ 8.000	Yes
3. Support system for decision-making on climate change	P-12	Development of an online tool to support decisions that contribute to tourism planning with "Cartaclima" resilience criteria	Adaptation	1 yr	Medium term	Cartagena Climate Action Center	Project profile for management/activities	\$1.500	Yes
4. Education on climate change for tourists and service providers	P-13	Outlines to encourage environmental responsibility of visitors to the Rosario and San Bernardo Coral Reefs National Park.	Adaptation	2 yrs	Short term	National Natural Parks	Project profile for management/activities	\$ 20	Yes
	P-14	Implementation of energy and water efficiency icons in hotels and on tourist attractions in Cartagena de Indias	Mitigation	2 yrs	Long term	Corpoturismo	Project profile for management/activities	\$ 400	Yes
5. Marketing and promotion of climate change	P-15	Cartagena to host carbon zero events and a green convention center	Adaptation and mitigation	5 yrs	Medium term	Corpoturismo	Project profile for management/activities	\$ 150	Yes

\*The projects with sheets are the ones prioritized in the participation process.

## Project sheets

### Tourism sector committed to climate change





## PROGRAM 1. HOTEL SECTOR COMMITTED TO CLIMATE CHANGE

### PROJECT SHEET No. 7. MEASUREMENT OF THE CARBON AND WATER FOOTPRINT IN THE HOTEL SECTOR OF CARTAGENA


#### Problems and justification

The day-to-day activities of humans require, either directly or indirectly, the resources provided by the planet. In an attempt to measure what it is using the proportion in which nature can be regenerated to continue providing these resources, man has established calculations of its consumption, thus determining its footprint.

This project is focused on reducing the carbon and water footprints. The carbon footprint refers to greenhouse gases that a person, business, product, city or nation emit. According to UNWTO and PNUMA (2008), this sector is responsible for 5% of emissions worldwide, where hotels contribute with a little more than 1%. Apart from this, the water footprint refers to the total volume of fresh water it to provide goods and services to individuals, their community or companies. It includes the operational water footprint and that of water in the supply chain. The former covers all the water that a company requires for its normal operation, plus the water it throws away. The latter refers to the water required in the supply chain of products for preparation and also includes spills. At present, neither the carbon nor the water footprint of the hotels located in the city are known. This measurement will establish a baseline to direct actions towards a reduction in these footprints in order to reduce the impacts that lead to climate change in the environment.

#### Purpose of the project

To measure the carbon and water footprints produced by hotels in Cartagena de Indias.

Intervention area	Estimated cost
	\$120,000,000
	Duration
	1 year
	Executor
	CDKN, Office of the Mayor of Cartagena
	Other actors
	Corpoturismo, hotels in the city
	Financial mechanisms
	International cooperation

#### Specific actions

- Signature of the protocol (memorandum of understanding) by the hotel sector, DCKN, Office of the Mayor of Cartagena and MADS for the project to start. In this memorandum three hotel supply chain products must be selected in order to determine the water footprint.
- Preparation of a calculator to determine the carbon and water footprints of the hotels in the city, as a diagnostic tool for the present situation of energy and hydric consumption of each of the hotels.
- Preparation of the water footprint of the three products identified in the supply chain.
- Dissemination of the result of the study to the public sector and to the hotels in the city.

#### Indicators

- Calculator to measure the carbon footprint.
- Calculator to measure their hydric footprint.
- Number of hotels that measure their carbon footprint.
- Number of hotels that measure their water footprint.

**PROGRAM 1. HOTEL SECTOR COMMITTED TO CLIMATE CHANGE****PROJECT SHEET No. 8. DESIGN AND IMPLEMENTATION OF ACTIONS TO REDUCE THE WATER AND CARBON FOOTPRINT OF THE HOTEL SECTOR OF CARTAGENA****Problems and justification**

The hotel sector is committed at world level to a reduction in its carbon footprint. In this respect, global initiatives, such as the Carbon Measurement in Hotels (HCMI), have arisen, by the World Travel and Tourism Council (WTTC) which is confirmed by large hotel chains, such as Hilton, Marriott, Accor and Nh. The HCMI methodology was launched in 2012 and obtaining it costs nothing. It has been implemented in over 15,000 hotels around the world, establishing a protocol to reduce carbon emissions in establishments of all types (from large chains to bed and breakfast type hostels). Likewise, the commitments to reduce the water footprint are vital, taking into account, in addition, that the products acquired by hotels to provide their goods and services have also already left a footprint and not forgetting that water is an asset that is becoming more and more scarce because of climate change.

At present the hotel sector of Cartagena de Indias is working, on its own initiative, in isolation and in particular cases on prices actions aimed at achieving reductions in the aspects of energy and water consumption; these actions are mainly the result of the high costs of public services in the city and the need to generate awareness of more friendly treatment of the environment. This project intends to unite the entire sector in order to implement specific actions that have an impact at the level of the city, to convert Cartagena de Indias into a more sustainable and competitive destination. Cartagena requires a hotel sector committed to mitigating climate change, that uses energy and hydric resources that the city provides efficiently, which, in turn, will bring savings on operating expenses resulting from the reduction in the costs of public services. While some hotel chains are committed worldwide to these changes, work must first be done at local level to implement them and multiply them, in accordance with what is established in the policies, plans, programs and projects of the national government.

**Purpose of the project**

To reduce GHG emissions and encourage sustainable consumption of water in the hotels of Cartagena de Indias to produce savings in the payment of public services for the sector and, at the same time, reducing the carbon and water footprints.

**Intervention area****Estimated cost**

\$13,000,000,000

**Duration**

5 years

**Executor**

Hotels, Corpoturismo

**Other actors**

Cotelco, Asotelca, MEDS, MCIT, Bancoldex, Office of the Mayor of Cartagena, EPA

**Financial mechanisms**

Internal credits, international climate funds, multilateral development banks, carbon funds, private investment.

**Specific actions**

- Identify the common measure to be implemented in order to achieve efficient energy and water consumption, focused on reducing water and carbon footprints.
- Prepare technical studies for the purpose of defining the measures necessary to implement energy and hydric efficiency.
- Prepare a general budget for each hotel, with defined investments, considering different implementation scenarios.
- Introduce measures to permit a reduction in the consumption of energy and water in each hotel.
- Negotiate with suppliers of the products on the supply chain and measure the water footprint, aimed at reducing it.
- Monitor and evaluate the actions carried out, identifying and applying actions to improve them where necessary.

**Indicators**

- % reduction in GHG.
- % reduction in water consumption.
- Number of products acquired from suppliers committed to reducing the water footprint.
- Amount of saving on water bills.
- Amount of saving on electricity bills.
- Number of Cartagena companies involved in the project.
- Number of jobs created.

## PROGRAM 1. HOTEL SECTOR COMMITTED TO CLIMATE CHANGE

### PROJECT SHEET No. 9. DEVELOPMENT OF A MANUAL OF CLIMATE CHANGE BEST PRACTICES FOR THE TOURISM SECTOR


#### Problems and justification

According to the Oxford dictionary, good practices are commercial or professional procedures accepted or prescribed as correct or effective. Good practices can be replicated among sectors and even among companies in the same sector, seeking efficiency and efficacy in the processes and resources they use.

Within the framework of this plan, projects that target the hotel sector are stipulated for a reduction in carbon and water footprints on the part of the hotel sector by means of specific actions to generate energy efficiency and more rational water consumption. While these vary from one hotel to another, because of size, infrastructure, amount of the investment, etc., it is important for the actions implemented in an effort to reduce the footprints to be documented, compiled and disseminated and then adapted and implemented by other hotels of the city. Experience gained by some to be applied by others will increase competitiveness in the sector and contribute to the city's climate change issues.

#### Purpose of the project

To make known good practices in matters of climate change carried out by different establishments of the hotel sector of Cartagena de Indias at local, national and international levels, so that they can be replicated by other establishments of the same kind.

Intervention area	Estimated cost
	\$50,000,000
	Duration
	1 year
	Executor
	Corpoturismo
	Other actors
	Cartagena hotels, MADS, EPA
	Financial mechanisms
	District Climate Change Fund of Cartagena (FDCCC), national foundations.

#### Specific actions

- Invitation for hotels to register their good practices.
- Presentation on good practices information by the hotels.
- Compiling information on good practices.
- Preparation of a good practices manual.
- Socialization of experience in good practices among the hotel sector of the city.
- Carry out exercises with hotels in order to learn who would be interested in replicating any of the good practices published.

#### Indicators

- Number of good practices registered.
- Published manual.
- Number of good practices replicated.
- Number of companies that replicate good practices.

**PROGRAM 1. HOTEL SECTOR COMMITTED TO CLIMATE CHANGE**
**PROJECT SHEET No. 10. CONSERVATION OF THE MANGROVE SWAMP IN THE LA VIRGEN MARSH TO STRENGTHEN TOURISM COMPETITIVENESS IN ITS ZONE OF INFLUENCE**
**Problems and justification**

The La Virgen marsh, which extends from the eastern to the northern zone of Cartagena, has been gradually getting smaller as a result of decisions taken by the city to improve its development. Until a short time ago, this body of water was the main one used to discharge waste waters (all waste water is now all discharged through a transmarine pipeline into the Caribbean Sea); the road to the sea (that connects Cartagena with Barranquilla) was built using landfills, opening the way for the development, both formal and informal, using the well known fishbone effect, that is, roads that cross natural zones, a trend which, as can be seen, serves for the building of housing and hotel infrastructure in all strata. The priority has been to satisfy basic needs and the reproduction of economic capital prior to the generation and protection of collective well-being achieved through the correct assessment of the ecological infrastructure and its integration into urban development.

The hotel sector in the zone of influence of the Marsh, aware of these facts, has decided to target actions to conservation of the mangrove swamp through the use of the environmental and landscape services it provides. The aim of the project is to raise awareness among the guests of those hotels, promoting compensation for its carbon footprint in the city (optional), to allow these resources to be used by the conservation fund for the mangrove swamps of the La Virgen and Juan Polo, together with the donations made by the hoteliers of the zone or of the city for the implementation of this project. Initially, restoration actions on the mangrove swamp of the Marsh would be implemented in the places where it has deteriorated as a result of anthropic activities. The actions to be undertaken must take into account the ecosystems' resilience capacity and the historic knowledge of the places where this action is required, in order not to cause harm to the flora and fauna existing in the zone.

**Purpose of the project**

To conserve the mangrove swamp zones in La Virgen and Juan Polo marsh, with a view to strengthening the ecosystemic values of the body of water as a natural adaptation barrier, while at the same time promoting it as a quality tourism product for visitors.

**Intervention area**

**Estimated cost**

\$350,000,000

**Duration**

2 years

**Executor**

Northern Zone Hotels

**Other actors**

Other hotels of the city, EPA, Cardique, Corpoturismo, foundations working in the northern zone.

**Financial mechanisms**

International climate funds, multilateral bodies, carbon funds, donations, international foundations.


**Specific actions**

- Signature of a memorandum of understanding among hotels wishing to participate in the initiative.
- Formation of the fund to collect resources from donations by hotels and two lists for the payment of the carbon footprint (optional).
- contracting and non-profit local entity with experience in mangrove swamps, recognized in the zone of influence of the project.
- Identification of zones for rehabilitation of the mangrove swamp and other interventions in the zone.
- Agreement with the local authorities of the restoration zones.
- Draw up with the timetable and a detailed budget of the project (with the existing and projected funds).
- Design and implementation of the "Paga tu huella" (Pay for your footprint) program in the hotels of the city (optional).
- Presentation and approval by donors in order to commence implementation of the project.
- Request the permits required from, and their approval by the local authorities.
- Launch the project.
- Commence rehabilitation actions for the mangrove swamp according to the approved timetable.
- Monitoring, analysis and evaluation of the actions carried out.
- Presentation of results to project donors.

**Indicators**

- m<sup>2</sup> of mangrove swamps rehabilitated.
- Number of tourists who pay for their carbon footprints.
- Amount of the donations.
- Number of jobs created.



PROGRAM 2. TOURISM INFRASTRUCTURE ADAPTED TO CLIMATE CHANGE	
PROJECT SHEET No. 11. TECHNICAL STUDIES TO DEFINE COASTAL PROTECTION WORKS IN THE CARTAGENA TOURIST ZONE (EL LAGUITO-MARBELLA)	
<b>Problems and justification</b>	
<p>Because of its strategic location on the Caribbean Sea, Cartagena de Indias is a sun and beach tourist destination. At present it has a coastline in the urban area that covers some 17 km, the majority of which are beaches. This land, which today forms part of the coast, includes areas that were submerged at some time and today have been consolidated thanks to the Marine breakwater (Historic Centre) and Bocagrande (from El Laguito to Tierrabomba), together with other hard structures, such as promenades and breakwaters. Because the sea has a memory and tries to recover what was once its own, in addition to the effects of climate change, such as SLR, waves and other extreme events, the urban coastal water has suffered an average rate of erosion of 0.37 m per year (Invemar et al., 2012). With these levels of regression, and seeking an integral intervention of the coastal border on the environmental scenic road par excellence, within a framework of high urban quality. The intention is for it to be exploited as a shock absorber between land and sea, which could articulate harmonically with the urban fabric and provide a public space that could be collectively enjoyed, while still fulfilling its functions of infrastructure protection.</p> <p>The project will begin when the Crespo tunnel (Marbella) is completed throughout the length of Santander Avenue as far as the entrance to Bocagrande. It runs all along Avenida 1a in Bocagrande and El Laguito as far as the Hilton Hotel. As this is a city macro-project, the first phase is proposed on the basis of the 4C Plan, which includes the technical studies for the definition of coastal protection works for recuperation of the coastal border in preparation for later urban intervention.</p>	
<b>Purpose of the project</b>	
To carry out technical studies in order to define the works required to protect the urban coastal border on the Caribbean Sea of Cartagena de Indias, from Marbella to El Laguito.	
<b>Intervention area</b>	<b>Estimated cost</b>
	\$8,000,000,000
	<b>Duration</b>
	2 years
	<b>Executor</b>
	District Evaluation Administrative Department
	<b>Other actors</b>
	Office of the Mayor of Cartagena, IPCC, Dimar
<b>Financial mechanisms</b>	
ICLD, Tourism Promotion Fund, multilateral development banks, research and academic institutions.	
<b>Specific actions</b>	
<ul style="list-style-type: none"> <li>Contracting a company to carry out the technical studies.</li> <li>Technical studies.</li> <li>Creation of designs under different modeling scenarios.</li> <li>Preparation of a detailed budget for the work.</li> <li>Validation and approval of results by national and district authorities.</li> <li>Socialization of the results.</li> <li>Presentation of the studies and designs to the executor.</li> </ul>	
<b>Indicators</b>	
<ul style="list-style-type: none"> <li>Company contracted.</li> <li>Technical studies carried out.</li> <li>Number of socialization effected.</li> </ul>	

**PROGRAM 3. SUPPORT SYSTEM FOR DECISION MAKING ON CLIMATE CHANGE****PROJECT SHEET No. 12. DEVELOPMENT OF AN ONLINE TOOL TO SUPPORT DECISIONS THAT CONTRIBUTE TO TOURISM PLANNING WITH “CARTACLIMA” RESILIENCE CRITERIA****Problems and justification**

Cartagena de Indias, an ideal tourism destination, has for several years been attracting investors to consolidate its provision of hotels. According to Tourism Corporation (2013), today the city has some 10,500 hotel rooms in 290 establishments providing accommodation and, within the period between 2013-2016, there will be some 3,900 additional rooms in hotel projects of internationally recognized chains such as Sheraton, Hilton, Radisson, GHL, Best Western, Four Seasons, Six Senses and Holiday Inn.

All these projects are located in the tourism zone of the city (including the Historic Center), which has medium or high vulnerability to climate change. While the present POT permits construction of this type of projects to strengthen Cartagena de Indias' competitiveness and position it as a world class tourist destination, it is important for them to be built taking into account the imminent risks in the zones where they are or will be located, defining and setting in motion the criteria of resilience to protect such investments.

Given that at present the city does not have an adequate amount of public information for decision taking, the ideal alternative is a support tool to be used for planning hotel activity within the framework of development schemes that are compatible with the climate. At world level, there are tools of this type, such as the Caribbean Climate Online Risk Adaptation Tool (CCORAL) in Caribbean and Cedrig countries, which was developed by the Swiss Agency for Development, which provides this type of information to be used for decision taking based on resilience to climate effects, thus minimizing the risks. Cartaclima is conceived as an online advisory instrument for investors in the hotel sector and whose purpose is for them to understand the influence of climate in all the processes of their particular project in order to guarantee the climate resilience of their investment.

**Purpose of the project**

To develop a responsible climate decisions support tool through the application of risk management processes to increase the resilience of the city's hotel infrastructure.

**Intervention area****Estimated cost**

\$1,500,000,000

**Duration**

1 year

**Executor**

Centro de Acción Climática de Cartagena (Cartagena Climate Action Center)

**Other actors**

Corpoturismo, Office of the Mayor of Cartagena

**Financial mechanisms**

International cooperation, international foundations, research and academic institutions

**Specific actions**

- Definition of the scope of the tool and contracting a company to do so.
- Identification and compiling the information necessary for the tool.
- Definition of the conceptual model of the decision making system.
- Proposal and validation of an “resilience index”.
- Description of critical variables for resilience assessment.
- Weighting of an agreement with experts' criteria.
- Creation of a mathematical integration model of decisions for the creation of the resilience index.
- Validation of the conceptual and mathematical model by the actors involved.
- Preparation of the technological solution and validation of the tool by local authorities.
- Creation of a website for the tool or uploading onto the existing website, and launching it (communications strategy).
- Monitoring and implementation of improvement actions.

**Indicators**

- Cartaclima validated conceptual and mathematical model.
- Number of hotels using the tool.
- Cartaclima developed on a participative basis.
- Number of hotels participating in the design of the model.
- Number of hotels participating in the design and formulation of the resilience indices or criteria.
- Number of visitors to the website.

## PROGRAM 4. EDUCATION ON CLIMATE CHANGE FOR TOURISTS AND SERVICE PROVIDERS

### PROJECT SHEET No. 13. OUTLINES TO ENCOURAGE ENVIRONMENTAL RESPONSIBILITY OF VISITORS TO THE ROSARIO AND SAN BERNARDO CORAL REEFS NATIONAL PARK.


#### Problems and justification

In 1977 the national authority declared the Corales del Rosario and San Bernardo areas as a Natural National Park; it is located 30 km from the city of Cartagena with an area of 120,000 hectares. It is a submarine protected area of great touristic importance in Colombia. According to Corpoturismo 2013, the Rosario islands received some 460,000 visitors, a figure that has been increasing yearly. While ecotourism activities on the islands are part of the attraction of the city, it is also a source of income for its native people. The use of the resources of the Park must be sustainable for the protection and preservation of its ecosystems and for the enjoyment and benefit of future generations.

For this reason, the 4C Plan proposes the preparation of outlines to encourage protection activities for the ecosystems that make the park an attraction for both the inhabitants of Cartagena and for foreigners. These outlines must be given to visitors and must also be published at the sailing points of the islands in order to raise their awareness of the need to protect this place that has for many years has suffered from severe degradation caused by anthropic activities. The sensitization outlines must be socialized in an informative presentation (which will also serve to encourage mainly children and young people), and must be translated into a number of languages so that foreigners visiting the Park will be aware of them.

#### Purpose of the project

To prepare an informative document to be given to visitors to the Corales National Natural Park of Rosario and San Bernardo, in order to encourage environmental responsibility in the protected area.

Intervention area	Estimated cost
	\$20,000,000
	Duration
	2 years
	Executor
	National Natural Parks of Colombia
	Other actors
	Corpoturismo, Office of the Mayor of Cartagena, Cardique.
	Financial mechanisms
	PNN resources

#### Specific actions

- Development of environmental outlines to be taken into account during the visit to PNNCRSB.
- Preparation of an informative, didactics pamphlet.
- Development of visual material to be installed at the sailing points for the Rosario and San Bernardo islands.
- Printing and publication of the informative pamphlet.
- Launching the project on the part of the competent authorities.
- Installation of the visual material at the sailing points for the Rosario and San Bernardo islands (La Bodeguita tourism dock and the docks of Bocagrande, Castillogrande and Bazurto).
- Insertion of outlines of environmental responsibility on the official websites of the Office of the Mayor of Cartagena, Corpoturismo and the National Parks, as well as those of the different travel agencies, tour operators and hotels.
- Survey of visitors on their knowledge of the outlines under application during the visits to PNNCRSB.

#### Indicators

- Number of pamphlets printed.
- Number of informative notice posters installed.
- Number of websites with information on the outlines to encourage environmental responsibility on the PNNCRSB.
- % of persons who know the environmental responsibility outlines for the PNNCRSB.
- % of persons who follow the environmental responsibility outlines during their visits to the PNNCRSB.

**PROGRAM 4. EDUCATION ON CLIMATE CHANGE FOR TOURISTS AND SERVICE PROVIDERS****PROJECT SHEET No. 14. IMPLEMENTATION OF ENERGY AND WATER EFFICIENCY ICONS IN HOTELS AND ON TOURIST ATTRACTIONS IN CARTAGENA DE INDIAS****Problems and justification**

With a view to creating a universal language that transcends the native tongue and reading, entities such as the International Organization for Standardization (ISO), together with the Consumption Policies Committee (Copolco) have created a series of graphic symbols that transmit messages on security regulations in public places such as “slippery floor” or “emergency exit”, apart from other internationally recognized important information, such as, for example, the signals that denote the proximity of airports, car parks, currencies exchange offices, restaurants, hotels, etc. Worldwide trends towards sustainable consumption and resources rationale have begun to create demand for a new type of iconography that is informative on these sustainable preferences, in order to encourage citizen awareness and inform the public of their importance. In the search to satisfy this demand, in Los Angeles, California, an initiative called The Noun Project has been created, which, in an alliance with the lighting company CREE Inc., held an event called “Iconatón” on energy efficiency”, where LED symbols, among others, were created for sustainable energy and biofuels, which were installed as an energy efficient artistic exhibition in the Convention Center in the city of Raleigh.

This initiative could be replicated in the city’s hotels and at other tourist sites in Cartagena (convention centers, museums, restaurants, etc.), informing visitors of the actions which these organizations have worked on and wish to incentivize energy or hydric efficiency. The symbols would refer, for example, to the specific sustainable consumption measures which each establishment has put into operation, indicating its achievement by contributing sustainability and adaptation to climate change.

**Purpose of the project**

To make the actions which are being introduced regarding energy and hydric efficiency visible using recognized universal symbols and calling the attention of people visiting the different tourist spots in the city.

**Intervention area****Estimated cost**

\$400,000,000

**Duration**

2 years

**Executor**

Corpoturismo

**Other actors**

EPA, hotels, convention centers, other tourist sites in the city.

**Financial mechanisms**

International cooperation, donations, international foundations

**Specific actions**

- Preparation of a memorandum of understanding between Corpoturismo, hotels and other establishments in the city, indicating their willingness to implement the icons.
- Specification of icons to be used.
- Selection and contracting a company to produce the icons.
- Implementation of icons in the different establishments of the city.
- Training employees of the establishments (hotels, convention centers, other tourist attractions in the city) in order to implement the icons and for them to provide adequate information to the public.
- Production of information for citizens (recognition of the project) and production of news of events (free press).

**Indicators**

- Number of establishments in the city that use energy and hydric efficiency icons.
- Number of icons implemented.



## PROGRAM 5. MARKETING AND PROMOTION OF CLIMATE CHANGE

### PROJECT SHEET No.15. CARTAGENA TO HOST CARBON ZERO EVENTS AND A GREEN CONVENTION CENTER

#### Problems and justification


Themes connected with climate change have given rise to spaces for discussion in international bodies, such as UNFCC and IPCC, in which multilateral, governmental, private sector and third sector entities unite to discuss, reach agreements on and establish commitments to climate change. Cities such as Cancun, Durban, Bali, Doha, Copenhagen and Warsaw have hosted this type of events held annually since 1997, the last of which was held in Kyoto.

In addition, Cartagena de Indias has hosted great events of worldwide importance, such as the Summit of Non-Aligned Countries (1995), Rio Group Summit of Heads of State and Government (2000), World Economic Forum (2010) and, more recently, the Americas Summit (2012), the Pacific Alliance Summit (2014) and the World Political Communication Summit (2014).

The present District Development Plan sees tourism as a development engine for the city, including the national and international promotion of Cartagena de Indias as a destination. To this effect, it is working on hosting a world event on climate change, which would not only generate economic growth, but also bring these subjects to the fore; however, it would have to be prepared to act as host of the event, which would be achieved by turning the city into a model of adaptation to climate change and a venue for "green events", as well as including practices that contribute to environmental sustainability

#### Purpose of the project

For Cartagena de Indias to host a world event on climate change.

Intervention area	Estimated cost
	\$150,000,000
	Duration
	5 years
	Executor
	Corpoturismo
	Other actors
	Presidency of the Republic, Ministry of Foreign Affairs, Proexport, CICAIVB, Office of the Mayor of Cartagena
	Financial mechanisms
	ICLD, FDCCC, Tourism Promotion Fund

#### Specific actions

- Draw up an inventory of world events on climate change.
- Identify the measures that hotels and convention centers can introduce in order to convert their facilities into "green events" venues, articulated with adaptation and mitigation initiatives proposed in this plan.
- Carry out specific actions to succeed in hotel and convention facilities becoming "green".
- Make contact with the entities that organize this type of events.
- Send communications from national and local authorities stating Cartagena's interest in being a venue and explaining the benefits this would mean for everyone.
- Follow-up of organizer entities which influence the selection of the city to host such events.
- Participation in international fairs to promote the city's interest in acting as the venue of climatically compensated events.
- Succeed in having Cartagena being the city venue of an event.

#### Indicators

- Number of actions implemented to succeed in Cartagena being a "green venue".
- Number of hotels that implement green initiatives.
- Number of convention centers that implement green initiatives.
- Number of events identified.
- Number of letters sent.
- % of replies received/letters sent.
- Number of Cartagena companies benefited.
- Number of jobs created.

### 9.1.3 Strategy 3: Protection of historic heritage

Centuries ago, what is today the historic heritage of Cartagena was built to protect the city against the attack of corsairs and also natural inclement conditions, mainly along the coastline of the Cartagena bay. Today, this heritage is affected by floods, coastal erosion and tidal waves. Added to this is the lack of required maintenance for the protection structures built in the colonial period.

The most pessimistic climate scenario (without adaptation actions) suggests that 86% of the historic heritage buildings would be in areas prone to flooding by 2040. This risk could be reduced by 25% if adequate mitigation and adaptation measures are introduced, such as, for example, maintenance, improvement and construction (sic) of the present drainage system of the Historic Centre (Invemar *et al.*, 2012).

## Vision by 2040

**By the year 2040, the historic heritage of Cartagena de Indias will be resilient to climate change. This will be made possible by carrying out actions within the framework of climate compatible development, maintaining its value as a World Heritage City and a Cultural Interest Asset for the people of Cartagena and visitors.**



### Key data

- ❖ The historic center of Cartagena de Indias was declared a National Monument under Law 163 of 1959.
- ❖ The area of this urban sector, founded 481 years ago, is 10 hectares.
- ❖ As of 1984, when Unesco declared Cartagena a Historic Heritage of Humanity, great efforts began to be made to plan, coordinate and implement actions to ensure its conservation, protection and sustainability.
- ❖ The Historic Center includes the Central, San Diego and Getsemaní neighborhoods.
- ❖ As well as the Historic Center being monument in its entirety, the city has Cultural Interest Assets (CIA) at national and district level in the neighborhoods of Manga, Castillogrande, Pie del Cerro and Manzanillo, Tierrabomba Island and Cerro de la Popa.
- ❖ The city also has under water heritage in the Bay of Cartagena and the Caribbean Sea.

### Key factors to achieve this vision

- ❖ Protect assets of cultural interest from the effects of erosion, rain and the SLR.
- ❖ Revitalize large and small public squares and pedestrian axes in the San Diego Center, Matuna and Getsemani with works containing adaptation components and native trees.
- ❖ Develop sustainable transportation in the Historic Center, where the pedestrians and non-emission producing means of transport predominate.
- ❖ Promote energy efficiency, the consumption of water and the effective disposal of waste in the buildings in the Historic Center and its zone of influence.
- ❖ Establish and adopt the planning and land management instruments applicable to the Historic Center and its zone of influence, guaranteeing subsidiariness at all levels.

**Table 10.** Description of programs of the historic heritage protection strategy

Program	Description and results expected
1. Protection of assets of cultural interest from climate change	Cartagena de Indias has a large number of assets declared to be of cultural interest throughout the length of its coastline, including the part within the city walls referred to as the Historic Center. Because of its historic, cultural and landscape value, and as a heritage of humanity, these fixed assets must be protected from the effects that climate change will bring with it, by means of actions to safeguard them. In this way, the historic heritage of the city will be able to remain at the service of local people and visitors for many centuries.
2. Greener Historic Center and its zone of influence with reduced emissions	At present, the Historic Centre and the zone of influence of Cartagena is subject to emissions that have a negative effect on it, on the heritage, on the inhabitants of the neighborhood, and on the large floating population that enters the city center every day. This program seeks, among other things, to implement clean technologies and create green spaces, in both public and private areas, in order to reduce emissions and counteract the effects of climate change.

**Table 11.** List of projects under the Historic Heritage Protection strategy (figures in millions of pesos).

Program	No.	Project	Type of Measure	Duration	Start of Term	Executors	Management Status	Cost COL\$	Sheet
1. Protection of assets of cultural interest from climate change	P-16	Studies, design and implementation of works to prevent floods in the Historic Center of Cartagena de Indias	Adaptation	2 years	Medium term	IPCC, Cartagena Mayor's Office	Preparation	\$20.000	Yes
	P-17	Plan for the implementation of maintenance and preservation techniques for the ancient and open air buildings that have suffered the effects of climate change	Adaptation	4 years	Short term	IPCC	Project profile for management	\$12.000	Yes
2. Greener Historic Center and its zone of influence with reduced emissions	P-18	Installation of public lighting either efficient or using alternative energies in the Historic Center	Mitigation	2 years	Short term	Public Lighting Concession	Project profile for management	\$ 8.000	Yes
	P-19	Creation of pocket parks in the zone of influence of the center and in the other BICs.	Adaptation and Mitigation	2 years	Long Term	Cartagena Mayor's Office	Project profile for management	\$ 1.000	Yes
	P-20	Green roofs and walls in public and private buildings to reduce temperature, absorb rainwater and CO2, creating landscape value at the same time	Adaptation and Mitigation	10 years	Long Term	Public and Private Institutions and establishments	Project profile for management	\$ 180	No

\* Los proyectos con fichas corresponden a aquellos que fueron priorizados en el proceso de participación.

## Project sheets

### Protection of the historic heritage





## PROGRAM 1. PROTECTION OF ASSETS OF CULTURAL INTEREST FROM CLIMATE CHANGE

### PROJECT SHEET No. 16. STUDIES, DESIGN AND IMPLEMENTATION OF WORKS TO PREVENT FLOODS IN THE HISTORIC CENTER OF CARTAGENA DE INDIAS

#### Problems and justification

So far the maintenance works and interventions on the drains in the Historic Center are insufficient to protect this architectural jewel from the vagaries of climate and the increase in sea level. Although a drainage system was built in Colonial times (state of the art for its time and which continues to operate) and the necessary measures were introduced to protect the walled city from rain and sea, today these works require reinforcement in order to conserve the buildings declared a Heritage of Humanity by UNESCO in 1984. Not to act implies a cost too high for the city, as a heritage considered to be at risk may not only lose the UNESCO declaration, but also can reduce the attractive nature of Cartagena for both national and foreign tourism.

The works involved must be in accordance with the city's Drainage Master Plan and take advantage of the drains built by Transcribe and under the Historic Center Revitalization Plan. Works to prevent flooding on the perimeter of the wall and in the streets and plazas of the Center and Getsemani (which have not yet been intervened), taking into account the models of floods caused by rain and SLR in the future. In any event, any interventions carried out must respect the heritage so that the conditions of the assets of cultural interest are not affected.

#### Purpose of the project

To prevent flooding caused by rain and SLR in the Historic Center, so that the BIC located in the zone are protected and the day to day activities of both local people and visitors are not hindered.

#### Intervention area



#### Estimated cost

\$20,000,000,000

#### Duration

2 years

#### Executor

IPCC, Office of the Mayor of Cartagena

#### Other actors

Ministry of Culture

#### Financial mechanisms

ICLD, FDCCC, Royalties Fund, Research and academic institutions, internal credit

#### Specific actions

- Perform a survey of the present drainage system, including its operating status.
- Design alternative solutions to prevent flooding in the Historic Center.
- Carry out the required technical studies.
- Detailed engineering of the works, adjusted to the respective designs, budget and timescale.
- Validation of the different authorities competent in the solution suggested.
- Request the necessary permits for the works to be carried out.
- Carry out the works designed according to the outlines stipulated for interventions in the BICs.

#### Indicators

- % of work completed.
- Time for implementation/ estimated time of the works.
- Meters of drains intervened.
- Meters of channels built.
- Pumping stations installed.
- Number of jobs created.
- Number of Cartagena companies involved.

**PROGRAM 1. PROTECTION OF ASSETS OF CULTURAL INTEREST FROM CLIMATE CHANGE**
**PROJECT SHEET No.17. PLAN FOR THE IMPLEMENTATION OF MAINTENANCE AND PRESERVATION TECHNIQUES FOR THE ANCIENT AND OPEN AIR BUILDINGS THAT HAVE SUFFERED THE EFFECTS OF CLIMATE CHANGE**
**Problems and justification**

According to Unesco (2007), because the historical buildings are more porous, they are the most vulnerable to the effects of the climate on their structures, as they absorb water from the ground, which causes erosion and corrosion; increased humidity can cause crystallization, which is harmful to decorated surfaces and produces instability of the ground and, eventually subsidence; variations in temperature and humidity cause breakage, cracking, peeling and dust. Likewise, climate change also causes social and cultural consequences, such as forced migration, abandonment of properties and the loss of rituals. In general, an analysis of the impacts of climate change on heritage must take into account the interactions between natural, cultural and social aspects.

The ancient buildings of Cartagena are not exempt from suffering the effects of climate change. This is why they must be intervened in order to maintain and preserve them in the original condition, as their value is universal and exceptional. Interventions must include the buildings that require them, regardless of their use (housing, institutional, commercial, hotels), because, in the Historic Center, all the uses come together and, without them, it would not be a space for pluri-social encounters. The interventions must include the façades of the buildings in order to safeguard the urban landscape, as well as the interiors, taking into account the criteria and levels of intervention stipulated for the typology of the asset.

**Purpose of the project**

To protect the BICs of the city from the effects of climate change, conserving their status as Historic Heritage of Humanity.

**Intervention area**

**Estimated cost**

\$12,000,000,000

**Duration**

4 years

**Executor**

IPCC

**Other actors**

Ministry of Culture, Office of the Mayor of Cartagena, Cartagena de Indias School Workshop, Public Improvements Society.

**Financial mechanisms**


ICLD, FDCCC, Findeter (for buildings used for housing according to Decree 1762 of 2012), donations.


**Specific actions**

- Identify the buildings that require intervention in the Historic Center and its zone of influence.
- Survey of the present condition of each building to be intervened.
- Project maintenance and/or preservation of the asset.
- Technical studies and historic study of the building.
- Draw up the budget for the works and the respective schedule.
- Request the necessary permits from the competent authorities.
- Ex post follow-up.

**Indicators**

- Number of buildings intervened.
- Number of jobs created.
- Number of Cartagena companies benefited by the project.

PROGRAMA 2. GREENER HISTORIC CENTER AND ITS ZONE OF INFLUENCE WITH REDUCED EMISSIONS	
PROJECT SHEET No. 18. INSTALLATION OF PUBLIC LIGHTING EITHER EFFICIENT OR USING ALTERNATIVE ENERGIES IN THE HISTORIC CENTER	
<b>Problems and justification</b>	
<p>According to The Climate Group (2012), lighting is responsible for 19% of world electricity consumption and produces 6% of the GHG emissions of the planet. World capitals, such as New York, London and Sidney, considered the most sustainable and those which minimize their carbon footprint, have gradually introduced pilot public lighting projects with LED technology and achieving energy savings of between 50 and 70% (using intelligent controls that can reach up to 80%) and a useful life of 50,000 to 100,000 additional hours).</p> <p>The ancient urban sector of the city of Regensburg in Germany, was declared a Heritage of Humanity by Unesco in 2006. Recently, the city took the decision to use LED technology in the public lighting of the sector declared a heritage. With yellow lights that maintain a warm and natural light, the municipality reports that the new lamps are much more efficient, because they only require 40W against the 90W consumed by conventional lamps and double the useful life with replacements every 10 years.</p> <p>The Historic Center of Cartagena is illuminated at present by high pressure sodium lamps, which are permitted, according to the Technical Illumination and public Lighting Regulations (Retilap) (Resolution 180540 of 2010) and have a useful life of 3.5 years. Since a part of the electricity networks of the Historic Center (Centro neighborhood) have been underground, illumination is by means of lamps placed on the façades of the buildings. In the case of neighborhoods where the networks are not underground (San Diego and Getsemani), the public lighting lamps are placed on posts that conduct the electric networks. The Public Lighting Concession of Cartagena now intends to install part of the networks of Getsemani neighborhood underground, so that the new lighting must contain LED technologies as a pilot project, then to continue extending this type of lighting to the existing underground networks and eventually to where the networks have already been conditioned. It should be clarified that LED type lights are permitted under the current Retilap "providing they comply with the general requirements for efficient, safe lighting established under regulation" (p. 53). It is also noteworthy that LED type lights cause less damage to monuments.</p>	
<b>Purpose of the project</b>	
To convert the public spaced in the Historic Center of Cartagena into models of energy efficiency using LED technology, which consumes less energy, produces lesser emissions and has a longer useful life.	
	<b>Intervention area</b>
	<b>Estimated cost</b>
	\$8,000,000,000
	<b>Duration</b>
	12 years
	<b>Executor</b>
	Public Lighting Concession
	<b>Other actors</b>
	Office of the Mayor of Cartagena, IPCC, Cartagena de Indias School Workshop
	<b>Financial mechanisms</b>
	International climate funds, carbon funds, Public Lighting Concession resources
<b>Specific actions</b>	
<ul style="list-style-type: none"> <li>Define the zone where it is wished to implement efficient lighting.</li> <li>Photometric study for LED type lighting.</li> <li>Prepare a budget for the development of the lighting and a work schedule.</li> <li>Prepare a cost/effective analysis (LED lighting vs. sodium lighting) on a horizon of 10 years.</li> <li>Select and acquire the lighting projectors and equipment to be installed.</li> <li>Request the necessary permits from the competent authorities and install the public lighting using LED technology.</li> <li>Monitor consumption of the new lighting.</li> </ul>	
<b>Indicators</b>	
<ul style="list-style-type: none"> <li>Number of lights installed.</li> <li>% saving on the electricity bill (in KW and Colombian pesos).</li> <li>Number of jobs created.</li> </ul>	

PROGRAMA 2. GREENER HISTORIC CENTER AND ITS ZONE OF INFLUENCE WITH REDUCED EMISSIONS	
PROJECT SHEET No. 19. CREATION OF POCKET PARKS IN THE ZONE OF INFLUENCE OF THE CENTER AND IN THE OTHER BICS.	
<b>Problems and justification</b>	
<p>Pocket parks are small green zones created in abandoned or irregular spaces in urban areas. They comply with landscape functions (improve the urban façade) while at the same time they increase the number of zones for citizens' enjoyment and provide environmental services, among them the uptake of CO<sub>2</sub>, absorption of rainwater, prevention of landslides, increase in biodiversity and temperature reduction. This type of parks created on small scale must contain grass and trees, thus contributing to greenery in urban spaces and creating the impression of freshness within a concrete landscape. These actions contribute to creating more environmentally sustainable cities and are aimed at mitigating effects of climate change, such as, for example, the increase in precipitation and temperature intensity. Cities such as London, New York, Copenhagen and Mexico DF have been implementing programs for the creation of pocket parks along their urban perimeters in order to become greener and more resilient cities.</p> <p>According to Doria and Villarreal (2011), Cartagena de Indias has 7.01 m<sup>2</sup> of effective public space per inhabitant, a figure below the minimum established under Decree 1504 of 1998, which is 15m<sup>2</sup> per inhabitant. Consequently, the city is carrying out precise actions for the creation of effective urban public space, which can be achieved by implementing pocket parks. This type of spaces in zones bordering on the Historic Center and other BICs located in the district will also make buildings and monuments accessible for citizens, thus promoting meeting places around Cartagena patrimony and contributing to the urban prosperity of the city.</p> <p>This action is viewed in the long term, because at present the district administration is focusing its efforts on the adoption of the parks, green zones and pedestrian paths in the city, according to District Agreement 048 of 2006 and Agreement 010 of 2013, through the Cartagena de Indias District Parks and Green Zones Committee.</p>	
<b>Purpose of the project</b>	
To create green spaces in urban zones next to the BICs in order to increase their environmental and socio-cultural services.	
<b>Intervention area</b>	<b>Estimated cost</b>
	\$1,000,000,000
	<b>Duration</b>
	2 years
	<b>Executor</b>
	Office of the Mayor of Cartagena
	<b>Other actors</b>
	EPA, IPCC, environmental guards, Acuacar, District Parks Committee
	<b>Financial mechanisms</b>
	Capital gain, FIDCCC, Royalties Fund, Action Fund, donations.
<b>Specific actions</b>	
<ul style="list-style-type: none"> <li>Identify the areas that can be converted into pocket parks in the Historic Center and its zone of influence.</li> <li>Validate spaces where parks can be built with the community.</li> <li>Prepare a critical route of parks to be intervened and a survey of each one, beginning with the prioritized ones. For the prioritized parks. <ul style="list-style-type: none"> <li>Draw up a conceptual design for each one.</li> <li>Carry out technical studies.</li> <li>Adjust the design, timetable and budget for the works.</li> <li>Determine the amount of the resources necessary for the construction of the pocket park.</li> <li>Request the permits and build the pocket park.</li> <li>Inaugurate the park together with the authorities and the community.</li> <li>Define the actors and resources for maintenance of the park.</li> </ul> </li> </ul>	
<b>Indicators</b>	
<ul style="list-style-type: none"> <li>Number of parks created (total per neighborhood).</li> <li>Number of parks adopted.</li> <li>Index of effective urban public space (per neighborhood and city).</li> <li>Number of jobs created.</li> <li>% increase in effecting urban public space.</li> </ul>	

4. According to CONPES 3718 of 2012, effective public space consists of green zones, parks, plazas and small squares.



## 9.2 Axis of citizens and adaptation to climate change

### 9.2.1 Strategy 4: Neighborhoods adapted to climate change

Adapted neighborhoods are those which cease to be vulnerable to the consequences of climate change, to climate variations and to extreme climate events (runoff water, floods, drought, SLR, etc.) and become neighborhoods whose communities lead their own adaptation process, are capable of getting used to these phenomena participatively and contribute to improving the quality of life of the local inhabitants.

In this context, the proposal for Cartagena de Indias and its islands is the development of adapted pilot projects in vulnerable zones. Intervention must be integral and within the framework of the outlines traced by the city's planning instruments (POT, Development Plan, etc.) with the community playing the part of leader of its own development process.

## Vision by 2040

By the year 2040, the district of Cartagena will have adapted neighborhoods, with innovative designs that will be replicated in other vulnerable neighborhoods, thus becoming, at both national and international levels, an example of a model to overcome the challenges of climate change and sustainable development, with participation at the local level.

### Key factors to achieve the vision

- ❖ Carry out planning and land use processes, taking into account the criteria of climate change adaptation and mitigation and respecting the ecological structure of the city because of the functions it provides.
- ❖ Involve the community in the conceptualization, construction and maintenance of the neighborhood.



### Key data

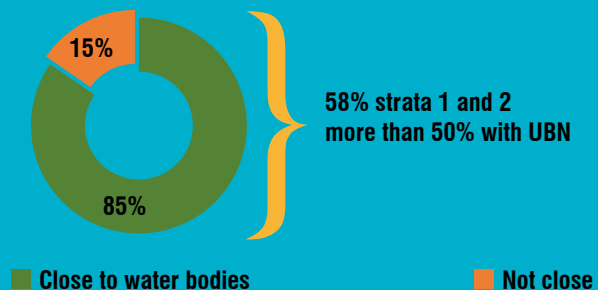
- ❖ Inventory of the infrastructure that would be affected by climate change on pessimistic scenarios

	Total Infrastructure	Effect		
		Phenomenon	2019	2040
Housing	132753	Erosion	506	506
		Flooding	23.806	37.775
Equipment	649	Flooding	120	230
Green urban areas (ha)	15,75	Flooding	2,9	7,9
Roads (km)	620	Flooding	111,6	217

Fuente: Invermar, *et al.* 2012.

- ❖ 26 neighborhoods were identified as vulnerable to climate change in an area with a population of 285,000 persons (29% of the population) and 56,000 housing units (27% of the total).

26 neighborhoods vulnerable to climate change



**Table 12.** Description of programs under the neighborhoods adapted to climate change strategy.

Program	Description and expected results
1. Urban neighborhoods adapted to climate change	Due to unplanned urban growth, in Cartagena de Indias many vulnerable communities have settled in high risk coastal zones, thus interrupting the natural processes and exposing themselves to the adverse effects of the climate, for example, extreme events and floods. These unplanned neighborhoods must adapt their houses, equipment and public spaces to the effects of climate change in order to generate urban prosperity compatible with the climate.
2. Community-based Adaptation in rural communities	Adaptation based on communities is a process of empowerment that arises in the interior of the most vulnerable groups in order to recognize the causes and effects brought about by climate change; this adaptation to overcome future climate-related obstacles can be achieved by adequate planning that will reduce their impacts by knowledge and strengthening local capacities. Because of their conditions of poverty and vulnerability, this process is suitable to be applied in the insular zone of Cartagena de Indias, seeking to consolidate in it a resilient community aiming for development that is sustainable and compatible with the climate.

**Tabla 13.** List of projects in the neighborhoods adapted to climate change strategy (figures in millions of pesos)

Program	No.	Project	Type of measure	Duration	Start Term	Executors	Management Status	Cost COL\$	Sheet
1. Urban neighborhoods	P-21	Selection, design and putting into operation of a model neighborhood that adapts to climate change	Adaptation	2 years	Short term	Office of Mayor of Cartagena	Preparation	\$ 6.000	Yes
2. Community-based Adaptation in rural communities	P-22	Model project of houses adapted to climate change in island areas	Adaptation	2 years	Medium term	Office of Mayor of Cartagena PNN	Profile of project to be managed	\$ 1.000	Yes

\* The projects with sheets are those that were prioritized in the participation process.

## Project sheets

### Neighborhoods adapted to climate change



**PROGRAM 1. URBAN NEIGHBORHOODS ADAPTED TO CLIMATE CHANGE**
**PROJECT SHEET No. 21. SELECTION, DESIGN AND PUTTING INTO OPERATION OF A MODEL NEIGHBORHOOD THAT ADAPTS TO CLIMATE CHANGE**
**Problems and justification**

Because of its special morphology, the neighborhoods of Cartagena de Indias have formed historically around the bodies of water. Initially (in Colonial times) this location provided a natural protective barrier, but, as of 1950 and as a result of phenomena such as migration, forced by violence, the city gradually developed in a disorderly fashion, with settlements in high risk zones or coastal protection soils, such as on the south eastern side of the Virgen marsh, that began to be filled in order to build precarious, informal housing, although today the soil has consolidated with normalized neighborhoods.

The adaptation must include the intervention of houses, roads and drainage systems, as well as the revitalization of public spaces and green zones in order to recuperate it's landscapes, and environmental functions. In turn, this intervention must improve both the access to the neighborhood and the interior roadways and those that communicates with the rest of the city; promote alternative means of transportation, efficient use of public services, produce income based on the job opportunities created in the process of sustainability of the adapted neighborhood and to increase social cohesion and citizen participation. As a result, the neighborhood intervened should not only be adapted to climate change, but also to become a space of urban prosperity. It should be stressed that intervention must be carried out, taking into account the urban treatments stipulated in the land use plan or in any other structural regulations of the National or district nature, or which stipulate the actions to be undertaken in the zone. Likewise, the efforts that have been made by the district must be coordinated through other future plans and projects, or the ones that are already underway for the zone, in order not to duplicate the interventions.

**Purpose of the project**

To promote development of the neighborhood respecting the environmental surroundings and applying the land use regulations and the Development Plan according to environmental sustainability criteria, creating policies of integration and mitigation to be adapted to climate change.

**Intervention area**

**Estimated cost**

\$6,000,000,000

**Duration**

2 years

**Executor**

Office of the Mayor of Cartagena, Corvivienda

**Other actors**

EPA, Aguas de Cartagena, Surtigas, private enterprise, community.

**Financial mechanisms**

ICLD, Specific Use Income (IDE), Adaptation Fund, National Disaster Risk Management Fund (FNGRD), International Cooperation, donations, foundations, research and academic institutions.


**Specific actions**

- Define the criteria for the selection of the neighborhood and demarcate the area to be intervened.
- Define the instruments for management of the soil applicable to the sector of the neighborhood.
- Select and contract an NGO that works in the zone and formalize the relationship with the project for it to begin social work with the community.
- Select and contract (if necessary) a company to draw up the designs and carry out the technical studies.
- Define the interventions necessary in both public spaces and in houses.
  - In houses: increase height levels, install hydro-sanitary connections and apparatus, implement recycling and waste management program, campaign for management of waste water and implement a renewable energies project.
  - In public spaces, paving and repairs of roads, cleaning, dragging and rectifying channels, recuperate public spaces and green zones by planting native species.
- Prepare technical studies for detailed engineering with work budgets and work timetable.
- Request the respective permits for the interventions defined.
- Intervened houses and public spaces.
  - Socio-economic and cultural interventions in the community who live in the demarcated polygon, take the Pedro Romero (PES) Social Emergency Plan to the neighborhood; identify and put into operation productive projects for the community, implement socializations with the community to make known the interventions and to construct social capital.
  - Monitor and evaluate the interventions.
- Replicate the pilot project in another sector of the neighborhood or in another one of the City.

**Indicadores**

- Number of inhabitants benefited.
- Number of houses intervened.
- Meters of road built.
- Meters of drains intervened.
- Number of jobs created.
- M<sup>2</sup> of green zones created.
- Number of trees planted.
- M<sup>2</sup> of public spaces created.
- % of income generated.



PROGRAM 2. RURAL ADAPTATION BASED IN COMMUNITIES	
PROJECT SHEET No. 22. MODEL PROJECT OF HOUSES ADAPTED TO CLIMATE CHANGE IN ISLAND AREAS	
<b>Problems and justification</b>	
<p>Climate change will cause impacts on the populations in the island sector of Cartagena de Indias and its main effects will be related to the loss of land and flooding of low-lying areas, a reduction in thermal comfort, increased droughts, greater exposure to events of extreme meteo-marine events and regression of mangrove areas.</p> <p>Given that these zones were populated without taking any environmental functions into account, adequate planning must be promoted, which will require implementing appropriate practices of intervention in houses, accessibility, drains and revitalization of green zones for their landscape and environmental functions. The intervention must promote efficient use of hygienic and energy resources, generation of income based on work opportunities surrounding the sustainability of the area, the increase in social cohesion and citizen participation. It must be stressed that intervention must be carried out taking as a conceptual framework the planning of assets, which is based on joint work with members of the community and local government representatives, the private sector and the NGOs that work in the area, creating a space for dialogue to allow them to identify, negotiate and agree on climate change adaptation solutions that are viable in legal, financial, social and technical spheres (Stein and Moser, 2014). So far, some progress has been made which could contribute to the process; the communities who inhabit the islands have presented solar energy projects to the Ministry of Mines and Energy as an alternative power supply, and they also have a prototype bioclimatic house that could be improved and used to promote the development of the project. Moreover, the community is in the process of establishing collective territories.</p>	
<b>Purpose of the project</b>	
To promote the development of housing models respecting the environmental surroundings, applying environmental sustainability criteria and generating integration and mitigation policies for climate change in the island territory of Cartagena de Indias.	
<b>Intervention area</b>	<b>Estimated cost</b>
	\$1,000,000,000
	<b>Duration</b>
	2 years
	<b>Executor</b>
	Office of the Mayor of Cartagena, Corvivienda, Cardique, National Natural Parks
	<b>Other actors</b>
	Surtigas, private enterprise, community
	<b>Financial mechanisms</b>
	IDE, Adaptation Fund, Royalties Fund, FNGRD, international climate funds, multilateral organisms, donations, national foundations
<b>Specific actions</b>	
<ul style="list-style-type: none"> <li>Define the criteria for the selection of the island and demarcate the area to be intervened.</li> <li>Select and contract an NGO that works in the zone and formalize the relationship with the project for it to begin social work with the community.</li> <li>Select and contract (if necessary) a company to draw up the designs and carry out technical studies.</li> <li>Define interventions according to the places where they are necessary. <ul style="list-style-type: none"> <li>In houses: increase height levels, install hydro-sanitary connections and apparatus, implement recycling and waste management program, campaign for management of waste water and implement a renewable energies project.</li> <li>Plant native species in public spaces.</li> </ul> </li> <li>Prepare technical studies for detailed engineering with work budgets and work timetable.</li> <li>Request the respective permits for the interventions defined.</li> <li>Identify productive projects for the community and put them into operation</li> <li>Select and contract persons from the community and companies (if necessary) to carry out the interventions <ul style="list-style-type: none"> <li>Socio-economic and cultural interventions in the community who live in the demarcated polygon:</li> <li>Carry out socializations in the community to inform them of the interventions and build social capital.</li> </ul> </li> <li>Monitor and evaluate the interventions.</li> <li>Replicate the pilot project in another sector or island.</li> </ul>	
<b>Indicators</b>	
<ul style="list-style-type: none"> <li>Number of persons benefited.</li> <li>Number of houses intervened.</li> <li>m<sup>2</sup> green zones created.</li> <li>Meters of drains intervened.</li> <li>% income generated</li> <li>Number of productive projects implemented</li> <li>Number of trees planted.</li> <li>Number of jobs created.</li> </ul>	

## 9.3 Axis of ecological restoration: water and life

### 9.3.1 Strategy 5: Ecosystem-based Adaptation

The ecosystems and the insular system of the district of Cartagena de Indias are highly vulnerable to climate change. The beaches, coastal lagoons, mangroves and coral reefs would be the most affected. In this context, the strategy seeks to restore, maintain and empower the ecological structure of the city and its island areas through actions of preservation and the cooperation of the marine and coastal ecosystems, in order to be able to provide environmental services that allow people and the city to increase their resilience to climate change. Their implementation, in addition, will provide social and economic benefits, including improvements in ways of life, reduction in the risk of disasters and the conservation of biodiversity.

## Vision by 2040

By 2040, the district of Cartagena de Indias will have taken advantage of the city's ecosystems and its insular areas as a climate change adaptation and mitigation measure, by restoring its ecological heritage and rescuing its landscape, economic, social and environmental values.

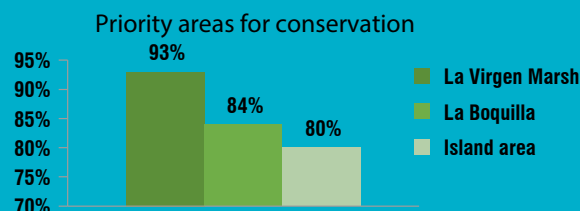
### Key factors to achieve the vision

- ❖ Taking advantage of the marine and coastal areas to capture greenhouse gases.
- ❖ Using the ecosystems for economic, social and cultural activities sustainably and, in turn, supporting their capacity for reduction of the effects of climate change.
- ❖ Increasing the environmental capital of the district.



### Key data

- ❖ Climate change impacts by 2040.
  - 100% of the mangrove swamp areas in the city would be affected by an increase in sea level.
  - 100 % of the Cartagena beaches and the uses associated with them would suffer from coastal erosion.
  - 18% of island territory would be affected by the increase in sea level.
- ❖ What is the citizens' opinion of the importance of ecosystems in a situation of climate change? (Invemar survey of perception, 2013):



The main coverage of the marine and coastal ecosystems of the district is concentrated in these areas.



**Table 14.** Description of the programs of the Ecosystem-based Adaptation Strategy

Program	Description and results expected
1. Resilient ecosystems	The ecosystems of the urban and rural zones provide landscape and environmental services which are affected as a result of the effects climate change brings with it. This program seeks to increase the capacity for response and re-generation of these ecosystems in order to continue providing its services increasing the district's environmental capital.
2. Promotion of ecological connectivity	The city of Cartagena de Indias has a great variety of ecosystems, both in the continental zone and in the insular area which must be connected by means of corridors in order to preserve and conserve the ecosystems and favor biodiversity.
3. Habitat and reduction of emissions	In general, it is in the densest zones of the city where the effects of climate change are felt most, for example, the increase in temperature and rainwater runoff. In these areas it is necessary to create spaces that improve the quality of life in the urban and rural neighborhoods of the city, while at the same time contributing to reducing emissions of GHG, thus targeting the adaptation and mitigation of climate change.

**Table 15.** List of projects of the Ecosystem-based Adaptation Strategy

Program	No.	Project	Type of Measure	Duration	Start Time	Executors	Status of management	Cost COL\$	Sheet
1. Resilient Ecosystems	P-23	Pilot project of modular mangrove swamps as a strategy of adaptation to climate change on Tierrabomba Island.	Adaptation	1 yr	Short term	Invemar	Evaluation for financing	\$ 400	Yes
	P-24	Demarcation of the La Virgen Marsh wetland as an input for environmental land use and the management of future climate phenomena.	Adaptation	1 yr	Short term	Humboldt Institute, Cardique	Implementation	\$ 4.000	Yes
	P-25	Restoration of the ecological structure with emphasis on the mangrove swamp in order to reduce the effects of climate change on the Rosario and San Bernardo archipelagos and Fuerte Island.	Adaptation	5 yrs	Medium term	Cardique	Project profile for management	\$ 2.805	No
	P-26	Regeneration of beaches using external supply and direct supply from dredging.	Adaptation	5 yrs	Medium term	Office of Mayor of Cartagena, Dimar, MADS	Project profile for management	\$ 23.000	No
	P-27	Recuperation and re-population of coral reefs on the islands.	Adaptation	3 yrs	Short term	National Natural Parks (PNN), CEINER	Implementation	\$ 600	No
2. Promotion of ecological connectivity	P-28	Design and implementation of biological corridors (land and marine) to maintain and increase the ecological connectivity of the islands.	Adaptation	5 yrs	Long term	MADS, Cardique	Project profile for management	\$ 1.500	No
3. Habitat and reduction in emissions	P-29	Tree planting in populated centers to establish green barriers that will serve as protection against extreme events and provide thermal protection for the communities.	Adaptation and Mitigation	5 yrs	Medium term	Office of Mayor of Cartagena, Cardique, private enterprise	Project profile for management	\$ 850	No

\* Los proyectos con fichas corresponden a aquellos que fueron priorizados en el proceso de participación.

## Project sheets

### Ecosystem-based adaptation strategy



## PROGRAM 1. RESILIENT ECOSYSTEMS

### PROJECT SHEET No. 23. PILOT PROJECT OF MODULAR MANGROVE SWAMPS AS A STRATEGY OF ADAPTATION TO CLIMATE CHANGE ON TIERRABOMBA ISLAND.

#### Problems and justification


According to Invemar (2003) Cartagena de Indias is one of the five national areas, and the first for the Colombian Caribbean, to be identified as critical because of its vulnerability to climate change due to the effects of a rapid increase in the sea level. Taking as a basis the work referred to, Invemar, associated with Alianza Clima y Desarrollo (CDKN) and the Office of the Mayor of Cartagena de Indias, analyzed the vulnerability of the city and, during the process, identified several zones susceptible to flooding on climate change scenarios projected to 2019 and 2040 on the island of Tierra Bomba.

In order to minimize the impacts that an increase in sea level and coastal erosion cause on island territory, this project seeks to protect the coast, recuperate mangrove swamp zones and increase coverage of the intertidal forests, thus increasing the provision of environmental services with which this important ecosystem provides the population.

In the medium term, the mangrove swamp modules will act as nuclei for mangrove propagation, resulting in the long-term for seeds of other species of mangrove to settle, forming the habitual zoning of the mangroves from the area. The construction of the modules, their location on the coast and the planting of seedlings will be carried out jointly with the local communities of selected sites. Likewise, monitoring of the survival and growth of the seedlings, as well as the physical changes in the area, will be done monthly with their accompaniment during the project. Later, it will be up to these communities to take responsibility for the care and continuity of the project.

#### Purpose of the project

In view of the challenges of climate change in Colombia, the purpose is to identify and implement a replicable adaptation strategy based on coastal ecosystems and to strengthen, at Latin American and Caribbean levels, the good practices and political and technical strategies of states to deal with them.

Intervention area	Estimated cost
	\$400,000,000
	Duration
	1 year
	Executor
	Invemar
	Other actors
	IOM, UNEP
	Financial mechanisms
	Multilateral organisms, research and academic institutions

#### Specific actions

- Define two points of the study to demarcate land parcels in which the mangrove swamp structure will be determined.
- Calculate the propagules and seedlings of each species.
- Measure the physico-chemical variables in the mangrove swamp soils.
- Coordinate, construct and place the modules jointly with the community.
- Collect and plant the propagules in the modules.
- Measure on a monthly basis the survival, height and diameter of the seedlings.
- Create beach profiles before the community places the modules.
- Create beach profiles up to the distance and the depth at which the modules are to be placed.
- Design a monitoring system for the area to follow up its development and evolution over time.

#### Indicadores

- Coverage (changes in the time of the coverage).
- Survival rate = number of individuals alive/number of individuals planted.
- Potential for natural regeneration (follow-up of pioneer species and species in late development stages).
- Presence of species associated with the mangrove swamp ecosystems (crustaceans and mollusks , among others).
- Analysis of technological integrity (in comparison with the initial analysis).



# PROGRAM 1. RESILIENT ECOSYSTEMS

## PROJECT SHEET No. 24. DEMARCATION OF THE LA VIRGEN MARSH WETLAND AS AN INPUT FOR ENVIRONMENTAL LAND USE AND THE MANAGEMENT OF FUTURE CLIMATE PHENOMENA.

### Problems and justification

The phenomenon of La Niña 2010-2011 affected hydrographic basins in the entire country. Given this situation, the MADS, together with the Alexander von Humboldt Institute, signed an agreement whose purpose is to establish mitigation measures and the prevention of risks in affected zones, in preparation for future climate phenomena on high plateaus and wetlands. For this project, the National Adaptation Fund has allocated some \$65,000 million pesos for pilot projects in both types of ecosystems, of which some \$12,000 million would be assigned to pilot projects for wetlands.

Since the La Virgen marsh has been defined as a strategic wetland for the country because of its environmental importance and, given its vulnerability to the effects of climate change, there is a risk to the ecosystems and communities that are located along its border. For this reason, the demarcation of this body of water, together with its flood zones, is an important input for the city and serves as a criterion for the relocation of houses in high risk zones and to prevent future invasions in these and other zones defined as liable to flooding.

### Purpose of the project

To deliver to the respective authorities the demarcation proposal for the Cienaga de la Virgen in order for it to be adopted and used as a tool for territorial land use and to the management of risks and disasters caused by extreme events as part of climate change.

### Intervention area



### Estimated cost

\$4,000,000,000

### Duration

1 year

### Executor

Alexander von Humboldt Institute, Cardique

### Other actors

MADS, Office of the Mayor of Cartagena, EPA, Incoder

### Financial mechanisms

National Adaptation Fund

### Specific actions

- To carry out technical studies to allow for demarcation of the functional limit. As part of this activity, mapping of the marsh at the scale of 1:100.000 will be prepared.
- Develop technical studies in order to identify the criteria for decision making and its implications, in both the urban and rural areas, taking four factors into account:
  - Analysis of the actors.
  - Institutions and governments.
  - Ecosystems services and trade-off.
  - Analysis of the socio-environmental history and adaptation to change
  - Benefits of the ecosystem in terms of protection.
- Handover recommendations to the local actors for their implementation.
- Presentation of the mapping with the demarcation of coverage of the wetland at a scale of: 1:100.000

### Indicadores

- Mapping of actors.
- Cartography with the functional order of the wetland and coverages.
- Technical support document.

## 10. Cross-cutting axes

### 10.1 Information and monitoring

Climate Compatible Development is a process based on knowledge and information gained from scientific research. This gives rise to the need to promote the appropriation and analysis of technical information on the causes and effects of climate change at different levels, in order for them to be used by the public sector for decision taking, and to circulate to the public in general. In addition, this information must constitute a key input for follow-up and evaluation of the plans and projects within the framework of climate compatible development schemes.

In general, there must be a scientific information system (statistical and geographic) to permit monitoring and follow-up of the indicators associated with sustainable development and climate change in Cartagena de Indias (elevation of sea level and extreme meteo-marine events). The system must bring together the Marine Research Centers Network, academia, social, economic and environmental research centers and thinkers and experts, local, national and international, in order to produce the information necessary to promote actions for adaptation to climate change in the district. If we are lucky, these will serve as an example or as pilots to be used in other zones of the planet with similar characteristics, thus becoming a qualified center of training and experience and of traditional knowledge for the Grand Caribbean region.



### Vision by 2040

**By 2040, Cartagena de Indias will have a space for climate action, observation and thought, working in coordination with different public and private actors to generate information for governments and citizens, thus contributing to the monitoring for climate change adaptation and mitigation.**

**Table 16.** Description of the cross-cutting axis program: Information and monitoring.

Program	Description and results expected
1. Information on climate change within everybody's reach	At present in Cartagena de Indias there is an obvious lack of information on climate change and its effects, in spite of different studies having been made, which, in addition to being insufficient, in some cases are not disseminated among the population. Monitoring this phenomenon requires, as a basis for decision making and to inform citizens, the production of a constant flow of information. As we have carried out a great deal of climate change investigation, both the decision takers and citizens will be better prepared to face the challenges that the climate of the future will bring.

**Table 17.** List of projects of the cross-cutting axis projects: Information and monitoring (in millions of pesos)

Program	No.	Project	Type of Measure	Duration	Start Term	Executors	Management Status	Cost COL\$	Sheet
1.Information on climate change within everybody's reach	P-30	Development of an application for smart phones with up to date meteorological information on the city (including the Rosario and San Bernardo National Natural Park)	Adaptation	1 yr	Medium term	Climate Action Center	Project profile for management	\$ 50	Yes
	P-31	Population ecology of vectors of diseases and their relation to climate change in the city of Cartagena de Indias	Adaptation	1 yr	Medium term	Climate Action Center	Project profile for management	\$ 100	Yes
	P-32	System of information on present and future climate risks for Cartagena de Indias	Adaptation and Mitigation	4 yrs	Long Term	Climate Action Center	Project profile for management	\$ 700	Yes
	P-33	Bio-physical and socio-economic inventory of the coastal zone of the district of Cartagena	Adaptation and Mitigation	2 yrs	Short Term	Climate Action Center	Project profile for management	\$ 800	No

\* Projects with sheets are the ones prioritized in the participation process.

## Project data sheets

### Information and monitoring axis



**PROGRAM 1. INFORMATION ON CLIMATE CHANGE WITHIN EVERYBODY'S REACH****PROJECT SHEET No.30. DEVELOPMENT OF AN APPLICATION FOR SMART PHONES WITH UP TO DATE METEOROLOGICAL INFORMATION ON THE CITY****Problems and justification**

In the city of Cartagena de Indias at the moment there are four stations monitoring climate and marine variables. Two of them are located in urban zones and the other two in rural zones. The information they provide is mainly area humidity, precipitation, temperature, sea level, direction of the wind and sunshine.

Today, the citizens of, and visitors to Cartagena de Indias have little information on heat islands, intrusion of the tide into the city or floods resulting from rain and extreme events. In order to obtain updated meteo-marine information that is accessible by citizens and visitors, the entities who manage this must be committed to delivering this information in real-time in order to feed the platform on which the application for intelligent phones will be created, called "Clima Cartagena"; those who do not have one of these devices will be able to access it the website.

Cities such as Venice, where daily tourism activities are seriously affected by increases in low areas of the city caused by the tide, have developed applications of this type in order to obtain reliable information on the times of day when the tide comes in and goes out at the different points of the city. This information is useful for people who take decisions regarding places to visit, routes to take and even the appropriate type of clothes to wear and which are the most comfortable when facing this natural phenomenon that affects the city and which will continue to be increased by the effects of climate change.

**Purpose of the project**

To gather information on the meteo-marine phenomena in Cartagena de Indias and its islands on a platform that can be consulted using free download applicatives, on the web or using intelligent phones, in order to provide users with reliable information in real-time.

**Intervention area****Estimated cost**

\$50,000,000

**Duration**

1 year

**Executor**

Cartagena Climate Action Center

**Other actors**

Office of the Mayor of Cartagena, Ideam, CIOH, Invemar,

**Financial mechanisms**

FDCCC, Corporation for Development, international foundations

**Specific actions**

- Sign agreements of understanding with CIOH, IDEAM and INVEMAR to receive meteo-marine information.
- Seek a portal (or create a new one) in which to place the information provided by the entities.
- Cross data and models showing the increase in sea level by tides/waves with the height at different points of interest of the city, in order to calculate the flooding by SLR at these points.
- Develop an application for intelligent phones that shows the existing information on the web.
- Disseminates the website address and the location of the application to make them known to residents and visitors.
- Carry out a user satisfaction survey.
- Tabulate the results of the survey and identify possible actions for improvement.
- Implement improvement actions.

**Indicadores**

- Virtual platform created.
- Application for intelligent phones developed.
- Number of downloads of the application.
- Qualification of the users of the application.
- Number of improvement opportunities implemented.



## PROGRAM 1. INFORMATION ON CLIMATE CHANGE WITHIN EVERYBODY'S REACH

### PROJECT SHEET No. 31. POPULATION ECOLOGY OF VECTORS OF DISEASES AND THEIR RELATION TO CLIMATE CHANGE IN THE CITY OF CARTAGENA DE INDIAS


#### Problems and justification

According to the World Health Organization, 1.2 million people die annually from malaria, the majority of whom are children under 5 years of age; in addition, dengue is the vector transmitted disease increasing most rapidly worldwide. One of the reasons for which these high death rates and accelerated growth of diseases may be due to climate change, because the transmitter mosquitoes find the environment most propitious for procreating in temperatures that vary between 16° and 30°C in minimum rainfall conditions (Invemar et al., 2012).

Because Cartagena is a city where conditions are ideal for the propagation of these vectors (in particular those that transmit dengue), it is necessary, apart from the actions aimed at eradication of the vector, to understand their population ecology, in order to obtain precise and timely information that serves to prevent the disease. Likewise, these studies must state how effective the measures that are being adopted are in order to make the processes and the use of resources available for the integrated management of vectors more efficient.

#### Purpose of the project

To study the population ecology of the factors that cause tropical diseases in the city, as well as the alterations that occur as a result of climate change.


Intervention area	Estimated cost
	\$100,000,000
	Duration
	1 year
	Executor
	Climate Action Center
	Other actors
	Office of the Mayor of Cartagena, Dadis, EPA, Cardique, Ministry of Health and Social Protection, Banco de la República (central bank)
	Financial mechanisms
	Multilateral bodies, research and academic institutions, international foundations

#### Specific actions

- Define the team that will work on research (internal and through alliances).
- Prepare the research including:
  - Description of the problem.
  - Preparation of the theoretical framework.
  - Identification of key factors.
  - Information compiling and analysis.
  - Test of the hypothesis(es).
  - Construction of conclusions.
- Publish research work.
- Socialize and publish the results

#### Indicadores

- Map of the population ecology of vectors prepared.
- Research published.
- Preparation of a pamphlet of recommendations.
- Number of socializations.
- Number of persons socialized.

PROGRAM 1. INFORMATION ON CLIMATE CHANGE WITHIN EVERYBODY'S REACH	
PROJECT SHEET No. 32. SYSTEM OF INFORMATION ON PRESENT AND FUTURE CLIMATE RISKS FOR CARTAGENA DE INDIAS	
<b>Problems and justification</b>	
<p>The earth's climate is becoming more and more unstable, which causes drastic changes in the behavior of precipitation, tides and temperature; for this reason, it becomes more and more necessary to develop monitoring systems to allow authorities, companies and civil society to have timely information on extreme events and to prepare themselves to protect their lives, the infrastructure of cities, rural areas and patrimonial assets. Likewise, this information serves as a basis to predict later climate phenomena so that they can plan and take timely decisions in order to minimize the risks. This type of initiative exists at present at both international level (El Niño International Research Center (CIFEN) of which Colombia and other South American countries are members) and national level (Ideam issues monthly bulletins called "Climate Prediction and Alerts for Planning and Deciding"). This project was conceived as a system that makes it possible to have reliable information at local level and to identify climate phenomena and the potential risks to which the city is exposed; moreover, it serves to generate a large amount of information for the preparation of a climate change analysis over time, and as an early meteorological alert. It is useful not only for the public sector and civil society, but also for the city's productive sectors, as all the economic activities (above all tourism and the ports) are sensitive to climate variations.</p>	
<b>Purpose of the project</b>	
<p>To have timely information on climate phenomena in Cartagena de Indias in order to minimize the negative impacts that these can cause to the population and their goods, as well as to city infrastructure.</p>	
<b>Intervention area</b>	<b>Estimated cost</b>
	\$700,000,000
	<b>Duration</b>
	4 years
	<b>Executor</b>
	Cartagena Climate Action Center
	<b>Other actors</b>
	Cardique, EPA, Office of the Mayor of Cartagena, CIOH, Ideam, Invermar
	<b>Financial mechanisms</b>
	FDCCC, research and academic institutions, Royalties Fund, Adaptation Fund
<b>Specific actions</b>	
<ul style="list-style-type: none"> <li>• Sign an agreement with the environmental authorities and research centers with meteorological stations within the urban perimeter.</li> <li>• Place additional stations required for the information system.</li> <li>• Prepare the general budget and the timetable for implementation of the works.</li> <li>• Select and contract a supplier to install the monitoring centers.</li> <li>• Request the permits required for the installation of monitoring centers.</li> <li>• Install the monitoring centers and contract staff to run such centers.</li> <li>• Have the Action Center and the district authorities launch the information system.</li> <li>• Collect and analyze climate information and other alerts.</li> <li>• Disseminates and socialize the results.</li> <li>• Include the system of alerts that would operate on the basis of the information collected by the stations in the "Cartagena Climate" application.</li> <li>• Carry out pre-feasibility studies to acquire the necessary equipment to develop an early alert system.</li> </ul>	
<b>Indicators</b>	
<ul style="list-style-type: none"> <li>• Number of monitoring stations working.</li> <li>• Number of reports issued.</li> <li>• Alert system created.</li> <li>• Number of alert concentrations on the web.</li> </ul>	

## 10.2 Education and communication

“Education, training and raising awareness of the citizens on climate change is fundamental to promote the creation of capabilities of adaptation and mitigation. It is the responsibility of all to make that which at present is within the restricted area of knowledge of technicians and scientists – given the relative complexity and novelty of the phenomenon, to be of public knowledge” (Ideam, 2010).

Because Cartagena is highly vulnerable to the effects of climate change it is important that people be aware of this phenomenon and its effects. The inhabitants of the most vulnerable zones must have the necessary information to learn when extreme events will occur and how to prepare their assets to protect them and avoid economic losses. Likewise, it is important that the new generations learn at school, from pre-school to high school and then higher education, about climate change. It is also necessary to promote a citizens environmental culture with emphasis on climate change through the mass media and spaces for dialogue inside and outside the communities.



### Vision by 2040

**By 2040 the people of Cartagena will be educated and sensitized to the causes and effects of climate change and will be aware of adaptation and mitigation measures. This knowledge will be the main input for decision making at local level and for citizens to become involved in their own development through climate compatible schemes.**

**Tabla 18.** List of projects of the cross-cutting axis on education and communication (in millions pesos).

Program	Description and results expected
1. Raising climate change awareness of citizens	Because Cartagena de Indias is a city that is highly vulnerable to climate change, its inhabitants must learn about the causes and effects of the phenomenon and be prepared for the climate of the future by taking the necessary measures to deal with it from today. This raising of the climate change awareness will be carried out, in both traditional and alternative media, through campaigns that include clear messages for all citizens of all the strata.
2. Education for the climate of the future	Subjects relating to climate change must be included in the formal education of children and young people (from their earliest years up to university) through school environmental projects (Praes) and University environmental projects (Praus). It is in this way that the new generations will learn how to be prepared for the climate of the future.

**Tabla 19.** List of projects of the cross-cutting axis on education and communication (in millions pesos)

Program	No.	Project	Type of Measure	Duration	Start of Term	Executors	Management Status	Cost COL\$	Sheet
1. Raising climate change awareness of citizens	P-34	Social campaign with recognized inhabitants of Cartagena to raise awareness on climate change.	Adaptation and Mitigation	2 yrs	Short term	EPA	Project profile for management	\$ 1.500	Yes
	P-35	Education campaign to promote conservation of mangrove swamps.	Adaptation and Mitigation	2 yrs	Short term	Mayor's Office of Cartagena	Project profile for management	\$ 400	Yes
2. Education for the climate of the future	P-36	Climate change as the cross-cutting axis in the Praes, Praus and Procedas.	Adaptation and Mitigation	3 yrs	Medium term	District Education Department, Cidea	Project profile for management	\$ 1.000	No

\* Projects with sheets are those that were prioritized in the participation process.

## Project sheets Education and communication axis





**PROGRAM 1. RAISING CLIMATE CHANGE AWARENESS OF CITIZENS****PROJECT SHEET No. 34. SOCIAL CAMPAIGN WITH RECOGNIZED INHABITANTS OF CARTAGENA TO RAISE AWARENESS ON CLIMATE CHANGE****Problems and justification**

The lack of information on the consequences of the effects of climate change in the city of Cartagena in the year 2040 poses an enormous challenge; the intention is for citizens to have a clear and present idea of what their contribution to mitigating the impact of climate change should be and what actions they themselves can undertake.

For this purpose, it is relevant for Plan 4C to contain a social campaign disseminated by the mass communications media that will succeed in generating sensitivity to the subject in a clear educational manner that is easily remembered by the citizens.

**Purpose of the project**

To create a social campaign to raise the awareness of all citizens of the effects of climate change in the city of Cartagena de Indias and its Islands.

**Intervention area****Estimated cost**

\$1,500,000,000

**Duration**

2 years

**Executor**

EPA

**Other actors**

Office of the Mayor of Cartagena, Chamber of Commerce-BID, mass media, Corpoturismo, OPE, Publik, private enterprise, civil society

**Financial mechanisms**

ICLD, FDCCC, donations, international foundations


**Specific actions**

Media strategy with messages on climate change from people well known in Cartagena that include:

- Contracting public billboards, both printed and digital and notices at bus stops.
- Prepare and broadcast radio slots.
- Make promotional videos.
- Invite well-known opinion columnists to speak on the subject.
- Send virtual messages through the social media.
- Include different private actors and institutions to replicate the campaign internally in their organizations.
- Create a *champeta* on climate change.
- Include subjects relating to climate change in the agendas of events organized in Cartagena (HAY Festival, Classical Music Festival, Biaci, Ficci, National Beauty Contest, etc.).
- Amusement activities with children and young people to promote climate change education.

**Indicadores**

- Number of *Cartageneros* involved in the campaign.
- Number of children and young people who participate in the activities.
- Number of messages published in the different mass media.
- Number of interviews published in different mass media and/or public or private organizations.
- Number of billboards installed in the city.

PROGRAM 1. RAISING CLIMATE CHANGE AWARENESS OF CITIZENS	
PROJECT SHEET No. 35. EDUCATION CAMPAIGN TO PROMOTE CONSERVATION OF MANGROVE SWAMPS	
<b>Problems and justification</b>	
Mangrove swamps are natural protectors against the effects of climate change; however, the lack of information regarding their importance has resulted in the city of Cartagena suffering from their destruction with the respective environmental consequences. It is therefore urgent to mount a campaign in schools and universities to promote the conservation of the mangrove swamps and to plant more at the most critical points of the city.	
<b>Purpose of the project</b>	
To promote the culture of planting and conserving mangrove swamps in the city of Cartagena and its island areas.	
<b>Intervention area</b>	<b>Estimated cost</b>
	\$400,000,000
	<b>Duration</b>
	2 years
	<b>Executor</b>
	Office of the Mayor of Cartagena
	<b>Other actors</b>
	EPA, Cardique, public and private schools, environmental promotion groups, NGOs and foundations, National Natural Parks, communication media, universities
<b>Financial mechanisms</b>	
Donations, national foundations, international foundations	
<b>Specific actions</b>	
<ul style="list-style-type: none"> <li>• Hold a “One day for your city” in which well-known Cartagena personalities plant mangroves with students of public and private schools once a year.</li> <li>• Promote discussions on the importance of mangrove swamps in public and private schools in Cartagena and its islands.</li> <li>• Hold half yearly mangrove planting and conservation days at strategic points of the city and in schools joining in the campaign.</li> <li>• Disseminate information on the campaign through the mass media (with their support and sponsorship).</li> <li>• Organize the sale of mangrove seeds to be planted by public schools as a form of donation at tourist points in the city.</li> </ul>	
<b>Indicators</b>	
<ul style="list-style-type: none"> <li>• Number of Cartagena notables who join in the campaign.</li> <li>• Number of talks held at schools.</li> <li>• Public announcements of mangrove planting days in the different mass media.</li> <li>• Number of seeds sold.</li> </ul>	

## 10.3 Planning and land use

There are planning instruments that facilitate the inclusion of climate compatible development in the District of Cartagena today. It is therefore necessary to update the different instruments (Table 20) including in them the impacts of climate change and the strategies and measures proposed in this plan, seeking a coordinated and effective campaign through joint efforts of all the actors (national, regional, departmental and local) that can exert influence in the territory.



**Table 20.** Principal planning instruments of the District of Cartagena de Indias.

Number	Planning Instrument	Entity Responsible	Status of management
1	District Development Plan	Office of Mayor of Cartagena	Implementation
2	Departmental Development Plan	Government	Implementation
3	Cartagena de Indias Territorial Regulation Plan	Office of Mayor of Cartagena	Implementation
4	Cartagena District Risk Management Plan	Office of Mayor of Cartagena	Implementation
5	Dengue Control Plan	Office of Mayor of Cartagena, DADIS	Implementation
6	Cartagena de Indias Sectoral Tourism Plan	Corpoturismo	Pending approval
7	Organization and Management Plan of the River Magdalena Coast, Dique channel complex – lagoon system of the Santa Marta Ciénaga Grande (Bolívar Sector)	MADS, Cardique, Invemar	Formulation
8	Special Management and Protection Plan for the Historic Center and its zone of influence (PEMP)	Ministry of Culture/ Office of Mayor of Cartagena / IPCC	To be formulated
9	PEMP for other assets of national cultural interest in the city	Ministry of Culture	Formulation
10	Management Plan of the Environmental Estuary Coast of the River Sinu and Morrosquillo gulf (Bolívar sector)	MADS, Cardique	To be formulated
11	La Virgen marsh District Park macro-project	Office of Mayor of Cartagena	Implementation
12	Cerro de La Popa Macro-project	Office of Mayor of Cartagena	Formulated
13	Tierra Bomba Macro-project	Office of Mayor of Cartagena	To be formulated
14	Partial Plan for the Integral Improvement of La Boquilla	Office of Mayor of Cartagena	Formulation
15	Mobility Master Plan	Office of Mayor of Cartagena	Formulation

In addition, it must not be forgotten that a series of projects that would complement the strategies proposed in this plan have been identified, some

of which are in the process of implementation and others in preparation (Table 21).

**Table 21.** Projects of the city that would complement the management of climate compatible development

No.	Project	Start of term	Entity Responsible	Management Status
1	Certification form of Cartagena de Indias as a sustainable tourism destination	Medium-term	Corpoturismo, city hotels	Implementation
2	Alternative transport systems that do not produce emissions for movements inside the walled city and discouraging the use of a vehicles.	Long-term	Office of Mayor of Cartagena, Transit and Transport Administrative Dept.	Implementation
3	NAMA of the tourism sector	Short-term	MADS	Implementation
4	Sanitation project for the internal bodies of water of Cartagena (axes 1, 2 and 3)	Medium-term	Edurbe	Implementation
5	Hydro-sanitary connections in the south eastern zone of Cartagena de Indias	Short-term	Corvivienda	Implementation
6	Campaigns to sensitize citizens' environmental culture	Short-term	EPA	Implementation
7	Restoration of the Canal del Dique	Medium-term	Adaptation Fund, MADS, Ministry of Finance and Public Credit	Implementation
8	Cartagena Rainwater Drainage Master Plan (stages I and II)	Short term	Office of Mayor of Cartagena DAVD	Implementation Formulation
9	Cartagena Rainwater Drainage Master Plan (stage III)	Long term	Office of Mayor of Cartagena DAVD	To be formulated
10	Construction of the Bicentenary avenue	Medium term	Office of Mayor of Cartagena	Formulation
11	Maintenance of the present drainage system of the Historic Center	Short term	Office of Mayor of Cartagena	Formulation
12	Avenida Rafael Nuñez Linear Park, taking advantage of the view of the lagoon, the mangrove swamp ecosystem and, in turn, respecting the wall that surrounds its course	Medium term	Office of Mayor of Cartagena	Formulation
13	Creation of green corridors with native species in the Historic Center	Medium term	EPA, IPCC	Formulation
14	Remodeling of the Marine Park	Medium term	National Navy	Formulation
15	Development of engineering works as a measure to control coastal erosion on Tierra Bomba	Short term	Office of Mayor of Cartagena	Formulation
16	Education in adaptation and mitigation of climate change pilot project as a contribution to strengthen environmental education processes and higher education training at educational institutions in the area of influence of the Corales del Rosario and San Bernardo National Natural Park.	Short term	National Natural Parks	Formulation
17	Urban woodland master plan to reduce heat islands in the city	Medium term	EPA	Formulation
18	Termination of the perimeter road	Medium term	Office of Mayor of Cartagena	Formulation
19	Works to prevent tidal intrusion in Bocagrande and Castillogrande	Short term	Office of Mayor of Cartagena	Implementation
20	Coastal Protection Master Plan	Short term	MADS	Formulation







## **Chapter IV**

# **Financing the plan**

# 11. Costs of the plan

Financing Plan 4C requires the support of both public and private sectors, local, national and international actors, who assume a commitment to prompt actions, which will be more cost-effective in the medium and long-term than investing resources in restoration and adaptation of the city and its islands tomorrow.

It is estimated that the cost of the adaptation and mitigation measures proposed in Plan 4C is COP \$147,125 million for the period 2014-2024 (Figure 22)<sup>5</sup>. To guarantee the effectiveness of this plan, the amounts of the investments will be reviewed regularly in light of the evaluation and monitoring stipulated by the plan. Likewise, escalation of the pilots will require investments that are not covered at present.

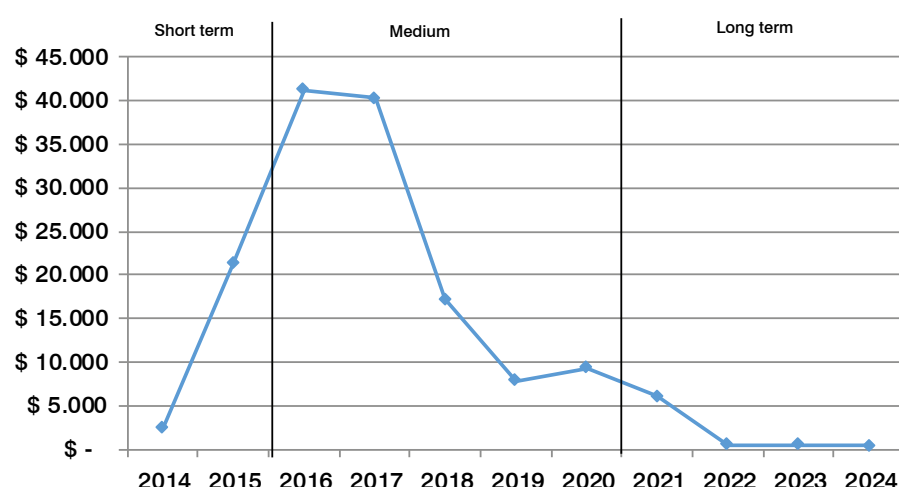


Figure 22 shows the total annual cost of Plan 4C for the period between 2014 and 2024. It is notable that the greater part of the investment is in the short and medium term, because the initial measures of adaptation and mitigation required by the city has to be completed within these terms.

Corto plazo: \$23.675 millones  
Mediano plazo: \$115.885 millones  
Largo plazo: \$7.565 millones

Figure 22. Total costs of Plan 4C 2014-2024 (figures in millions of pesos)

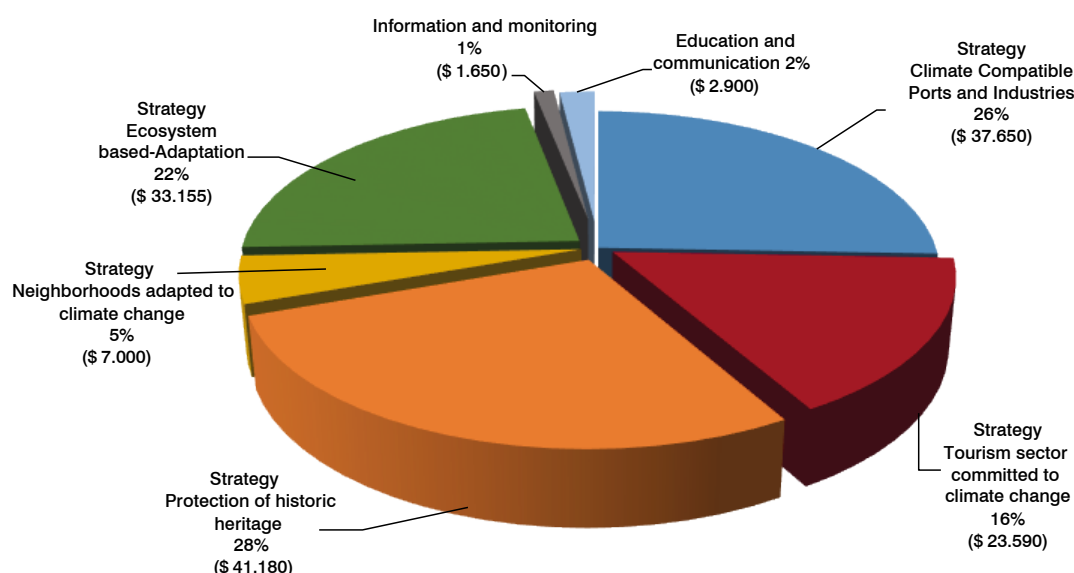
Regarding the distribution of resources as part of the plan (Table 22 and Figure 23), it is notable that the structural axes require a larger investment plan than those of the cross-cutting axes. More specifically, the investment required for the Integrated adaptation to the economic development of the city axis, that contains three strategies and the respective portfolio of projects, is of the order of COL\$102,420 million. For its part, the “The citizens and the climate” axis

is less weighty than the rest, because it covers a strategy with two adaptation projects: one for an urban neighborhood and another for a rural one. As these projects are implemented and their efficacy is evaluated, the experience acquired will make it possible to replicate them in other zones of the city and the islands, for which additional costs will be generated as part of the medium and long term strategy.

5. This amount does not include the estimated costs of the city and nation projects mentioned in the transversal axis of planning and regulation which are of COP \$1.4 million million. It is estimated that the total cost of adaptation of the city of Cartagena, including the city projects, would be of the order of COP \$1.5 million million (current in 2014).

**Table 22.** Distribution of the amounts of investment required for Plan 4C by axes and strategies, 2014 to 2040 (figures in millions of pesos)

Axes		Strategy	Cost per strategy	Total Cost
Structural	Integrated adaptation to the economic development of the city	Climate Compatible Ports and Industries.	\$ 37.650	\$ 102.420
		Tourism sector committed to climate change.	\$ 23.590	
		Protection of Historic Heritage.	\$ 41.180	
	Citizens and adaptation to climate change	Neighborhoods adapted to climate change.	\$ 7.000	\$ 7.000
	Ecological restoration: water and life	Ecosystem-based adaptation.	\$ 33.155	\$ 33.155
Cross-cutting				
Information and monitoring			\$ 1.650	\$ 4.550
Education and Communication.			\$ 2.900	
Total cost of Plan 4C				\$ 147.125



**Figure 23.** Distribution of the amounts of investment required for Plan 4C by axes and strategies, 2014-2040 (figures in millions of pesos)

## 12. Sources of financing

To obtain public and private financial resources it is indispensable to guarantee the effective introduction of the measures set out in the Plan 4C. Public financing will be from local, regional or national governments, either from their own

resources or obtained from loans (internal or external) or grants, while private funds are monies invested by private enterprises for their own adaptation and mitigation projects or ones to which the city contributes. These funds can be complemented by national and international corporation resources.

To ensure the financial sustainability of Plan 4C, what is necessary is a long-term strategy in which the different city administrations are involved. It should be stressed that a large part of the resources for the Plan will be administered by the Cartagena de Indias District as part of its function as paymaster of the territory and manager of economic and social development works of the city.

## 12.1 Public and local resources

There are various financial mechanisms available to the district that facilitate the financing of the measures under the plan, some of which are broken down as follows.

**Table 23.** Local financial mechanisms identified for financing of Plan 4C.

Financial Mechanisms	Description
Resources of the first Development Plan	The specific actions that materialize the plan are mainly set out in the purpose of territorial development of the “Ahora Sí Cartagena” (Cartagena Yes Now) territorial Development Plan, in the habitat and infrastructure strategies and, on a smaller scale, in the social inclusion objective. According to the multiannual investment plan for the year 2014, there are programs and sub-programs that could articulate with those contained in Plan 4C, which are: i) investment projects program for the maintenance and recuperation of material patrimony, ii) science, technology and innovation sub-program; iii) construction and/or improvement of housing on owned sites; iv) environmental management sub-programs, v) Adaptation to Climate Change Plan sub-program, and vi) Rainwater Drainage Master Plan.
Land management instruments	Another source of local resources is, for example, revaluation and capital gains tax. The latter is mentioned in the Land Use Plan and in the present Tax Statute, in which, according to Agreement 022 of 2004, 15% of the funds received by the district in this respect must be used for the generation of public space and the implementation of recreational works projects in parks and green zones. For this purpose, if this mechanism is employed, it would be possible to capture important resources to invest in public spaces whose functions are recreational and at the same time provide ecosystemic services and contribute landscape values in the coastal zones, which are permanently under threat from the effects of climate change.

### 12.1.1 Cartagena District Climate Change Fund (FDCCC)

A measure that the present administration could introduce in order to guarantee future resources in favor of climate change adaptation and Plan 4C is the creation of the Cartagena de Indias Climate Change District Fund. This fund is conceived as a fund-account without

legal corporate existence, formed by a fixed percentage of one of the headings of the district ICLD, such as, for example, the Industry, Commerce, Signs and Boards tax (ICAT). The budgetary base of the Cartagena District Climate Change Fund could be established with 1% of the district income received from ICAT (see Table 24)<sup>6</sup>.

**Table 24.** Projection on income from ICAT and District Climate Change Fund 2015-2024 (figures in millions of pesos).

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total ICAT	\$230.794	\$244.849	\$252.195	\$259.761	\$267.554	\$275.580	\$283.848	\$292.363	\$301.134	\$310.168
FDCCC	2.177	2.308	2.377	2.448	2.522	2.598	2.676	2.756	2.838	2.924

6. This percentage constitutes an initial proposal.



If 1% of the income from the ICAT tax for the period 2015-2024 were to be assigned to the FDCCC, it would have resources equivalent to COL\$25,000 million, which would be available to finance part of the projects under this Plan, payable by the district or by one of its decentralized entities.

The creation of this fund must be approved by the District Council, in accordance with the powers granted to it under article 313 of the Political Constitution and Ruling 075 of 1993 of the Constitutional Court, through one of the three mechanisms put forward here:

- A reform of the present Tax Statute, by presenting a law bill to be approved under agreement by the District Council.
- Presentation to the District Council of an independent bill stipulating the creation of the FDCCC and the source of its resources.
- Creation of the FDCCC and the source of its resources by adopting this Plan under a district agreement.

## 12.2 National Public resources

There are also different national financial mechanisms with which the city of Cartagena could finance the measures of this Plan.

Among the entities that form Plan 4C in regards to environmental conservation are Cardique

and the National Natural Parks Administrative Unit, which is responsible for the Corales del Rosario and San Bernardo National Natural Parks (PNNCRSB). This institution administers resources from the environmental surtax and other resources whose use is prescribed by law. In this context, some of the actions put forward in the “ecological restoration: water and life” axis can be financed by this entity in accordance with its own legal functions. In turn, the management of the PNNCRSB also has resources to administer the area, as well as to conserve ecosystems, to provide and maintain environmental services and to contribute to sustainable human development.

Likewise, this country has allocated resources through the figure of the National Funds, such as the Royalties Fund (for example, through the corresponding resources assigned to Bolivar Department), the Adaptation Fund, the Tourism Promotion Fund and the National Disaster Risk Management Fund, among others, which, in spite of having been created for a variety of purposes, constitute viable financial options to fulfill the adaptation and mitigation goals and projects set forth in Plan 4C (Figure 24).

Another possibility to gain resources for the district is by obtaining credits from organisms in the financial sector, such as Findeter, Bancoldex, Fonade and diverse commercial banks. The latter depend on the city’s indebtedness capacity and must be authorized by the District Council.



<b>Adaptation Fund</b>	<ul style="list-style-type: none"> <li>• Risk mitigation.</li> <li>• Habitat (new housing, water supply and sanitation).</li> <li>• Environment.</li> </ul>
<b>Royalties Fund</b>	<ul style="list-style-type: none"> <li>• Habitat (housing, drinking water and basic sanitation).</li> <li>• Environment and sustainable development.</li> <li>• Urban equipment and public infrastructure.</li> <li>• Science and technology.</li> <li>• Energies (not conventional).</li> <li>• Prioritization of projects to improve the quality of life of the communities of African descent and permit recuperation and the environmental establishment of non-conventional energies.</li> </ul>
<b>Tourism Promotion</b>	<ul style="list-style-type: none"> <li>• Improvement of tourism competitiveness (tourism infrastructure, project structuring).</li> <li>• Marketing and touristic promotion (International).</li> </ul>
<b>Action Fund (Colombia USA)</b>	<ul style="list-style-type: none"> <li>• Restoration and maintenance of protected areas.</li> <li>• Protection, restoration and exploitation of biodiversity</li> </ul>
<b>National Disaster Risks Management Fund</b>	<ul style="list-style-type: none"> <li>• Minor rehabilitation of infrastructures.</li> </ul>

**Figure 24.** National funds with resources to finance Plan 4C projects.

## 12.3 International climate finance

Climate finance at the international level has considerable weight today. It is estimated that the annual world flow of climate finances reaches around US\$ 100,000 million (IADB et al., 2014). While local and national financial mechanisms are an effective way of leveraging resources, international sources also represent opportunities to complement Plan 4C financing. To this effect, the mechanisms for bilateral cooperation, the United Nations Framework Convention on Climate Change (UNFCCC), Official Assistance for Development (OAD),

multilateral funds and carbon markets provide options to obtain resources (see Figure 25); they can be grouped as follows:

- **Official Assistance for Development (OAD).** These resources are channeled through cooperation agencies for development of the countries, bilateral or multilateral finance organisms.
- **Additional Climate Finances.** This includes additional resources from developed countries for use in climate actions that are not classified as OAD, channeled through bilateral, multilateral finance organisms and the UNFCCC.

- Income from the Carbon Markets. The Kyoto Protocol has created mechanisms, such as the CDM, that permit the flow of resources for

specific emission reduction initiatives; there is also the possibility of entering voluntary markets.

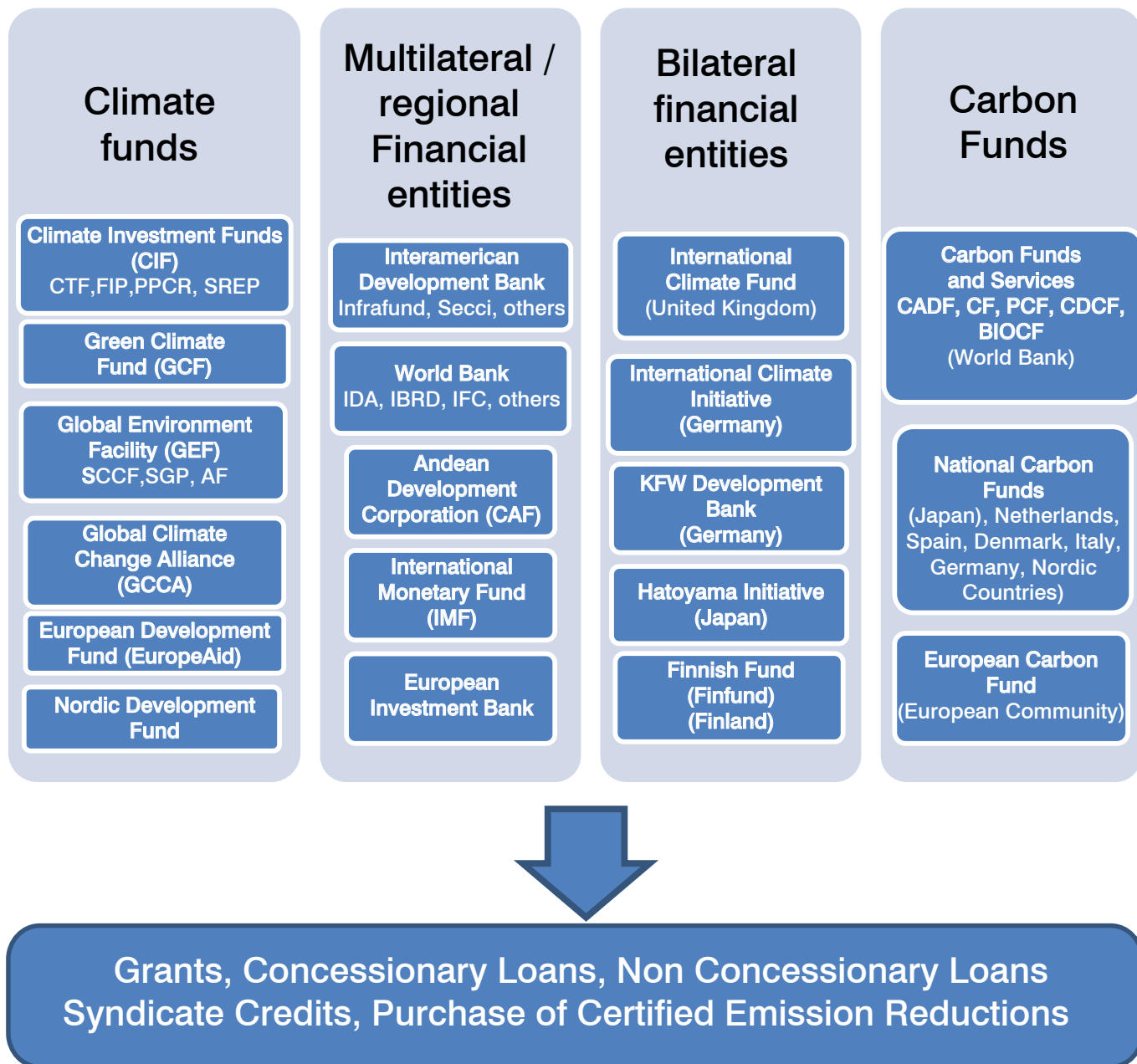


Figure 25. Channels through which International climate finance is provided (excludes private funds).

## 12.4 Private resources at national and international levels

At national level there are donors, such as companies or their respective foundations, with financial capacity and similar lines of investment in the different projects stipulated in this Plan. Figure 26 shows some Colombian foundations which make social and environmental investments

that can contribute to the financing of some of the measures proposed in Plan 4C.

Likewise, several international foundations grant financing to local NGOs for climate change related projects. Many of these entities now have climate change programs that could be added to the plan, such as, for example, the Rockefeller Foundation, Ford Foundation and Moore Foundation, among others.

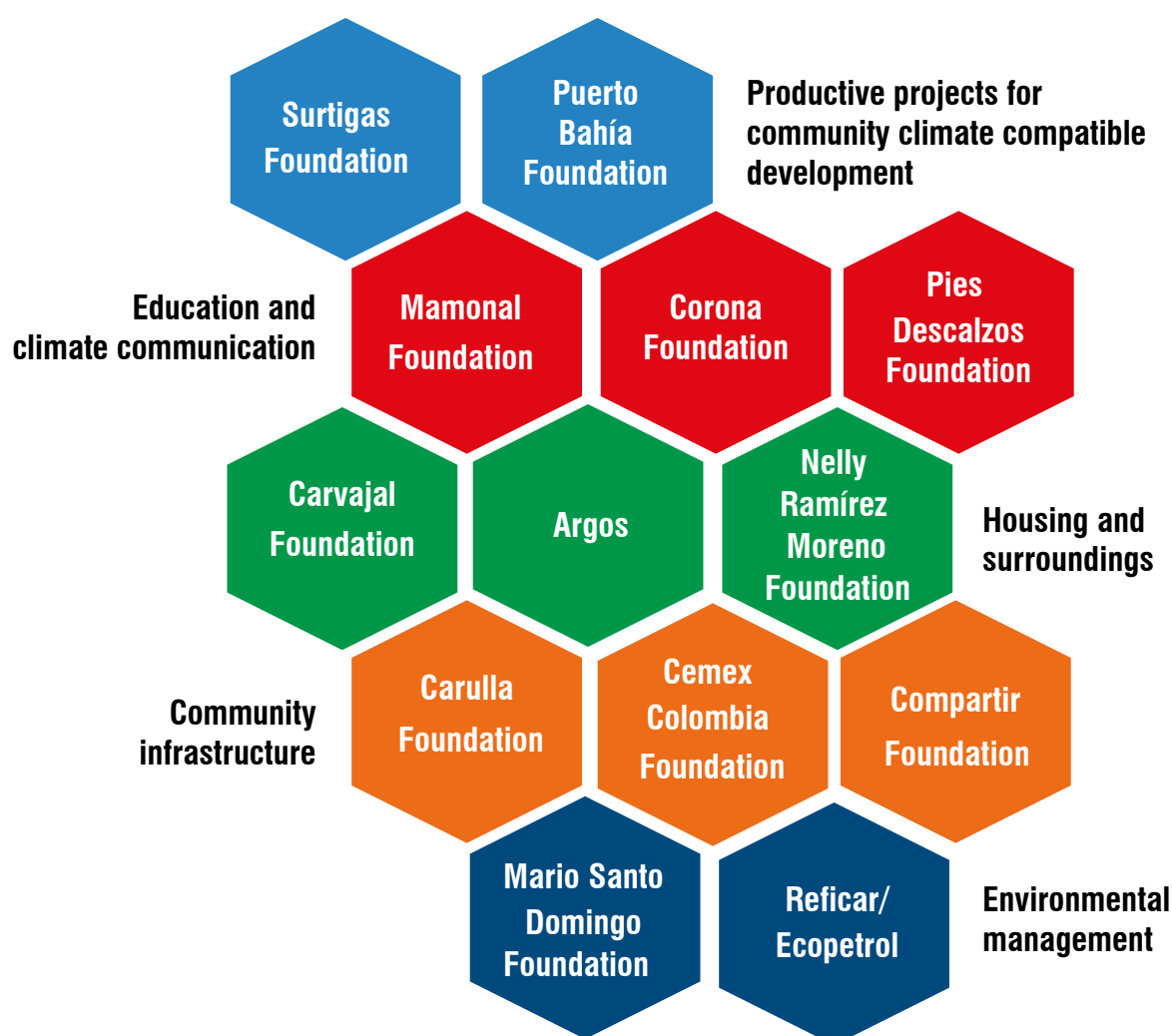


Figure 26. Foundations in Colombia which could finance projects under the Plan.

## 12.5 Projection of investment in Plan 4C by financial sources

As a result of the measures and projects set out in this plan, a projection of investment by financial

sources for the period 2014-2040 (see Figure 27) was created. The proportion and the source of the funds necessary for the implementation of same are fixed indicatively.

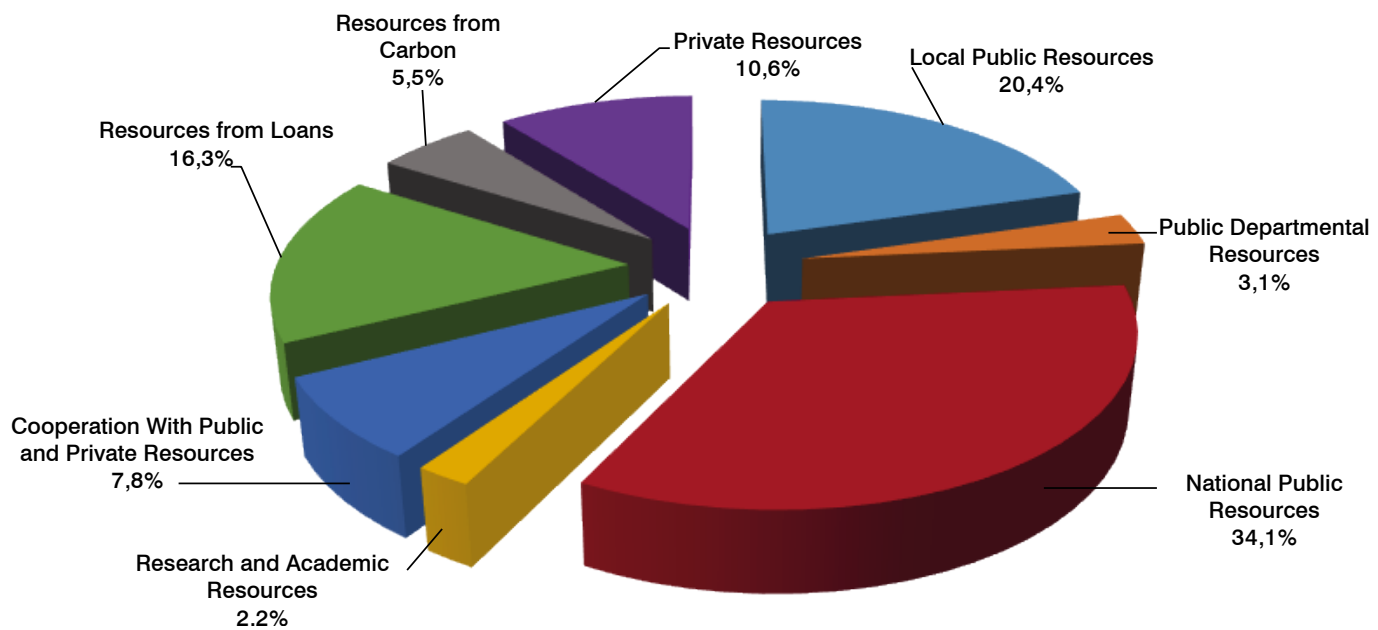


Figure 27. Resources to finance Plan 4C projects according to their origin.

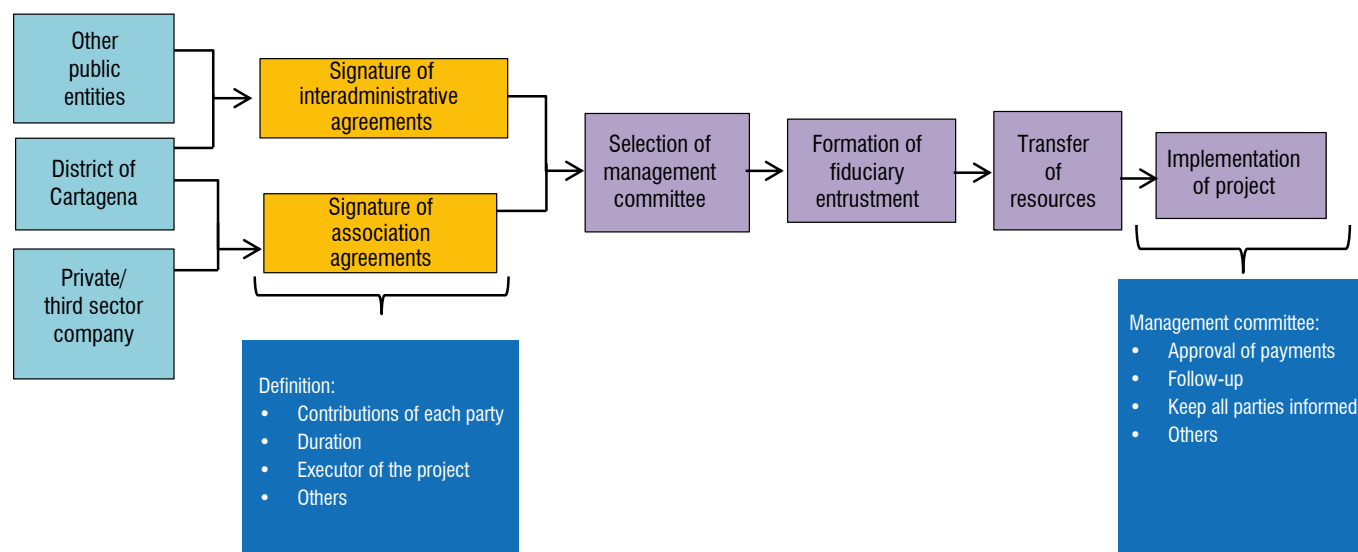
### 13. Operationality for the spending of resources from different origins

In seeking a scheme in which all public and private actors contribute, and with the intention of spending the resources efficiently and transparently within the regulatory framework governing public resources, it is necessary for both public and private entities to establish alliances, which must be formalized under association agreements, in accordance with the stipulations of articles 1 of Law 1508 of 2012, 96 of Law 489 of 1998 and 355 of the Political Constitution. These agreements may be signed between a state entity and a private law natural or legal person and must specify the objectives, terms, obligations and contributions (monetary and in-kind) of each of the parties, the coordination system and all aspects considered pertinent for the implementation of the programs or projects such as, for example, identifying the contractual executor.

In the case of an association between public entities, the district of Cartagena may execute internal administrative agreements with other public entities at national, regional or local level, in order to “cooperate in performing administrative functions or jointly providing the services for which they are responsible” (Article 95, Law 489 of 1998). Under this modality, the National Government can contribute resources from its budget for concrete actions of adaptation and/or mitigation of climate change in Cartagena, within the framework of the programs and projects stipulated in this Plan.

In the case of alliances between private companies for the implementation of projects for which they are responsible, the formalization and execution scheme for the resources will be defined within the interior of same, in accordance with the regulations by which they are governed (Law 1508 of 2012).

Regarding the spending of the resources derived from agreements, fiduciary entrustments may be established for each of the projects of the Plan to be put into operation



**Figure 28.** Flow chart of operation of Plan 4C projects.

(as required). The trust may be formed between entities (public and/or Private) which can sign association or inter-administrative agreements, in which the transfer of resources stipulated in same may be considered a guarantee of implementation of the project, as the parties give the monetary resources to a third person for their administration, thus protecting them from the possibility that one of the parties might fail to comply with the delivery agreed on.

Likewise, the signatory parties of the agreement may form a Management Committee, in which each of them delegates a representative who will be responsible for the follow up and control of the program or project according to the schedule and the previously established resources. The committee must be governed by operational regulations, and is the body that must approve any payments which have to be drafted by the trust to the executor for implementation of the program or project.





## Chapter V

# Implementation of the plan

## 14. Institutional scheme

### 14.1 Climate Action Center for Cartagena

A structure of public and private efforts and resources, which must be managed by the Climate Action Center for Cartagena (CACC), is required for the correct implementation and accompaniment of this Plan. It is conceived as an

organism that will ensure the due implementation of, and compliance with the Plan, providing it with a functional institutionality as a key determining factor for its success. The CACC is viewed as an intermediary that permanently supports the district of Cartagena. It must also coordinate the actions of the different actors mentioned throughout the Plan, ensuring that each of them assumes that role and carries out the actions which are stipulated in it. The principal functions of the CACC are shown in Figure 29.



Figure 29. Initial operational structure of the Climate Action Center for Cartagena.

The creation will start with the contracting of a manager, who will create a suitable legal figure for the Center, will carry out actions aimed at finding the resources (public and private) for functioning and, as far as possible, to finance the projects under the Plan, will structure the entity administratively and prepare its plan of action. It will also put into operation the climate change website in the city, support the projects that gradually go into operation and seek a technical team suitable to work in the entity.

The CACC will be governed by a Board of Directors, whose members will be the Office of

the Mayor of Cartagena, the National Government and the private and third sector organisms that will contribute with resources for its commissioning and functioning. The initial operating structure of the Center is shown in Figure 30. We stress the importance of ensuring the continuation of the CACC after it is put into operation as a guarantor that the strategies, programs and projects of the Plan are implemented within the stipulated terms and as a permanent support for the Office of the Mayor for the implementation of the climate change adaptation and mitigation measures.

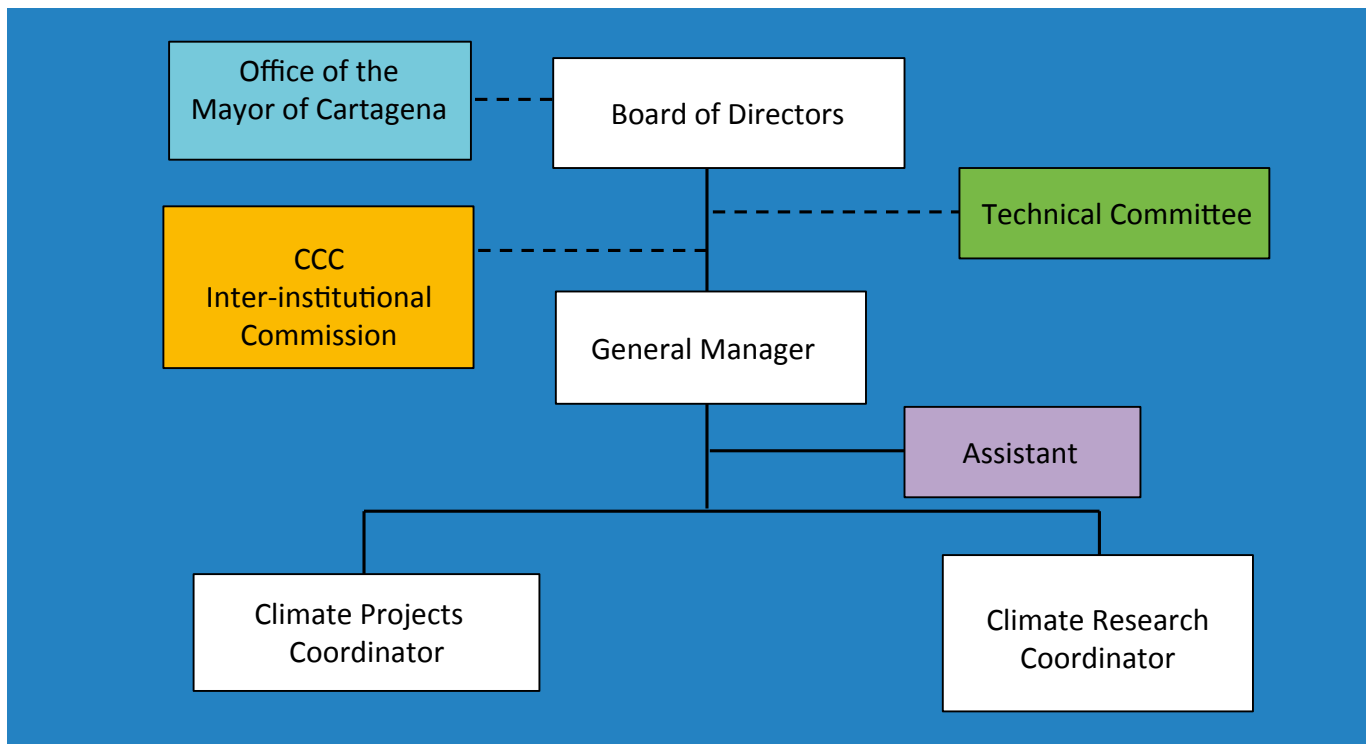


Figure 30. Initial operational structure of the Climate Action Center for Cartagena.

The operational structure of the CACC includes two coordination actions:

- **Coordination of Climate Projects.** Responsible for the coordination and support to the projects included in the structural axes and cross-cutting axis on education and awareness of this Plan. It may support the Office of the Mayor, as necessary (or any of the members of the Committee of Directors who so require) in adaptation projects which are a present or future initiative of the city.
- **Coordination of Climate Research.** Responsible for carrying out research (independent or through alliances with other entities). Initially, it would execute those included in the cross-cutting information and monitoring axis and, if required, may make technical contributions to the cross-cutting regulation and planning axis.

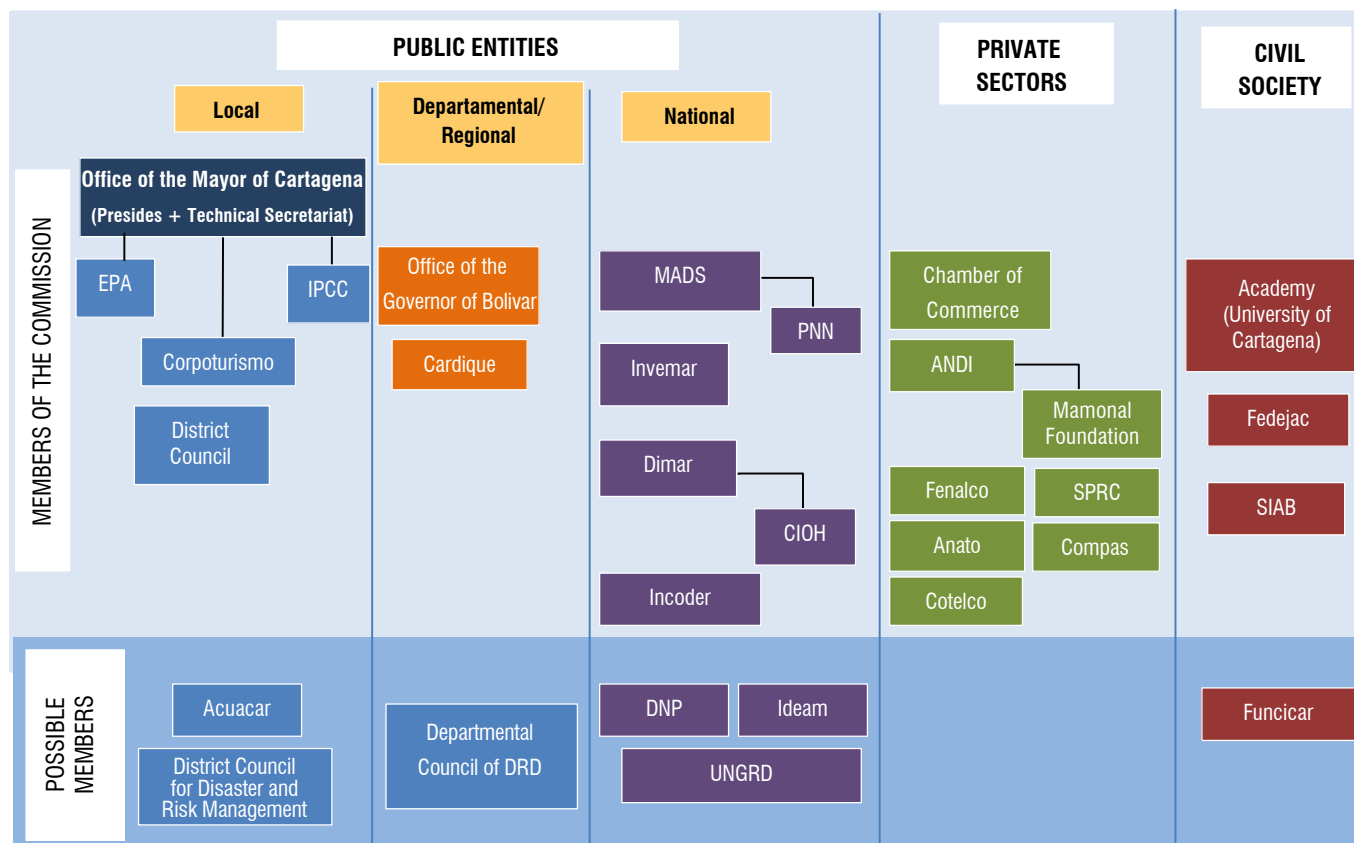
## 14.2 Inter-Institutional Climate Change Commission for Cartagena (CICCC)

Plan 4C is an instrument that involves a multiplicity of actors (public institutions, private sector, community, among others) with different competences, interests and visions and it is therefore necessary to consider a common space where they can participate and contribute from their areas of expertise, under the premise of coherent and harmonious articulation to achieve compliance with the vision and the objectives of the Plan.

Under this premise, in January 2013, the Inter-institutional Climate Change Commission of Cartagena (CICCC) was formed and has served as a scenario for discussion and debate on issues relating to this phenomenon and of which key actors and representatives of a variety of sectors of the city, political, public, private, entrepreneurial, academic, sectoral, social and institutional, will be members. The CICCC is conceived as an advisory

body that strengthens the mainstreaming of climate change within institutions, bringing the decision takers into one single space. The

Commission meets regularly, as a forum in which progress is socialized and feedback is provided for the people who created the plan.



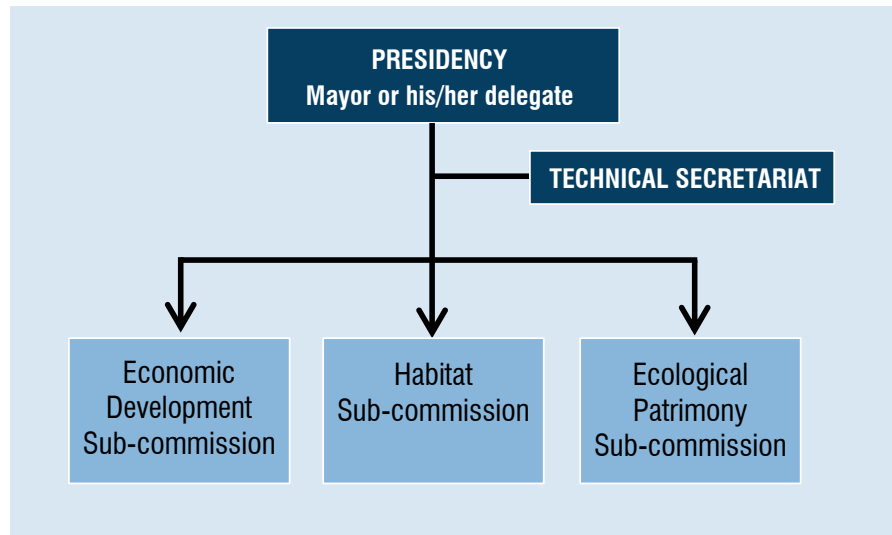
**Figure 31.** Actors of the Inter-Institutional Commission of Climate Change for Cartagena de Indias.

Among the main attributes of the CICC are the following:

- To serve as a forum or scenario for dialogue, discussion, debate and reflection on subjects relating to the formulation and implementation of the PACCC.
- Issue guidelines and general outlines for the adequate articulation of Plan 4C with the land use planning (POT) and other planning instruments of the district and the sectors involved.
- Regular, permanent follow-up of compliance with the indicators and goals of the different structural axes defined in Plan 4C.

- Resolve conflicts between actors in an effort to always maximize the positive externalities of cooperative work.
- Decide on the entry of new members or removal of existing ones.
- Establish its regulations, defining, among other aspects, the regularity of the meetings.

In turn, some sub-Commissions must be created at the heart of the Commission (one for each of the structural axes of the plan) to facilitate discussion, follow-up and decision making on tracking and monitoring each of the structural axes of the plan, taking into account that, because of its cross-cutting nature, different actors come together and have different responsibilities in each of them.



**Figure 32.** Structure of the sub-commissions of the Inter-Institutional Commission of Climate Change.

### 14.3 Follow-up and Plan evaluation entity

The evaluation and follow-up of Plan 4C will be the responsibility of an entity specialized in the subject, which has the required experience to calculate the management indicators and follow-up which form part of the Plan (Chapter 6). The entity is expected to be external to CICC because of the neutrality required for evaluation

of the plan. However, the CICC will have to back the entity as it is the organism authorized for follow-up and evaluation of the Plan and to provide it with the information requested for this to be done in a timely fashion. The entity, for its part, will be required to produce regular reports to be presented to the CCCCC, the CACC and the public in general, in order to keep all the stakeholders and citizens informed of the progress of Plan 4C.







## **Chapter VI**

# **Follow-up and evaluation**

## 15. Climate management follow-up and evaluation indicators

To progress in climate compatible development, a repetitive follow-up and strategic evaluation process will have to be established in order to ensure that the Plan is efficient and effective. The process will fundamentally be based on performance indicators (efficiency) and impact (efficacy),

which may be quantitative and qualitative (Table 26). It should be stressed that there will also be a series of evaluation indicators (see project sheets).

This follow-up and evaluation process is extremely important, because it establishes the need for continuous improvement in the proposals of the Plan in line with the progress of scientific information on climate change. To this effect, annual revisions and short, medium and long-term revision cohorts are proposed (Table 25).

**Table 25.** Terms for implementation of Plan 4C.

Implementation term	Period of time
Short term	2015
Medium term	2020
Long term	2024

Evaluation and follow-up of the measures and projects of the Plan must be coordinated by CACC through a specialized entity with the experience required to calculate and analyze the

indicators. For this purpose, the entity will have the information provided by those responsible who are listed in Table 26.

**Table 26.** Indicators of management and impacts for evaluation and follow-up of Plan C.

Aspect referred to by indicator	No.	Name of Indicator	Type	Calculation or description	Measurement unit	Baseline	Goal			Entity responsible for providing information
							Short term	Medium term	Long term	
Indicadores de desempeño o eficiencia										
Inter-institutional coordination	1	Adoption of Plan 4C	Qualitative	Plan adopted under administrative act	An administrative act	0	1			Office of Mayor of Cartagena
	2	Creation of CACC	Qualitative	Formation of coordination stage	CACC Officially formed	0	1			Office of Mayor of Cartagena
Progress in implementation of strategies and measures of the Plan	2	Implementation of projects	Qualitative	Number of projects under way/number of projects proposed in the Plan	% of implementation (accumulated)	35 projects of the Plan	20%	54%	100%	Office of Mayor of Cartagena
	3	Budget spending	Qualitative	número de proyectos propuestos en el Plan	% of implementation (accumulated)	\$ 132.400 \$millones	20%	96%	100%	CACC
Efficacy or impact indicators										
Integration of climate change in planning	4	Articulation in instruments of local and sectoral planning	Qualitative	Strategies and projects of the Plan are inserted into the different local and sectoral planning instruments	Number of plans (PDD, POT, Mo-bility Plan, macroprojects and plans to be or are being formulated, PGDR, Pormiuc	10 plans (cumulative)	4	8	10	CACC
	5	Exposed population	Qualitative	Total number of population affected by flooding. / total population	% of population	28% of exposed population	25%	20%	15%	Local Disaster Management Council
Reduction of impacts and vulnerability	6	Socio-economic vulnerability	Qualitative	Percentage area with high socio-economic vulnerability according to aggregate index	% of high vulnerability	80%	75%	50%	20%	Planning Department
	7	Economic losses	Qualitative	Present economic losses/departmental or district GDP of the year in question	% of economic losses	5,4% of annual departmental GDP	<5,4%	<5%	<5%	Local Disaster Management Council

Continuation of Table 26

Aspect referred to by indicator	No.	Name of Indicator	Type	Calculation or description	Measurement unit	Baseline	Goal			Entity responsible for providing information
							Short term	Medium term	Long term	
Reduction of impacts and vulnerability	8	Ecological patrimony affected	Qualitative	Area of mangrove swamp affected/total mangroves in the district	% of areas of mangrove swamps affected	70% of area of mangroves that would be affected by climate	60%	40%	30%	EPA, Cardique, Invermar
	9	Historic heritage	Qualitative	Area of historic heritage affected by flooding/total area that containing the heritage	% of area of his-toric heritage affected	86%	<86%	<70%	<60%	IPCC
Raising awareness through robust knowledge and information on climate change	10	Persons made aware of the climate	Qualitative	Population made aware/ total population	% of the population (accumulated)	N.D.	10%	25%	40%	Cartagena Cómo Vamos* (perception measurements)
	11	Climate Change campaigns carried out	Qualitative	Number of climate change campaigns carried out in the city	Number of campaigns	0	1	1	1	EPA-District Planning Department
	12	Schools with climate change Praes	Qualitative	Number of schools with climate change Praes under way	Number of schools (accumulated)	0	5	20	30	District Education Department
	13	Climate Change research	Qualitative	Number of climate inves-tigations carried out	Number of investigations	1	1	3	3	CACC
Competitiveness in the climate context of the future	14	Climate jobs created	Qualitative	Number of persons contracted within the frame work of the portfolio of projects	Number of jobs	0	50	150	30	CACC
	15	Climate companies created in Cartagena	Qualitative	Number of companies created to satisfy demand for climate change projects	Number of companies	0	1	2	2	CACC, Cartagena Chamber of Commerce
	16	Companies in Cartagena working on development compatible with the climate	Qualitative	Number of companies that implement climate change adaptation and mitigation measures according to portfolio of projects	Number of companies	0	3	8	4	CACC

\*Cartagena Cómo Vamos – (Cartagena How are we Doing)





## **Chapter VII**

# **The resilient and competitive Cartagena we dream of**

## Conclusions

Plan 4C envisages a resilient Cartagena, both competitive and adapted to the effects of climate change by 2040, as demonstrated in the vision of the Plan and each of its axes and strategies.

This Plan therefore becomes the road map to promote different actions to succeed, jointly, in motivating long term policies in which the city's different administrations accumulate results in favor of climate compatible development. With this in view, it is fundamental to include the vision of climate change in its territorial planning instruments and development plans.

It also creates a union of efforts between the public and private sectors to succeed in promoting the city's productive targets (industry, ports, tourism) compatible with the climate of the future.

The people, both the Cartagenos and its visitors, are at the heart of this Plan: they must have broader knowledge and awareness of the risks and opportunities that will be brought about by climate change and they must be willing to act. Firstly, to adapt their own neighborhoods, islands and housing through innovative and interesting options in order to ensure better quality of life. Secondly, to conserve, protect and rehabilitate both the green zones (mangrove swamps and remnants of tropical dry forest), and the blue zones (channels, marshes and wetlands) associated with the ecosystems that ensure the city's stability and at the same time endow it with the beauty of its landscapes and recreational spaces.

To ensure and safeguard Cartagena's historic heritage, as well as its coastline, will require a profound understanding of what is at risk and the need for lasting solutions and timely actions.

This transformation of the city may, in turn, result in the creation of a variety of job opportunities, attract more tourists interested in the projection of a resilient city and in obtaining national and international resources which, added to local resources, will make all the difference to the sustainability of the Plan.

It is in this way that Cartagena will become a city prepared to cope with the impacts of floods caused by the rise in sea level and extreme climate events and one where its ecosystems are assigned their true value for climate protection and whose inhabitants are aware of the causes and effects of this phenomenon, become involved in the solutions and enjoy the certainty of having a strengthened institution that is committed to achieving climate compatible development. It will be a city that attracts visitors from the entire world, who will come not only to admire the walled city, but also to see the transformation that this city will have experienced in its most popular neighborhoods, who will have shown their capacity to overcome not only poverty, but also the challenge of a changing climate. The aspects covered by this Plan are absolutely indispensable for the achievement of a competitive Cartagena de Indias that is resilient to the climate of the future.

## BIBLIOGRAPHY

- Acosta, K. 2012. Cartagena, entre el progreso industrial y el rezago social. Banco de la República, Centro de Estudios Económicos Regionales (CEER). Cartagena, Colombia. 64 p.
- Alcaldía de Cartagena. 2001. Plan de Ordenamiento Territorial del Distrito Turístico y Cultural de Cartagena de Indias. Síntesis del diagnóstico. Decreto No. 0977 de 2001 “Por medio del cual se adopta el Plan de Ordenamiento Territorial del Distrito Turístico y Cultural de Cartagena de Indias”. Cartagena. 232 p.
- Alcaldía de Cartagena. 2013. Plan de Desarrollo Distrital-Ahora Sí Cartagena 2013-2015. Acuerdo 016 “Por medio del cual se adopta el Plan de Desarrollo del Distrito Turístico y Cultural de Cartagena de Indias-Ahora Sí Cartagena 2013-2015”. Cartagena. 205 p.
- Andrade, C. A. 2002. Análisis del nivel del mar en la zona costera colombiana. ÁMBITO DE PÁGINAS. En: Invemar (Ed.). Definición de la vulnerabilidad de los sistemas biogeofísicos y socioeconómicos debido a un cambio en el nivel del mar en la zona costera colombiana (Caribe, Insular y Pacífico) y medidas para su adaptación. Informe técnico No. 4, Santa Marta, Colombia.
- BID, Pnuma, World Bank Institute, Uned Riso Centre, PNUD y Fundación Torcuato Di Tella. 2014. Financiamiento Climático. Finanzas y Carbono. Disponible en [<http://finanzascarbono.org/financiamiento-climatico/>]. Recuperado en junio de 2014.
- Cartagena Cómo Vamos. 2013. Evaluación de la calidad de vida 2012. Cartagena. Disponible en: [[http://www.cartagenacomovamos.org/temp\\_downloads/calidad-de-vida-2012.pdf](http://www.cartagenacomovamos.org/temp_downloads/calidad-de-vida-2012.pdf)]. Recuperado en febrero de 2014.
- CCC. 2013. Las 200 empresas más grandes de Cartagena, 2012. Centro de Estudios para el Desarrollo y la Competitividad (Cedec). Cartagena, Colombia. 50 p.
- CCC. 2014. Cartagena en cifras. Cámara de Comercio de Cartagena. Centro de Estudios para el Desarrollo y la Competitividad (Cedec). Serie No. 84. Cartagena, Colombia. 5 p.
- Cepal. 2012. Valoración de daños y pérdidas. Ola invernal en Colombia, 2010-2011. Misión BID-Cepal. Comisión Económica para América Latina y el Caribe. Bogotá. Disponible en [[http://www.cepal.org/colombia/noticias/documentosdetrabajo/7/49587/Libro\\_Ola\\_invernal\\_en\\_Colombia\\_BID\\_CEPAL.pdf](http://www.cepal.org/colombia/noticias/documentosdetrabajo/7/49587/Libro_Ola_invernal_en_Colombia_BID_CEPAL.pdf)]. Recuperado en enero de 2014.
- Cepal. 2013. Panorama de cambio climático en Colombia. Comisión Económica para América Latina y el Caribe. Serie Medio Ambiente y Desarrollo No. 146. Naciones Unidas, Santiago de Chile. Disponible en [<http://www.eclac.cl/publicaciones/xml/5/49725/PanoramadelcambioclimaticoCOL.pdf>]. Recuperado en mayo de 2014.
- Corpoturismo. 2013. Indicadores de turismo de Cartagena de Indias. Cartagena de Indias, Colombia. 53 p.
- DNP. 2011. Estrategia institucional para la articulación de políticas y acciones en materia de cambio climático en Colombia. Departamento Nacional de Planeación, Documento Conpes 3700. Bogotá. 75 p.
- DNP, MADS, Ideam y UNGRD. 2012. Plan Nacional de Adaptación al Cambio Climático, ABC. Marco conceptual y lineamientos. Resumen ejecutivo. Departamento Nacional de Planeación, Ministerio de Ambiente y Desarrollo Sostenible, Instituto COMPLETAR y ungrd completar. Bogotá. 74 p.
- Doria, A. y H. Villareal. 2011. Indicadores de espacio público. Alcaldía de Cartagena de Indias. Cartagena, Colombia. 133 p.

- Ecoversa. 2010. Estimación de la oferta y la demanda hídrica nacional. Segundo informe. Contrato de Consultoría con Unicef. Bogotá.
- Gobernación de Bolívar. 2011. Balance de Gestión sobre la atención a la emergencia invernal por el Fenómeno de La Niña 2010-2011 en Bolívar. Gobernación de Bolívar, Colombia Humanitaria. Cartagena, Colombia. 32 p.
- Gilman, E., J. Ellison, N. Duque y C. Field. 2008. Threats to mangroves from climate change and adaptation options: a review. *Aquatic Botany*, 89: 237-250 p.
- Ideam. 2010. Estrategia nacional de educación, formación y sensibilización de públicos sobre cambio climático. Instituto de Hidrología, Meteorología y Estudios Ambientales y Ministerio de Ambiente, Vivienda y Desarrollo Sostenible con el apoyo de PNUD. Bogotá. 70 p.
- Invemar. 2003. Programa holandés de asistencia para estudios en cambio climático: Colombia. Definición de la vulnerabilidad de los sistemas biogeofísicos y socioeconómicos debido a un cambio en el nivel del mar en la zona costera colombiana (Caribe continental, Caribe insular y Pacífico) y medidas para su adaptación. Resumen ejecutivo y CD atlas digital. Instituto de Investigaciones Marinas y Costeas, Santa Marta, Colombia.
- Invemar. 2008. Capacity building to improve adaptability to sea level rise in two vulnerable points of the Colombian coastal areas (Tumaco-Pacific coast and Cartagena-Caribbean coast) with special emphasis on human populations under poverty conditions. Technical Report NCAP Colombia Project. Project Number 032135. Instituto de Investigaciones Marinas y Costeras, Santa Marta, Colombia. 292 p.
- Invemar, MADS, Alcaldía Mayor de Cartagena de Indias y CDKN. 2012. Lineamientos para la adaptación al cambio climático de Cartagena de Indias. Proyecto integración de la adaptación al cambio climático en la planificación territorial y gestión sectorial de Cartagena de Indias. Serie de Publicaciones Generales del Invemar No. 55, Santa Marta, Colombia. 227 p.
- IPCC. 2007. Cambio climático 2007: Informe de síntesis. Contribución de los Grupos de trabajo I, II y III al Cuarto Informe de evaluación del Grupo Intergubernamental de Expertos sobre el Cambio Climático. Intergovernmental Panel on Climate Change, Ginebra, Suiza. 104 p.
- IPCC. 2014. Summary for policymakers. 1-18 p. En: Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel y J. C. Minx (Eds.). *Climate change 2014, mitigation of climate change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, Reino Unido y Nueva York. Disponible en [<http://mitigation2014.org/report/summary-for-policy-makers>]. Recuperado en mayo de 2014.
- Kholostyakov, R. 2010. Estudio sobre la variabilidad de la temperatura superficial del Mar en el Caribe colombiano. Nota técnica del Ideam, Bogotá, Colombia.
- Lhumeau, A. y D. Cordero. 2012. Adaptación basada en ecosistemas: una respuesta al cambio climático. UICN, Quito, Ecuador. 17 p.
- Málikov, I. 2010. Análisis de las tendencias del nivel del mar a nivel local y su relación con las tendencias mostradas por los modelos internacionales. Instituto de Hidrología, Meteorología y Estudios Ambientales, Bogotá, Colombia.
- MMA, Ideam y Pnud. 2001. Primera comunicación nacional ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático. Ministerio del Medio Ambiente, Instituto de Hidrología, Meteorología y Estudios Ambientales y Programa de las Naciones Unidas para el Desarrollo. Bogotá, Colombia. 267 p.

- OCDE. 2014. OECD DAC Statistics: Climate related aid. Organización para la Cooperación y el Desarrollo Económico. Disponible en [<http://www.oecd.org/dac/environment-development/Climate-related%20aid%20Flyer%20-%20May%202014%20final.pdf>]. Recuperado en mayo 2014.
- Posada, B. y W. Henao. 2011. Diagnóstico de la erosión costera del territorio insular colombiano. Serie de Publicaciones Especiales del Invemar No. 13, Santa Marta, Colombia. 200 p.
- Rangel Buitrago, N., A. Anfuso, G. Correa y M. Stancheva. 2010. Evaluación preliminar de impactos de defensas costeras en algunos sectores del litoral Caribe colombiano. 399-404. En: Invemar y Acimar (Eds.). Libro de resúmenes extendidos. XIV Seminario Nacional de Ciencias y Tecnologías del Mar (Senalmar). Serie de Publicaciones Especiales de Invemar No. 21, Santa Marta, Colombia. 578 p.
- Segunda Comunicación Nacional –SCN– ante la Convención Marco de las Naciones Unidas sobre Cambio Climático. (2010). IDEAM. República de Colombia. Bogotá.
- Stein, A. y C. Moser. 2014. Asset planning for climate change adaptation: lessons from Cartagena, Colombia. *Environment and Urbanization*, 26: 166-183 p.
- The Climate Group. 2012. Lighting the clean revolution. The rise of LED and what it means for cities. Londres, Reino Unido. 66 p.
- Unesco. 2007. Case studies on climate change and world heritage. Unesco World Heritage Center, París. 82 p.
- Universidad de Cartagena y Alcaldía de Cartagena de Indias. 2010. Valoración de niveles de riesgos ambientales en el distrito de Cartagena de Indias. Informe final Diagnóstico línea base ambiental Cartagena de Indias. Tomo II. Diagnóstico ambiental Cartagena. Convenio interadministrativo No. 293. Instituto de Hidráulica y Saneamiento Ambiental (IHSA). Universidad de Cartagena y Alcaldía de Cartagena de Indias. Cartagena de Indias, Colombia. 57 p.
- Uninorte. 2001. Canal del dique. Plan de restauración ambiental (primera etapa). Universidad del Norte. Barranquilla, Colombia. 328 p.
- UNWTO and UNEP. 2008. Climate change and tourism, responding to global challenges. Organización Mundial del Turismo y Programa de las Naciones Unidas para el Medio Ambiente, Madrid. 269 p.
- UNWTO. 2014. UNTWO Tourism Highlights, UNWTO. Organización Mundial del Turismo. Disponible en [<http://mkt.unwto.org/publication/unwto-tourism-highlights-2013-edition>]. Recuperado en marzo 2014.



